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CLASS–11 (GEOGRAPHY)
COMPETENCY BASED TEST ITEMS

Foreword

It is with great pride and satisfaction that I present this published compilation of Competency-Based Education (CBE) test items for Class XI Geography. This initiative reflects our unwavering commitment to promoting student-centered learning, critical thinking, and problem-solving skills, as envisioned by the National Education Policy (NEP) 2020.

The development of these test items has been a collaborative endeavour involving the expertise and hard work of PGT Geography teachers from across the country. Their dedication and commitment have resulted in a resource that is both pedagogically sound and student-friendly.

I extend my sincere appreciation to Dr. Mamta Singh, Principal, PM Shri Kendriya Vidyalaya CRPF Gandhinagar, who served as the subject coordinator for this initiative. Her leadership and insightful guidance have played a crucial role in shaping this endeavour.

A special word of appreciation to Mr. P. Selvamani, Training Associate (Geography), ZIET Mysore, for his exemplary coordination and administrative support throughout the process. His meticulous planning and organizational efficiency have been vital to the successful completion of this initiative.

This publication is a significant milestone in our ongoing efforts to equip teachers and students with innovative assessment tools. It is my hope that this resource will not only enhance classroom practices but also inspire educators to design similar competency-based assessments that promote holistic learning.

I congratulate the entire team of educators, resource persons, and coordinators for their tireless efforts and unwavering dedication. May this initiative serve as a catalyst for further innovation and excellence in the field of education.

(Menaxi Jain)
Director
ZIET, Mysuru

Message from the Subject Coordinator

It gives me immense pleasure to be part of this significant initiative—the publication of Competency-Based Education (CBE) test items for Class XI Geography. This effort is a step forward in aligning assessment practices with the principles of the National Education Policy (NEP) 2020, aiming to foster higher-order thinking skills and promote real-world application of knowledge among students.

The collaborative contributions of PGT Geography teachers from across the country have culminated in a well-rounded and thoughtfully curated collection of test items. Their dedication, expertise, and hard work deserve heartfelt appreciation. I extend special gratitude to Sh. Varun Kumar Yadav, PGT Geography, PM SHRI Kendriya Vidyalaya CRPF Gandhinagar, and Mr. Deepak Kumar, TGT Computer Instructor, PM SHRI Kendriya Vidyalaya CRPF Gandhinagar, for their invaluable support in reviewing, Editing and finalizing this material.

I would also like to acknowledge the exemplary coordination and support provided by Mr. P. Selvamani, Training Associate (Geography), ZIET Mysore, whose meticulous planning and efforts ensured the smooth and successful execution of this initiative.

It is my sincere hope that this resource will prove to be an effective tool for educators, enabling them to design meaningful and competency-based assessments. I encourage teachers to leverage this publication to create dynamic, engaging, and student-centered learning environments.

Dr. Mamta Singh,
Principal,
PM Shri Kendriya Vidyalaya,
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CHAPTER 1: –

GEOGRAPHY AS A DISCIPLINE

MIND MAP

Importance of Geography
- study the variations and association of the features on the earth surface
- studies the cause-and-effect relationships
- study of the relation between earth and man.
- helps to predict climate and handling natural calamities

GEOGRAPHY AS A DISCIPLINE

Geography as an Integrated Discipline
- It is a discipline of synthesis; it includes spatial and temporal synthesis.
- Its approach is holistic in nature.
- It recognizes the fact that the world is a system of interdependence.

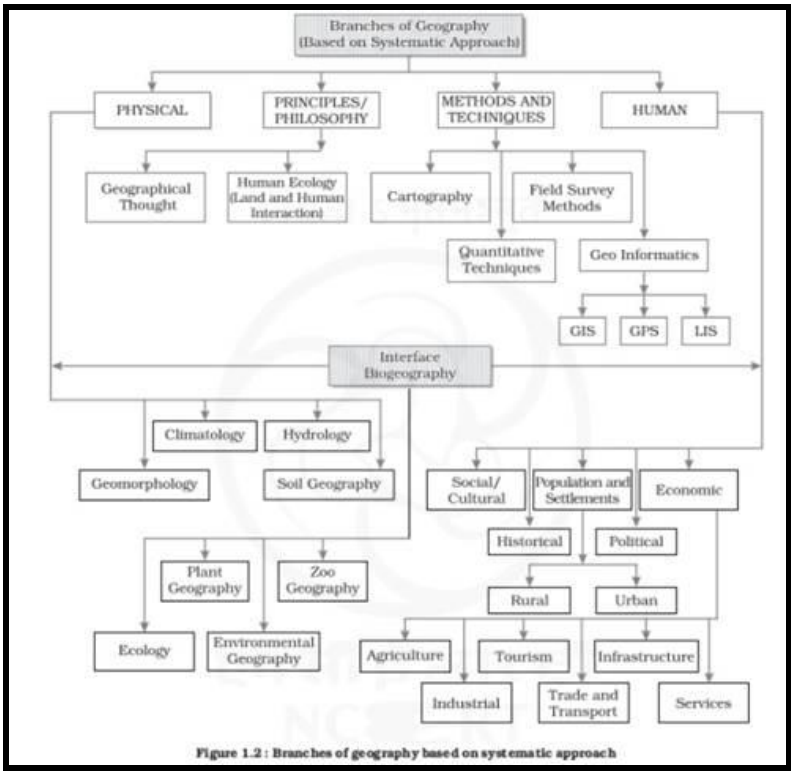


Figure 1.2 : Branches of geography based on systematic approach

PHYSICAL GEOGRAPHY AND ITS IMPORTANCE

- Physical geography includes study of Lithosphere, Atmosphere, Hydrosphere & Biosphere.
- Landforms provide base for agriculture, industries, transport and communication, and settlements.
- Mountains provide water to rivers, forests-centre for tourist spots.
- Climate influences on the cropping pattern, livestock, food and clothes of the people.
- Climate and precipitation influence the type of forests.

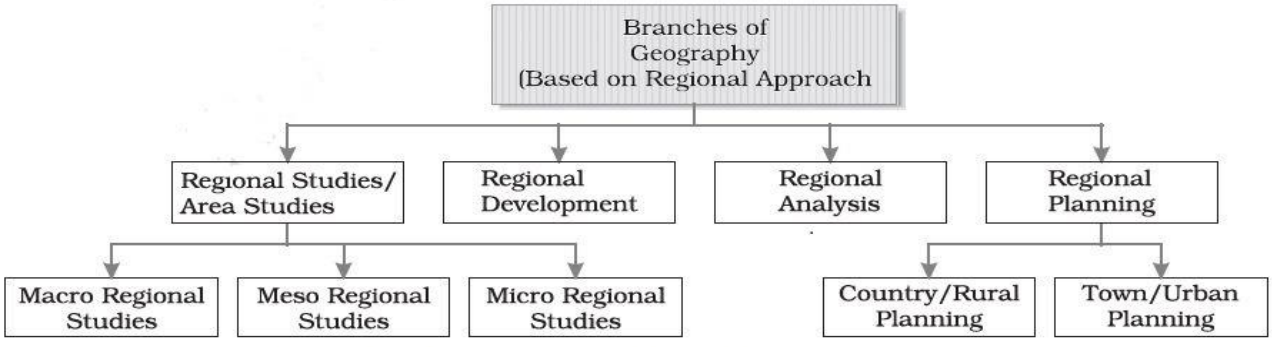
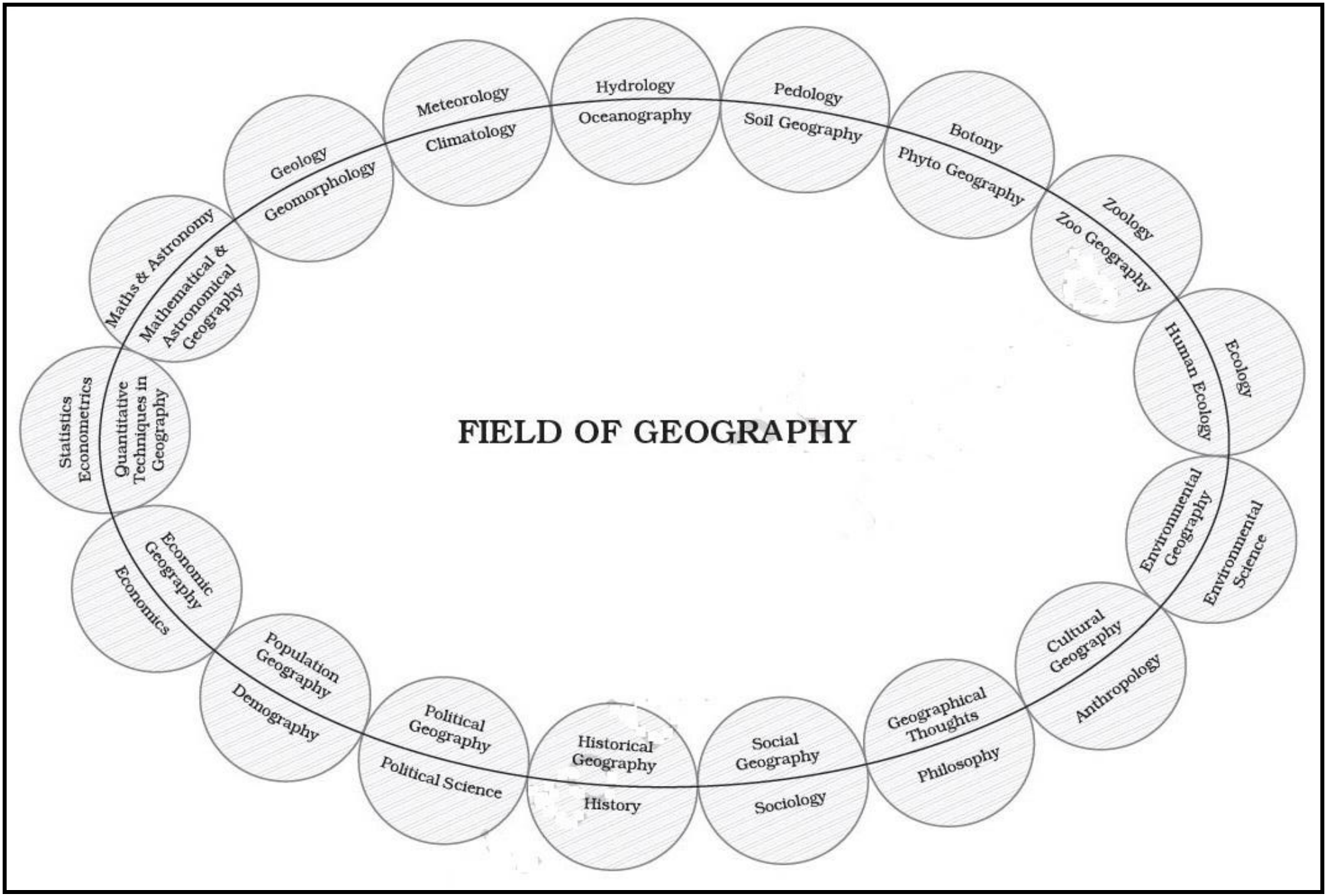


Figure 1.3 : Branches of geography based on regional approach


FIELD OF GEOGRAPHY
Meteorology
Climatology
Hydrology
Oceanography
Pedology
Soil Geography
Botony
Phyto Geography
Zoology
Zoo Geography
Ecology
Human Ecology
Environmental Science
Environmental Geography
Cultural Geography
Anthropology
Geographical Thoughts
Philosophy
Social Geography
Sociology
Historical Geography
History
Political Geography
Political Science
Population Geography
Demography
Economic Geography
Economics
Quantitative Techniques in Geography
Statistics
Econometrics
Mathematical & Astronomical Geography
Maths & Astronomy
Geology
Geomorphology

Fill in the Blanks

1. Geography is a discipline of synthesis which attempts ----------synthesis.
2. All the sciences, whether natural or social, have one basic objective, of----------.
3. _____ helped human beings to move from the stage of necessity to a stage of freedom.
4. _____ a phenomenon is studied world over as a whole, and then the identification of typologies or spatial patterns is done.
5. _____ said that 'geography is concern with the description and explanation of the areal differentiation of the earth's surface'.

Multiple Choice Questions (MCQs)

1. Consider the following example carefully and identify the approach of geography reflected in it.
"A phenomenon is studied world over as a whole, and then the identification of typologies or spatial patterns is done".

A. Welfare approach
B. Regional approach
C. Systematic approach
D. Environmental adaptation

2. Consider the following characteristics and choose suitable title for them from the given options:

I. Dualism is one of the main characteristics of geography which got introduced from the very beginning.
II. In the regional approach, the world is divided into regions at different hierarchical levels.
III. The fertility of the soil is both naturally determined and culturally induced.

Options:

(A) Only I and II are correct
(B) Only I and III are correct
(C) Only II and III are correct
(D) All are correct

3. Which of the following factor is ESSENTIAL for sustainable development?

A. To understand the nature of human being
B. To understand the nature of landforms
C. better understanding of human culture and their habits
D. a better understanding of physical environment

4. Which of the following is NOT a recent development in the field of geography?

A. Explorations of new areas through voyages
B. Transformation of manual cartography into computer cartography
C. Development of GIS and GPS to increase knowledge
D. Availability of extensive information through internet

5. Which of the following factors helped human beings to move from the stage of necessity to a stage of freedom?

A. Technology
B. Laws of nature
C. Literacy level
D. Availability of resources

6. Which of the following forms a correct group?

A. Economic geography, Geomorphology, Historical geography

B. Regional Analysis, Regional planning, Climatology
C. Geomorphology, Climatology, Hydrology, Soil geography
D. Social geography, Regional Development, Population and settlement, Hydrology

7. Which of the following concept is described by most of the scholars in the definition about geography?

A. The Earth as the home of human being only
B. The earth as the abode of plants and animals
C. The earth as the abode of human beings
D. The earth and its cultural and physical features

8. There exist variations over the surface of the earth in its physical as well as cultural environment. This concept in Geography is suitably depicted by which of the following concepts?

A. Spatial distribution
B. Areal differentiation
C. Areal variations
D. Differential relations

9. Under which approach is the world divided into regions at different hierarchical levels and then all the geographical phenomena in a particular region are studied.

(A) Systematic Approach
(B) Physical Approach
(C) Dualism Approach
(D) Regional Approach

10. Which of the following statement is not true with respect to Regional Geography?

(A) This approach was given by Karl Ritter.
(B) In this approach the world is divided into regions at different hierarchical levels.
(C) This approach is the same as that of general geography.
(D) In this approach a region is studied in a holistic manner.

Match the Following

1. Match the List I with List II and choose correct answer with the help of given codes.

LIST I	**LIST II**
I. Geography	i scientific study of the habitats
II. History	ii spatial characteristics and attributes
III. Ecosystem	iii infrastructure and services
IV. Economic geography	iv Temporal synthesis
V. Hydrology	v Realms of water

Options–

	I	II	III	IV	V
a.	v	i	ii	iii	iv
b.	i	v	ii	iv	iii
c.	ii	iv	i	iii	v
d.	I	ii	iii	iv	v

2. Which of the following is NOT matched correctly?

a. Political Geography – Delimitation of constituencies
b. Historical Geography – Temporal changes of geographical phenomena
c. Soil Geography – Cultural elements
d. Geomorphology – Evolution of landforms

- **Assertion and Reasoning**

1. **Assertion (A):** Geography in the twentieth century became a discipline that studied the earth's surface from two perspectives systematic and regional.
   Reason (R Humans remained a central theme in the study of geography
   (A) Both A and R is true and R is the correct explanation of A.
   (B) Both A and R is true but R is NOT the correct explanation of A.
   (C) A is true but R is false.
   (D) A is false and R is true.

2. Assertion (A): A geographer should have some knowledge in mathematics and art, particularly in drawing maps.
Reason (R): Geography is very much linked with astrological studies.
   (A) Both A and R is true and R is the correct explanation of A.
   (B) Both A and R is true but R is NOT the correct explanation of A.
   (C) A is true but R is false.
   (D) A is false and R is true.

3. Assertion (A): Population geography is closely linked with the discipline of demography.
Reason (R): It studies population growth, density, distribution, sex ratio, migration, and occupational structure, etc.
   (A) Both A and R is true and R is the correct explanation of A.
   (B) Both A and R is true but R is NOT the correct explanation of A.
   (C) A is true but R is false.
   (D) A is false and R is true.

4. Assertion (A): Assertion (A): Climate does not influence life of human beings.
   Reason (R): Temperature and precipitation affects density of forests and quality of grassland.
   (A) Both A and R is true and R is the correct explanation of A.
   (B) Both A and R is true but R is NOT the correct explanation of A.
   (C) A is true but R is false.
   (D) A is false and R is true.

<u>Source–Based/Case Study–Based Questions</u>

1. Read the source given below and answer the questions that follow:

Dualism is one of the main characteristics of Geography which got introduced from the very beginning. This dualism depended on the aspect emphasized in the study. Earlier scholars laid emphasis on Physical Geography. But human beings are an integral part of the earth's surface. They are part & parcel of nature. They also have contributed through their cultural development. Thus, developed human geography with emphasis on human activities.

i) Initially geographers laid emphasis on which geography?
(A) Human Geography
(B) Physical Geography
(C) Regional Geography
(D) Systematic Geography

ii) Which of the following is an example of cultural development?
(A) Community

(B) Religion
(C) Establishment of National Parks
(D) Both A and B

iii) What is the main emphasis of human geography?

(A) Physical Change
(B) Natural change
(C) Human activities
(D) All of the Above

2. Read the source given below and answer the questions that follow:

Geography is a discipline of synthesis. It attempts spatial synthesis & history attempts temporal synthesis. Its approach is holistic in nature. It recognizes the fact that the world is a system of interdependencies. It recognises the fact that the world is a system of interdependencies. The present world is being perceived as a global village. The distances have been reduced by better means of transportation increasing accessibility. The audio-visual media and information technology have enriched the data base. Technology has provided better chances of monitoring natural phenomena as well as the economic and social parameters. Geography as an integrating discipline has interface with numerous natural and social sciences. Every discipline, concerned with scientific knowledge is linked with geography as many of their elements vary over space. Geography helps in understanding the reality in totality in its spatial perspective.

i) How would you distinguish between Geography & History?
ii) What is the approach of Geography & how it recognizes the world?

Short Answer Questions

1. How can we say that the earth is 'multidimensional'?

Answer: – Many Sciences developed to describe the physical features of the earth such as Geology, Pedology, Oceanography Botany Zoology and Meteorology etc. & Cultural features of the earth such as Economics, History, Sociology Political Science, Anthropology,

2. How does technology help man?

– to loosen the shackles of the physical conditions.
– to develop resources and utilise them.
– to reach the higher needs of the life. It increased the production of the crops& mobility of labour.

3. Which are the three questions concerned with Geography?

Answer: (i) Some questions are related to the identification of the patterns of natural and cultural features as found over the surface of the earth. These are the questions about **what?**
(ii) Some questions are related to the distribution of the natural and human/ cultural features over the surface of the earth. These are the questions about **where?**
(iii)The third question is related to the explanation or the causal relationships between features and the processes and phenomena. This aspect of geography is related to the question, **why?**

4. Explain the changes occurred in the civilization of man in course of time?

Answer: – Man moved from stage of necessity to stage of freedom.
– Created new possibilities from the nature
– We find now humanized nature and naturalised man
– Space got organized with the help of transport and communication.

5. What are the recent techniques that helped the geographer to understand the earth's surface better?

Answer: GIS and GPS, Computer cartography.

6. What do you mean by "areal differentiation"?

Answer: When there is similarity and dissimilarity among the physical and cultural features on the earth surface, it is called aerial differentiation.

7. Geography is an integrated discipline. How?

Answer: It is a discipline of synthesis; it includes spatial and temporal synthesis. Its approach is holistic in nature. It recognizes the fact that the world is a system of interdependence. The present world is a global village. The efficient transport and communication helped the world to become unified village. The audio-visual media helped the data to be enriched. Technology provided better chances for monitoring natural phenomena as well as the economic and social parameters.

8. What is studied under Biogeography?

Answer: It has emerged as a result of the interface between physical geography and human geography. It has three branches: Plant Geography. Zoo Geography and Ecology.

9. How does Geography differ from other subjects

Answer: Geography differs from other subjects in terms of matter and methodology. Geography derives its data from Social Sciences and Natural Sciences and attempts their synthesis

10. What is the relation between man and nature?

Answer: – Humans are sophisticated and evolved animals who have modified the natural environment to make it suitable for living.
– While human dependency on nature has been decreased over the process of evolution, people still demonstrate many forms of nature contentedness.
– This includes emotional attachment to nature, perception of themselves as a part of nature, and activities aimed at nature protection.
– Human is an integral part of nature and nature has imprints of man.

Critical Thinking and Problem-Solving Questions with Real-Life Situations and Higher Order Thinking Questions (HOTs)

1. Geographers play an important role for a country. How?

Answer: Geographers are important for any country because:
– They study the variations and association of the features on the earth surface e.g. cropping pattern differs from place to place and it is due to difference in the climate, soil, demand, transport facility and capacity of the farmer.
– A geographer also studies the cause-and-effect relationships.
– The interaction between man and nature is highly dynamic and not static; so, it is also called as the study of the relation between unstable earth and untrusting man.

– He helps to predict climate.
– He helps in handling natural calamities.

2. Distinguish between Systematic and Regional approach of Geography.

There are two main approaches to study geography. These are as under: -

Systematic Geography	**Regional Geography**
- This approach was introduced by Alexander Von Humboldt, a German geographer (1769-1859)	- Regional geography approach was developed by Karl Ritter German geographer (1779-1859).
- In systematic approach a phenomenon is studied world over as a whole, and then the identification of typologies or spatial patterns is done.	- In the regional approach, the world is divided into regions at different levels and then all the geographical phenomena in a particular region are studied.
- For ex. if one is interested in studying natural vegetation, the study will be done at the world level as a first step. The typologies such as equatorial rain forests or softwood conical forests or monsoon forests, etc. will be identified, discussed and delimited.	For example, life in Kerala we study about population, area, wildlife, climate etc. in detail about Kerala.

3. Describe the subject-matter of Physical Geography and its importance.

Answer: Physical geography includes study of Lithosphere, Atmosphere, Hydrosphere & Biosphere- each element is very important for human beings.

Landforms provide base for agriculture, industries, transport and communication, and settlements. Mountains provide water to rivers, forests-centre for tourist spots.

Climate influences on the cropping pattern, livestock, food and clothes of the people.

Climate and precipitation influence the type of forests.

Oceans provide food, water transport, and influence the climate; and the source of hydrological cycle.

(i) Geomorphology is devoted to the study of land forms, their evolution and its processes.

(ii) Climatology encompasses the study of structure of atmosphere and elements of weather and climates and climatic types and regions.

(iii) Hydrology studies the realm of water over the surface of the earth including oceans, lakes, rivers and other water bodies and its effect on different life forms including human life and their activities.

4. Physical and human factors both are dynamic not static. Substaintiate

Answer: The geographical phenomena, both the physical and human, are not static but highly dynamic. They change over times as a result of the interactive processes between ever changing earth and untiring and ever-active human beings.

1. Primitive human societies were directly dependent on their immediate environment. Human beings have come to terms with nature through adaptation and modification.

2. The present society has passed the stage of primitive societies, which were directly dependent on their immediate physical environment for sustenance. Present societies have modified their natural environment by inventing and using technology and thus, have expanded the horizon of their operation by appropriate utilisation of the resources provided by nature.

3. With the gradual development of technology, human beings were able to loosen the shackles of their physical environment. Technology helped in reducing the harshness of labour, increased labour efficiency and provided leisure to human beings to attend to the higher needs of life.

4. The space got organised with the help of the means of transportation and communication network. The links (routes) and nodes (settlements of all types and hierarchies) integrated the space and gradually, it got organised.

5. It takes note of the associations and interrelationships between the phenomena over space and interprets them providing explanations for these patterns.

5. On the basis of regional approach, explain different branches of geography?

Answer: Branches of geography based on regional approach:

Regional Studies/Area Studies: It comprises of Macro, Meso and Micro regional studies.

Regional Planning: It comprises of country/rural and town/urban planning.

Regional Development: It deals with the developmental issues of region.

Regional Analysis: There are two aspects which are common to every discipline, these are:

Philosophy

· Geographical thought

· Land and human interaction/Human Ecology.

Methods and techniques

· Cartography including computer cartography.

· Quantitative techniques/statistical techniques.

6. You observe every day in your surroundings that there is variation in natural as well as cultural phenomena. All the trees are not of the same variety. All the birds and animals you see, are different. All these different elements are found on the earth. Can you now argue that geography is the study of "areal differentiation"?

Answer: We observe every day in our surroundings that there is variation in natural as well as cultural phenomena. All the trees are not of the same variety. All the birds and animals we see, are different. All these different elements are found on the earth.

It is right to say that Geography is the study of "areal differentiation" but it will be absolutely wrong to say that geography is the study of only "areal differentiation."

Geography as a discipline is related to space and takes note of spatial characteristics and attributes. It studies the patterns of distribution, location and concentration of phenomena over space and interprets them providing explanations for these patterns.

It takes note of the associations and inter- relationships between the phenomena over space and interprets them providing explanations for these patterns. It also takes note of the associations and inter-relationships between the phenomena resulting from the dynamic interaction between human beings and their physical environment.

Geography helps in understanding the reality in totality in its spatial perspective. Geography, thus, not only takes note of the differences in the phenomena from place to place but integrates them holistically which may be different at other places.

FUNDAMENTALS OF PHYSICAL GEOGRAPHY

CHAPTER: 1 GEOGRAPHY AS A DISCIPLINE

ANSWER KEY

Fill in the Blanks

1. Spatial
2. Understanding the reality
3. Technology
4. Systematic approach
5. Richard Hartshorne

Multiple Choice Questions (MCQs)

1. C. Systematic approach
2. D. All are correct
3. D. A better understanding of physical environment
4. A. Explorations of new areas through voyages
5. A. Technology
6. C. Geomorphology, Climatology, Hydrology, Soil geography
7. C. The earth as the abode of human beings.
8. B. Areal differentiation
9. D. Regional Approach
10. D. In this approach a region is studied in a holistic manner.

Match the following

1. C
2. C

Assertion and Reasoning

1. (B) Both A and R is true but R is NOT the correct explanation of A
2. (B) Both A and R is true but R is NOT the correct explanation of A
3. (A) Both A and R is true and R is the correct explanation of A.
4. (D) A is False but R is True.

Source-Based/Case Study-Based Questions

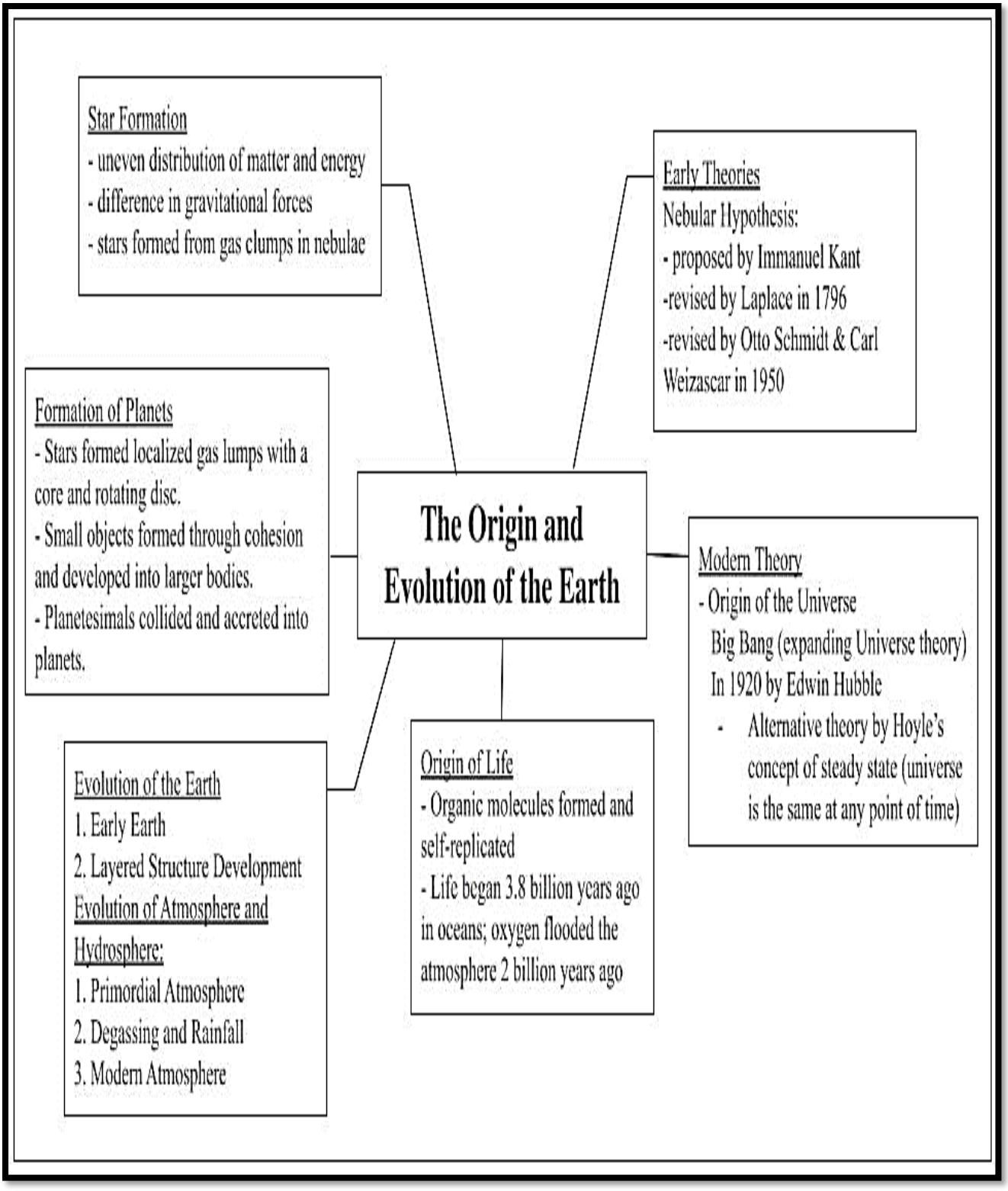
1 i) (B) Physical Geography
ii) (D) Both A and B
iii) (C) Human activities

2. i Geography is a discipline of synthesis. It attempts spatial synthesis & history attempts temporal
synthesis.
ii) Its approach is holistic in nature. It recognizes the fact that the world is a system of interdependencies. It recognises the fact that the world is a system of interdependencies. The present world is being perceived as a global village.

CHAPTER – 2

THE ORIGIN AND EVOLUTION OF THE EARTH

MIND MAP:



FILL IN THE BLANKS:

1. The Nebular Hypothesis was proposed by _____ and later revised by Laplace.
2. The planets and the Sun are believed to have formed from a massive rotating cloud of gas and _____.

3. The event of the Big Bang is estimated to have occurred about _____ billion years ago.
4. An alternative theory to the Big Bang is the _____ theory, which proposed that the universe remains the same over time.
5. The distribution of _____ and energy in the early universe was uneven, leading to the formation of galaxies.
6. The diameter of galaxies ranges between _____ to _____ light years.
7. Planetesimals are small _____ objects that formed during the early stages of planetary development.
8. The process of _____ led to the accumulation of small objects into larger planetary bodies.
9. A rotating _____ of gas and dust forms around the core of a developing star during planetary formation.
10. The early atmosphere of Earth was composed of hydrogen and _____.
11. _____ Winds stripped away the primordial atmosphere of the terrestrial planets.
12. The gases were outpoured from the interior through a process called_____.
13. The composition of the atmosphere was modified by the living world through the process of _____.
14. The process of _____ involves organisms converting sunlight into energy and releasing oxygen.
15. The record of life that existed on the planet Earth in different periods is found in rocks in the form of _____.

MULTIPLE CHOICE QUESTIONS (MCQs):

1. Which theory explains the origin of the universe?
   a) Steady State Theory
   b) Big Bang Theory
   c) String Theory
   d) Nebular Hypothesis

2. What does the Big Bang Theory state about the universe?
   a) It is shrinking.
   b) It is static.
   c) It is expanding.
   d) It will collapse soon.

3. The first stage of atmospheric evolution involved the loss of _____ atmosphere.
   a) Primordial
   b) Present-day
   c) Oxygen-rich
   d) Carbon dioxide

4. Which gas was least present in the early atmosphere of Earth?
   a) Carbon dioxide
   b) Methane
   c) Oxygen
   d) Water vapours

5. The planetesimals were formed by the process of:
   a) Differentiation
   b) Accretion
   c) Degassing
   d) Photosynthesis

6. The earth's interior is composed of layers due to:
   a) Accretion
   b) Differentiation
   c) Nebular cooling
   d) Gas compression

7. What is the approximate distance covered by light in one year?
   a) 300,000 km
   b) 149.6 million km
   c) 9.461 trillion km
   d) 1.5 million km

8. The Earth's oceans were formed within _____ years after its formation.
   a) 1 billion
   b) 500 million
   c) 4 billion
   d) 2 billion

9. Which event increased the oxygen content in the Earth's atmosphere?
   a) Volcanic eruptions
   b) Photosynthesis
   c) Differentiation
   d) Solar winds

10. What marks the last phase in Earth's evolution?
    a) Formation of crust
    b) Origin of life
    c) Evolution of oceans
    d) Loss of primordial atmosphere

MATCH THE COLUMNS:

- **Q. I**

Column A	Column B
1. Big Bang Theory	a. Small bodies forming planets
2. Differentiation	b. Formation of atmosphere
3. Degassing	c. Formation of Layers
4. Planetesimals	d. Expanding universe

- **Q. II**

Column A	Column B
1. Photosynthesis	a. Stripped by solar winds
2. Primordial atmosphere	b. Fossil evidence of evolution
3. Formation of oceans	c. Condensation of water vapor
4. Geological Time Scale	d. Oxygen production

- **Q. III**

Column A	Column B
1. Formation of Stars	a. 4.6 billion years
2. Age of the Earth	b. Formed within 500 million years from the formation of the Earth
3. Formation of oceans	c. Contributed water vapour and gases to the atmosphere
4. Volcanic eruptions	d. 5-6 billion years ago

- **Q. IV**

Column A	Column B
1. Evolution of Life	a. Record of life in rocks
2. Oxygen flooding atmosphere	b. 3,800 million years ago
3.Fossils	c. First forms of life on earth
4.Unicellular bacteria	d. 2000 million years ago

ASSERTION AND REASONS:

1. Assertion (A): The Nebular Hypothesis suggests that planets formed from a rotating cloud of gas and dust.
Reason (R): Gravitational forces did not cause the materials in the cloud to collide and form larger bodies.

A. Both A and R are true, and R explains A.
B. Both A and R are true, but R does not explain A.
C. A is true, but R is false.
D. A is false, but R is true.

2. **Assertion (A):** The Big Bang Theory explains the origin of the universe as a massive expansion of a singularity.
Reason (R): The universe has been expanding since the Big Bang, which occurred approximately 13.7 billion years ago.

A. Both A and R are true, and R explains A.
B. Both A and R are true, but R does not explain A.
C. A is true, but R is false.
D. A is false, but R is true.

3. Assertion (A): Stars form within large clouds of gas called nebulae.
Reason (R): Differences in gravitational forces cause matter in the nebula to clump together and form stars.

A. Both A and R are true, and R explains A.
B. Both A and R are true, but R does not explain A.
C. A is true, but R is false.
D. A is false, but R is true.

4. Assertion (A): Galaxies are collections of stars, gas, and dust held together by gravity.
Reason (R): A galaxy forms from the accumulation of hydrogen gas into a nebula.

A. Both A and R are true, and R explains A.
B. Both A and R are true, but R does not explain A.
C. A is true, but R is false.
D. A is false, but R is true.

5. Assertion (A): Planetesimals are small objects that form during the early stages of planet formation.
Reason (R): Cohesion and collisions among smaller particles lead to the development of planetesimals.

A. Both A and R are true, and R explains A.
B. Both A and R are true, but R does not explain A.
C. A is true, but R is false.
D. A is false, but R is true.

6. Assertion (A): Accretion is the process responsible for forming planets from planetesimals.
Reason (R): Planetesimals are small objects that form during the early stages of planet formation.

A. Both A and R are true, and R explains A.
B. Both A and R are true, but R does not explain A.
C. A is true, but R is false.
D. A is false, but R is true.

7. Assertion (A): The early Earth's atmosphere was dominated by Hydrogen and Oxygen.
Reason (R): Hydrogen and Helium were stripped away by solar winds during Earth's early evolution.

A. Both A and R are true, and R explains A.
B. Both A and R are true, but R does not explain A.
C. A is true, but R is false.
D. A is false, but R is true.

8. Assertion (A): Oceans formed as water vapours condensed and accumulated in surface depressions.
Reason (R): Continuous volcanic eruptions released large amounts of water vapours into the atmosphere.

A. Both A and R are true, and R explains A.
B. Both A and R are true, but R does not explain A.
C. A is true, but R is false.
D. A is false, but R is true.

9. Assertion (A): Photosynthesis by early organisms transformed Earth's atmosphere.
Reason (R): Photosynthesis released oxygen, which eventually became a major component of the atmosphere.

A. Both A and R are true, and R explains A.
B. Both A and R are true, but R does not explain A.

C. A is true, but R is false.
D. A is false, but R is true.

10. Assertion (A): Life on Earth began approximately 3.6 billion years ago.
Reason (R): Chemical reactions in early Earth's oceans formed complex organic molecules that could duplicate themselves converting inanimate matter into living substance.

A. Both A and R are true, and R explains A.
B. Both A and R are true, but R does not explain A.
C. A is true, but R is false.
D. A is false, but R is true.

SOURCE BASED QUESTIONS:

I Origin and Evolution of the Earth

"The most popular argument regarding the origin of the universe is the Big Bang Theory. It is also called expanding universe hypothesis. Edwin Hubble, in 1920, provided evidence that the universe is expanding. As time passes, galaxies move further and further apart. You can experiment and find what does the expanding universe mean. Take a balloon and mark some points on it to represent the galaxies. Now, if you start inflating the balloon, the points marked on the balloon will appear to be moving away from each other as the balloon expands. Similarly, the distance between the galaxies is also found to be increasing and thereby, the universe is considered to be expanding. However, you will find that besides the increase in the distances between the points on the balloon, the points themselves are expanding. This is not in accordance with the fact. Scientists believe that though the space between the galaxies is increasing, observations do not support the expansion of galaxies. So, the balloon example is only partially correct."

Questions:

1. Explain the Big Bang Theory and its alternative name, the expanding universe hypothesis.
2. What evidence did Edwin Hubble provide in 1920, and why is it considered significant?
3. What do scientists believe about the space between galaxies and the expansion of galaxies themselves?

Formation of Planets

"The following are considered to be the stages in the development of planets:
(i) The stars are localised lumps of gas within a nebula. The gravitational force within the lumps leads to the formation of a core to the gas cloud and a huge rotating disc of gas and dust develops around the gas core.
(ii) In the next stage, the gas cloud starts getting condensed and the matter around the core develops into small-rounded objects. These small-rounded objects by the process of cohesion develop into what is called planetesimals. Larger bodies start forming by collision, and gravitational attraction causes the material to stick together. Planetesimals are a large number of smaller bodies.
(iii) In the final stage, these large numbers of small planetesimals accrete to form a few large bodies in the form of planets."

Questions:

1. What role does gravitational force play in the initial stages of planetary development?
2. How does the condensation of gas clouds lead to the formation of planetesimals, and what is their significance?
3. How does the process of accretion contribute to the final formation of planets?

Evolution of the Earth

"The earth was mostly in a volatile state during its primordial stage. Due to gradual increase in density, the temperature inside increased. As a result, the material inside started getting separated depending on their densities. This allowed heavier materials (like iron) to sink towards the centre of the earth and the lighter ones to move towards the surface. With the passage of time, it cooled further and solidified, condensing into a smaller size. This later led to the development of the outer surface in the form of a crust. During the formation of the moon, due to the giant impact, the earth was further heated up. It is through the process of differentiation that the earth-forming material got separated into different layers. Starting from the surface to the central parts, we have layers like the crust, mantle, outer core, and inner core. From the crust to the core, the density of the material increases."

Questions:

1. Describe the primordial state of the earth and how density changes affected its structure.
2. How did the separation of materials based on density lead to the formation of the earth's layers?
3. What role did the formation of the moon play in the earth's evolution, and how did it affect its heating?
4. Explain the process of differentiation and its significance in the earth's layered structure.
5. How does the density of materials change from the crust to the core, and what does this indicate about the earth's composition?

SHORT ANSWER TYPE QUESTIONS:

1. What is the Nebular Hypothesis, and who proposed it?
2. Describe the role of hydrogen and helium in the early solar nebula.
3. How does the expansion of the universe relate to the distances between galaxies?
4. What are planetesimals, and how do they form?
5. Describe the process by which planets evolve from a nebula.
6. How did the earth transform from a gas cloud to a solid structure?
7. How did the earth's interior contribute to the evolution of the atmosphere?
8. Describe the process of differentiation in the earth's structure.
9. How did water bodies like oceans form on the early earth?
10. What are the key differences between the primordial atmosphere and the present atmosphere?

LONG ANSWER TYPE QUESTIONS:

1. Discuss the Big Bang Theory, including its stages and significance in understanding the origin of the universe.
2. Describe the evolution of the earth's lithosphere, including the processes that led to its layered structure.

3. Discuss the significance of volcanic activity and degassing in shaping the earth's atmosphere and hydrosphere.
4. How did the earth transition from a barren, rocky object to one capable of supporting life?
5. Describe the formation and evolution of earth's oceans, including their role in the development of early life forms.

HIGH ORDER THINKING SKILL QUESTIONS (HOTS)/CRITICAL THINKING:

1. If the universe is expanding, how might this affect the long-term evolution of galaxies and planetary systems? Discuss the implications on the life cycle of stars.
2. If the steady-state theory had been correct, how would our understanding of cosmic evolution differ from the Big Bang model?
3. How would the planet formation process differ if the composition of the solar nebula had been primarily heavy elements instead of hydrogen and helium?
4. Evaluate the role of volcanic activity in shaping the earth's atmosphere. Could life have emerged without this process?
5. If earth's primordial atmosphere had not been stripped away, how might this have impacted the evolution of its current atmosphere and hydrosphere?

THE ORIGIN AND EVOLUTION OF THE EARTH

ANSWER KEY

Q. No.	ANSWERS
	FILL IN THE BLANKS (1X15)
1	Immanuel Kant
2	Dust
3	13.8
4	Steady State
5	Matter
6	80,000 to 1,50,000
7	Rounded
8	Accretion
9	Disc
10	Helium
11	Solar
12	Degassing
13	Photosynthesis
14	Photosynthesis

15	Fossils
Q. No.	MULTIPLE CHOICE QUESTIONS (1X10)
1	Big Bang
2	It is Expanding
3	Primordial
4	Oxygen
5	Accretion
6	Differentiation
7	9.461 x 10^12 km
8	500 million
9	Photosynthesis
10	Origin of life
Q. No.	MATCH THE COLUMNS (2x4)
1	1-d, 2-c, 3-b, 4-a
2	1-d, 2-a, 3-c, 4-b
3	1-d, 2-a, 3-b, 4-c
4	1-b, 2-d, 3-a, 4-c
Q. No.	ASSERTION AND REASON (1X10)
1	C) A is true, R is false
2	A) Both A and R are true, and R explains A
3	A) Both A and R are true, and R explains A
4	B) Both A and R are true, but R does not explain A
5	A) Both A and R are true, and R explains A
6	B) Both A and R are true, but R does not explain A
7	D) A is false, but R is true
8	A) Both A and R are true, and R explains A
9	A) Both A and R are true, and R explains A
10	D) A is false, but R is true
Q. No.	SOURCE BASED QUESTIONS

I	The Big Bang Theory, also known as the expanding universe hypothesis, suggests that the universe originated from a massive explosion and has been expanding ever since. In 1920, Edwin Hubble provided evidence that the universe is expanding. He observed that galaxies move further and further apart over time, which supports the idea of an expanding universe. Scientists believe that the space between galaxies is increasing, but observations do not support the idea that the galaxies themselves are expanding.
II	Gravitational force within the localized lumps of gas in a nebula leads to the formation of a core to the gas cloud. This results in the development of a huge rotating disc of gas and dust around the core. The gas cloud starts condensing, and the matter around the core develops into small-rounded objects. These objects, through the process of cohesion, develop into planetesimals, which are small bodies that serve as the building blocks for the formation of larger planetary bodies through collisions and gravitational attraction. Accretion involves the accumulation of large numbers of small planetesimals, which collide and stick together due to gravitational forces. This leads to the formation of a few large bodies, which eventually become planets.
III	The earth was in a volatile state during its primordial stage. Gradual increases in density caused the internal temperature to rise, leading to the separation of materials based on their densities. Heavier materials, such as iron, sank toward the center of the earth, while lighter materials moved toward the surface. Over time, this process led to the formation of distinct layers such as the crust, mantle, outer core, and inner core. The formation of the moon, caused by a giant impact, further heated the earth. This additional heat contributed to the differentiation process that helped separate earth-forming materials into different layers. Differentiation is the process through which materials inside the earth are separated based on their densities. This process resulted in the development of layers like the crust, mantle, outer core, and inner core, each with distinct properties. The density of materials increases from the crust to the core, indicating that the core consists of heavier elements like iron, while lighter materials make up the crust and mantle.
Q. No.	SHORT ANSWER TYPE QUESTIONS (3x10)
1	The Nebular Hypothesis suggests that planets formed from a cloud of material associated with a youthful sun, which was slowly rotating. This hypothesis was first proposed by Immanuel Kant and later revised by mathematician Laplace in 1796.
2	In the early solar nebula, hydrogen and helium were the primary components. They formed a large rotating disk of gas and dust around the youthful sun. These gases played a crucial role in the formation of the planets through the processes of collision, friction, and accretion.
3	The expansion of the universe means that the space between galaxies increases over time.

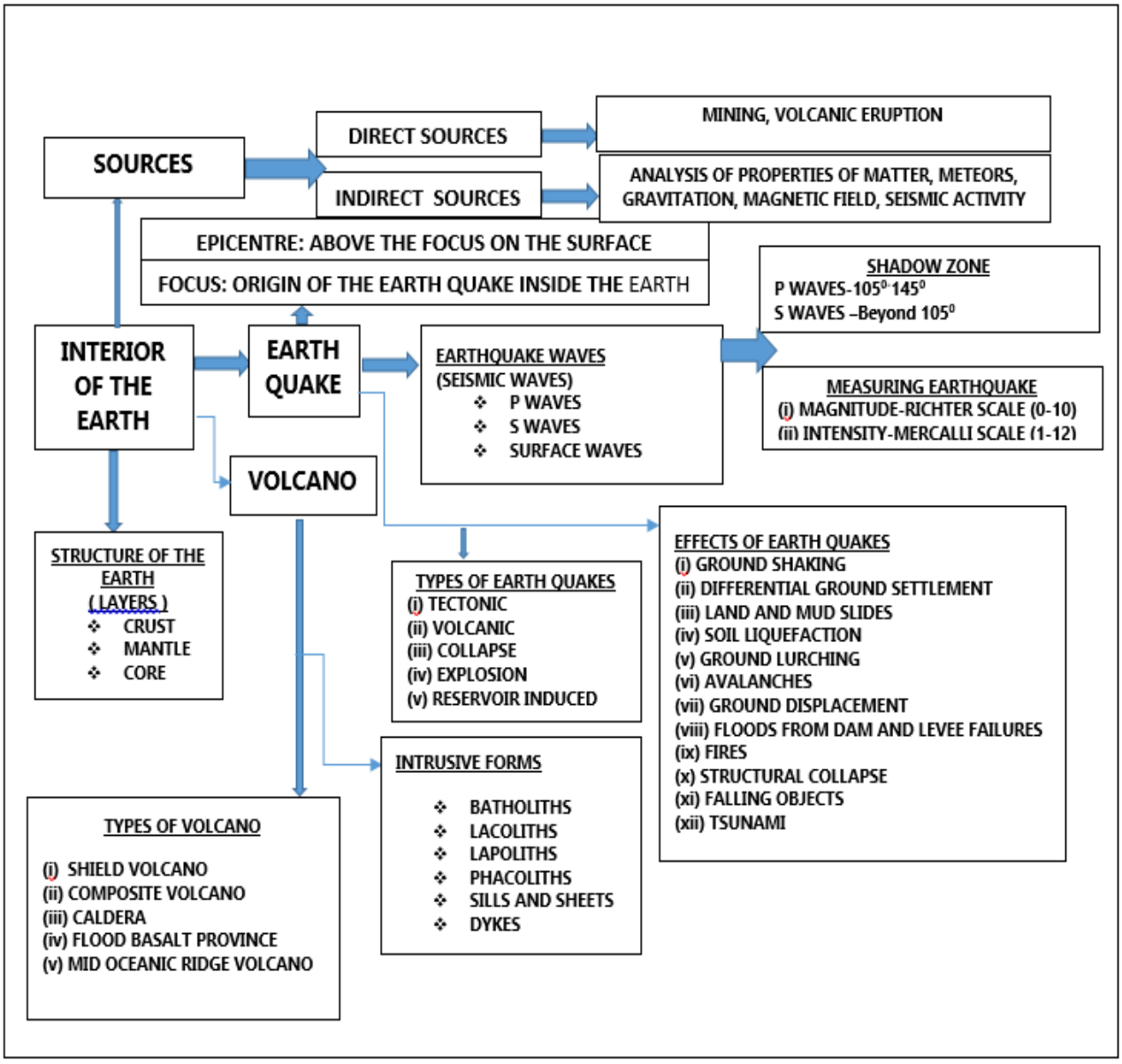
	Edwin Hubble provided evidence of this phenomenon in 1920, demonstrating that galaxies are moving further apart as the universe expands.
4	Planetesimals are small, rounded objects formed during the condensation of the gas cloud around the core of a nebula. Through cohesion and collisions, these small bodies develop into larger structures, eventually leading to the formation of planets.
5	Planets form through a series of stages: localized lumps of gas within a nebula create a rotating disc around a gravitational core. The gas and dust condense to form small planetesimals. Over time, these planetesimals collide and stick together through accretion, resulting in the formation of planets.
6	The earth initially existed as a volatile gas cloud. Due to gradual increases in density, the temperature inside the earth rose, leading to the separation of materials based on their densities. Heavier materials, such as iron, sank toward the core, while lighter materials moved to the surface. Over time, the earth cooled and solidified into its current form.
7	The hot interior of the earth released gases through volcanic activity, contributing to the evolution of the atmosphere. This process, known as degassing, released water vapours, carbon dioxide, nitrogen, and other gases, forming the early atmosphere.
8	Differentiation is the process by which the earth's materials separate based on their densities. Heavier materials like iron sank toward the core, while lighter materials rose to form the crust. This process led to the formation of distinct layers: the crust, mantle, outer core, and inner core.
9	Water vapours released during volcanic eruptions condensed as the earth cooled. The condensed water accumulated in surface depressions, forming oceans. This process occurred within 500 million years of the earth's formation.
10	The primordial atmosphere consisted mainly of hydrogen and helium, which were stripped away by solar winds. The present atmosphere, contributed by volcanic activity and photosynthesis, contains primarily nitrogen and oxygen
Q. No.	LONG ANSWER TYPE QUESTIONS (5x5)
1	The Big Bang Theory explains the origin and expansion of the universe. All matter was concentrated in a "tiny ball" with infinite density and temperature. Approximately 13.7 billion years ago, this ball exploded violently, causing rapid expansion. Energy transformed into matter, and within three minutes, the first atoms formed. By 300,000 years, the universe cooled to 4,500 K, becoming transparent and allowing atomic matter to develop.

	Edwin Hubble's observations in 1920 confirmed the universe's expansion, showing galaxies moving apart.
2	The earth was initially in a volatile state with high internal temperatures. Gradual increases in density caused heavier materials like iron to sink towards the center. Lighter materials rose to the surface, forming distinct layers. The process of differentiation resulted in the core, mantle, and crust. Over time, the earth's surface cooled, solidifying into a stable lithosphere. The lithosphere evolved into a rigid outer layer that supports tectonic activity.
3	Volcanic activity released gases like water vapor, carbon dioxide, and nitrogen during earth's early stages. This process, known as degassing, contributed to forming the primordial atmosphere. Water vapours condensed as the earth cooled, leading to the formation of oceans. Carbon dioxide dissolved in rainwater, reducing atmospheric temperatures further. Continuous volcanic eruptions maintained the supply of gases for atmosphere and hydrosphere development. These processes laid the foundation for a stable climate conducive to life.
4	The earth was initially rocky and barren, with a thin atmosphere of hydrogen and helium. Volcanic activity released gases, forming a new atmosphere rich in water vapours, carbon dioxide, and nitrogen. Cooling allowed water vapours to condense, forming oceans within depressions. Oceans became habitats for early life, evolving from chemical reactions. Photosynthesis by microorganisms increased oxygen levels in the atmosphere. This transformation created a life-supporting environment over millions of years.
5	Water vapours released during volcanic activity condensed as the earth cooled. Rainwater collected in surface depressions, forming oceans within 500 million years of earth's formation. Oceans became stable reservoirs of water, enabling chemical reactions necessary for life. Early microorganisms thrived in oceans, contributing to oxygen production via photosynthesis. Oceans supported biodiversity and became the cradle of life for billions of years. Their role in regulating temperature and climate enabled complex life to evolve.
Q. No.	HOTS/CRITICAL THINKING

1	As the universe expands, the distance between galaxies continues to grow, reducing gravitational interactions between them. The dispersion of matter across vast distances may slow the process of star formation over time. Within galaxies, local gravitational forces remain strong, keeping planetary systems stable. The expansion implies that over billions of years, the universe may become a darker place as existing stars burn out, and fewer new stars are born. Planetary systems around stars will not be directly affected by expansion, as they are bound by the strong local gravity of their host stars. Ultimately, the long-term evolution could lead to an era where galaxies grow dimmer, and the universe transitions into a state dominated by faint remnants of stars like white dwarfs, neutron stars, and black holes.
2	The steady-state theory suggests the universe has no beginning or end and maintains a constant density through the continuous creation of matter. This theory contradicts observations of the cosmic microwave background radiation, which supports the Big Bang model. If the steady-state theory were correct, we would not observe redshift in galaxies, as it implies no universal expansion. The finite age of the universe, as predicted by the Big Bang model, would not apply, and the universe would be eternal. Cosmic evolution would lack an initial singularity, and the origin of elements and stars would require alternative explanations.
3	Heavy elements would make the nebula denser, accelerating gravitational collapse. Planetesimals would form faster due to the increased availability of solid materials. Gas giants like Jupiter and Saturn would likely not form, as hydrogen and helium are their primary components. Terrestrial planets might develop larger cores with denser atmospheres due to the dominance of heavy elements. The distribution of planetary masses would be skewed, with fewer gas-rich bodies and more rocky planets.
4	Volcanic activity released gases like water vapours, carbon dioxide, and nitrogen, forming Earth's early atmosphere. These gases contributed to the development of the hydrosphere as water vapours condensed into oceans. Continuous eruptions replenished atmospheric components and provided heat energy for chemical reactions. Life depended on the chemical environment created by volcanic activity. Without volcanic activity, the atmosphere and hydrosphere would not have formed, making life unlikely
5	The primordial atmosphere, rich in hydrogen and helium, was unsuitable for life. Stripping by solar winds allowed volcanic degassing to create a secondary atmosphere containing water vapours, carbon dioxide, and nitrogen. Retention of the primordial atmosphere would have prevented the formation of oceans and an oxygen-rich environment. Life as we know it would not have evolved due to the lack of essential atmospheric components like oxygen and stable hydrospheric conditions

CHAPTER 3

INTERIOR OF THE EARTH



FILL IN THE BLANKS:

1. When the lava makes its way through cracks and the fissures, developed in the land, it solidifies almost perpendicular to the ground. It gets cooled in the same position to develop a wall-like structure. Such structures are called----------.

2. The mantle contains a weaker zone called ----------. It is from this that the molten rock materials find their way to the surface.

3. Though the actual quake activity lasts for a few seconds, its effects are devastating provided the magnitude of the quake is more than ---------- on the Richter scale.

4. ---------- is a large body of magmatic material that cools in the deeper depth of the crust develops in the form of large domes.

5. ----------waves are the type of earthquake waves last to report on seismograph.

MULTIPLE CHOICE QUESTIONS (MCQS)

6. Which of the following statement is the most appropriate reason of earthquake waves developing a shadow zone?

(a) Composition of material in the shadow zone is impermeable.
(b) The body waves (p and s waves) follow the Snell's law when they pass from one medium to another and hence deflect from the path.
(c) Secondary waves do not pass through liquid medium (outer core).
(d) Both (b) and (c).

7. Seismic activity is one of the most important sources of information about the interior of the earth. Choose the correct statement(s) regarding the nature of p and s waves:

(a) Both P and S waves can travel only in solid and gaseous mediums.
(b) P waves speed is highest in solid medium.
(c) Shadow zone of S waves form the boundary of outer core as it is in liquid state.
(d) Both (b) and (c)

8. How do meteorites contribute to our understanding of the Earth's interior?

(a) The material that becomes available for analysis from meteors, is from the interior of the earth.
(b) They provide information about volcanic activity
(c) The material and the structure observed in the meteors are similar to that of the earth.
(d)They help in understanding seismic wave behaviour.

9. Consider the various sources of information about the interior of the earth:

1. Seismic Activity
2. Volcanoes
3. Gravitational force
4. Magnetic field
5. Meteors
6. Surface Rocks

Which one of the above sources are indirect source of information about the Interior of the Earth?

(a) 1, 3, 4 and 5
(b) 1, 2, 3 and 5
(c) 6 only
(d) All of the above

10. Which of the following sources provides the most direct evidence about the composition of the Earth's mantle?

(a) Seismic waves
(b) Meteorites

(c) Volcanic eruptions
(d) Gravitational studies

11. Identify the incorrect statement.
(a) Different types of earthquake waves travel in same manner.
(b) P-waves vibrate parallel to the direction of the wave.
(c) The direction of vibrations of S-waves is perpendicular to the wave direction in the vertical plane.
(d) Surface waves are considered to be the most dangerous.

12. Hawaiian volcanoes are famous examples of:
(a) Flood basalt province
(b) Shield volcanoes
(c) Composite volcanoes
(d) Caldera

13. Earth quakes are generated due to sliding of rocks along a fault plane. Identify the type of earth quakes.
(a) Collapse Earthquakes
(b) Tectonic Earthquakes
(c) Volcanic Earthquakes
(d) Explosion Earthquakes

14. Identify the incorrect statement.
(a) Velocity of earthquake waves changes as they travel through materials with different densities.
(b) The denser the material, the lower is the velocity.
(c) Their direction also changes as they reflect or refract when coming across materials with different densities
(d) None of the above

15. -------- causes waves to rebound whereas ------- makes waves move in different directions.
(a) Refraction, Reflection
(b) Reflection, Refraction
(c) Absorption, Resonance
(d) Resonance, Absorption

16. Consider the following statements and identify the statement associated with P- waves.
(a) These waves move along the surface of the earth.
(b) They create density differences in the material leading to stretching and squeezing of the material.
(c) They create troughs and crests in the material through which they pass.
(d) are considered to be the most damaging waves.

17. Consider the following statements regarding layered structure of earth:
1. Inner Core is the densest layer of earth's interior.
2. Continental crust is thicker than the oceanic crust.

Choose the correct statements?

a) Only 1

b) Only 2

c) Both 1 and 2

d) None of the above

MATCH THE FOLLOWING

18. **Match the following and choose the correct option.**

A P -Waves	1. They cause displacement of rocks, and hence, the collapse of structures occurs.
B. S-Waves	2. They travel through gaseous, liquid and solid materials.
C. Surface Waves	3. They can travel only through solid materials.

(a) A-2, B-3, C-1

(b) A-3, B-2, C-1

(c) A-1, B-2, C-3

(d) A-2, B-1, C-3

19. Which of the following pair is NOT correctly matched?

(a) Shield Volcanoes	These volcanoes become explosive if somehow water gets into the vent.
(b) Composite Volcanoes	These volcanoes outpour highly fluid lava that flows for long distances.
(c) Caldera	They are usually so explosive that when they erupt they tend to collapse on themselves rather than building any tall structure.
(d) Flood Basalt Provinces	The Deccan Traps from India, presently covering most of the Maharashtra plateau, are a much larger flood basalt province.

20. **Following columns are related to intrusive forms. Which column is matched correctly?**

(a) Batholiths	When the lava moves upwards, a portion of the same may tend to move in a horizontal direction and it develops into a saucer shape, concave to the sky body,
(b) Dykes	A large body of magmatic material that cools in the deeper depth of the crust develops in the form of large domes
(c) Lacoliths	These are large dome-shaped intrusive bodies with a level base and connected by a pipe-like conduit from below.
(d) Lapoliths	When the lava makes its way through cracks and the fissures developed in the land, it solidifies almost perpendicular to the ground.

21. The following components are associated with one of the Earth's layer. Make the correct pair:

Components	Earth's layer
A. Silica and aluminium (SIAL)	1. Mantle
B. Silica and magnesium (SIMA)	2. Core
C. Nickel and Iron (NIFE)	3. Crust

Options:
(a) A-2, B-3, C-1
(b) A-3, B-1, C-2
(c) A-1, B-2, C-3
(d) A-2, B-1, C-3

22. Which of the following are correctly matched?

1.Lithosphere	Crust and the uppermost part of the mantle.
2. Shadow zone	Upper portion of the mantle.
3. Asthenosphere	NIFE layer

Choose the correct answer:
(a) Only 1
(b) Only 2
(c) Both 1 and 3
(d) All are correctly matched.

ASSERTION AND REASONING

23. Assertion (A): S- waves create troughs and crests in the material through which they pass.
Reason (R): The direction of vibrations of S-waves is perpendicular to the wave direction in the vertical plane.
(a) A and R are true and R is the correct explanation of A.
(b) A and R true but R is not the correct explanation of A.
(c) A is false but R is true.
(d) A is true but R is false.

24. Assertion (A): The outer core of the earth's interior is in liqud state while the inner core is in solid state.
Reason (R): The p-waves disappear in outer core while S-waves penetrate up to the inner core.
(a) A and R are true and R is the correct explanation of A.
(b) A and R true but R is not the correct explanation of A.
(c) A is false but R is true.
(d) A is true but R is false.

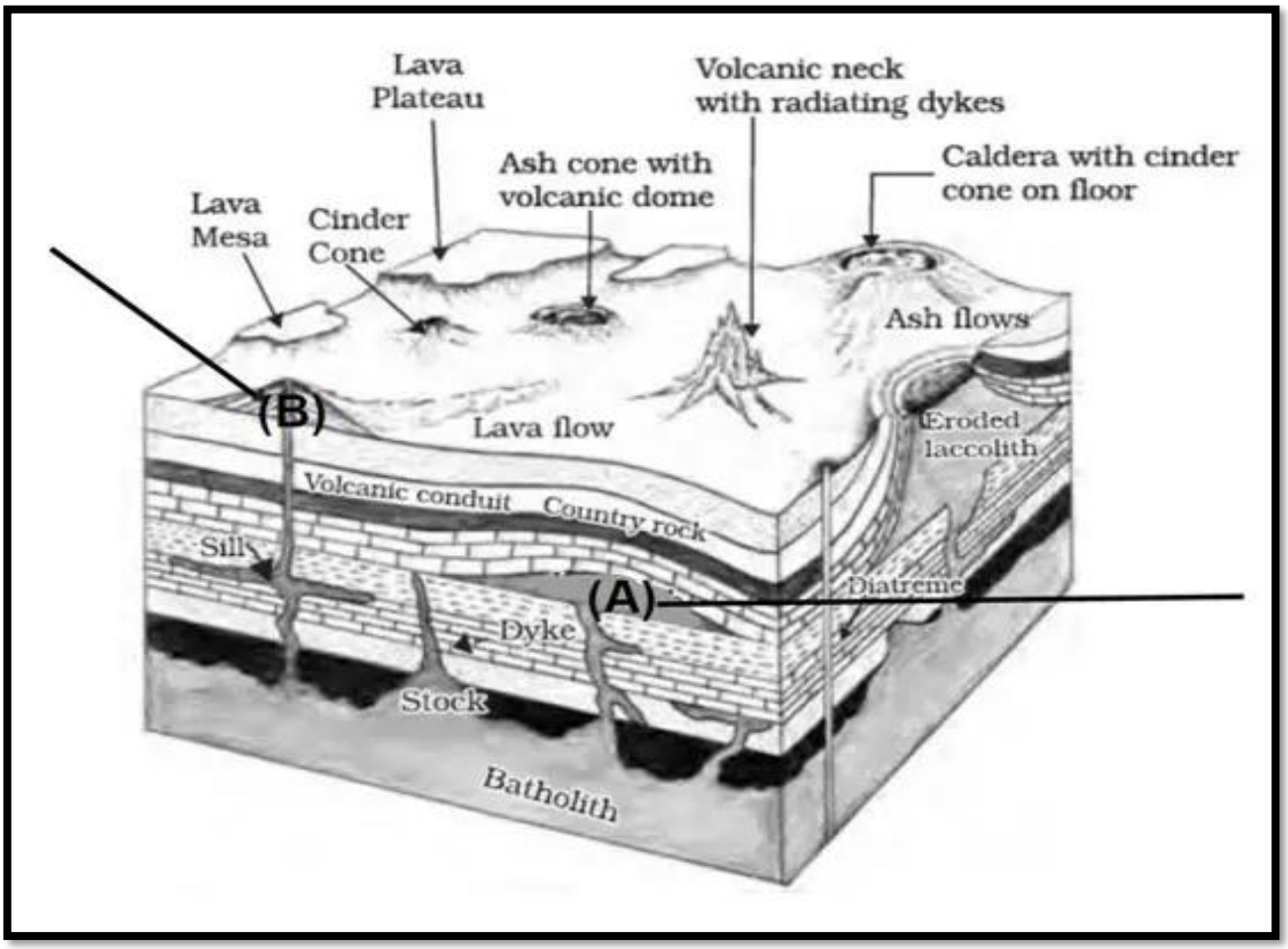
25. Assertion (A) The upper portion of the mantle is called asthenosphere.
Reason (R) Asthenosphere is the main source of magma.
(a) A and R are true and R is the correct explanation of A.
(b) A and R true but R is not the correct explanation of A.
(c) A is false but R is true.
(d) A is true but R is false.

26. Assertion (A): Shield volcanoes are not very steep.
Reason(R): These volcanoes are mostly made up of basalt, a type of lava that is very fluid when erupted.
(a) A and R are true and R is the correct explanation of A.
(b) A and R true but R is not the correct explanation of A.
(c) A is false but R is true.
(d) A is true but R is false.

27. Assertion (A): The configuration of the surface of the earth is largely a product of the processes operating in the interior of the earth.
Reason(R): Exogenic as well as endogenic processes are constantly shaping the landscape
(a) A and R are true and R is the correct explanation of A.
(b) A and R true but R is not the correct explanation of A.
(c) A is false but R is true.
(d) A is true but R is false.

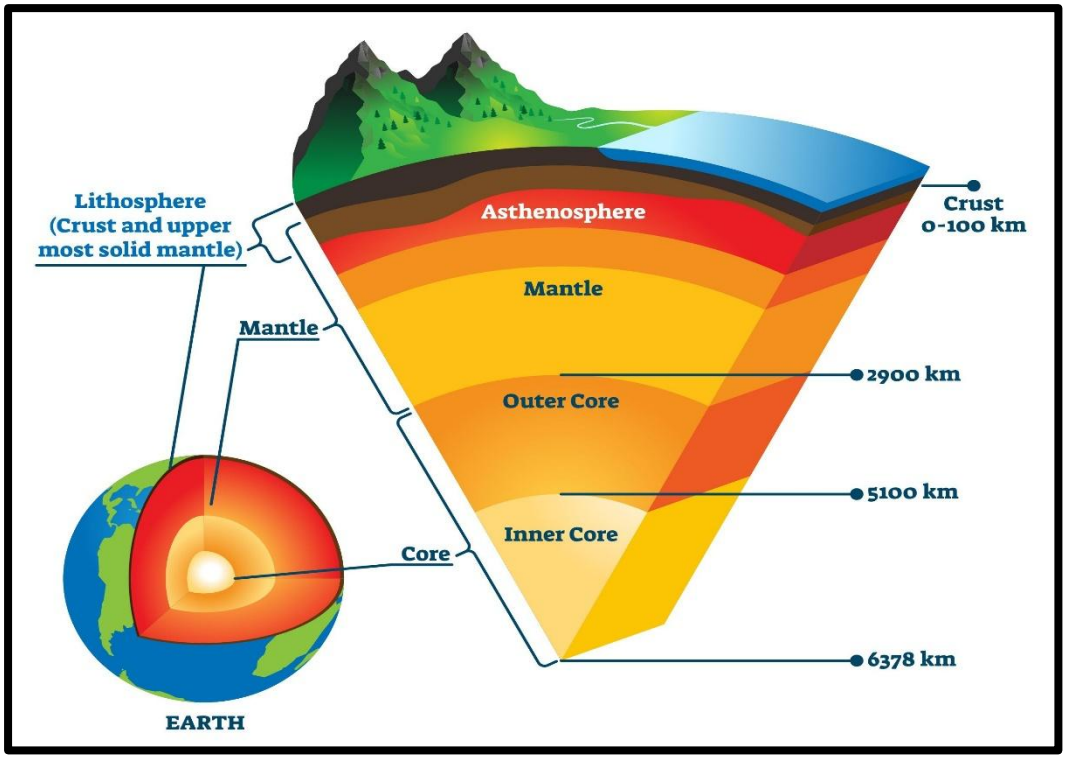
DIAGRAM BASED QUESTION

28. Identify the features marked as A and B in the given diagram:



(a) Lapolith and cinder cone
(b) Batholith and Caldera
(c) Lacolith and Composite Volcano
(d) Dykes and Shield volcano

29. Read the diagram and answer the following questions:



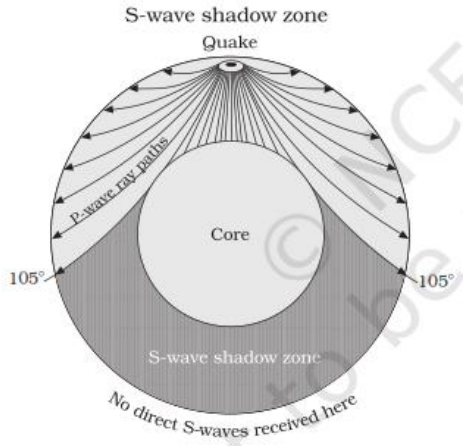
29.1. Which of the following is the thinnest part of Earth's interior?
(a) Core
(b) Oceanic crust
(c) Continental crust
(d) Mantle

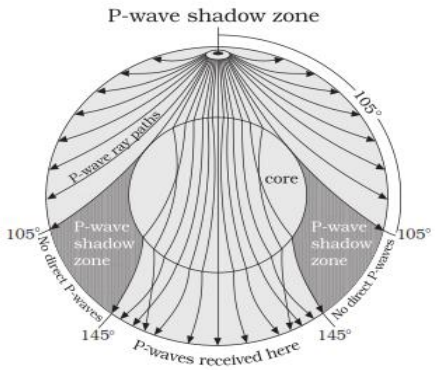
29.2 Which of the following separates the crust and mantle ?
(a) Gutenberg discontinuity
(b) Moho discontinuity
(c) Conrad discontinuity
(d) Lehman discontinuity

29.3 What is the main source of magma inside earth surface?
(a) Core
(b) Crust
(c) Asthenosphere
(d) Magnetosphere

29.4 Which of the following layers is known as NiFe?
(a) Mantle
(b) Continental crust
(c) Oceanic crust
(d) Core

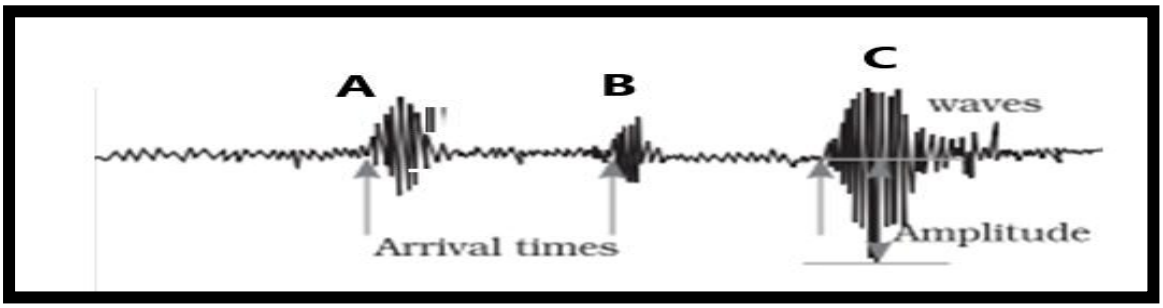
30. Earthquake shadow zones are very important source of information about the materials inside the earth. Read the figures and answer the following questions.





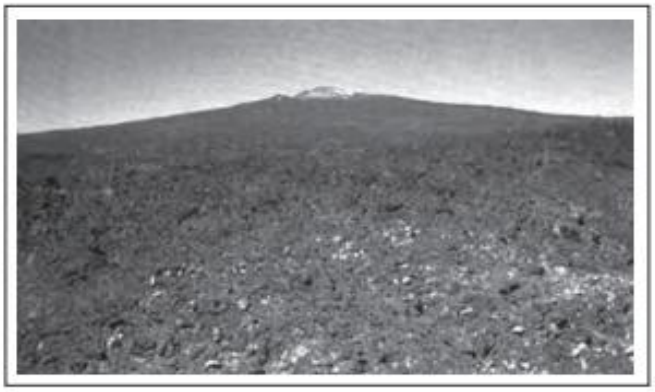
1. What do you mean by the term Shadow zone of an earthquake?
2. What is the shadow zone of S-waves? How does it help to know about the interior of the earth?

31. Identify the type of seismic waves marked by the letters- A,B and C

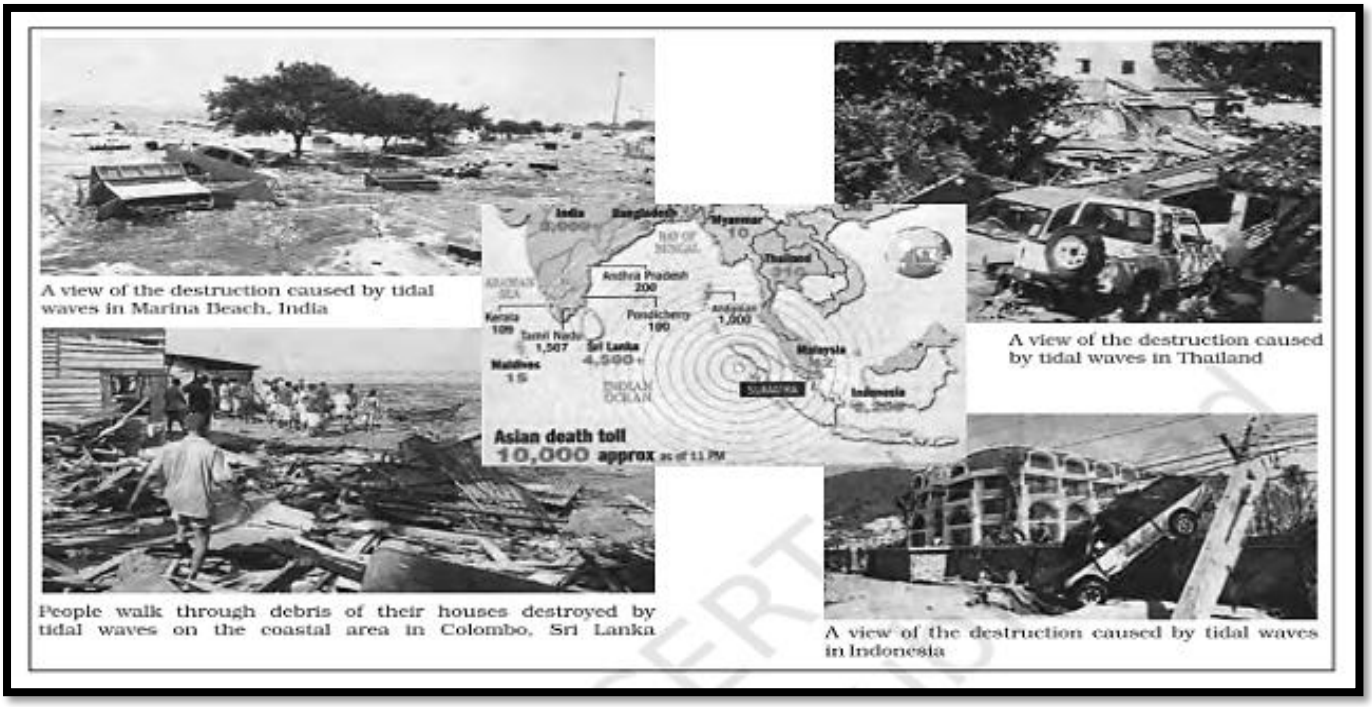


32. Identify the type of volcano depicted with the help of information provided.

32.1		These volcanoes are mostly made up of basalt, a type of lava that is very fluid when erupted.

32.2		It develops as the upcoming lava moves in the form of a fountain and throws out the cone at the top of the vent .
332.3		These volcanoes are characterised by eruptions of cooler and more viscous lavas than basalt.

33. Read the collage and answer the following.

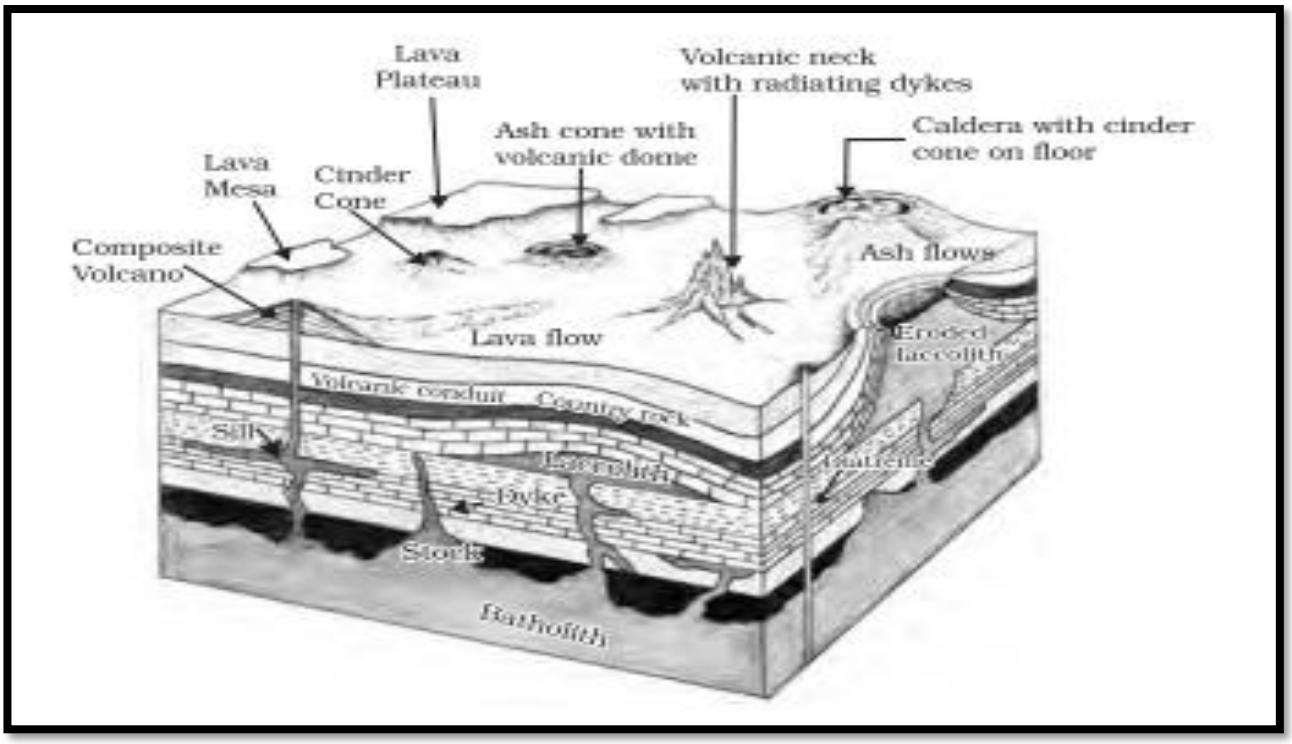


33.1. Name the natural hazard that led to this disaster.

33.2. Mention the year of this disaster.

33.3 Name any two countries worstly hit by the hazard.

34. Read the picture and answer the following questions:

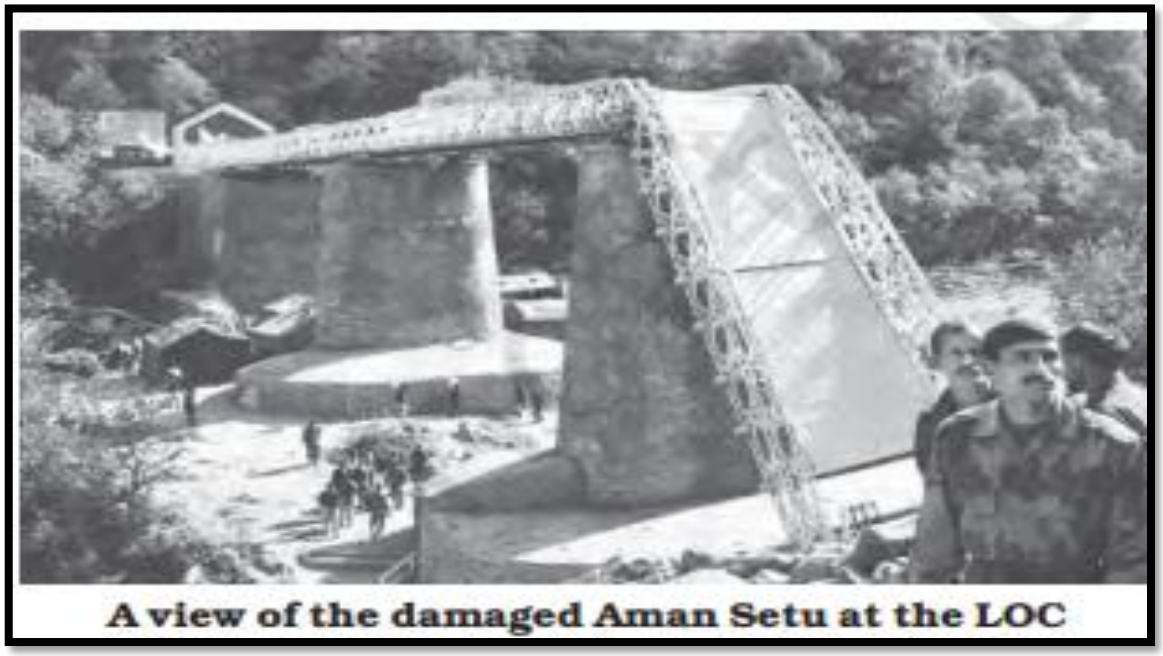


34.1. Name the type of landform shown in the picture.

34.2. How is it formed?

34.3. What are the two types of rocks formed by this process?

35. **Aman Setu (Bridge of Peace) is a bridge located in the borders of India and Pakistan. It is a friendship bridge between India and Pakistan. The bridge was damaged in 2005 by a natural hazard.**



A view of the damaged Aman Setu at the LOC

35.1 Mention the name of the natural hazard damaged Aman Setu.

35.2. Where is Aman Setu located? Mention the name of the town and the Union Territory.

<u>SOURCE BASED QUESTIONS</u>:

36.Read the following passage and answer the questions that follow:

The most easily available solid earth material is surface rock or the rocks we get from mining areas. Gold mines in South Africa are as deep as 3 – 4 km. Going beyond this depth is not possible as it is very hot at this depth. Besides mining, scientists have taken up a number of projects to penetrate deeper depths to explore the conditions in the crustal portions, scientists world over are working on two major projects such as "Deep Ocean Drilling Project" and "Integrated Ocean Drilling Project". The deepest drill at Kola, in Arctic Ocean, has so far reached a depth of 12 km. This and many deep drilling projects have provided large volume of information through the analysis of materials collected at different depths.

Volcanic eruption forms another source of obtaining direct information. As and when the molten material (magma) is thrown onto the surface of the earth, during volcanic eruption it becomes available for laboratory analysis. However, it is difficult to ascertain the depth of the source of such magma. Analysis of properties of matter indirectly provides information about the interior .Another source of information are the meteors that at times reach the earth. However, it may be noted that the material that becomes available for analysis from meteors, is not from the interior of the earth The other indirect sources include gravitation, magnetic field, and seismic activity. The gravitation force (g) is not the same at different latitudes on the surface. It is greater near the poles and less at the equator. This is because of the distance from the centre at the equator being greater than that at the poles. The gravity values also differ according to the mass of material. The uneven distribution of mass of material within the earth influences this value. The reading of the gravity at different places is influenced by many other factors. These readings differ from the expected values. Such a difference is called gravity anomaly. Gravity anomalies give us information about the distribution of mass of the material in the crust of the earth. Magnetic surveys also provide information about the distribution of magnetic materials in the crustal portion, and thus, provide information about the distribution of materials in this part.

36.1 Which among the following can be classified as a direct source of information of the interior of the Earth?

(a) Gravitation
(b) Volcanic magma
(c) Meteors
(d) All of above

36.2. Which of the following is the reason for different value of gravity at different places on earth?

(a) Uneven distribution of mass
(b) Magnetic field of the earth
(c) Tilt of the earth
(d) Attraction of Moon

36.3. Which of the following sources gives information of Earth's interior indirectly?

(a) Volcanoes
(b) Gravitation anomaly
(c) Oceanic crust
(d) All of the above

36.4. What is the deepest point up to which scientists have been able to drill inside the Earth's surface?
(a) 50 km
(b) 12 km
(c) 24 km
(d) 19 km

37. Read the given source and answer the questions that follow:

All natural earthquakes take place in the lithosphere. It is sufficient to note here that the lithosphere refers to the portion of depth up to 200 km from the surface of the earth. An instrument called 'seismograph' records the waves reaching the surface. Earthquake waves are basically of two types — body waves and surface waves. Body waves are generated due to the release of energy at the focus and move in all directions travelling through the body of the earth. Hence, the name body waves. The body waves interact with the surface rocks and generate new set of waves called surface waves. These waves move along the surface. The velocity of waves changes as they travel through materials with different densities. The denser the material, the higher is the velocity. Their direction also changes as they reflect or refract when coming across materials with different densities.

37.1 Which portion of the earth is referred as lithosphere?

37.2 Give one difference between body waves and surface waves.

37.3 What is the correlation between velocity of waves and the density of materials?

VERY SHORT ANSWER QUESTIONS

38. Identify the type of volcano with the help of the information given below:
A volcano is a place where gases, ashes and/or molten rock material – lava – escape to the ground and
the materials mentioned are being released or have been released out in the recent past.

39. What do you mean by gravitational anomaly?

40. What do you mean by hypocentre?

41. What is the difference between magma and lava?

SHORT ANSWER QUESTIONS

42. Differentiate between Body waves and Surface waves?

43. Differentiate between Primary" waves and Secondary" waves

44. Why does the earth shake?

CRITICAL THINKING AND PROBLEM-SOLVING QUESTIONS WITH REAL-LIFE SITUATIONS:

45.EFFECTS OF EARTHQUAKE: Earthquake is a natural hazard. The following are the immediate hazardous effects of earthquake:
(i) Ground Shaking (ii) Differential ground settlement (iii) Land and mud slides (iv) Soil liquefaction (v) Ground lurching (vi) Avalanches (vii) Ground displacement (viii) Floods from dam and levee failures (ix) Fires (x) Structural collapse (xi) Falling objects (xii) Tsunami

Some effects have bearings upon landforms, while others may be considered the effects causing immediate concern to the life and properties of people in the region

Identify the effects causing immediate concern to the life and properties of people in the region

46."The earthquake events are scaled either according to the magnitude or intensity of the shock". Differentiate between these two measuring scales of earth quake.

HIGHER ORDER THINKING QUESTIONS (HOTS)

47."Analysis of properties of matter indirectly provides information about the interior". Elaborate the statement.

48."The shadow zone of S-wave is much larger than that of the P-waves" Give reasons.

49."An important fact about S-waves is that they can travel only through solid materials. This characteristic of the S-waves is quite important. It has helped scientists to understand the structure of the interior of the earth". Explain the inferences arrived by this fact.

50."Gravitation, magnetic field, and seismic activity are the important indirect sources to know about the interior of the earth" Support the statement with suitable explanation.

ANSWER KEY

1	Dykes
2	Asthenoshere
3	5
4	Batholiths
5	Surface waves
6	(d) Both (b) and (c).
7	(d) Both (b) and (c).
8	(c) The material and the structure observed in the meteors are similar to that of the earth.
9	(a)1,3,4,5
10	(c) Volcanic eruptions
11	(a) Different types of earthquake waves travel in same manner.
12	(b) Shield volcanoes
13	(b) Tectonic Earthquakes
14	(b) The denser the material, the lower is the velocity.
15	(b) Reflection, Refraction
16	(b) They create density differences in the material leading to stretching and squeezing of the material.
17	(c) Both 1 and 2

18 (a) A-2, B-3, C-1

19 (b) Composite Volcanoes

20 (c) Lacoliths

21 (b) A-3, B-1, C-2

22 (a) Only 1

23 (a) A and R are true and R is the correct explanation of A.

24 (d) A is true but R is false.

25 (b) A and R are true and R is not the correct explanation of A.

26 (a) A and R are true and R is the correct explanation of A.

27 (a) A and R are true and R is the correct explanation of A.

28 (c) Lacolith and Composite Volcano

29 1. (b) Oceanic crust 2. (b) Moho discontinuity 3. (c) Asthenosphere 4. (d) Core

30 **1. Shadow Zone:**

- Earthquake waves get recorded in seismographs located at far off locations.
- However, there exist some specific areas where the waves are not reported.
- Such a zone is called the **'shadow zone'**

2. The entire zone beyond 105° from the epicentre.

- An important fact about S-waves is that they can travel only through solid materials. This characteristic of the S-waves is quite important. It has helped scientists to understand the structure of the interior of the earth.

31 A. P -waves B.S-waves C.Surface waves

32 1.Shield volcano 2.Cinder cone 3.Composite volcano

33 1. Tsunami 2. 2004 3.Thailand and India.

34 1. Volcanic landforms 2. Due to volcanic eruption 3.Volcanic rocks and Plutonic rocks

35 1. Earth quake.2.URI,Jammu and Kashmir

36 1.(b)Volcanic magma 2(a) Uneven distribution of mass 3.(b) Gravitation Anomaly 4.(b)12 kms

37 1. Crust and the Upper mantle 2. Body waves travel through the body of the earth. Surface move along the surface of the earth.3. The denser the material, the higher is the velocity.

38 Active volcano.

39 The gravity values differ according to the mass of material. The uneven distribution of mass of material within the earth influences this value. The reading of the gravity at different places is influenced by many other factors. These readings differ from the expected values. Such a difference is called gravity anomaly.

40 The point where the energy is released is called the focus of an earthquake, alternatively, it is called the hypocentre.

41 The material in the upper mantle portion is called magma. Once it starts moving towards the crust or it reaches the surface, it is referred to as lava.

42 Main differences between body waves and surface waves are given below:

Body waves:

- These are generated due to the release of energy at the focus.
- They move in all directions travelling through the body of the earth.
- These are less destructive than the surface waves.

Surface waves:

- The body waves interact with the surface rocks and generate new set of waves called surface waves.
- These waves move along the surface.
- These waves are more destructive.

43 **P – WAVES**

- Primary waves
- Faster
- Pass through solid, liquid and gaseous state
- P-waves vibrate parallel to the direction of wave.

S–WAVES

- Secondary Waves
- Slower
- Pass through only solid state.
- S-waves vibrate perpendicular to wave direction.

44
- The release of energy occurs along a fault.
- A fault is a sharp break in the crustal rocks.
- Rocks along a fault tend to move in opposite directions.
- As the overlying rock strata press them, the friction locks them together.
- However, their tendency to move apart at some point of time overcomes the friction.

- As a result, the blocks get deformed and eventually, they slide past one another abruptly.
- This causes a release of energy, and the energy waves travel in all directions .
- It leads to shaking of the earth.

45
- Ground displacement
- Floods from dam and levee failures
- Fires
- Structural collapse
- Falling objects
- Tsunami

46
- The earthquake events are scaled either according to the magnitude or intensity of the shock.
- The magnitude scale is known as the Richter scale.
- The magnitude relates to the energy released during the quake.
- The magnitude is expressed in numbers, 0-10.
- The intensity scale is named after Mercalli, an Italian seismologist.
- The intensity scale takes into account the visible damage caused by the event.
- The range of intensity scale is from 1-12.

47
- Analysis of properties of matter indirectly provides information about the interior.
- We know through the mining activity that temperature and pressure increase with the increasing distance from the surface towards the interior in deeper depths.
- Moreover, it is also known that the density of the material also increases with depth.
- It is possible to find the rate of change of these characteristics.
- Knowing the total thickness of the earth, scientists have estimated the values of temperature, pressure and the density of materials at different depths.

48
- The shadow zone of S-wave is much larger than that of the P-waves.
- The shadow zone of P-waves appears as a band around the earth between 105° and 145° away from the epicentre.

- The shadow zone of S-waves is not only larger in extent but it is also a little over 40 per cent of the earth surface.
- P- waves can pass through liquid ,solid and gaseous materials.
- S-waves can pass only through solid state.
- The outer core is in liquid state. So S waves can not penetrate through the core.
- So the shadow zone of S waves is larger.

49
- An important fact about S-waves is that they can travel only through solid materials
- This characteristic of the S-waves is quite important.
- It has helped scientists to understand the structure of the interior of the earth.
- Reflection causes waves to rebound whereas refraction makes waves move in different directions.
- The variations in the direction of waves are inferred with the help of their record on seismograph.
- It was observed that seismographs located at any distance within 105° from the epicentre, recorded the arrival of both P and S-waves.
- However, the seismographs located beyond 145° from epicentre, record the arrival of P-waves, but not that of S-waves.
- Thus, a zone between 105° and 145° from epicentre was identified as the shadow zone for both the types of waves.
- The entire zone beyond 105° does not receive S-waves.
- The shadow zone of S-wave is much larger than that of the P-waves.
- The shadow zone of P-waves appears as a band around the earth between 105° and 145° away from the epicentre.
- The shadow zone of S-waves is not only larger in extent but it is also a little over 40 per cent of the earth surface.
- It helps us to understand that the outer core is in liquid state.

50
- Gravitation, magnetic field, and seismic activity are the important indirect sources of information about the interior of the earth.
- The gravitation force (g) is not the same at different latitudes on the surface.
- It is greater near the poles and less at the equator.

- This is because of the distance from the centre at the equator being greater than that at the poles.
- The gravity values also differ according to the mass of material
- The uneven distribution of mass of material within the earth influences this value.
- The reading of the gravity at different places is influenced by many other factors. These readings differ from the expected values.
- Such a difference is called gravity anomaly.
- Gravity anomalies give us information about the distribution of mass of the material in the crust of the earth
- Magnetic surveys also provide information about the distribution of magnetic materials in the crustal portion, and thus, provide information about the distribution of materials in this part.
- Seismic activity is one of the most important of source of information about the interior of the earth.

CHAPTER 4– DISTRIBUTION OF OCEANS AND CONTINENTS

MIND MAP

Abraham Ortelius, -Dutch map maker, proposed two Americas, Europe and Africa to be once joined together- 1596

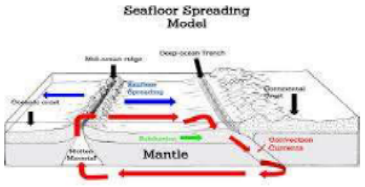
Antonio Pellegrini drew a map showing the three continents together.

POST DRIFT STUDIES

1. Convectional Current Theory
2. Mapping of the Ocean Floor
3. Ocean Floor Configuration
4. Distribution of earthquakes and volcanoes

SEA FLOOR SPREADING

HARRY HESS-1961



CONTINENTAL DRIFT

Alfred Wegener—German Meteorologist
Continental drift theory-1912
All the continents formed a single continental mass
A mega ocean surrounded this continental mass
Super continent –**PANGAEA**-all earth
Mega ocean-**PANTHALASSA**-all water
200 million years ago-Pangaea divided into two
Laurasia-north
Gondwanaland-south
Laurasia and Gondwana is divided into seven continents at present

DISTRIBUTION OF OCEANS AND CONTINENTS

PLATE BOUNDARIES

Three types of plate boundaries

1. Divergent boundaries
2. Convergent boundaries
3. Transform boundaries

PLATE TECTONICS

- 1967, **McKenzie** and **Parker** and also **Morgan**
- A **tectonic plate** is a massive irregularly shaped slab of solid rock composed of both continental and oceanic lithosphere
- **MAJOR PLATES**
  1. Antarctica and the surrounding oceanic plate
  2. North American (with western Atlantic floor separated from the South American plate along the Caribbean islands) plate
  3. South American (with western Atlantic floor separated from the North American plate along the Caribbean islands) plate
  4. Pacific plate
  5. India-Australia-New Zealand plate
  6. Africa with the eastern Atlantic floor plate
  7. Eurasia and the adjacent oceanic plate
- ,**MINOR PLATES**
  1. Cocos plate
  2. Nazca plate
  3. Arabian plate
  4. Philippine plate
  5. Caroline plate
  6. Fuji plate

RATE OF PLATE MOVEMENT

- Slowest-
  - Arctic ridge-less than 2.5cm/year
- Fastest-
  - East Pacific Rise-greater than 15cm/year

EVIDENCE IN SUPPORT OF THE CONTINENTAL DRIFT

1. The Matching of Continents (Jig-Saw-Fit)
2. Rocks of Same Age Across the Oceans
3. Tillite
4. Placer Deposits
5. Distribution of Fossils

MOVEMENT OF INDIAN PLATE

- **225** million years ago- India was a large island situated off the Australian coast. It was separated from Asian continent by Tethys sea
- **200** million years ago -northward journey started
- **140** million years ago- it was located at 50°S latitude
- **60** million years ago-outpouring of lava and formation of Deccan plateau
- **40-50** million years ago-India collided with Asia and upliftment of Himalayas took place

FILL IN THE BLANKS

1 _____ drew a map showing three continents America, Europe, and Africa.

2 In 1930 _____ discussed the possibility of convection currents operating in the mantle portion.

3 The sites where the plates move away from each other are called ----------

4 The location where sinking of a plate occurs is called a ----------

5 ---------- is the sedimentary rock formed out of deposits of glaciers

6 Wegener suggested that the movement responsible for the drifting of the continents was caused by ---------- and ----------

7 ---------- are extensive plains that lie between the continental margins and mid-oceanic ridges.

8 The rim of the --------is also called rim of fire due to the existence of active volcanoes in this area.

Answers

1. Antonio Pellegrini
2. Arthur Holmes
3. spreading sites.
4. subduction zone.
5. Tillite
6. pole-fleeing force and tidal force
7. Abyssal Plains
8. Pacific

MCQ

9 Who among the following was the first to consider the possibility of Europe, Africa and America having been located side by side.

a. Alfred Wegener
b. Antonio Pellegrini
c. Abraham Ortelius
d. Edmond Hess

10 Pole fleeing force relates to

a. Revolution of the earth
b. Rotation of the earth
c. Gravitation
d. Tides

11 Which one of the following is not a minor plate

a. Nazca
b. Arabia
c. Phillippines
d. Antarctica

12 Which one of the following facts was not considered by those while discussing the concept of sea floor spreading

a. Volcanic activity along the mid oceanic ridges
b. Stripes of normal and reverse magnetic field observed in rocks of ocean floor
c. Distribution of fossils in different continents
d. Age of rocks from the ocean floor

13 Which one of the following is a type of plate boundary of the Indian plate along the Himalayan mountains

a. Ocean continent convergence
b. Divergent boundary
c. Transform boundary
d. Continent Continent convergence

14 Identify the incorrect statement:
   a. Alfred Wegner propounded continental drift theory in 1912.
   b. All continents formed a single continental landmass-Panthalassa.
   c. 200 years ago the super continent began to split.
   d. Super continent broke into Laurasia and Gondwanaland.

15 The pacific rim is also called rim of fire due to:
   a. Prevalence of occurrence of forest fires.
   b. High temperatures throughout the year.
   c. High occurrence of earthquakes.
   d. Existence of active volcanoes.

16 Identify the incorrect statement.
   a. A tectonic plate is a massive irregularly-shaped slab of solid rock.
   b. A plate is generally composed of either continental or oceanic lithosphere.
   c. A plate may be referred to as continental or oceanic plate.
   d. The thickness of tectonic plate varies between 5-200 kms.

Answers

9. Abraham Ortelius
10. Rotation of the earth
11. Antarctica
12. Distribution of fossils in different continents
13. Continent Continent convergence
14. All continents formed a single continental landmass-Panthalassa.
15. Existence of active volcanoes.
16. A plate is generally composed of either continental or oceanic lithosphere

MATCH THE FOLLOWING

17

Column A	**Column B**
1. Cocos Plate	a) Between Central America and Pacific Plate
2. Nazca Plate	b) Between South America and Pacific Plate
3. Arabian Plate	c) Mostly the Saudi Arabian landmass
4. Philippine Plate	d) Between the Asiatic and Pacific Plate

18

1.Harry Hess	a. first to consider the possibility of Europe, Africa and America having located side by side
2. Alfred Wegner	b. drew a map showing the three continents together
3. Arthur Holmes	c. continental drift theory
4. Abraham Ortelius	d. convectional current theory
5. Antonio Pellegrini	e. sea floor spreading

Answers

Q.17

1. *Cocos plate*: Between Central America and Pacific plate
2. *Nazca plate*: Between South America and Pacific plate
3. *Arabian plate*: Mostly the Saudi Arabian landmass
4. *Philippine plate*: Between the Asiatic and Pacific plate

Q.18

1. Harry Hess-. sea floor spreading
2. Alfred Wegner- continental drift theory
3. Arthur Holmes- convectional current theory
4. Abraham Ortelius-.first to consider the possibility of Europe, Africa and America having located side by side
5. Antonio Pellagrini - drew a map showing the three continents together -

ASSERTION AND REASONING

19 **Assertion (A)** Divergent plate margin are also called constructive plate margins.
Reason (A) Along divergent plate margins magma comes up to the surface and forms new crust.

a. A and R are true and R is the correct explanation of A.
b. A and R true but R is not the correct explanation of A.
c. A is false but R is true.
d. A is true but R is false.

20 **Assertion (A)** Along transform boundaries, crust is neither produced nor destroyed.
Reason (R) Along transform boundaries the plates horizontally pass each other.

a. A and R are true and R is the correct explanation of A.
b. A and R true but R is not the correct explanation of A.
c. A is false but R is true.
d. A is true but R is false.

21 **Assertion (A)** Rich placer deposits of gold are found on the Ghana coast and gold bearing veins are found in Brazil.
Reason (B) At some points of time these continents were joined together along the Atlantic coast.

a. A and R are true and R is the correct explanation of A.
b. A and R true but R is not the correct explanation of A.
c. A is false but R is true.
d. A is true but R is false.

Answers
19. [a] A and R are true and R is the correct explanation of A.
20. [a] A and R are true and R is the correct explanation of A.
21. [a] A and R are true and R is the correct explanation of A.

SOURCE BASED QUESTIONS

22 **Force for the Plate Movement**

At the time that Wegener proposed his theory of continental drift, most scientists believed that the earth was a solid, motionless body. However, concepts of sea floor spreading and the unified theory of plate tectonics have emphasised that both the surface of the earth and the interior are not static and motionless but are dynamic. The fact that the plates move is now a well-accepted fact. The mobile rock beneath the rigid plates is believed to be moving in a circular manner. The heated material rises to the surface, spreads and begins to cool, and then sinks back into deeper depths. This cycle is repeated over and over to generate what scientists call a convection cell or convective flow. Heat within the earth comes from two main sources: radioactive decay and residual heat. Arthur Holmes first considered this idea in the 1930s, which later influenced Harry Hess' thinking about seafloor spreading. The slow movement of hot, softened mantle that lies below the rigid plates is the driving force behind the plate movement

1. What are the two main sources of heat within the Earth?
2. Who first considered the idea of convection cells in the Earth's mantle?
3. How does the convection cycle contribute to the movement of tectonic plates?

23 A tectonic plate (also called lithospheric plate) is a massive, irregularly-shaped slab of solid rock, generally composed of both continental and oceanic lithosphere. Plates move horizontally over the asthenosphere as rigid units. The lithosphere includes the crust and top mantle with its thickness range varying between 5 and100 km in oceanic parts and

about 200 km in the continental areas. A plate may be referred to as the continental plate or oceanic plate depending on which of the two occupy a larger portion of the plate. Pacific plate is largely an oceanic plate whereas the Eurasian plate may be called a continental plate. The theory of plate tectonics proposes that the earth's lithosphere is divided into seven major and some minor plates. Young Fold Mountain ridges, trenches, and/or faults surround these major plates

1. How do tectonic plates move over the Earth's surface?
2. How is a plate classified as a continental plate or oceanic plate?
3. What features surround the major plates according to the theory of plate tectonics?

Answers

22.

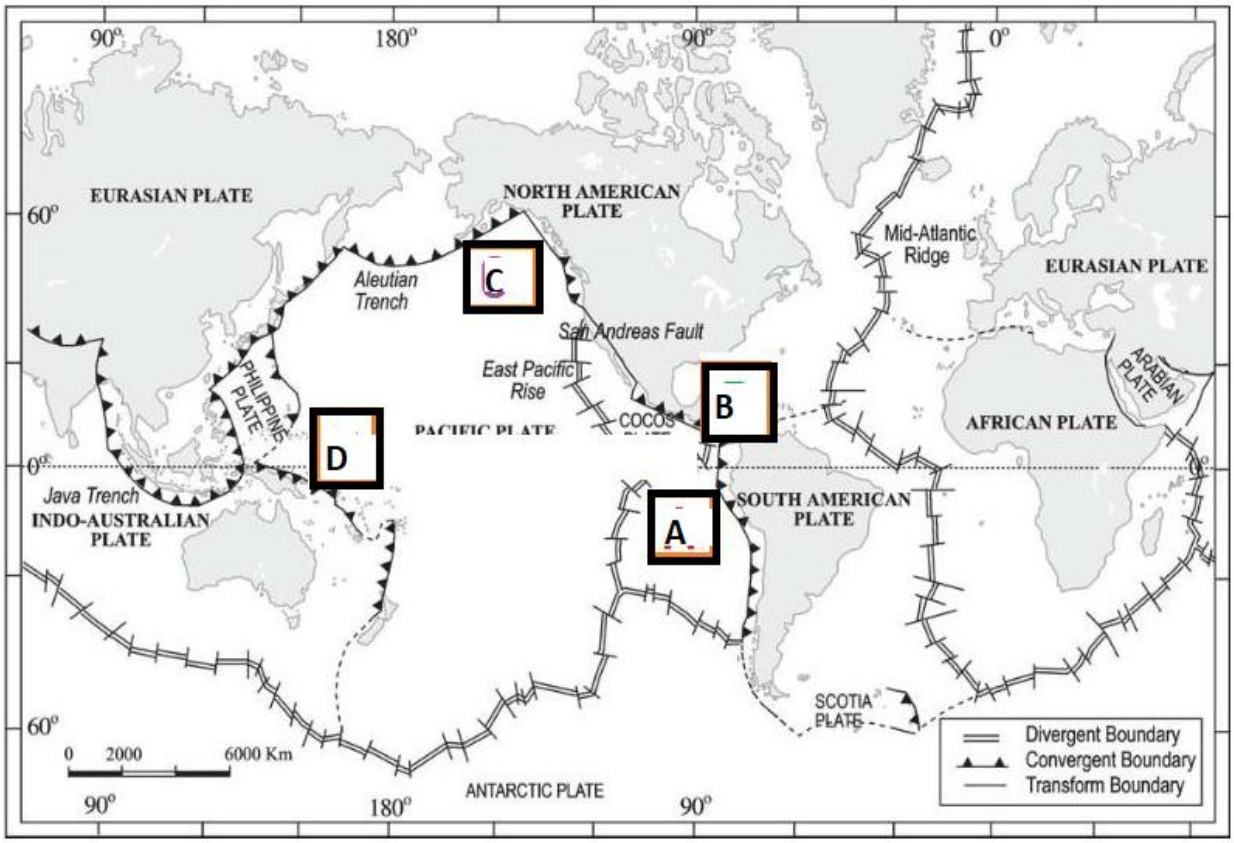
1. radioactive decay and residual heat
2. Arthur Holmes
3. The slow movement of hot, softened mantle that lies below the rigid plates is the driving force behind the plate movement

23

1. Plates move horizontally over the asthenosphere as rigid units
2.. A plate may be referred to as the continental plate or oceanic plate depending on which of the two occupy a larger portion of the plate
3. Young Fold Mountain ridges, trenches, and/or faults surround these major plates

MAP BASED QUESTIONS

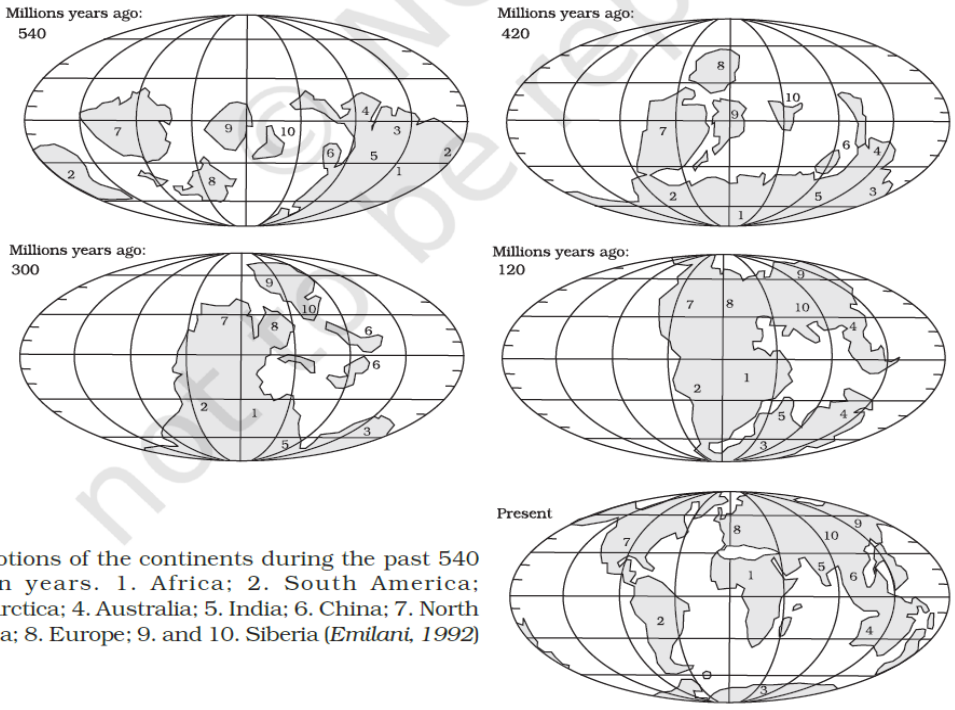
24



Identify the plates marked with A,B,C,D on map.

A=Nazca plate, B=Caribbean plate, C= Juan De Fuca plate, D= Caroline plate

25



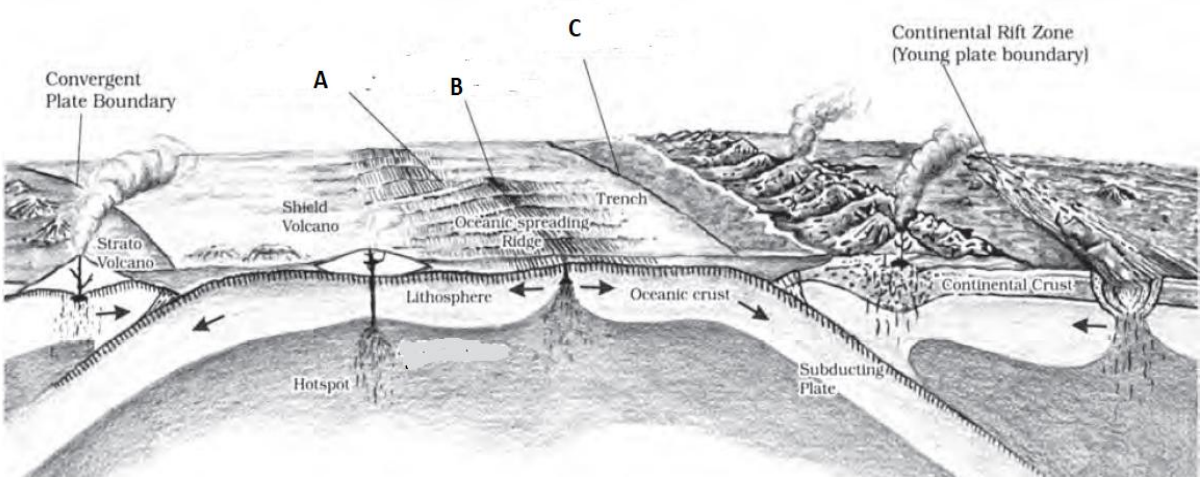
The motions of the continents during the past 540 million years. 1. Africa; 2. South America; 3. Antarctica; 4. Australia; 5. India; 6. China; 7. North America; 8. Europe; 9. and 10. Siberia (*Emilani, 1992*)

Which two major landmasses did the supercontinent Pangaea eventually split into?
a) Eurasia and Africa
b) Laurasia and Gondwana
c) North America and South America
d) Antarctica and Australia
Answer: b) Laurasia and Gondwana

Which modern continents were part of the southern landmass of Gondwana?
a) Africa, South America, Antarctica, Australia, and India
b) North America, Europe, and Asia
c) Europe, Africa, and South America
d) Australia, Asia, and Antarctica
Answer: a) Africa, South America, Antarctica, Australia, and India

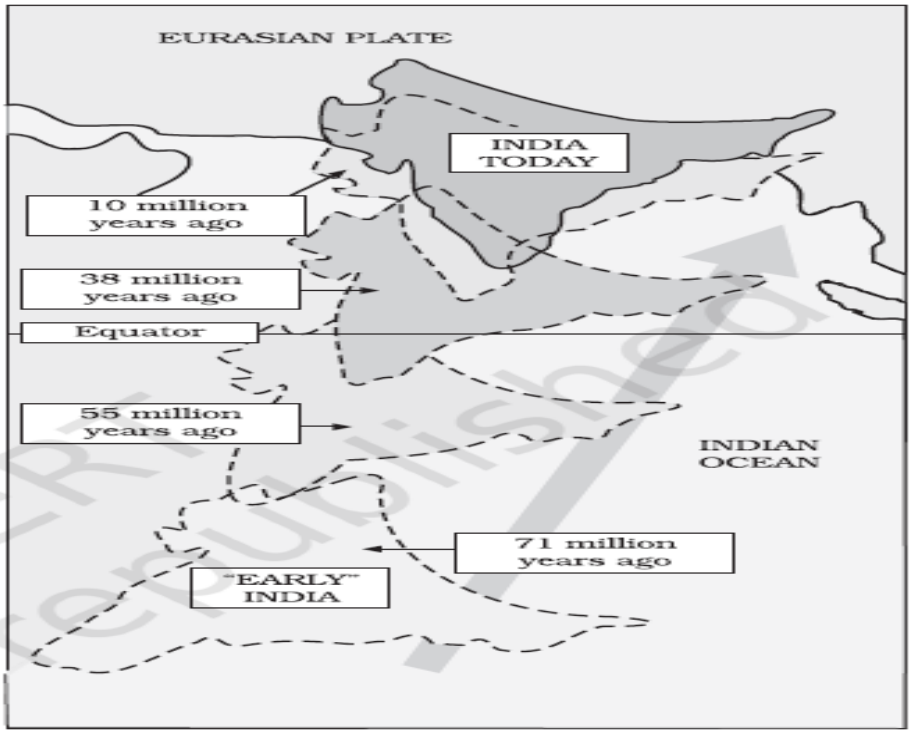
Around how many million years ago did the process of continental drift begin to significantly alter the positions of the continents?
a) 200 million years ago
b) 300 million years ago
c) 100 million years ago
d) 50 million years ago
Answer: a) 200 million years ago

26



Identify the plate margins shown A, B, C, in the above diagram.
A=Transform
B=Divergent
C=Convergent plate margin

27

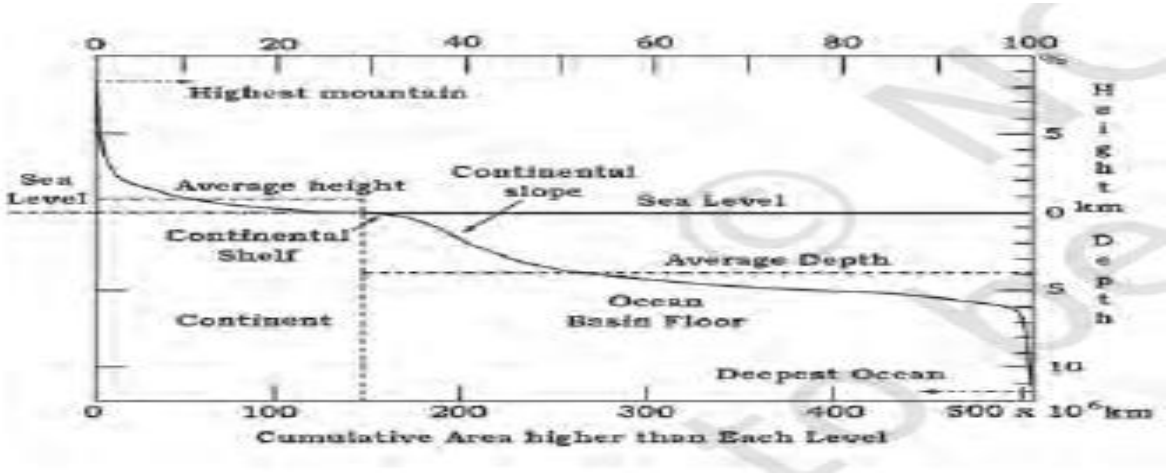


What separated the Indian Plate from the Asian continent during the time when India was a large island?
a) Atlantic Ocean
b) Tethys Sea
c) Pacific Ocean
d) Indian Ocean
Answer: b) Tethys Sea
Which mountain range formed as a result of the collision between the Indian Plate and the Eurasian Plate?
a) Rocky Mountains
b) Andes Mountains
c) Himalayas
d) Alps
Answer**:** c) Himalayas
What major geological event occurred around 60 million years ago due to the movement of the Indian Plate?
a) Formation of the Himalayas
b) Formation of the Deccan Traps
c) Formation of the Alps
d) Breakup of Pangaea
Answer: b) Formation of the Deccan Traps
How far south was the Indian subcontinent located about 140 million years ago?
a) 40°S latitude
b) 50°S latitude
c) 60°S latitude
d) 30°S latitude
Answer**:** b) 50°S latitude
Which geological boundary marks the northern plate boundary of the Indian Plate?

a) Continental-continental convergence
b) Oceanic-continental convergence
c) Oceanic divergence
d) Continental-divergent boundary
Answer: a) Continental-continental convergence

What evidence suggests that the formation of the Himalayas is still ongoing?
a) The height of the Himalayas is decreasing
b) The Himalayas are eroding at a fast pace
c) The height of the Himalayas is still rising
d) The region is sinking under the ocean
Answer: c) The height of the Himalayas is still rising

28



Where are the abyssal plains located?
a) Between the deep-sea basins and mid-ocean ridges
b) Between the continental margins and mid-ocean ridges
c) Along the continental slopes
d) Near the oceanic trenches
Answer: b) Between the continental margins and mid-ocean ridges

Which oceanic feature is considered the longest mountain chain on Earth's surface?
a) The Andes Mountains
b) The Himalayan Mountain Range
c) The Mid-Oceanic Ridges
d) The Rocky Mountains
Answer: c) The Mid-Oceanic Ridges

The mid-oceanic ridges are characterized by which of the following?
a) A central rift system, a fractionated plateau, and a flank zone
b) A flat ocean floor with no volcanic activity
c) Oceanic trenches and abyssal plains
d) Shallow water zones and coral reefs
Answer: a) A central rift system, a fractionated plateau, and a flank zone

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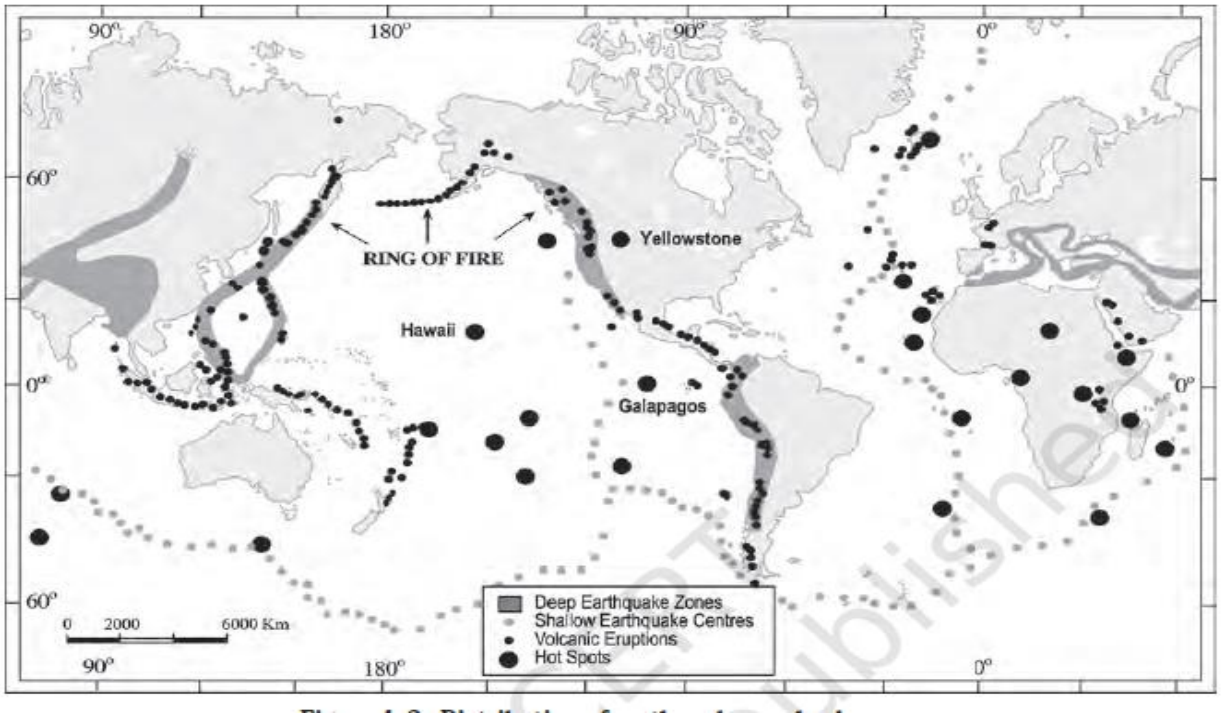

What causes the intense volcanic and seismic activity along the Pacific Ring of Fire?

a) Subduction of oceanic plates beneath continental plates
b) Collision of tectonic plates in the middle of the ocean
c) Divergence of continental plates
d) Atmospheric pressure variations
Answer: a) Subduction of oceanic plates beneath continental plates

Which tectonic plate boundary is most commonly found along the Pacific Ring of Fire?

a) Transform boundary
b) Divergent boundary
c) Convergent boundary
d) Passive boundary
Answer: c) Convergent boundary

VERY SHORT ANSWER QUESTIONS

3 **What were the forces suggested by Wegener for the movement of the continents?**

0 a. Pole fleeing force[due to rotation of the earth]
b. Tidal force[due to attraction of sun and the moon]

31 **How are the convectional currents in the mantle initiated and maintained?**

- Convection currents are operating in mantle portion
- Currents are caused by thermal difference
- thermal difference generated due to radioactive elements

32 **What was the location of the Indian landmass during the formation of the Deccan Traps?**
It was located as south as 50°S latitude.

33 **Define a tectonic plate.**
A tectonic plate is a massive, irregularly shaped slab of solid rock, generally composed of both continental and oceanic lithosphere

SHORT ANSWER QUESTIONS

34 **What is the major difference between the transform boundary and the convergent or divergent boundaries of plates**
PLATE BOUNDARIES
There are three types of plate boundaries

1. Divergent boundaries
2. Convergent boundaries
3. Transform boundaries

Divergent boundaries

~ Plates pull away from each other
~ Such sites where plates move away are called spreading sites
~ New crust is generated
~ Eg. Mid Atlantic ridge

Convergent boundaries

~ One plate is diving under another
~ Location of sinking is called subduction zone'
~ crust is destroyed
~ eg-boundary of Indian plate and Eurasian plate

Transform boundaries

~ Plate slide horizontally pass each other
~ Crust is neither produced nor destroyed
~ Eg- San Andreas fault

35 **Describe the continental drift theory.**

~ Put forth by Alfred Wegener-German meteorologist in 1912
~ According to him all the continents formed a single continental mass
~ A mega ocean surrounded this continental mass
~ Super continent was named –PANGAEA- meaning all earth
~ Mega ocean was called -PANTHALASSA-meaning all water
~ 200 million years ago-Pangaea divided into two large continental mass
  - Laurasia-the northern component
  - Gondwanaland- the south component

Subsequently Laurasia and Gondwana continued to break into various smaller continents that exist today

CRITICAL THINKING PROBLEMS SOLVING QUESTIONS

36 **Bring about the basic difference between the drift theory and plate tectonics.**

~ It is not continent that moves as believed by Wegener. Continents are part of a plate and what moves is the plate.
~ Wegener had thought of all continents to have initially existed as a super continent in the form of Pangaea. Later discoveries reveal that the continental masses resting on the plates have been wandering all through the geological period and Pangaea was a result of converging of different continental masses that were parts of one or the other plates
~ Wegener believed that the continents are moving over ocean water. But it is the plates that move over the molten asthenosphere.
~ Wegener had suggested that the movement responsible for the drifting of the continents was caused by pole fleeing force and tidal force. It is the slow movement of hot softened mantle that lies below the rigid plates which is the driving force behind the plate movement.

37 **What were the major post drift discoveries that rejuvenated the interest of scientists in the study of distribution of oceans and continents?**

1. Convectional Current Theory

~ By Arthur Holmes in 1930's
~ Convection currents are operating in mantle portion
~ Currents are caused by thermal difference
~ thermal difference generated due to radio active elements

2.Mapping of the ocean floor

~ Ocean floor is not just a vast plain. It is full of relief- mountain ranges, plains, trenches.
~ Rocks of oceanic crust is much younger than the continental areas
~ Rocks on either side of the oceanic ridges and equidistant locations from the crest were similar in terms of constituents and age

3. Ocean floor configuration

~ Ocean floor consists of continental margins, deep sea basins and mid ocean ridges

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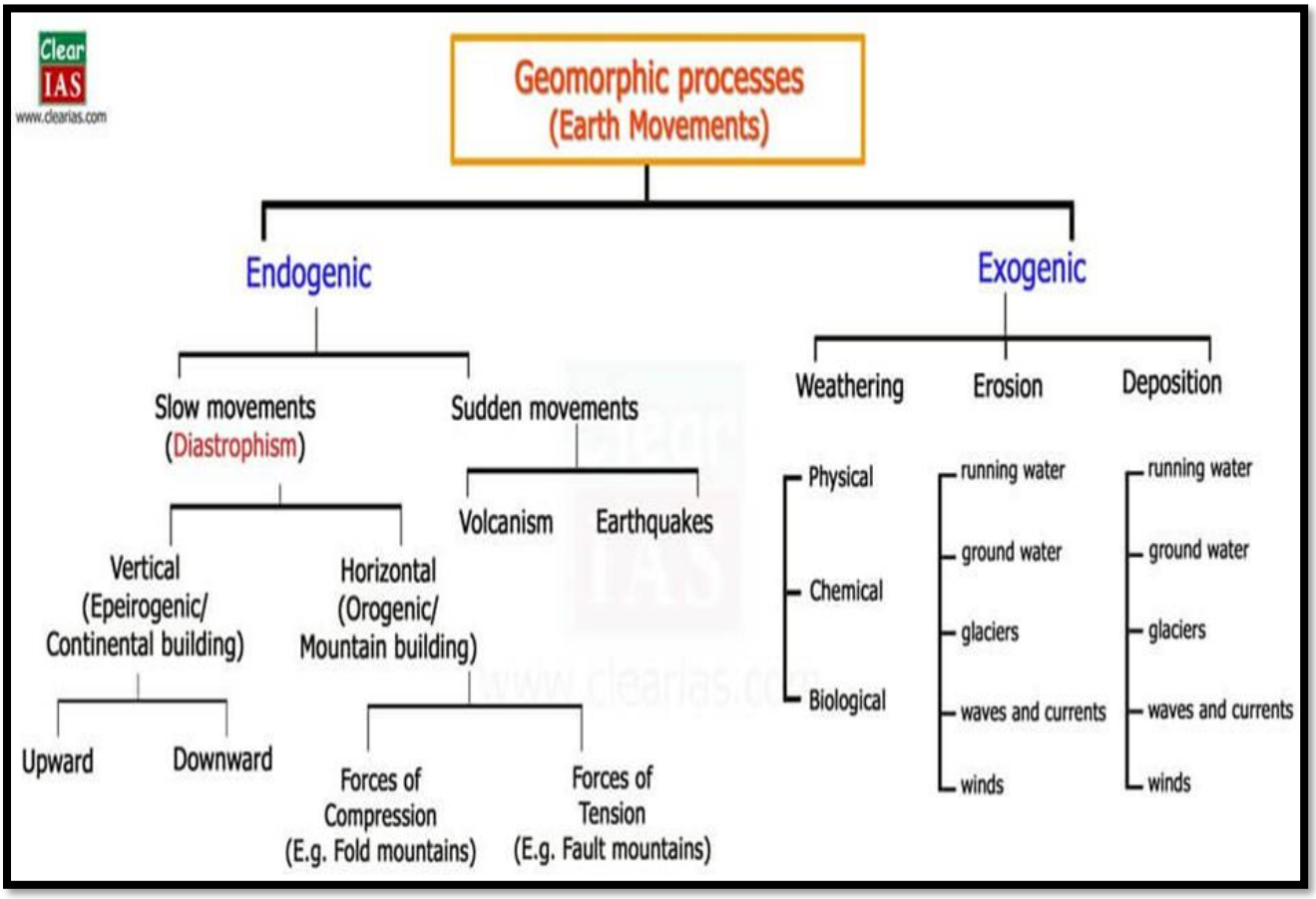
CHAPTERS– 5
GEOMORPHIC PROCESS
MIND MAP



MULTIPLE CHOICE QUESTIONS

Q1. Which force helps in Geomorphic Processes?
a. Endogenic Forces b. Exogenic Forces
c. Both a& b d. None

Q2. Which one of the following materials is affected by hydration process?
a. Granite b. Clay
c. Quartz d. Salts

Q3. Which of the following is a type of mass movements?
a. Slow movements b. Rapid movements
c. Landslides d. All of the above

Q4. Which of the following is not correct with respect to epeirogenic processes?
(a) Uplifting or warping of earth's crust
(b) Involved in continental building
(c) Crust is severely deformed into folds
(d) It is a form of diastrophism

Q.5 Which of the following is not a reason for landslide in Western Ghat and Nilgiri region?
(a) Steeper slopes
(b) Mechanical weathering due to temperature changes
(c) Heavy rainfall
(d) Tectonic instability

Q.6 Which of the following is not correct about deposition?
(a) It is a consequence of erosion
(b) Finer material gets deposited first and then coarser material.
(c) It is an endogenic process.
(d) Both (b) and (c)

Q.7 Consider the following statements. Which of the given statements is correct?
1. Earth materials experience only gravitational stress.
2. Shear stress results in angular displacement of rocks.
Codes
(a) Only 1 (b) Both 1 and 2
(c) Only 2 (d) None of these

SHORT ANSWER TYPE QUESTIONS

Q1.What is geomorphic processes? Describe briefly.
Q2.Distinguish between exogenetic and endogenetic forces.
Q3.What is directional force and what is its role?
Q4. What are mass movements that are real rapid and perceptible? List

LONG ANSWER TYPE QUESTIONS

Question 1. What are different types of mass movements?
Question 2. Explain different types of chemical weathering.
Question 3. What is the sole driving force behind all the exogenic processes? Explain how?

HOTS

Question 1. Is it essential to distinguish between geomorphic agents and geomorphic processes? If yes, explain the difference.

Question 2. Do you think that slopes or gradients are created by tectonic forces? Why?

Question 3. "All comers of the earth do not have same slope". Why?

Question 4. Time and parent material play a passive role in soil formation. Do you agree? Justify.

MARKING SCHEME

MULTIPLE CHOICE QUESTIONS

Q.1 Ans: (c) Both a and b
Q.2 Ans- d) Salts
Q.3 Ans-(d) All of the above
Q.4 Ans (c) Crust is severely deformed into folds
Q.5 Ans (d) Tectonic instability
Q.6 Ans (d) Both (b) and (c)
Q.7 Ans (c) Only 2

SHORT ANSWER TYPE QUESTIONS

Q.1 Answer: The endogenetic and exogenetic forces causing physical; stresses and chemical actions on earth materials and bringing about changes in the configuration of the earth's surface are known as geomorphic processes. Diastrophism and volcanism are endogenetic geomorphic processes.

Q.2 Ans- Exogenetic forces: The earth's surface is being continuously subjected to external forces induced basically by the energy (sun). These external forces are known as exogenic forces. Endogenic forces: The forces originating within the earth from its interior are known as endogenic forces. They are responsible for building up and wearing down of the earth's surface

Q.3 Ans-Gravity is a directional force. It activates the movements of matter and also causes stresses on the earth materials. Indirect gravitational stresses activate wave and tide induced currents and winds. Without gravity and gradients, there would be no mobility and hence no erosion.

Q.4 Answer: Mass movements transfer the mass of rock debris down the slopes under the direct influence of gravity. No geomorphic agent like running water, glaciers, wind, waves and currents participate in the process of mass movements.

The mass movements that are real rapid and perceptible are: Earth flow Mud flow Landslide

LONG ANSWER TYPE QUESTIONS

Q.1 Answer:

There are three types of mass movements: Slow Movements: Creep is one type under this category which can occur on moderately steep, soil covered slopes. Movement of materials is extremely slow and imperceptible except through extended observation. Materials involved can be soil or rock debris. Soil creep, talus creep, rock creep, rock- glacier creep etc can be identified. It also includes solifluction which involves slow downslope flowing soil mass or fine grained rock debris saturated or lubricated with water. This process is quite common in moist temperate areas where surface melting of deeply frozen ground and long continued rain respectively, occur frequently. When the upper portions get saturated and when the lower parts are impervious to water percolation, flowing occurs in the upper parts.
Rapid Movements: These movements are mostly prevalent in humid climate regions and occur over gentle to steep slopes. Movements of water- saturated clayey or silty earth materials down low angle terraces or hill slides is known as earth flow. When slopes are steeper ever the bedrock especially of soft sedimentary rocks like shale or deeply weathering igneous rock may slide downslope. With heavy rainfall, thick layers of weathered materials get saturated with water and either slowly or rapidly flow down along definite channels. It looks like a stream of mud within a valley.

Landslides: The types of landslides.

- Slumps: The slipping of one or several units of rock debris with a backward rotation with respect to the slope over which the movement takes place.
- Debris slide: rapid rolling or sliding of earth debris without backward rotation of mass is known as Debris slide.
- Rockslide: Sliding of individual rock masses down bedding, joint or fault surface is rockslide.
- Rock fall: Rock fall is free falling of rock blocks over any steep slope keeping itself away from the slope. Rock falls occurs from the superficial layers of the rock face.

Q.2 Answer:
Different types of chemical weathering includes:

1. Oxidation and Reduction: Oxidation is the effect of oxygen in air and water on the rocks. The atmospheric oxygen in rainwater unites with minerals in rocks specially with iron

compounds. When oxidised minerals are placed in an environment where oxygen is absent, reduction takes place. It exists normally below water table, in area of stagnant water in more hot and humid climates.

2. Carbonation: When the carbon dioxide in atmosphere dissolves in water it form carbonic acid that affects the rocks, it is carbonation. It has acidic affect and dissolves calcium carbonates and magnesium carbonates such as gypsum, marble, limestone.

3. Hydration: When the hydrogen of water dissolves in rocks hydration occurs. Certain minerals in rocks increase their volume and become heavy when observe water contains hydrogen. They break due to its increased pressure and the colour also changes.

4. Solution: Rainwater is able to dissolve certain minerals and leaching of the soil occurs. Normally solids are also removed during leaching. For e.g.: gypsum, rock salt, etc. undergo solution.

Q.3 Answer:

Solar energy is the sole driving force behind all exogenic processes. Exogenic processes derive their energy from atmosphere determined by the ultimate energy from the sun and also the gradients created by tectonic factors.

1. Various minerals in rocks possess their own limits of expansion and contraction.

2. With rise in temperature, every mineral expands and pushes against its neighbour and as temperature falls, a corresponding contraction takes place. Because of diurnal changes in the cause splitting of individual grains within rocks, which eventually fall off. This process of falling off of individual grains may result in granular disintegration or granular foliation. Salt crystallisation is most effective of all salt-weathering processes.

3. In areas with alternating wetting and drying conditions salt crystal growth is favoured and the neighbouring grains are pushed aside. Sodium chloride and gypsum crystals in desert areas heave up overlying layers of materials and with the result polygonal cracks develop all over the heaved surface. With salt crystal growth, chalk breaks down most readily, followed by limestone, sandstone, shale, gneiss and granite etc.

HOTS

Q.1 Answer:

Yes, it is essential to distinguish between geomorphic agents and geomorphic processes because former is the cause and latter is the stepwise process.

Geomorphic agent: An agent is a mobile medium (like running water, moving ice masses, wind, waves and currents, etc.) which removes, transports and deposits earth materials. Running water, groundwater, glaciers, wind, waves and currents, etc., can be called geomorphic agents.

Geomorphic Processes: The Endogenic and Exogenic forces causing physical stresses and chemical actions on earth material and bringing about changes in the configuration of the surface of the earth is known as Geomorphic Process.

Q.2 Answer:

Yes, I think that slopes or gradients are created by tectonic forces. Those areas where there is excessive magma formation, have higher slopes and they have emerged as mountains. The strength of gradients also determine the type of landforms.

Q.3 Answer:

The difference in the operation of the internal forces from within i ie earth which built up the crust have been responsible for the variations in the outer surface of the crust. Due to variations in geothermal gradients and strength, the actions of Endogenic forces are not uniform and hence the tectonically controlled original crystal surface is uneven.

Q.4 Answer:

Yes, I agree.

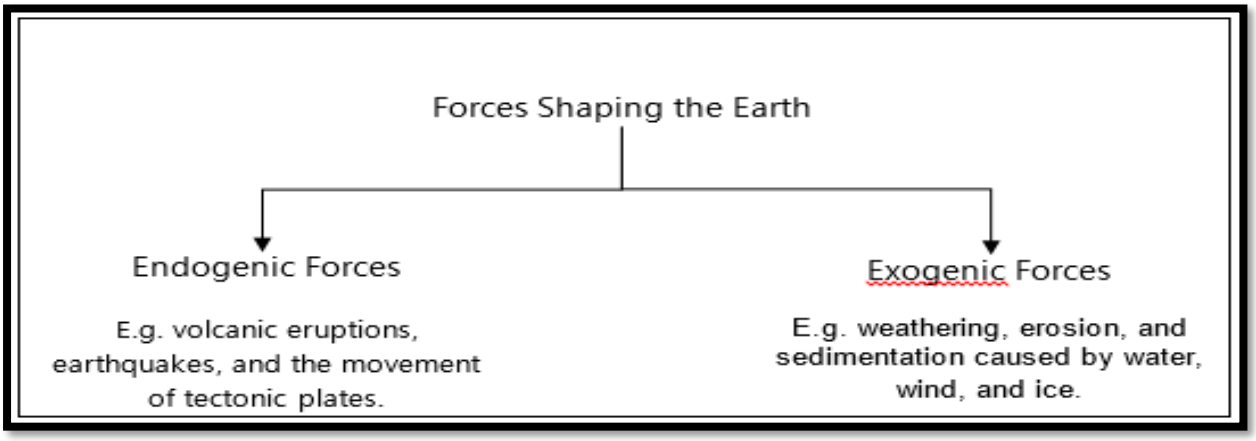
Time: It is the passive controlling factor in soil formation. The length of time the soil forming processes operate determine maturation of soils and profile development.

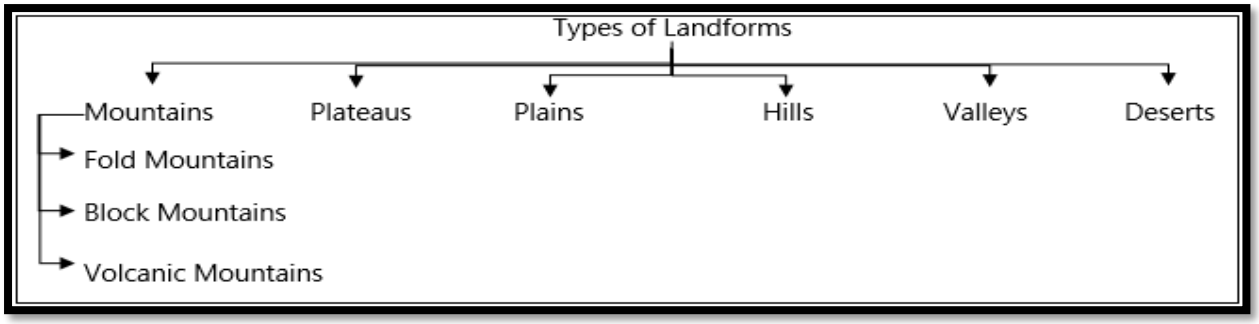
Parent Material: It is a passive factor in soil formation. Parent material can be moved or transported debris. Soil formation depends upon the texture, structure as well as mineral and chemical composition of the rock debris/ deposits.

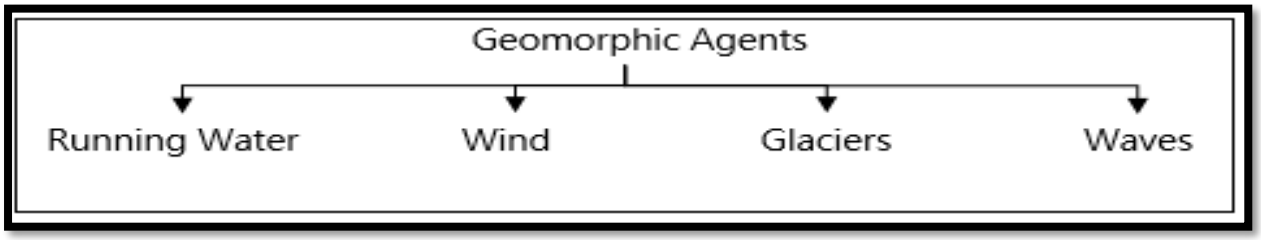
CHAPTER – 6

LANDFORMS AND THEIR EVOLUTION

MIND MAP







1. RUNNING WATER	
EROSIONAL LANDFORMS	**DEPOSITIONAL LANDFORMS**
Valleys	Alluvial Fans
Potholes and Plunge Pools	Deltas
Incised or Entrenched Meanders	Floodplains, Natural Levees and Point Bars
River Terraces	Meanders

2. GROUNDWATER/ KARST TOPOGRAPHY	
EROSIONAL LANDFORMS	**DEPOSITIONAL LANDFORMS**
Pools	Stalactites
Sinkholes	Stalagmites
Lapies and Limestone Pavements	Pillars
Caves	

3. GLACIERS	
EROSIONAL LANDFORMS	**DEPOSITIONAL LANDFORMS**
Cirque	Moraines
Sinkholes	Eskers
Glacial Valleys/Troughs	Drumlins
Horns and Serrated Ridges	

4. WAVES AND CURRENTS	
EROSIONAL LANDFORMS	**DEPOSITIONAL LANDFORMS**
Cliffs	Beaches
Terraces	Dunes
Caves	Bars
Stacks	Barriers and Spits

5. WINDS	
EROSIONAL LANDFORMS	**DEPOSITIONAL LANDFORMS**
Pediments and Pediplains	Sand Dunes
	barchans
Playas	Parabolic dunes
	Seif

Key Terms

- **Tectonic Plates:** Large sections of the Earth's crust that move and interact.
- **Erosion:** The process of wearing away rocks and soils.
- **Weathering:** The breakdown of rocks at the Earth's surface.
- **Sedimentation:** The process of depositing materials that have been erode

Multiple Choice Questions (MCQs) (1 Mark Questions)

Q.1. In which of the following stages of landform development, downward cutting is dominated?

a) Youth stage
b) Late mature stage
c) Early mature stage
d) Old stage

Q.2. A deep valley characterized by steep step-like side slopes is known as

a) U-shaped valley
b) Gorge
c) Blind valley
d) Canyon

Q.3. In which one of the following regions the chemical weathering process is more dominant than the mechanical process?

a) Humid region
b) Limestone region
c) Arid region
d) Glacier region

Q.4. A deep, long and wide trough or basin with very steep concave high walls at its head as well as in sides is known as:

a) Cirque
b) Glacial valley
c) Lateral Moraine
d) Esker

Q.5. Which one of the following processes is a gradational process?

a) Deposition
b) Diastrophism
c) Volcanism
d) Erosion

Q.6. Which one of the following sentences best defines the term 'Lapies'?

a) A small to medium sized shallow depression.
b) A landform whose opening is more or less circular at the top and funnel shaped towards bottom.
c) A landform formed due to dripping water from the surface.
d) An irregular surface with sharp pinnacles, grooves and ridges.

Short Answer Type Questions (3 Mark Questions)

Q.1. How does wind forms geomorphic landforms or how does wind performs its tasks in the desert areas?

Q.2. Explain the depositional landforms formed by groundwater.

Q.3. How are river terrace formed?

Q.4. What do incised meanders in rocks and meanders in plains of alluvium indicate?

Q.5. Differentiate between gorge and Canyon.

Long Answer Type Questions (5 Mark Questions)

Q.1. Limestone behave differently in humid and arid climates. Why? What is the dominant and almost exclusive geomorphic process in limestone areas and what are its results?

Q.2. How do glaciers accomplish the work of reducing high mountains into low hills and plains?

Q.3. Explain the landform created by erosion through wind.

Q.4. Explain the depositional landform created by running water.

Higher Order Thinking Questions (HOTs)

Q.1. Explain how different landforms are created by the forces of weathering and erosion. Provide examples. 3 marks

Q.2. Describe the role of rivers in the formation and evolution of different landforms. 3 marks

Q.3. Differentiate between fluvial, glacial, and Aeolian landforms with suitable examples. 3 marks

Q.4. How do tectonic forces influence the formation of landforms? Give examples. 3 marks

Q.5. What are the differences between young, mature, and old river stages, and how does each stage impact the surrounding landforms? 3 marks

Q.6. Explain how a waterfall is formed and how it evolves over time. 3 marks

Q.7. Explain the formation of karst topography and its main features. 5 marks

Answer Key:

Model Answers	Marks

Multiple Choice Questions (MCQs) 1 each

Q.1 Ans: a) Youth stage

Q.2. Ans: d) Canyon

Q.3. Ans: b) Limestone region

Q.4. Ans: a) Cirque

Q.5. Ans: d) Erosion

Q.6. Ans: d) An irregular surface with sharp pinnacles, grooves and ridges.

Short Answer Type Questions 3 each

Q.1. Ans: Wind move along the desert floors with great speed and the obstructions in their path create turbulence. Wind causes deflations, abrasion and impact. Deflation includes lifting and removal of dust and smaller particles from the surface of rocks. In the transportation process sand and silt act as effective tools to abrade the land surface. The impact is simply sheer force of momentum which occurs when sand is blown into or against a rock surface.

Q.2. Ans:

1. Stalactite drops of water containing dissolved limestone seep down through cracks in the cave roof. Drops of water lose carbon dioxide and deposit calcite. Overtime deposition of calcite forms pillars hanging down from the roof of the cave. It is called as stalactite and where the stalactite stretches towards the sides are known as Helictites.

2. Stalagmite Deposition of calcite forming icicles growing upward from the cave floor is called as stalagmite. Stalactites are calcium carbonate deposits hanging as icicles while Stalagmites are calcium carbonate deposits which rise up from the floor.
3. Pillar: When both the stalagmite and stalactite join together, it is known as pillers. Ha Long Bay, Vietnam: This UNESCO World Heritage Site is known for its tower-like limestone formations, which are formed by Karst Topography.

Q.3. Ans: River terrace are basically products of erosion as they result due to vertical erosion by the stream into its own depositional flood plains. The terraces may result due to:-

· Receding water after a peak flow.

· Change in hydrological regimes due to climatic changes.

· Tectonic uplift of land. Sea level changes in case of rivers closer to the sea

Q.4. Ans: A meander, in general, is a bend in a sinuous watercourse or river. A meander forms when moving water in a stream erodes the outer banks and widens its valley, and the inner part of the river has less energy and deposits silt. In streams that flow rapidly over steep gradients, normally erosion is concentrated on the bottom of the stream channel. In the case of steep gradient streams lateral erosion on the sides of the valleys is not much when compared to the streams flowing on low and gentle slopes. Because of active lateral erosion, streams flowing over gentle slopes, develop sinuous or meandering courses. It is common to find meandering courses over flood plains and delta plains where stream gradients are very gentle. But very deep and wide meanders can also be found cut in hard rocks. Meander loops develop over original gentle surfaces in the initial stages of development of streams and the same loops get entrenched into the rocks normally due to erosion or slow, continued uplift of the land over which they start. They widen and deepen over time and can be found as deep gorges and canyons in hard rock areas. They give an indication on the status of original land surfaces over which streams have developed.

Q.5. Ans: Gorge and Canyon A gorge is a deep valley with very steep to straight sides and a canyon is characterized by steep step- like side slopes and may be

as deep as a gorge. A gorge is almost equal in width at its top as well as its bottom. In contrast, a canyon is wider at its top than at its bottom. In fact, canyon is a variant of gorge.

Long Answer Type Questions 5 each

Q.1. Ans: Many depositional forms develop within the limestone caves. The chief chemical in limestone is calcium carbonate which is easily soluble in carbonated water i.e. carbon dioxide absorbed rainwater. This calcium carbonate is deposited when the water carrying it in solution evaporates or loses its carbon dioxide as it trickles over rough rock surfaces. Stalactites, Stalagmites and Pillars Stalactites hang as icicles of different diameters. Normally they are broad at their bases and taper towards the free ends showing up in a variety of forms. Stalagmites rise up from the floor of the caves. In facts, stalagmites form due to dripping water from the surface or through the thin pipe, of the stalactite, immediately below it. The results of the work of groundwater cannot be seen in all types of rocks. But in rocks like limestone or dolomites rich in calcium carbonate, the surface water as well as groundwater through the chemical process of solution and precipitation deposition develop varieties of landforms. These two processes of solution and precipitation are active in limestone or dolomites occurring either exclusively or interbedded with other rocks. Therefore, underground flow of water is more common than surface run off in limestone areas.

Q.2. Ans: Masses of ice moving as sheets over the land or as linear flows down the slopes of mountains in broad trough-like valleys are called glaciers. A glacier in its valley is slow unlike water flow. The movement could be a few centimeters to a few meters a day or even less or more. Glaciers move basically because of the force of gravity. Erosion by glaciers is tremendous because of friction caused by sheer weight of the ice. The material plucked from the land by glaciers get dragged along the floors or sides of the valleys and cause great damage through abrasion and plucking. Glaciers can cause significant damage to even un-weathered rocks and can reduce high mountains into low hills and plains. As glaciers continue to move, debris gets removed, divides get lowered and eventually the slope is reduced to such an extent that glaciers will stop moving leaving only a mass of low hills and vast outwash plains along with other depositional features.

Q.3. Ans:

Deflation Hollows: Deflation basins, called blowouts, are hollows formed by the removal of particles by wind. Blowouts are generally small, but may be up to several kilometers in diameter.

Caves: As wind-borne sand impacts the rock faces, some of the blow-outs become deeper and wider and fit to be called caves.

Yardangs: Yardangs are parallel troughs cut into softer rock running in the direction of the wind, separated by ridges. The direction of the yardangs can indicate the direction of the prevailing wind.

Zeugen: A zeugen is a tabular mass of resistant rock, standing prominently in the desert. It is usually composed of alternating layers of hard and soft rocks.

Playas: Playa is a flat-bottom depression found in interior desert basins and adjacent to coasts in arid and semiarid regions, periodically covered by water. It slowly filtrates into the groundwater system or evaporates into the atmosphere, causing salt, sand, and mud deposition along the bottom and around the depression's edges.

Q.4. Ans:

ALLUVIAL FANS

1. Found near the foot of the hills
2. The river breaks into number of channels
3. Low gradient
4. Coarse load is deposited
5. Low gradient
6. Cone shaped deposit

ALLUVIAL PLAIN Formed along the river banks

1. Made of alluvial soils
2. They are divided into two types' Khadar and Banger
3. Khadar soils are found near the river and banger soils are found away from the river
4. They are very fertile.

NATURAL LEVEES

Natural levees are found along the flood plains of large rivers. They are low linear, parallel ridges made of coarse material found along the river bank. When river shift laterally series of natural levees are formed.

POINT BARS

1. They are also called as meander bars.
2. Found along the convex side of meanders of large rivers. They are uniform in profile. If there are more than one ridge narrow and elongated depressions are found in between the point bars.

OXBOW LAKES Found along the river bank on the convex side of the meander. They grow long loops the curve is cut off and formed into Oxbow lakes.

BRAIDED CHANNEL When rivers carry coarse material, there can be selective deposition of coarser materials causing formation of a central bar, which diverts the flow towards the banks; and this flow increases lateral erosion on the banks. As the valley widens, the water column is reduced and more and more materials are deposited as islands and lateral bars developing a number of separate channels of water flow.

DELTAS

1. Found near by the mouth of the river.
2. Made of fine alluvial soils.
3. They are in triangular shape.
4. Similar to Greek letter Delta.
5. Divided by distributaries.
6. Deposited material is stratified on the basis of size. Coarse material is deposited first and then fine material

FLOOD PLAINS

1. Major landforms in the river deposition
2. Big boulders are deposited first and then fine material is carried to the longer distance.
3. The flood plains in deltas are called delta plains.

High Order Thinking Questions (HOTs) 3 marks

Q.1. Ans: Weathering and erosion are natural processes that shape landforms over time.

• Weathering is the breakdown of rocks at the Earth's surface due to various factors like temperature changes, water, and biological activity. This creates smaller particles or sediments. An example is the formation of soil from rocks.

• Erosion involves the movement of these weathered materials by agents like wind, water, ice, and gravity. For instance, river erosion creates valleys, while wind erosion forms desert landscapes with sand dunes. Together, weathering and erosion are crucial in shaping landscapes such as mountains, valleys, and plateaus. 3 marks

Q.2. Ans: Rivers play a major role in the creation and transformation of landforms through erosion, transportation, and deposition of sediments.

- Erosion: Rivers erode the land by cutting through rock layers, creating deep valleys and gorges. The Grand Canyon is a famous example.
- Transportation: Rivers carry sediments downstream. The particles break down into finer materials as they move.
- Deposition: As rivers slow down near their mouth, they deposit sediments, forming deltas like the Nile Delta. This deposition also leads to floodplains, which are fertile and support agriculture. Thus, rivers continually reshape landscapes, forming valleys, canyons, and deltas over time.

3 marks

Q.3. Ans: Fluvial, glacial, and aeolian landforms are formed by different natural agents— water, ice, and wind, respectively.

- Fluvial Landforms: Created by river action, they include valleys, floodplains, and deltas. Example: The Ganges delta in India.
- Glacial Landforms: Formed by the movement of glaciers, these include U-shaped valleys, moraines, and drumlins. Example: The fjords of Norway are U-shaped valleys carved by glaciers.
- Aeolian Landforms: Created by wind action, common in arid areas, they include dunes and loess deposits. Example: The sand dunes in the Thar

Desert. Each of these agents shapes the landscape in unique ways based on its properties and the surrounding environment.

Q.4. Ans: Tectonic forces arise from movements within the Earth's crust, causing the formation of various landforms. 3 marks

- Folding: When tectonic plates collide, rocks are compressed and fold, creating mountain ranges. Example: The Himalayas were formed by the collision between the Indian and Eurasian plates.
- Faulting: Tectonic stresses cause fractures in rocks, leading to faults. Landforms like rift valleys and block mountains are created. Example: The East African Rift Valley formed due to tectonic divergence.
- Volcanic Activity: Magma erupts through weak spots in the crust, forming volcanic mountains. Example: Mount Fuji in Japan is a volcanic landform. These tectonic processes significantly shape the Earth's surface, leading to the formation of mountains, valleys, and plateaus.

Q.5. Ans:

- Young Stage: The river flows swiftly, cutting deep valleys and forming V-shaped valleys, waterfalls, and rapids due to its high energy. 3 marks
- Mature Stage: The river slows down and starts to erode its banks more than its bed, leading to the formation of meanders (curves) and a wider valley.
- Old Stage: The river has very low energy and deposits sediments, forming features like floodplains, levees, and oxbow lakes. Each stage contributes differently to landform development. Young rivers carve landscapes, mature rivers create wide valleys, and old rivers deposit sediments, enriching the soil in floodplains.

Q.6. Ans: A waterfall forms where a river encounters a sudden drop in the landscape due to variations in rock resistance.

3 marks

Formation:

- Rivers erode softer rock layers beneath harder rock, creating a vertical drop.

Evolution:

- Over time, the waterfall erodes the rock at its base (plunge pool), causing the harder rock to collapse gradually.

• This process makes the waterfall recede upstream, leaving behind a gorge

Q.7. Ans: Karst topography is formed in regions with soluble rocks, primarily limestone, that are subject to chemical weathering (dissolution by acidic water). 5 marks

Formation:

• Rainwater, slightly acidic due to dissolved carbon dioxide, reacts with limestone and dissolves it over time.

• This creates unique landforms like caves, sinkholes, and underground drainage systems.

Main Features:

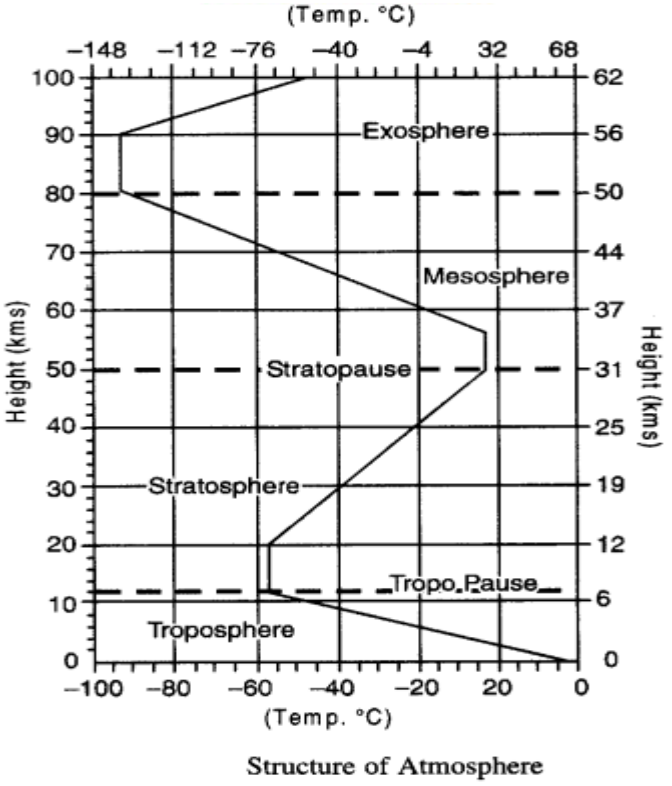
• Caves: Hollow spaces formed underground as limestone dissolves. Example: Carlsbad Caverns in the USA.

• Sinkholes: Depressions on the surface formed when the roof of a cave collapses.

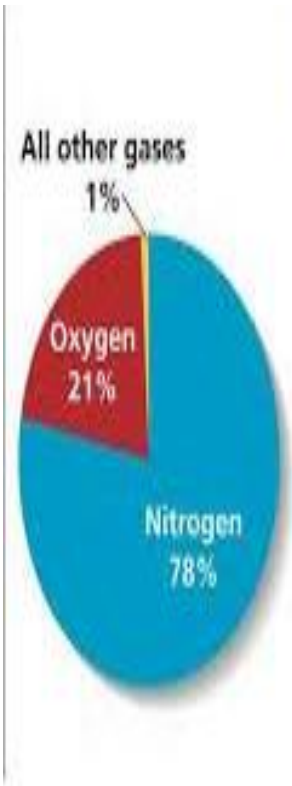
• Stalactites and Stalagmites: Mineral deposits that hang from ceilings or grow from the floor of caves, formed by dripping water. Karst topography is common in regions like the Yucatan Peninsula in Mexico and parts of Slovenia.

CHAPTER–7

COMPOSITION AND STRUCTURE OF ATMOSPHERE



Structure of Atmosphere



Gas	Percentage by Volume
Nitrogen (N_2)	78.084
Oxygen (O_2)	20.946
Argon (Ar)	0.934
Carbon dioxide (CO_2)	0.037
Neon (Ne)	0.00182
Helium (He)	0.00052
Methane (CH_4)	0.00015
Krypton (Kr)	0.00011

FILL IN THE BLANKS **5x1=5**

1.1. _____is the lowermost layer of the atmosphere.
1.2. The zone separating the troposphere from_____is known as the tropopause.
1.3. _____ is transparent to the incoming solar radiation but opaque to the outgoing terrestrial radiation.
1.4. Dust and salt particles act as _____around which water vapour condenses to produce clouds
1.5._____is found above the tropopause and extends up to a height of_____.

MULTIPLE CHOICE QUESTION **10X1=10**

2. Sea salt, pollen, ash, smoke soot, fine soil- these are associated with:
a) Gases b) Dust particles c) Water vapour d) Meteors

3. Ozone gas is present in –
a) Troposphere b) Stratosphere
c) Mesosphere d) Ionosphere

4. Which layer of atmosphere is found up between heights of 50-80 km?
a) Troposphere b) Ozone Layer
c) Mesosphere d) Ionosphere

5. Which layer of the atmosphere has average height is 13 km and extends roughly to a height of 8 km near the poles and about 18 km at the equator?

a) Troposphere b) Ozone Layer
c) Mesosphere d) Ionosphere

6. The temperature in troposphere decreases at the rate of 1°C for every_____ of height.

a) 180 km
b) 160 km
c) 165 km
d) 170 km

7. Which of the following statement is **not correct** related to composition of the atmosphere.

a) The atmosphere is composed of gases, water vapour and dust particles.
b) Carbon dioxide and water vapour are found only up to 90 km from the surface of the earth.
c) The proportion of gases doesn't changes in the higher layers of the atmosphere
d) Oxygen will be almost in negligible quantity at the height of 120 km.

8. Which of the following statement is **correct** about advantages of water transport.

a) The atmosphere consists of different layers with varying density and temperature.
b) Density is highest near the surface of the earth and decreases with increasing altitude.
c) The column of atmosphere is divided into five different layers depending upon the temperature condition.
d) All of above.

9. _____layer contains electrically charged particles.

a) Troposphere
b) Ozone Layer
c) Mesosphere
d) Ionosphere.

10. Which among them is **correctly matched?**

S.No.	Layer	Height
1	The troposphere	8-18 km
2.	The stratosphere	80 km
3.	The ionosphere	80-400 km
4.	The mesosphere	50 km

a) . 1&3 b). 1&4 c). 2&4 d). 2&3

11. Given below are two statements, Assertion (A) and the other is labelled as Reason (R):

Assertion (A): One important feature of the stratosphere is that it contains the ozone layer.
Reason (R): This layer absorbs ultra-violet radiation and shields life on the earth from intense, harmful form of energy.

a. Both A and R are true and R is the correct explanation of A.
b. Both A and R are true and R is the not correct explanation of A.
c. A is true but R is false.
d. A is false but R is true.

12. **Assertion (A):** The ionosphere is located between 80 and 400 km above the Mesopause.
Reasons (R): It contains electrically charged particles known as ions, and hence, it is known as ionosphere.

a) Both (A) and (R) are true and (R) is the correct explanation of (A).
b) Both (A) and (R) are true but (R) is not the correct explanation of (A).
c) (A) is correct but (R) is wrong. d) (A) is wrong but (R) is correct.
d) A is false but R is true

SOURCE BASED QUESTION

13. **Read the following passage and answer the question that follows: 3x1=3**

Atmosphere has a sufficient capacity to keep small solid particles, which may originate from different sources and include sea salts, fine soil, smoke-soot, ash, pollen, dust and disintegrated particles of meteors. Dust particles are generally concentrated in the lower layers of the atmosphere; yet, convectional air currents may transport them to great heights. The higher concentration of dust particles is found in subtropical and temperate regions due to dry winds in comparison to equatorial and Polar Regions.

Dust and salt particles act as hygroscopic nuclei around which water vapour condenses to produce clouds.

13.1 Sea salt, pollen, ash, smoke soot, fine soil- these are associated with:
a) Gases b) Dust particles c) Water vapour d) Meteors

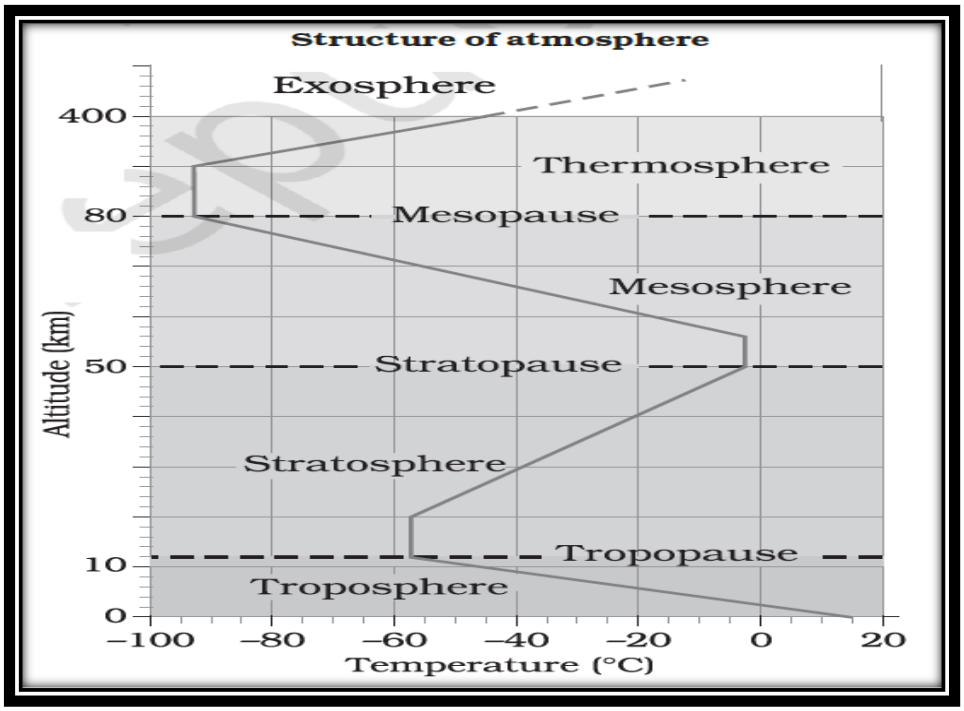
13.2 Why higher concentration of dust particles is found in subtropical and temperate regions?
13.3 Write the importance of dust particles.

14. **Read the given paragraph carefully and answer the questions that follow. 4x1=4**

The troposphere is the lowermost layer of the atmosphere. Its average height is 13 km and extends roughly to a height of 8 km near the poles and about 18 km at the equator. Thickness of the troposphere is greatest at the equator because heat is transported to great heights by strong convectional currents. This layer contains dust particles and water vapour. All changes in climate and weather take place in this layer. The temperature in this layer decreases at the rate of 1°C for every 165 m of height. This is the most important layer for all biological activity. The zone separating the troposphere from stratosphere is known as the tropopause. The air temperature at the tropopause is about minus 800C over the equator and about minus 450C over the poles. The temperature here is nearly constant, and hence, it is called the tropopause.

14.1 Why thickness of the troposphere is greatest at the equator?
14.2 What is the height of troposphere at the equator?
14.3 At what rate temperature decreases in the troposphere?
14.4 What is the air temperature at the tropopause over the poles?

15. **PICTURE BASED QUESTION (DIAGRAM BASED)** **4x1=4**



15.1 What is the average altitude and temperature at Mesopause?
15.2 Name the third layer of atmosphere from the earth surface.
15.3 What is the altitude (in km) of Stratosphere?
15.4 What is the temperature at Stratopause?

(SHORT QNSWER QUESTIONS) **3 MARKS**

CRITICAL THINKING AND HOT QUESTIONS

16. "The air is an integral part of the Earth's mass". Highlight the composition of the atmosphere.

17. Which layer of the atmosphere is the most important for human being and why?

Or

"This is the most important layer for all biological activity". Identify & write the main features of this layer.

18. "The elements of atmosphere are subject to change and influence human life on earth".

Justify the statement in context of elements of weather and climate.

Or

Mention the main elements of weather and climate.

19. "Water vapour is one of important variable gas in the atmosphere". Justify.

Or

Water vapour contributes to the stability and instability in the air. Explain.

(LONG QUESTION ANSWERS) **5 MARKS**

20. "Atmosphere is extended up to thousands of kilometres in the sky". Describe the various layers (structure) of the atmosphere.

21. "The atmosphere is composed of gases, water vapour and dust particles". Justify the statement.

22. "Radio waves transmitted from the earth are reflected back to the earth by this layer". Identify this layer of atmosphere and write its key features.

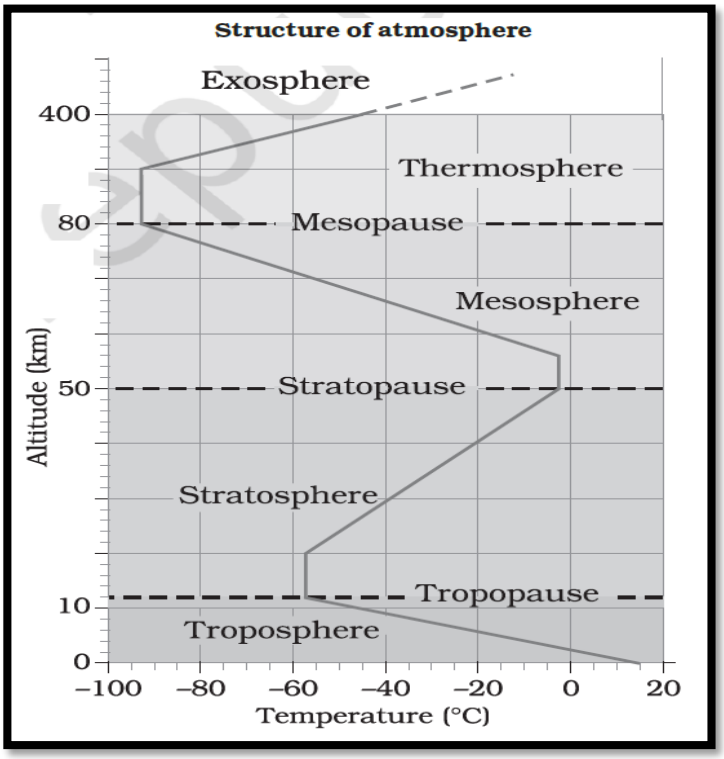
23. Discuss the composition and structure of atmosphere with the help of diagram.

MARKING SCHEME

QNO	EXPECTED ANSWER	MARKS
1	1.1) The troposphere. 1.2) Stratosphere 1.3) Carbon dioxide 1.4) Nuclei hygroscopic 1.5) The stratosphere & 50 km	5X1=5
2	b) Dust particles	1
3	b) Stratosphere	1
4	c) Mesosphere	1
5	a) Troposphere	1
6	c) 165 km	1
7	c) The proportion of gases doesn't changes in the higher layers of the atmosphere	1
8	d) All of above.	1
9	d) Ionosphere	1
10	a) 1&3	1
11	a) Both A and R are true and R is the correct explanation of A.	1
12	b) Both (A) and (R) are true but (R) is not the correct explanation of (A).	1
13	13.1- b) Dust particles 13.2 The higher concentration of dust particles is found in subtropical and temperate regions due to dry winds in comparison to equatorial and Polar Regions 13.3- Dust and salt particles act as hygroscopic nuclei around which water vapour condenses to produce clouds.	3x1=3
14	14.1- Thickness of the troposphere is greatest at the equator because heat is transported to great heights by strong convectional currents. 14.2- 18 km 14.3- Decreases at the rate of 1°C for every 165m 14.4 Minus 80 degree C.	4x1=4
15	15.1 80km & around -80 degree C. 15.2- Mesosphere 15.3- About 50 km 15.4- Near 0 degree C	4x1=4
16	1. The atmosphere is composed of gases, water vapour and dust particles. The proportion of gases changes in the higher layers of the atmosphere in such a way that oxygen will be almost in negligible	5x1=5 Page no. 64-65

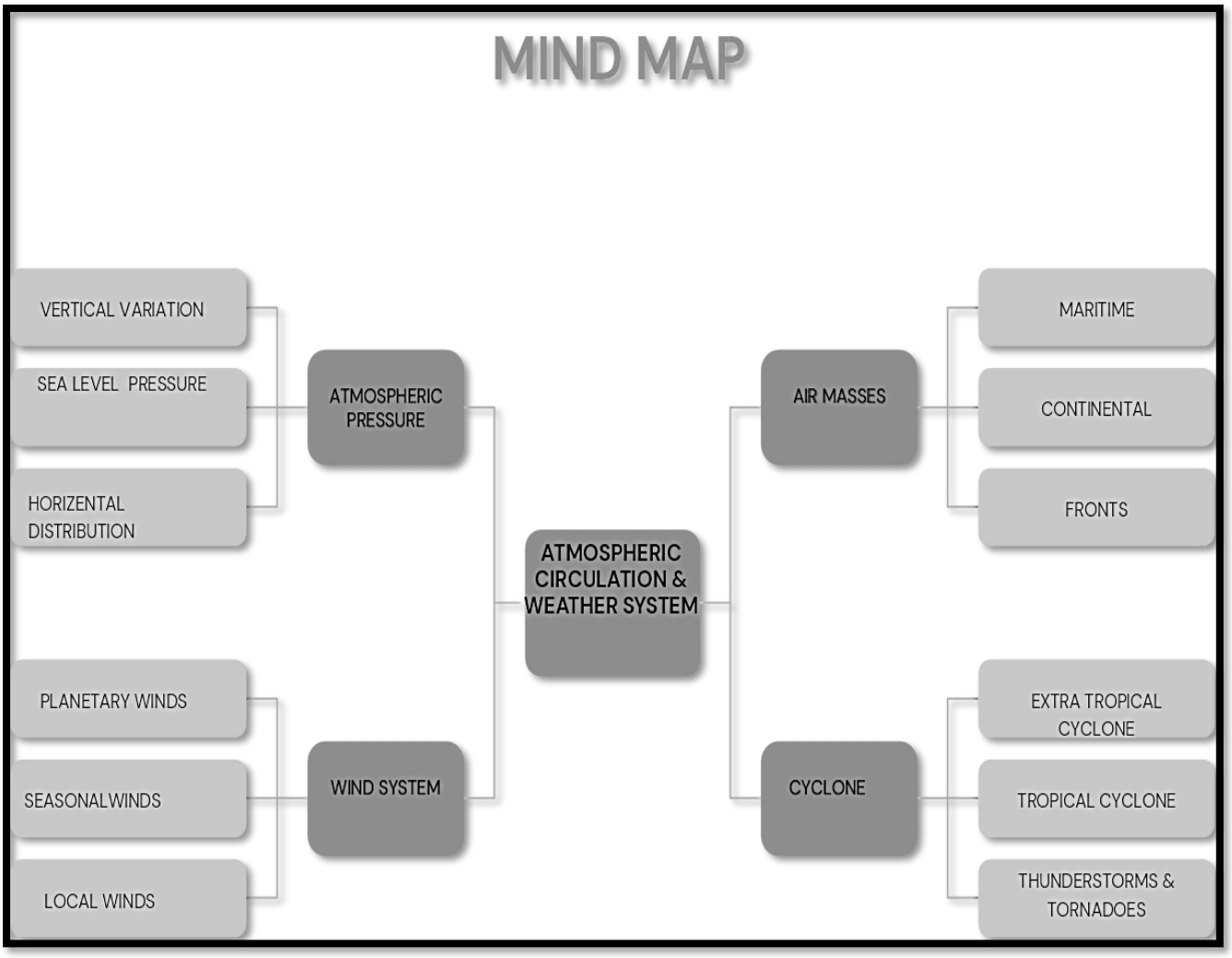
	quantity at the height of 120 km. Similarly, carbon dioxide and water vapour are found only up to 90 km from the surface of the earth. Carbon dioxide is meteorologically a very important gas as it is transparent to the Incoming solar radiation but opaque to the outgoing terrestrial radiation. Ozone is another important component of the atmosphere found between 10 and 50 km above the earth's surface and acts as a filter and absorbs the ultra-violet rays radiating from the sun and prevents them from reaching the surface of the earth. **2.Water Vapour** Water vapour is also a variable gas in the atmosphere, which decreases with altitude. In the warm and wet tropics, it may account for four per cent of the air by volume, while in the dry and cold are as of desert and polar regions, it may be less than one per cent of the air, it may be less than one per cent of the air. **3.Dust Particles** Atmosphere has a sufficient capacity to keep small solid particles, which may originate from different sources and include sea salts, fine soil, smoke-soot, ash, pollen, dust and disintegrated particles of meteors.	
17	1. Troposphere is the most important layer of human beings. It is equally important for other living beings on the earth. 2. Troposphere is the lower most layer and immediately in contact with the earth surface. Its average height is about 13 km. 3. Troposphere has maximum concentration of gases, dust particles and water vapour. However, amount decreases with height. 4. Oxygen need by humans, carbon dioxide needed by plants have maximum concentration in the troposphere. 56 5. Most of the weather / climate related phenomena take place in the troposphere only like lightening, thunder, hail, storm, rainfall, snowfall etc.	3X1=3 Page no. 65
18	The main elements of atmosphere which are subject to change and which influence human life on earth are 1. Temperature, 2. Pressure, 3. Winds, 4. Humidity, 5. Clouds 6. Precipitation.	3x1=3 Page no. 66
19	1. Water vapour is also a variable gas in the atmosphere, which decreases with altitude. In the warm and wet tropics, it may account for four per cent of the air by volume, while in the dry and cold areas of desert and polar regions, it may be less than one per cent of the air. 2. Water vapour also decreases from the equator towards the poles. It also absorbs parts of the insolation from the sun and preserves the earth's radiated heat. 3. It thus, acts like a blanket allowing the earth neither to become too cold nor too hot. Water vapour also contributes to the stability and instability in the air.	3x1=3 Page no. 64

20	Atmosphere is extended up to thousands of kilometres in the sky. It has five distinct layers. From the earth surface, these fiver layers are: a) Troposphere, b) Stratosphere, c) Mesosphere, d) Ionosphere and e) Exosphere. a) Troposphere is the lower most layers. It is also the most important layer because highest concentration of gases, water vapour is found in this layer. All the weather phenomena like rainfall, snowfall, hail, storm, lightening etc. take place in this layer only. This layer is extended up to 18 km. from the earth surface. b) Stratosphere is the second layer which is extended up to 50 km from the earth surface. Ozone gas is found in this layer which filters harmful ultraviolet radiation coming from the sun and protects life on the earth. c) Mesosphere: It is the middle layer. It extends from 50 km to 80 km in the sky. d) Ionosphere: Ionosphere is very important for communication as it transmit radio waves back to the earth surface; therefore this layer is used for radio communication. e) Exosphere: Exosphere is the last layer about which very little is known. Only light and rare gases are found in these layers. This layer starts from a height of 400 km. from the earth surface.	5 Page no. 65-66
21	1. The atmosphere is composed of gases, water vapour and dust particles. The proportion of gases changes in the higher layers of the atmosphere in such a way that oxygen will be almost in negligible quantity at the height of 120 km. Similarly, carbon dioxide and water vapour are found only up to 90 km from the surface of the earth. 2. Carbon dioxide is meteorologically a very important gas as it is transparent to the Incoming solar radiation but opaque to the outgoing terrestrial radiation. 3. Ozone is another important component of the atmosphere found between 10 and 50 km above the earth's surface and acts as a filter and absorbs the ultra-violet rays radiating from the sun and prevents them from reaching the surface of the earth. Water Vapour 4. Water vapour is also a variable gas in the atmosphere, which decreases with altitude. In the warm and wet tropics, it may account for four per cent of the air by volume, while in the dry and cold are as of desert and polar regions, it may be less than one per cent of the air, it may be less than one per cent of the air. Dust Particles 5. Atmosphere has a sufficient capacity to keep small solid particles, which may originate from different sources and include sea salts, fine soil, smoke-soot, ash, pollen, dust and disintegrated particles of meteors.	5 Page no. 64-65
22	**The ionosphere** 1. The ionosphere is located between 80 and 400 km above the mesopause. 2. It contains electrically charged particles known as ions, and hence, it Is known as ionosphere. 3. Radio waves transmitted from the earth are reflected back to the earth by this layer. 4. Temperature here starts increasing with height. 5. It contains electrically charged particles	1+ 4=5 Page no. 65

23	The atmosphere is composed of gases, water vapour and dust particles. The proportion of gases changes in the higher layers of the atmosphere in such a way that oxygen will be almost in negligible quantity at the height of 120 km. Similarly, carbon dioxide and water vapour are found only up to 90 km from the surface of the earth. Carbon dioxide is meteorologically a very important gas as it is transparent to the Incoming solar radiation but opaque to the outgoing terrestrial radiation. Ozone is another important component of the atmosphere found between 10 and 50 km above. the earth's surface and acts as a filter and absorbs the ultra-violet rays radiating from the sun and prevents them from reaching the surface of the earth. **Water Vapour** Water vapour is also a variable gas in the atmosphere, which decreases with altitude. In the warm and wet tropics, it may account for four per cent of the air by volume, while in the dry and cold are as of desert and polar regions, it may be less than one per cent of the air, it may be less than one per cent of the air. **Dust Particles** Atmosphere has a sufficient capacity to keep small solid particles, which may originate from different sources and include sea salts, fine soil, smoke-soot, ash, pollen, dust and disintegrated particles of meteors. The important layers of the atmosphere are followings:- 1) Troposphere 2) Stratosphere 3) Mesosphere 4) Thermosphere 5) Exosphere.  	5 Page no. 64-66

CHAPTER–9

ATMOSPHERIC CIRCULATION AND WEATHER SYSTEM



FILL IN THE BLANKS

Q1. Atmospheric pressure is defined as the weight of a column of air above a unit area at _____ level.

Q2. The area of high pressure, surrounded by low-pressure areas, is known as an _____.

Q3. The winds blow from the subtropical high-pressure belts towards the equatorial low-pressure belt in Northern hemisphere is _____

Q4. The pressure gradient force causes air to move from areas of _____ pressure to areas of _____ pressure.

Q5. The _____ law states that winds blow parallel to the isobars in the upper atmosphere due to the balance between the Coriolis force and the pressure gradient force.

Q6. The _____ effect is strongest at the poles and absent at the equator.

Q7. The Intertropical Convergence Zone (ITCZ) is characterized by _____ pressure and rising air.

Q8. The _____ wind system is responsible for monsoons in South Asia.

Q9. The vertical pressure gradient force is balanced by the gravitational force, a condition known as _____ equilibrium.

Q10. The phenomenon where cold, dense air flows down slope due to gravity is known as a _____ wind.

MULTIPLE CHOICE QUESTIONS

Q11. Which instrument is used to measure atmospheric pressure?
A. Thermometer
B. Barometer
C. Anemometer
D. Hygrometer

Q12. Katabatic winds are caused by:
A. Rapid heating of land during the day
B. Cooling of dense air that flows downslope
C. Interaction of the trade winds with the westerlies
D. High-pressure systems moving over low-pressure areas

Q13. The Coriolis effect causes wind to deflect to the _____ in the Southern Hemisphere.
A. Left
B. Right
C. East
D. West

Q14. Which of the following winds is an example of local wind?
A. Trade winds
B. Monsoon winds
C. Chinook
D. Westerlies

Q15. The Intertropical Convergence Zone (ITCZ) is a region of:
A . High pressure and dry winds
B. Low pressure and rising air
C. Stable air with no pressure difference
D. Converging cold and warm fronts

Q16. What causes the formation of cyclones in tropical regions?
A . High-pressure systems
B. Converging trade winds
C. Diverging winds at the surface
D. High altitude cooling

Q17. Which of the following is NOT a characteristic of an anticyclone?
A . High pressure at the centre
B. Outward movement of air
C. Clear and calm weather
D. Rising air currents

Q18. Which of the following best explains why atmospheric pressure decreases with altitude?
A . Gravitational force decreases with altitude.
B. The density of air decreases with altitude.
C. Temperature decreases consistently with altitude.
D. Solar radiation increases with altitude.

Q19. Which among the following is NOT a feature of geostrophic winds?
A. They blow parallel to the isobars.
B. They result from a balance between the Coriolis force and pressure gradient force.
C. They are affected by friction near the surface.
D. They occur at high altitudes.

Q20. The polar front theory explains the formation of:
A. Tropical cyclones
B. Jet streams
C. Mid-latitude cyclones
D. Anticyclones in subtropical regions

Q21. The movement of air in a cyclone is characterized by:
A. Outward and clockwise in the Northern Hemisphere
B. Inward and clockwise in the Northern Hemisphere
C. Inward and anticlockwise in the Northern Hemisphere
D. Outward and anticlockwise in the Southern Hemisphere

Q22. Which of the following best describes the Ferrel cell?
A. A circulation system between the equator and 30° latitude
B. A circulation system between 30° and 60° latitude
C. A circulation system between 60° and the poles
D. A circulation system confined to the equator

Q23.During a typical El Niño event, which of the following changes occurs in the Pacific Ocean?
A. Trade winds strengthen, leading to cooler sea surface temperatures near South America
B. Trade winds weaken, leading to warmer sea surface temperatures near South America
C. Increased upwelling off the coast of Peru
D. Expansion of polar ice caps

Q24. A coastal city frequently experiences a sea breeze during the day. This phenomenon occurs because:
A. The land heats up faster than the sea, causing air to rise over the land
B. The sea heats up faster than the land, causing air to rise over the sea
C. The Coriolis effect draws air toward the land
D. The Moon's gravitational pull influences the wind

Q25. A cyclone is predicted to make landfall in a coastal region. Which preparation measure is most appropriate?
A. Organize large-scale outdoor events to keep the population calm
B. Evacuate low-lying areas and secure loose objects
C. Avoid reporting the cyclone to prevent panic
D. Continue normal activities, as cyclones dissipate quickly

Q26. Arrange the following steps in the development of a tropical cyclone in the correct sequence:
1. Low-pressure area forms.
2. Warm Ocean water evaporates and rises
3. Wind speeds increase to form a cyclone.
4. Thunderstorms organize into a spiral structure

A. 1 → 2 → 3 → 4
B. 2 → 1 → 4 → 3
C. 1 → 3 → 2 → 4
D. 3 → 2 → 1 → 4

Q27. If the Earth's rotation were to stop, how would it affect the global wind patterns?
A. Winds would move in straight lines from high to low pressure without deflection.
B. Winds would move more vigorously due to increased atmospheric pressure.
C. The Coriolis effect would strengthen, causing extreme deflection of winds.
D. Global wind patterns would remain unaffected.

Q28. Which of the following statement is NOT true about tropical cyclone.
A. Tropical cyclones form over warm ocean waters with temperatures above 27°C.
B. The Coriolis effect is necessary for the rotation of tropical cyclones.
C. Tropical cyclones intensify as they move over colder waters.
D. The eye of a tropical cyclone is characterized by calm weather and descending air.

MATCH THE FOLLOWING:

Q29. Match the following with the correct option given below:

Column A (Air Mass Type)	**Column B (Characteristics/Regions)**
A. Continental Polar (cP)	1. Warm and humid, forms over tropical oceans
B. Maritime Tropical (mT)	2. Cold and dry, forms over high-latitude land
C. Continental Tropical (cT)	3. Cool and humid, forms over cold ocean regions
D. Maritime Polar (mP)	4. Hot and dry, forms over desert regions

A. A-1, B-2, C-3, D-4
B. A-2, B-3, C-4, D-1
C. A-4, B-1, C-2, D-3
D. A-2, B-1, C-4, D-3

Q30. Match the following atmospheric circulation cells with their primary locations:
A. Hadley Cell → 1. Between 0° and 30° latitude
B. Ferrel Cell → 2. Between 30° and 60° latitude
C. Polar Cell → 3. Between 60° and 90° latitude
A. A-1, B-2, C-3
B. A-2, B-3, C-1
C. A-3, B-1, C-2
D. A-1, B-3, C-2

Q31. Match the items in Column A with the correct description in Column B.

Column A	Column B
A. Tropical Cyclone	1. The calm central part of a cyclone
B. Temperate Cyclone	2. Cyclones formed in the mid-latitudes
C. Eye of a Cyclone	3. Intense low-pressure system over warm oceans
D. Storm Surge	4. Strong winds and rising sea levels during a cyclone

Options:

A. A-1, B-2, C-3, D-4
B. A-3, B-2, C-1, D-4
C. A-3, B-1, C-4, D-2
D. A-1, B-4, C-2, D-3

Q32. Match the items in Column A with the correct description in Column B.

Column A	Column B
A. Clockwise Rotation	1. Requires warm sea surface temperatures and low pressure
B. Anticlockwise Rotation	2. Issued to alert areas about an approaching cyclone
C. Cyclone Warning	3. Direction of cyclone rotation in the Northern Hemisphere
D. Cyclone Formation	4. Direction of cyclone rotation in the Southern Hemisphere

Option:

A. A-1, B-2, C-3, D-4
B. A-3, B-2, C-1, D-4
C. A-4, B-3, C-2, D-1
D. A-1, B-4, C-2, D-3

Q33. Match the terms in Column A with their correct descriptions in Column B.

Column A	Column B
A. Frontogenesis	1. The process of intensifying a weather front
B. Warm Front	2. A front formed when a cold front overtakes a warm front
C. Cold Front	3. A boundary where cold air displaces warm air
D. Occluded Front	4. A boundary where warm air replaces cold air

A. A-1, B-4, C-3, D-2
B. A-3, B-2, C-1, D-4
C. A-4, B-3, C-2, D-1
D. A-1, B-4, C-2, D-3

ASSERTION-REASONING

Q34. Assertion (A): The force exerted by the rotation of the Earth is known as the Coriolis force.
Reason (R): Winds move to the right from their original direction in the Northern Hemisphere and to the left in the Southern Hemisphere.
A. Both (A) and (R) are true and (R) is the correct explanation of (A).
B. Both (A) and (R) are true but (R) is not the correct explanation of (A).
C. (A) is true but (R) is false.
D. (A) is false but (R) is true.

Q35. Assertion (A): The Inter-Tropical Convergence Zone (ITCZ) is a region of intense rainfall and thunderstorms.
Reason (R): The ITCZ is a high-pressure belt where winds diverge.
A. Both (A) and (R) are true and (R) is the correct explanation of (A).
B. Both (A) and (R) are true but (R) is not the correct explanation of (A).
C. (A) is true but (R) is false.
D. (A) is false but (R) is true.

Q36. Assertion (A): Tropical cyclones are most common in the Bay of Bengal during the post-monsoon season.
Reason (R): Tornadoes occur most frequently and causes very much destructive in North America.
A. Both (A) and (R) are true and (R) is the correct explanation of (A).
B. Both (A) and (R) are true but (R) is not the correct explanation of (A).
C. (A) is true but (R) is false.
D. (A) is false but (R) is true.

Q37. Assertion (A):. The westerlies are stronger in winter than in summer
Reason (R): high-pressure areas are generally associated with lower temperatures
A. Both (A) and (R) are true and (R) is the correct explanation of (A).
B. Both (A) and (R) are true but (R) is not the correct explanation of (A).
C. (A) is true but (R) is false.
D. (A) is false but (R) is true.

Q38. Assertion (A): The eye of a cyclone is the most destructive region of the storm..
Reason (R): The eye of the cyclone is a low-pressure area where air rises and forms clouds, resulting in intense weather conditions.
A. Both (A) and (R) are true and (R) is the correct explanation of (A).
B. Both (A) and (R) are true but (R) is not the correct explanation of (A).
C. (A) is true but (R) is false.
D. (R) is true but (A) is false.

Q39. Assertion (A): The closer the isobars are to each other, the stronger the winds in that area.
Reason (R): Isobars are lines on a map connecting areas of equal pressure.
A. Both (A) and (R) are true and (R) is the correct explanation of (A).
B. Both (A) and (R) are true but (R) is not the correct explanation of (A).
C. (A) is true but (R) is false.
D. (R) is true but (A) is false.

Q40. Assertion (A): The ITCZ shifts northward during summer in the Northern Hemisphere.
Reason (R): The shift of the ITCZ is influenced by the apparent movement of the Sun.
A. Both (A) and (R) are true and (R) is the correct explanation of (A).
B. Both (A) and (R) are true but (R) is not the correct explanation of (A).
C. (A) is true but (R) is false.
D. (R) is true but (A) is false

SOUREC/CASE BASED QUESTIONS:

Q41. Read the passage and answer the following:

The air at the Inter Tropical Convergence Zone (ITCZ) rises because of convection caused by high insolation and a low pressure is created. The winds from the tropics converge at this low-pressure zone. The converged air rises along with the convective cell. It reaches the top of the troposphere up to an altitude of 14 km. and moves towards the poles. This causes accumulation of air at about 30o N and S. Part of the accumulated air sinks to the ground and forms a subtropical high. Another reason for sinking is the cooling of air when it reaches 30o N and S latitudes. Down below near the land surface the air flows towards the equator as the easterlies. The easterlies from either side of the equator converge in the Inter Tropical Convergence Zone (ITCZ). Such circulations from the surface upwards and vice-versa are called cells. Such a cell in the tropics is called Hadley Cell. In the middle latitudes the circulation is that of sinking cold air that comes from the poles and the rising warm air that blows from the subtropical high. At the surface these winds are called westerlies and the cell is known as the Ferrel cell. At polar latitudes the cold dense air subsides near the poles and blows towards middle latitudes as the polar easterlies. This cell is called the polar cell. These three cells set the pattern for the general circulation of the atmosphere. The transfer of heat energy from lower latitudes to higher latitudes maintains the general circulation.

Q41.1 Which of the following statements best describes the Inter Tropical Convergence Zone (ITCZ)?
A. A high-pressure zone where cold air sinks to the ground.
B. A low-pressure zone caused by convection due to high insolation.
C. A region where westerlies converge near the poles.
D. A subtropical region with sinking cold air.

41.2 What is the primary reason for the formation of subtropical high-pressure belts around 30° N and S?
A. The convergence of westerlies and polar easterlies.
B. Sinking of cold air from the poles.
C. Accumulation and sinking of air due to cooling and poleward movement from the ITCZ.
D. Direct heating by insolation at 30° N and S.

41.3 Which of the following cells is characterized by the interaction of sinking cold air from the poles and rising warm air from subtropical highs?
A. Hadley Cell
B. Ferrel Cell
C. Polar Cell
D. ITCZ Cell

Q42. Read the passage carefully and answer the questions that follows:

The velocity and direction of the wind are the net result of the wind generating forces. The winds in the upper atmosphere, 2 – 3 km above the surface, are free from frictional effect of the surface and are controlled mainly by the pressure gradient and the Coriolis force. When isobars are straight and when there is no friction, the pressure gradient force is balanced by the Coriolis force and the resultant wind blows parallel to the isobar. This wind is known as the

geostrophic wind the wind circulation around a low is called cyclonic circulation. Around a high it is called anti cyclonic circulation. The direction of winds around such systems changes according to their location in different hemispheres the wind circulation at the earth's surface around low and high on many occasions is closely related to the wind circulation at higher level. Generally, over low-pressure area the air will converge and rise. Over high pressure area the air will subside from above and diverge at the surface. Apart from convergence, some eddies, convection currents, orographic uplift and uplift along fronts cause the rising of air, which is essential for the formation of clouds and precipitation.

Q42.1 What is the primary factor that allows geostrophic winds to blow parallel to the isobars?
A. The effect of surface friction on wind.
B. The balance between pressure gradient force and Coriolis force.
C. The convergence of winds in low-pressure areas.
D. The divergence of winds in high-pressure areas.

Q42.2 Which of the following is true about wind circulation around pressure systems?
A. Cyclonic circulation occurs around a high-pressure system.
B. Anticyclonic circulation occurs around a low-pressure system.
C. Cyclonic circulation occurs around a low-pressure system, and its direction depends on the hemisphere.
D. Anticyclonic circulation occurs around a low-pressure system, and its direction is constant in all hemispheres.

Q42.3 What is one of the main causes of air rising in the atmosphere over a low-pressure area?
A. Surface friction reducing wind velocity.
B. Subsidence of air from above.
C. Convergence of air along with other mechanisms like convection currents and orographic uplift.
D. The divergence of air at the surface.

Q43. Read the passage carefully and answer the questions that follows:

When two different air masses meet, the boundary zone between them is called a front. The process of formation of the fronts is known as frontogenesis. There are four types of fronts: (a) Cold; (b) Warm; (c) Stationary; (d) Occluded. When the front remains stationary, it is called a stationary front. When the cold air moves towards the warm air mass, its contact zone is called the cold front, whereas if the warm air mass moves towards the cold air mass, the contact zone is a warm front. If an air mass is fully lifted above the land surface, it is called the occluded front. The fronts occur in middle latitudes and are characterised by steep gradient in temperature and pressure. They bring abrupt changes in temperature and cause the air to rise to form clouds and cause precipitation.

Q43.1 What type of front is formed when warm air moves toward cold air?

Q43.2 Why do fronts typically occur in the middle latitudes?

Q43.3 How the characteristics of a stationary front can lead to extreme weather events like flooding

Q44. Read the passage carefully and answer the questions that follows:

Warming and cooling of the Pacific Ocean is most important in terms of general atmospheric circulation. The warm water of the central Pacific Ocean slowly drifts towards South American coast and replaces the cool Peruvian current. Such appearance of warm water off the coast of Peru is known as the El Nino. The El Nino event is closely associated with the pressure changes in the Central Pacific and Australia. This change in pressure condition over Pacific is known as the southern oscillation. The combined phenomenon of southern oscillation and El Nino is known as ENSO. In the years when the ENSO is strong, large-scale variations in weather occur over the world. The arid west coast of South America receives heavy rainfall, drought occurs in Australia and sometimes in India and floods in China. This phenomenon is closely monitored and is used for long range forecasting in major parts of the world.

Q44.1 What is EL Nino? How is it related to Southern Oscillation?
Q44.2 How can monitoring ENSO help in weather forecasting?
Q44.3 What might be the impact of a strong ENSO event on agricultural activities in India?

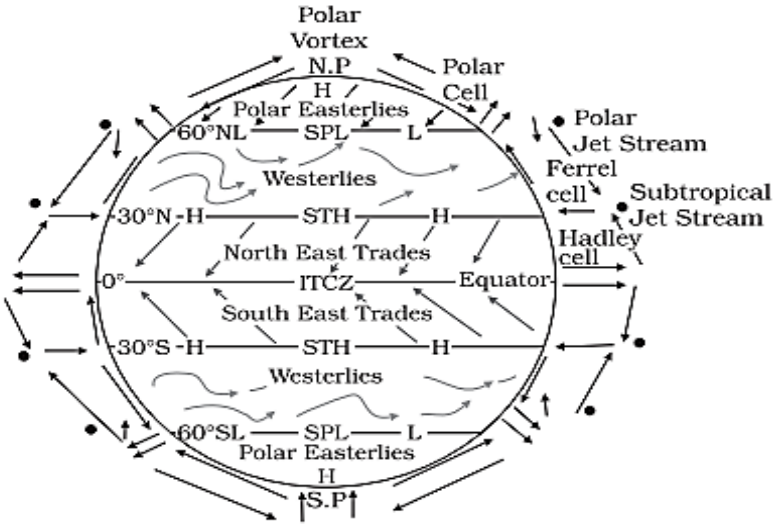
Q45. Study the following table and answer the questions follow:

Pattern of Wind Direction in Cyclones and Anticyclones

Pressure System	Pressure Condition at the Centre	Pattern of Wind Direction	
		Northern Hemisphere	Southern Hemisphere
cyclone	low	Anti-clockwise	Clockwise
Anticyclone	High	Clockwise	Anti-clockwise

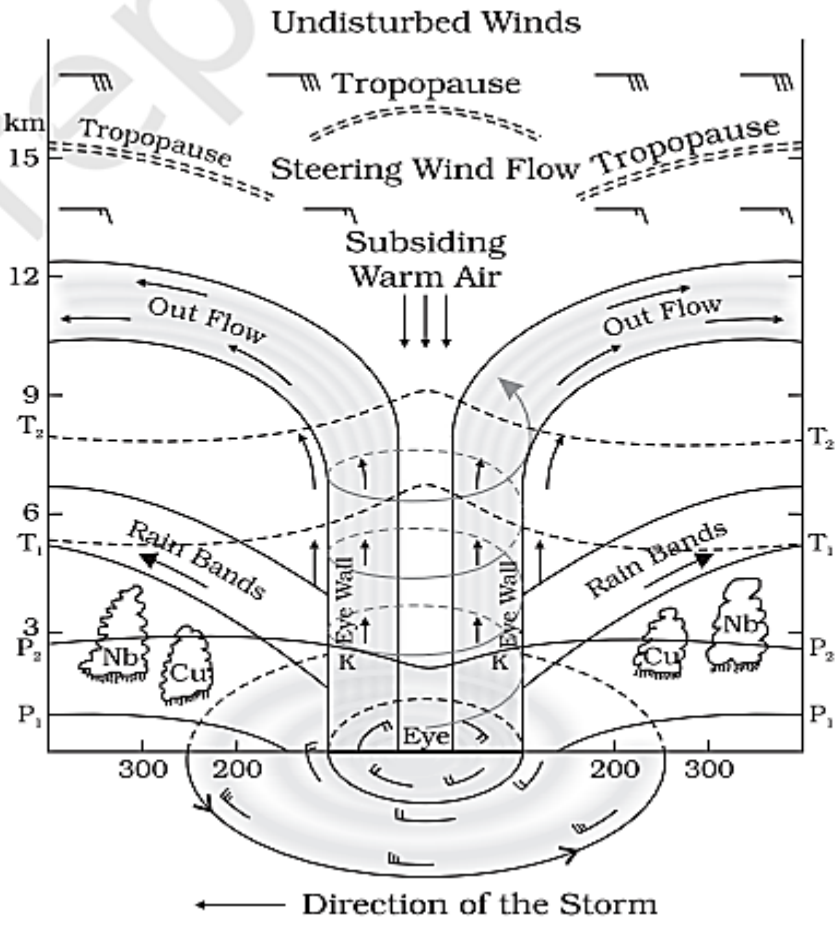
Q45.1 Why do cyclones in the Northern Hemisphere have an anticlockwise wind pattern at their center, while in the Southern Hemisphere they rotate clockwise?
Q45.2 How does the pressure condition at the center of cyclones and anticyclones influence the wind pattern?
Q45.3 What is the relationship between pressure systems and wind circulation in cyclones and anticyclones across hemispheres?

Q46. **Study the following diagram and answer the questions follow:**



Q46.1 Why does the ITCZ (Inter-Tropical Convergence Zone) shift during the year, and how does this impact global wind circulation patterns?
Q46.2 How the Hadley Cell contributes to the formation of subtropical high-pressure belts (STH) around 30° N and 30° S latitudes?
Q46.3 How do the polar easterlies and westerlies interact at 60° latitude, and what is its significance?

Q47. Study the following diagram and answer the questions follow:



Q47.1 What is the significance of the "Eye" in a tropical cyclone, as shown in the diagram?
Q47.2 What is the function of the "outflow" at the top of a tropical cyclone?
Q47.3 Why are "rain bands" significant in the structure of a tropical cyclone?

Q48. **Study the diagram and answer the questions follow:**

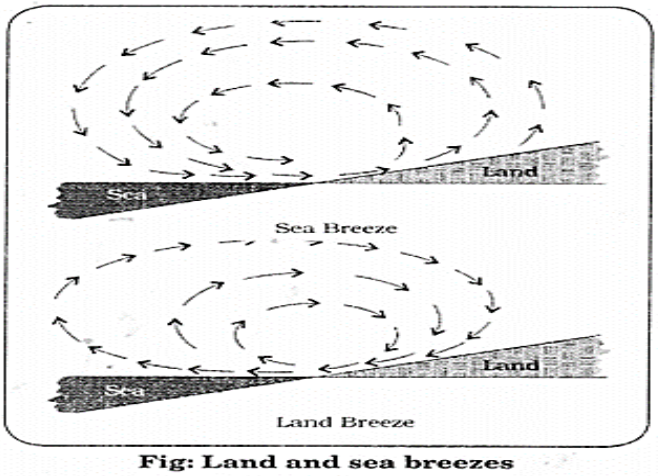


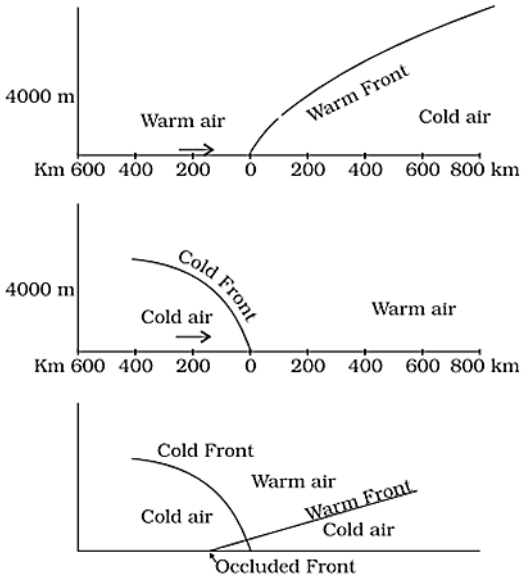
Fig: Land and sea breezes

Q48.1 What is the key difference between a land breeze and a sea breeze as shown in the diagram?

Q48.2 What causes a sea breeze?

Q48.3 Reeta was planning for a beach tour to enjoy the sea shore and gusty winds coming from the sea. What time do you prefer for Reeta to do so?

Q49. Look at the picture and answer the following questions:

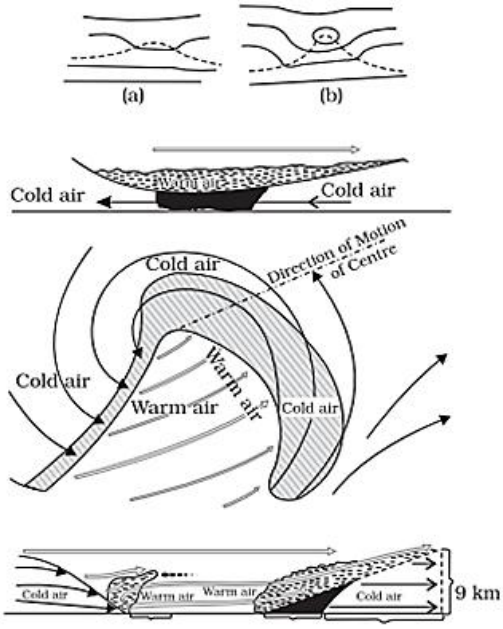


Q49.1 What is warm front?

Q49.2 What is cold front?

Q49.3 What weather conditions change ahead of, within, and behind the occluded front?

Q50. Read the following diagram and answer the questions:



Q50.1 What type of front is formed when a warm air mass is trapped between two cold air masses, as shown in the diagram?

Q50.2 In the diagram, what is the direction of motion of the centre of the system?

Q50.3 How can the weather patterns associated with an occluded front, as shown in the diagram, impact aviation and flight schedules?

MAP BASED QUESTIONS

Q51.Study the map given below and answer the following:

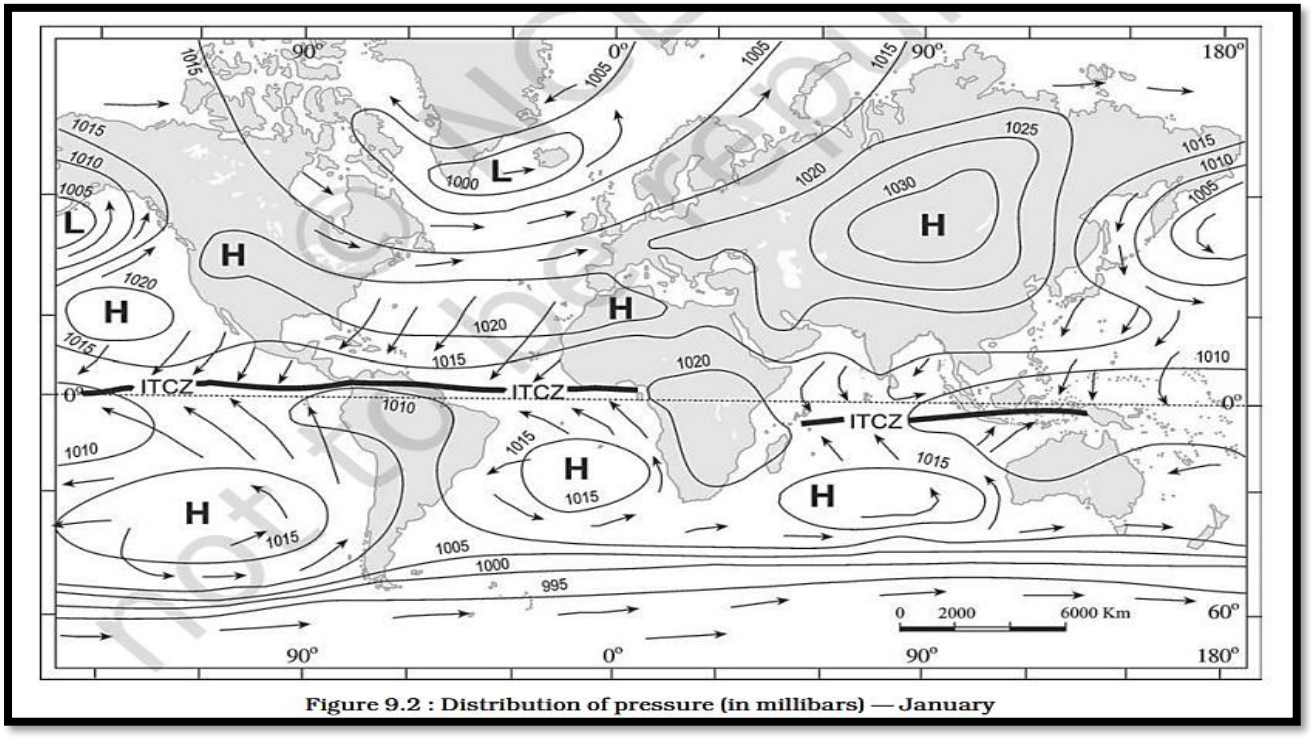


Figure 9.2 : Distribution of pressure (in millibars) — January

Q51.1 What does "H" denote on the map, and what type of weather is generally associated with it?

Q51.2 What does the ITCZ (Inter-Tropical Convergence Zone) represent on the map?

Q51.3 How does the distribution of pressure in January influence the movement of winds in the Northern Hemisphere?

Q52.Study the map given below and answer the following:

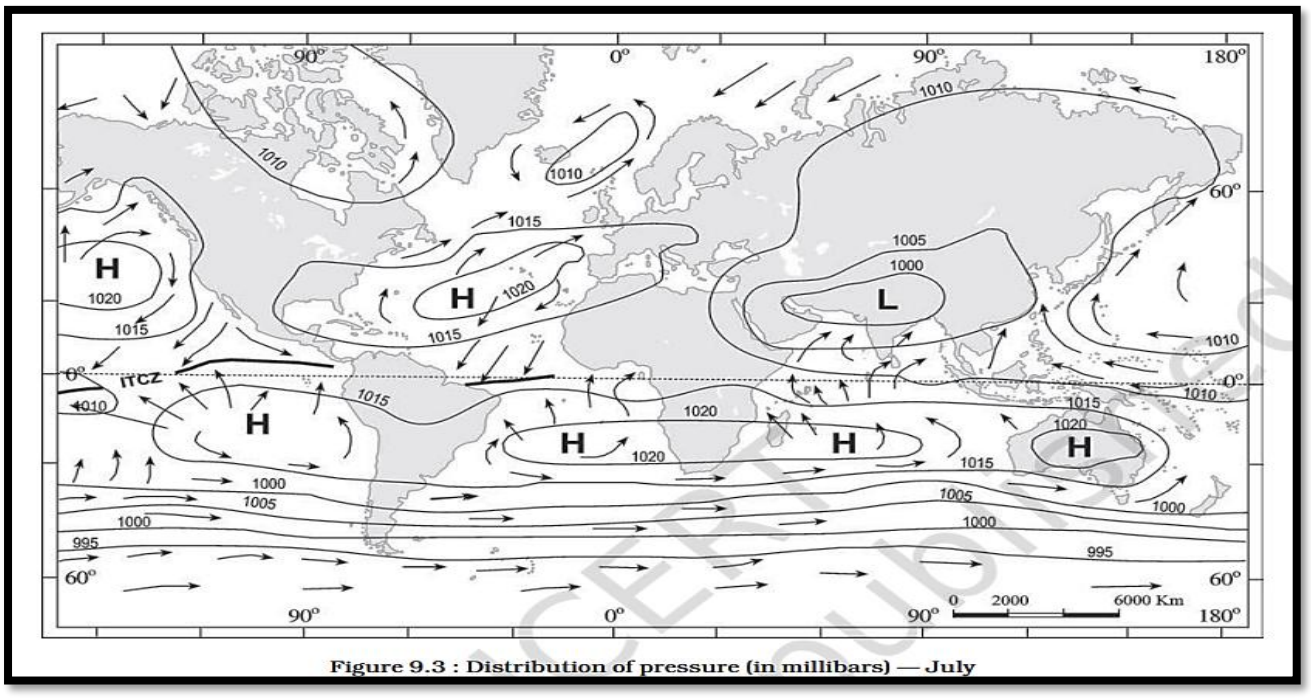


Figure 9.3 : Distribution of pressure (in millibars) — July

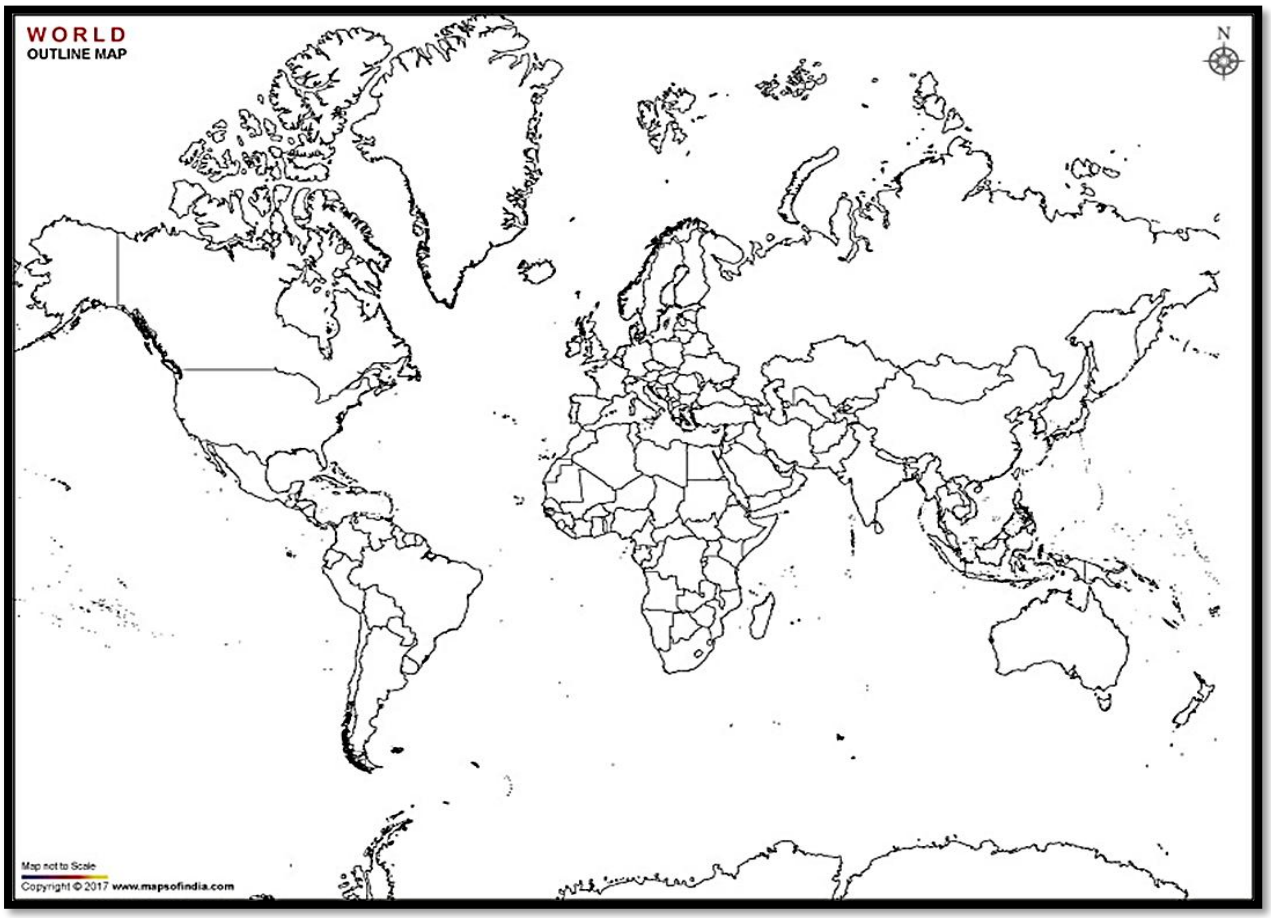
Q52.1 What is the predominant pressure pattern over the northern hemisphere in July?

Q52.2 Where is the Intertropical Convergence Zone (ITCZ) located in July?

Q52.3 What is the predominant wind direction over the Indian subcontinent in July as depicted by the map?

Q53. On the given political outline map of the world locate and label the following Deserts:

A. Mojave Desert
B. Patagonian Desert
C. Sahara Desert
D. Gobi Desert
E. The Thar Desert
F. Great Victoria Desert



ANSWER KEY

Q. NO.	ANSWERS
1	Sea
2	Anticyclone
3	North-east trade winds
4	high, low
5	geostrophic
6	Coriolis
7	low
8	seasonal
9	hydrostatic

10	katabatic
11	B. Barometer
12	B. Cooling of dense air that flows downslope
13	A. Left
14	C. Chinook
15	B. Low pressure and rising air
16	B. Converging trade winds
17	D. Rising air currents
18	B. The density of air decreases with altitude
19	C. They are affected by friction near the surface
20	D. Anticyclones in subtropical regions
21	C. Inward and anticlockwise in the Northern Hemisphere
22	B. A circulation system between 30° and 60° latitude
23	B. Trade winds weaken, leading to warmer sea surface temperatures near South America
24	A. The land heats up faster than the sea, causing air to rise over the land
25	B. Evacuate low-lying areas and secure loose objects
26	B. 2 → 1 → 4 → 3
27	A. Winds would move in straight lines from high to low pressure without deflection.
28	C. Tropical cyclones intensify as they move over colder waters.
29	D. A–2, B–1, C–4, D–3
30	A. A–1, B–2, C–3
31	B. A–3, B–2, C–1, D–4
32	C. A–4, B–3, C–2, D–1
33	A. A–1, B–4, C–3, D–2
34	A. Both (A) and (R) are true and (R) is the correct explanation of (A).
35	C. (A) is true but (R) is false.
36	B. Both (A) and (R) are true but (R) is not the correct explanation of (A).
37	B. Both (A) and (R) are true but (R) is not the correct explanation of (A).
38	D. (R) is true but (A) is false.
39	A. Both (A) and (R) are true and (R) is the correct explanation of (A).
40	A. Both (A) and (R) are true and (R) is the correct explanation of (A).

Source/data/diagram based

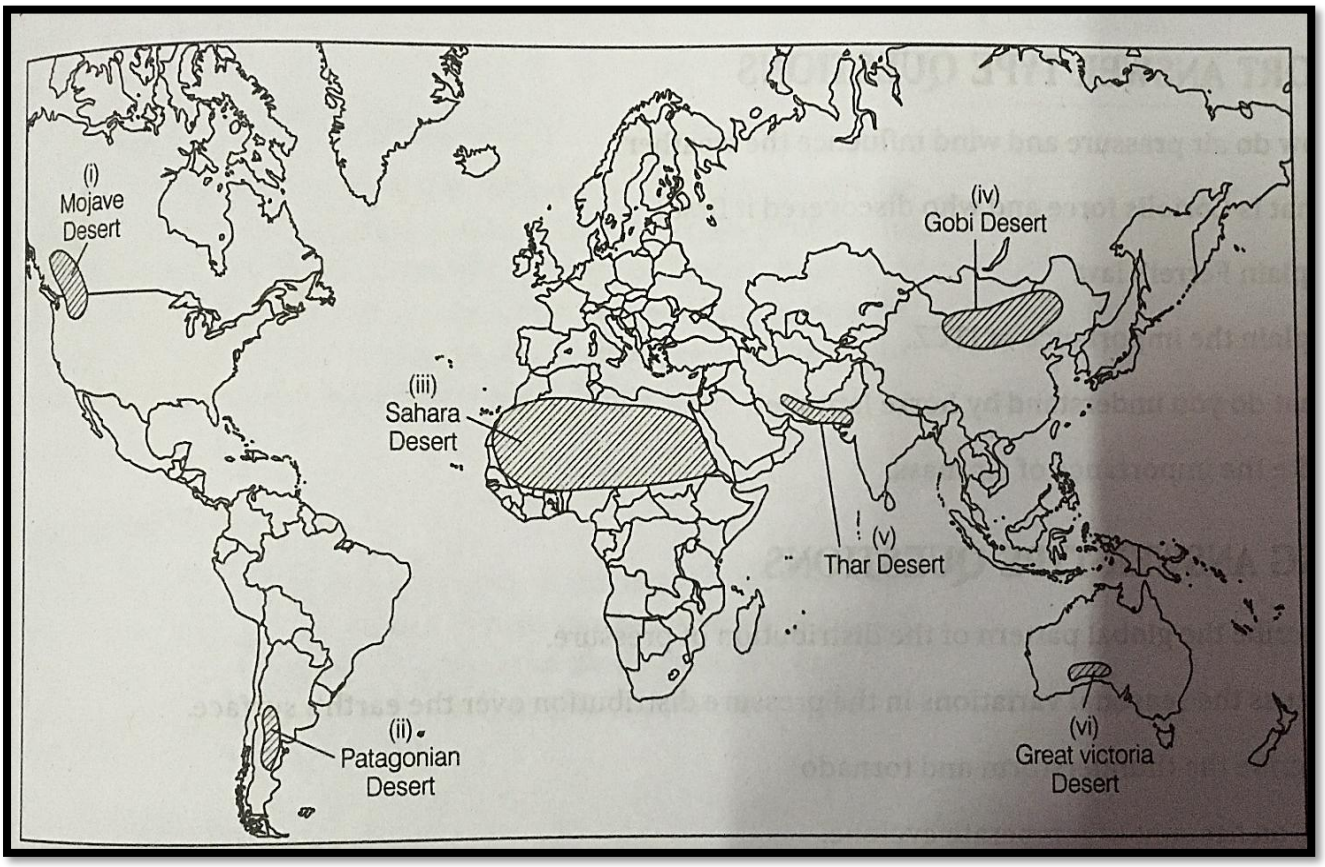
Q.NO.	ANSWERS
41.1	B. A low-pressure zone caused by convection due to high insolation
41.2	C. Accumulation and sinking of air due to cooling and poleward movement from the ITCZ.
41.3	B. Ferrel Cell
42.1	B. The balance between pressure gradient force and Coriolis force.
42.2	C. Cyclonic circulation occurs around a low-pressure system, and its direction depends on the hemisphere.
42.3	C. Convergence of air along with other mechanisms like convection currents and orographic uplift.

43.1	When warm air moves toward cold air, a warm front is formed
43.2	Fronts occur in middle latitudes because this is where cold polar air masses and warm tropical air masses converge, creating sharp gradients in temperature and pressure.
43.3	Stationary fronts remain in one place for an extended period, causing continuous rainfall over a specific area. If the precipitation is heavy and prolonged, it can saturate the soil and overwhelm drainage systems, leading to flooding.
44.1	El Nino is a climatic phenomenon characterized by the warming of sea surface temperatures in the central and eastern Pacific Ocean, particularly near the coast of Peru. The Southern Oscillation refers to periodic changes in atmospheric pressure over the central Pacific Ocean and the region near Australia. During an El Nino event: The atmospheric pressure in the western Pacific (near Australia) increases, while it decreases in the eastern Pacific (near Peru). This pressure shift reverses the normal trade winds, weakening them or even causing them to flow eastward. The combined phenomenon of El Nino and Southern Oscillation is called ENSO (El Nino-Southern Oscillation), which significantly impacts global weather patterns, including droughts, floods, and temperature anomalies
44.2	Monitoring ENSO allows meteorologists to predict large-scale weather variations, such as heavy rainfall on the west coast of South America, droughts in Australia and India, and floods in China. This information is vital for preparing long-range weather forecasts and planning disaster management strategies.
44.3	A strong ENSO event can cause drought in India, disrupting the monsoon season. This affects water availability for irrigation, reduces crop yields, and can lead to food shortages and economic challenges for farmers.
45.1	The difference in wind patterns is due to the Coriolis force, which deflects moving air to the right in the Northern Hemisphere and to the left in the Southern Hemisphere, causing opposite rotational directions.
45.2	In cyclones, the low-pressure centre causes air to converge and rise, leading to a counterclockwise rotation in the Northern Hemisphere and clockwise rotation in the Southern Hemisphere. In anticyclones, the high-pressure centre causes air to diverge and sink, resulting in the opposite wind patterns.
45.3	Cyclones have a low-pressure centre and exhibit inward wind circulation (convergence) with opposite rotational patterns in each hemisphere. Anticyclones have a high-pressure centre with outward wind circulation (divergence) and also rotate differently in the two hemispheres due to the Coriolis effect.
46.1	The ITCZ shifts northward or southward with the movement of the sun's overhead position during different seasons. This affects global wind circulation by altering the positions of trade winds, monsoonal patterns, and associated precipitation zones.
46.2	The Hadley Cell involves warm air rising at the equator (ITCZ), moving poleward in the upper troposphere, and cooling as it sinks around 30° N and 30° S. This

	sinking air creates subtropical high-pressure belts, leading to arid conditions in regions like the Sahara Desert.
46.3	The polar easterlies and westerlies converge at 60° latitude, forming the subpolar low-pressure zone (SPL). This interaction leads to the formation of cyclonic systems and frontal zones, which are crucial for weather changes and precipitation in mid-latitudes.
47.1	The "Eye" is the calm central region of a tropical cyclone where winds are light, skies may be clear, and air subsides. It forms due to intense low pressure surrounded by the rapidly rising air in the eyewall.
47.2	The "outflow" at the top of a cyclone helps maintain the low-pressure system by removing the rising air from the storm, allowing more air to rise from below, which sustains the cyclone's circulation.
47.3	"Rain bands" are spiralling bands of clouds and precipitation that extend outward from the eyewall. They contribute to the cyclone's overall energy and bring heavy rains, strong winds, and localized flooding far from the storm's centre.
48.1	A land breeze occurs at night when cooler air from the land moves toward the warmer sea, while a sea breeze occurs during the day when cooler air from the sea moves toward the warmer land.
48.2	A sea breeze is caused by the land heating up faster than the sea during the day, creating a low-pressure zone over the land that draws cooler air from the sea.
48.3	Reeta should plan her beach tour during the daytime to enjoy the gusty winds coming from the sea, known as the sea breeze. During the day, the land heats up faster than the sea, causing warm air over the land to rise. This creates a low-pressure zone, and the cooler, denser air from the sea moves toward the land, creating refreshing winds that make the beach experience enjoyable.
49.1	A boundary where warm air moves over cold air, bringing gradual warming and light precipitation.
49.2	A boundary where cold air pushes under warm air, causing storms and cooler weather.
49.3	Ahead: Clouds and steady rain. Within: Intense precipitation. Behind: Cooler, clearer weather.
50.1	An occluded front is formed when a warm air mass is trapped between two cold air masses.
50.2	The direction of motion of the center of the system is indicated by the arrows moving toward the right.
50.3	The weather patterns associated with an occluded front, such as strong winds, heavy precipitation, and turbulence due to rising warm air, can cause reduced visibility and hazardous flying conditions. This may lead to flight delays, rerouting, or cancellations to ensure passenger safety.
51.1	"H" denotes high-pressure areas, which are generally associated with clear skies and dry weather.
51.2	The ITCZ represents a low-pressure zone near the equator where trade winds from both hemispheres converge, leading to rising air and precipitation.

51.3	In January, winds in the Northern Hemisphere move from high-pressure areas to low-pressure areas, deflecting to the right due to the Coriolis effect, forming clockwise circulation around high-pressure zones and counterclockwise around low-pressure zones.
52.1	The predominant pressure pattern over the northern hemisphere in July is characterized by high pressure areas (H) over the continents and low pressure areas (L) over the oceans.
52.2	The ITCZ is located near the equator, between the northern and southern hemispheres. It is characterized by low pressure and convergence of winds.
52.3	The predominant wind direction over the Indian subcontinent in July is from the southwest.

Q53. Ans: world map



VERY SHORT ANSWER

Q1. What is atmospheric pressure?

Answer: Atmospheric pressure is the force exerted by the weight of air on a unit area of the Earth's surface, measured in millibars (mb).

Q2. Name the three main types of planetary wind systems in the atmosphere.

Answer: The three main wind systems are:

i. Trade winds

ii. Westerlies

iii. Polar easterlies.

Q3. What is an air mass?

Answer: An air mass is a large body of air with relatively uniform temperature and humidity characteristics, which it acquires from its source region.

Q4. What are cyclones, and how are they classified?

Answer: Cyclones are large systems of winds circulating around a low-pressure centre. They are classified into tropical cyclones (e.g., hurricanes, typhoons) and temperate cyclones (mid-latitude cyclones).

Q5. What causes the Coriolis effect, and how does it affect wind direction?

Answer: The Coriolis effect is caused by the Earth's rotation. It deflects winds to the right in the Northern Hemisphere and to the left in the Southern Hemisphere.

Q6. How do differences in atmospheric pressure lead to the formation of wind systems?

Answer: Wind systems are formed due to differences in atmospheric pressure. Air moves from areas of high pressure to low pressure to balance the pressure gradient. The Coriolis effect and friction further influence wind direction and speed, creating distinct wind systems such as trade winds, westerlies, and polar easterlies.

Q7. What is the role of air masses in influencing weather patterns. Give one example.

Answer: Air masses carry the temperature and humidity characteristics of their source regions. When different air masses meet, they form weather fronts, leading to changes in weather, such as storms, rain, or temperature shifts. For example, the interaction between a warm, moist air mass and a cold, dry air mass often results in cyclones.

Q8. Why do cyclones tend to cause more destruction in coastal regions compared to inland areas?

Answer: Cyclones cause more destruction in coastal regions because they draw energy from warm ocean waters, leading to strong winds, heavy rainfall, and storm surges. As they move inland, they lose energy due to reduced moisture and friction with land surfaces, which weakens their intensity. Coastal areas, therefore, face the brunt of their impact.

Q9. What precautions should a coastal community take when a cyclone warning is issued?

Answer: Evacuate to safer areas, secure loose objects, stock essential supplies, and follow government advisories.

Q10. How can farmers reduce crop loss due to strong winds during storms?

Answer: Farmers can install windbreaks, use sturdy crop varieties, and cover crops with protective materials.

SHORT ANSWER

Q1. What is the relationship between atmospheric pressure and altitude, and how does it affect weather conditions?

Answer:

i. Atmospheric pressure decreases with increasing altitude because the density of air molecules decreases.

ii. This variation affects weather by influencing wind patterns, precipitation, and temperature.

iii. For example, low-pressure areas at higher altitudes are associated with cloudy and rainy weather, while high-pressure areas bring clear skies.

Q2. Explain how the pressure gradient force and Coriolis effect work together to influence wind direction.

Answer:

i. The pressure gradient force causes air to move from high-pressure areas to low-pressure areas.

ii. The Coriolis effect, due to Earth's rotation, deflects this movement to the right in the Northern Hemisphere and to the left in the Southern Hemisphere.

iii. Together, they create curved wind patterns, such as geostrophic winds.

Q3. Difference Between Trade Winds and Westerlies

Answer:

Aspect	Trade Winds	Westerlies
Direction	Blow from east to west (northeast in Northern Hemisphere, southeast in Southern Hemisphere).	Blow from west to east in both hemispheres.
Location	Found between 0° and 30° latitude.	Found between 30° and 60° latitude.
Consistency	More consistent in direction and speed.	Variable in direction and stronger in speed.

Q4. How do air masses acquire their characteristics, and why are source regions important?

Answer:

i. Air masses acquire characteristics of temperature and humidity from their source regions, which are large, uniform areas like oceans or plains.

ii. Source regions determine whether an air mass will be cold, warm, dry, or moist, influencing the weather patterns in the areas they travel to.

Q5. What is a front, and how does it influence weather?

Answer:

i. A front is a boundary between two air masses with different temperatures and humidity levels.

ii. Fronts cause weather changes, such as precipitation, storms, or temperature shifts.

iii. For example, a cold front can bring heavy rain and cooler temperatures, while a warm front causes steady rain and gradual warming.

Q6. Why are cyclones more intense over warm oceans?

Answer:

i. Cyclones are more intense over warm oceans because they derive their energy from the heat and moisture provided by the warm water.

ii. Warm oceans (with surface temperatures above 26°C) cause high evaporation, leading to the release of latent heat during condensation in the cyclone's rising air. This heat intensifies the low-pressure core, strengthening the cyclone's winds and increasing its rainfall.

iii. Additionally, the continuous supply of moisture from the ocean sustains and amplifies the cyclone.

Q7. How does the Coriolis effect influence the rotation of cyclones in different hemispheres?

Answer:

i. The Coriolis effect, caused by Earth's rotation, deflects moving air to the right in the Northern Hemisphere and to the left in the Southern Hemisphere.

ii. This causes cyclones to rotate counterclockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere.

iii. The Coriolis effect is crucial for the cyclonic motion and helps in the development of the characteristic spiral shape.

Q8. How does the interaction between different air masses lead to the formation of weather fronts?

Answer:

i. When air masses of different temperatures and humidity levels meet, the boundary between them forms a weather front.

ii. If a cold air mass meets a warm air mass, the colder air forces the warm air to rise, leading to cloud formation, precipitation, and sometimes storms.

iii. The nature of the front (cold, warm, occluded, or stationary) determines the type of weather experienced, such as rain, snow, or clear skies.

LONG ANSWER TYPE

Q1. Give five differences Between Tropical Cyclones and Temperate Cyclones.

Answer:

Aspect	Tropical Cyclones	Temperate Cyclones
Formation Region	Develop over warm tropical oceans.	Form in mid-latitudes (30°–60°), over land or sea.
Energy Source	Derive energy from latent heat released during condensation.	Form due to the interaction of contrasting air masses (cold and warm).
Structure	Symmetrical, with a well-defined eye and intense winds.	Asymmetrical, associated with fronts and weaker winds.
Weather Effects	Heavy rainfall, strong winds, and storm surges.	Moderate to heavy rainfall, snow, and variable winds.
Duration	Lasts a few days to a week.	Can last several days to over a week.

Q2. Explain any five factors affecting atmospheric pressure.

Answer:

i. Altitude: Atmospheric pressure decreases with an increase in altitude because the density of air reduces as we move upward.

ii. Temperature: Warm air is lighter and rises, leading to low pressure. Cold air is denser and sinks, resulting in high pressure.

iii. Humidity: Moist air is lighter than dry air, causing lower pressure in areas with higher humidity.

iv. Earth's Rotation: The Coriolis effect, caused by Earth’s rotation, influences the distribution of atmospheric pressure.

v. Factors: Topography, vegetation, and human activities can create variations in pressure over small areas.

Q3. What are air masses, and how are they classified? Explain with example.
Answer:
Definition: Air masses are large bodies of air with uniform temperature, humidity, and pressure.

Source Regions: Form over extensive areas with uniform surface characteristics (e.g., oceans, deserts).

Classification:

Based on temperature: Tropical (T): Warm air masses from low latitudes.

Polar (P): Cold air masses from high latitudes.

Based on humidity:

Maritime (m): Moist air masses formed over oceans.

Continental (c): Dry air masses formed over land.

Examples: mT: Maritime Tropical (warm and moist).

cP: Continental Polar (cold and dry).

Impact: Influence regional weather conditions, such as rainfall, storms, and temperature changes.

Q4. What is cyclone? Explain in details about the structure, characteristics and impact of a cyclone.

Answer:

i. Cyclones are low-pressure systems characterized by inward spiralling winds.

ii. Types:

Tropical Cyclones: Form over warm oceans near the equator.

Temperate Cyclones: Form in the mid-latitudes due to frontal activities.

iii. Structure:

Eye: Calm, low-pressure centre.

Eye Wall: Surrounding intense wind and heavy rain.

Rain Bands: Spiral outward from the centre, with strong winds and rain.

iv. Characteristics:

Low-pressure core with high wind speeds.

Counterclockwise rotation in the Northern Hemisphere and clockwise in the Southern Hemisphere.

Causes heavy rainfall, flooding, and storm surges.

v. Impact:

Significant damage to life and property but can also aid in distributing heat energy across the globe.

Q5. Examine the role of atmospheric pressure in the formation of global wind systems.

Answer:

i. Atmospheric pressure is the force exerted by the weight of air above a specific area.

ii. Pressure Gradient Force:

Winds are generated due to differences in atmospheric pressure. Air moves from high-pressure areas to low-pressure areas to equalize pressure differences.

iii. Global Wind Systems:

Uneven heating of the Earth's surface creates pressure belts:

Equatorial Low: Intense heating causes warm air to rise, creating a low-pressure zone.

Subtropical High: Sinking cool air forms high-pressure zones at 30°N and 30°S.

Polar High: Cold, dense air creates high-pressure zones at the poles.

Winds flow between these pressure belts, forming trade winds, westerlies, and polar easterlies.

iv. Coriolis Effect:

Deflects winds, influencing their direction and shaping global wind patterns.

v. Impact on Weather:

These wind systems regulate Earth's climate and drive phenomena like monsoons, ocean currents, and cyclones.

CRITICAL THINKING AND PROBLEM-SOLVING QUESTIONS:

Q1. Explain how atmospheric pressure affects wind movement.
Answer:
Atmospheric pressure differences create a pressure gradient force, which drives wind from high-pressure to low-pressure areas.

The Coriolis effect and friction modify the wind's direction and speed.

Q2. A town experiences strong winds and heavy rain due to a cyclone warning. What precautions should people take immediately?
Answer:
i. Move to higher ground or cyclone shelters to avoid flooding.

ii. Secure loose objects and avoid staying near windows during the storm.

Q3. A local weather report mentions a drop in atmospheric pressure. What kind of weather can you expect?

Answer:

i. Likely stormy weather with strong winds and rainfall due to the formation of a low-pressure system.

ii. Potential development of cyclonic activity depending on the region.

Q3. A farmer in a coastal region notices a change in wind direction from land to sea during the night. What could explain this phenomenon, and how does it affect local activities?

Answer:

i. At night, land cools faster than the sea, creating high pressure over the land and low pressure over the water.

ii. This pressure difference causes land breezes to blow toward the sea.

iii. Helps fishermen set out for fishing as the winds blow toward the ocean.

iv. Reduced humidity and cooler temperatures benefit night-time outdoor activities.

Q4. During a road trip, Ritik encounter thick fog caused by a warm air mass moving over a colder surface. How would you ensure safe travel, and why did this fog form?

Answer:

i. Ensuring Safety: Reduce speed and use low-beam headlights to improve visibility.

Keep a safe distance from other vehicles to avoid collisions.

ii. Fog Formation: Warm, moist air from the air mass cools as it moves over the colder surface.

iii. Water vapor condenses into tiny droplets, creating fog.

iv. Impact on Travel: Poor visibility can delay transportation and increase accident risks.

HIGH ORDER THINKING QUESTIONS

Q1. Why do tropical cyclones weaken rapidly after making landfall?

Answer:

i. Lack of warm, moist air from the ocean to sustain energy.

ii. Increased friction with the land surface reduces wind speeds

Q2. How does the interaction between different air masses lead to extreme weather events?
Answer:
i. When warm and cold air masses meet, they form fronts.
ii. Cold Front: Brings sudden thunderstorms and heavy rainfall due to rapid uplifting of warm air.
iv. Warm Front: Leads to steady rainfall over a prolonged period.
v. Occluded Front: Results in complex weather patterns like intense storms.
Q3. Analyse the impact of atmospheric pressure on monsoonal wind systems in South Asia.
Answer:
Summer (Low Pressure Over Land):
i. Intense heating creates low pressure over the Indian subcontinent.
ii. Moist winds from high-pressure zones over the ocean bring heavy rains.
Winter (High Pressure Over Land):
i. Cooling creates high pressure over the landmass.
ii. Dry winds blow from the land to the ocean, resulting in dry conditions.
Q4. What would happen if the pressure gradient force increased significantly on a global scale? Discuss its impacts on wind systems and human activities.

Answer:

- **Changes in Wind Systems:**
  - Stronger winds would flow faster from high-pressure to low-pressure areas.
  - Intensification of storms and cyclones due to increased wind speeds.
- **Impacts on Human Activities:**
  - Disruption in aviation and shipping industries.
  - Increased damage to infrastructure and agriculture.
  - Greater challenges in managing natural disasters.
- **Environmental Consequences:**
  - Increased soil erosion and desertification due to strong winds.
  - Changes in ocean currents affecting marine ecosystems.

Q5. Analyze the role of cyclones in balancing atmospheric pressure and heat distribution. What challenges do they pose despite their benefits?
Answer:
Role in Heat Distribution:

Cyclones transfer heat from equatorial regions to higher latitudes.
They help balance atmospheric pressure by equalizing temperature differences.

Challenges Posed:
Destructive winds, storm surges, and heavy rainfall cause loss of life and property.
Disruption of ecosystems and damage to agricultural land.

Conclusion:
While cyclones play a crucial role in Earth's energy balance, their destructive impact necessitates improved forecasting and disaster management systems.

CHAPTER – 10
WATER IN ATMOSPHERE

1. When the water containing air becomes saturated, then
(a) it will be calm. **(b) it will be windy above sea and rainy above land.**
(c) it will start to rain. **(d) clouds will be formed.**

2. What is the energy required to change water's state or phase, without changing its temperature called?
(a) Latent heat of the Earth **(b) Latent heat of the water**
(c) Latent heat of the rock **(d) Latent heat of the atmosphere**

3. When air containing water reaches its saturation point, then
(a) No more water evaporates from the ground.
(b) It leads to evaporation above sea and precipitation above land.
(c) Water vapour forms droplets.
(d) The droplets fall out of the clouds.

4. The percentage of moisture present in the atmosphere as compared to its full capacity at a given temperature is known as the
(a) Relative humidity **(b) Specific humidity**
(c) Absolute humidity **(d) Saturated air**

5. The air can only contain a certain amount of water vapour before it is saturated. This amount is dependent on
(a) the temperature of the air. **(b) whether the air is above sea or land.**
(c) the wind speed. **(d) the amount of dust particles in the air.**

6. Orographic rainfall is more on
(a) windward slopes. **(b) leeward slopes.**
(c) plains. **(d) valleys.**

7. Rain shadow zone means
(a) windward slopes of the mountains. **(b) leeward side of the mountain.**
(c) mountainous area. **(d) coastal area.**

8. The alto clouds are found at
(a) high levels. **(b) mid levels.**
(c) low levels. **(d) low, mid and high levels.**

9. Transformation of water vapours into water is called
(a) evaporation. **(b) condensation.**

(c) sublimation. (d) saturation..

10. What is the temperature at which saturation occurs in a given sample of air known?
(a) Saturation point (b) Dew point
(c) Condensation point (d) Absolute humidity

11. The actual amount of the water vapour present in the atmosphere is known as _____
(a) Relative humidity (b) Absolute humidity
(c) Condensation (d) None of the above

12. _____is frozen raindrops and refrozen melted snow-water.
(a) Sleet (b) Frost (c) Cloud (d) Mist

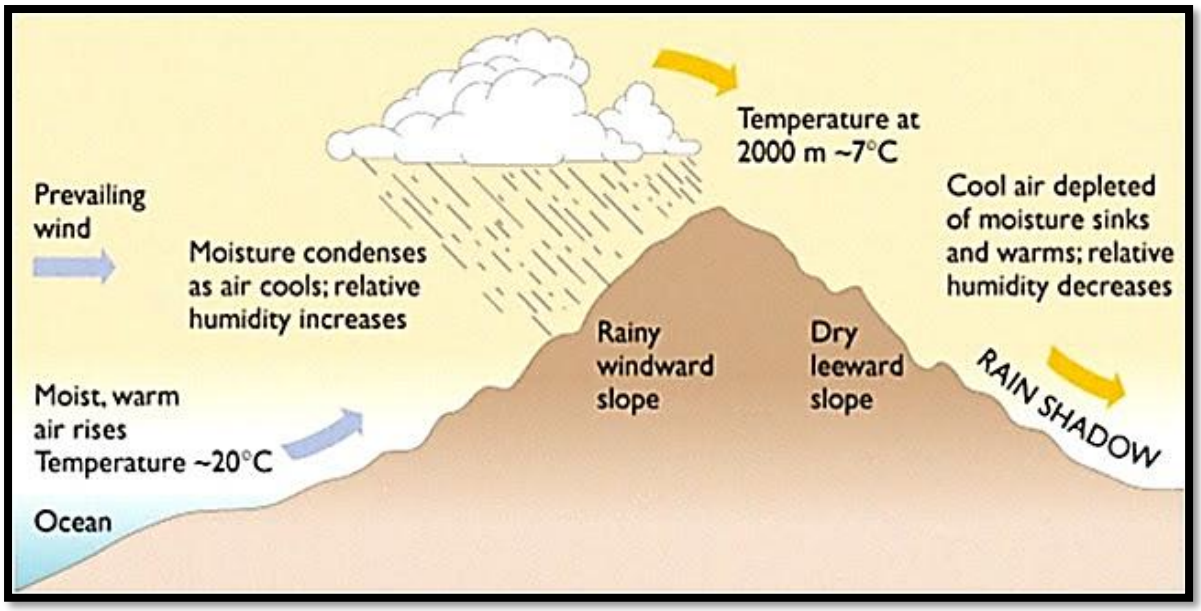
13. Orographic rainfall is more on _____.
(a) Windward slopes (b) leeward slopes
(c) plains (d) valleys

14. Which one of the following is the most important constituent of the atmosphere for human beings?
(a) Water vapour (b) Nitrogen
(c) Dust particle (d) Oxygen.

15. In atmosphere density of water vapour varies. To what per cent does it vary?
(a) 0 – 4% (b) 5–10%
(c) 7–12% (d) 9–15%.

16. If water vapour directly condenses into solid form, it is known as _____
(a) Evaporation (b) condensation
(c) sublimation (d) saturation

17. Study the following diagram & answer the following questions.: 3



17.1 Identify the type of rainfall.
17.2 How is Orographic rain caused?
17.3 What is rain shadow area?

18. Study the following passage & answer the following questions.:
The amount of water vapour in the atmosphere is added or withdrawn due to evaporation and condensation respectively. Evaporation is a process by which water is transformed from liquid to gaseous state. Heat is the main cause for evaporation. The temperature at which the water starts

evaporating is referred to as the latent heat of vapourisation. Increase in temperature increases water absorption and retention capacity of the given parcel of air. Similarly, if the moisture content is low, air has a potentiality of absorbing and retaining moisture. Movement of air replaces the saturated layer with the unsaturated layer. Hence, the greater the movement of air, the greater is the evaporation

18.1 What evaporation?
18.2 What is the main cause of evaporation?
18.3 How does condensation happen in free air?
19. Differentiate between Absolute humidity & relative humidity.
20. Why does the amount of water vapour decreases rapidly with altitude?
21. What factors influence the process of condensation?
22. What is dew? What are the ideal conditions for the formation of dew?
23. What are forms of condensation? Describe the process of dew and frost formation.
24. How are clouds formed? Classify them.
25. On the basis of rainfall received, in how many groups can we classify the world?
26. Which instrument is used to measure rainfall?
27. Name the instrument used for measuring humidity.
28. State the different forms of condensation.
29. Name the type of daily rainfall in the equatorial region.
30. Which type of rainfall occurs in N.W. India during winter?

Answers
1. Ans. (d) clouds will be formed.
2. Ans. (b) Latent heat of the water
3. Ans. (c) Water vapour forms droplets
4. Ans. (a) Relative humidity
5. Ans. (a) the temperature of the air.
6. Ans. (a) windward slopes.
7. Ans. (b) leeward side of the mountain.
8 . Ans. (b) mid levels.
9. Ans. (b) condensation
10. Ans. (b) Dew point
11. Ans. (b) Absolute humidity
12.Ans. (a) Sleet
13.Ans. (a) Windward slopes
14.Ans. (d) Oxygen.
15.Ans. (a) 0 – 4%
16.Ans. (c) sublimation
17.1 Orographic rainfall
17.2 Moist air being forced to rise over elevated terrain, such as mountains or hills. As the air rises, it cools and condenses, forming clouds and eventually leading to rainfall.
17.3 A rain shadow area is a dry region on the leeward side of a mountain or mountain range. This is the side of the mountain that faces away from the prevailing winds.
18.1 Evaporation is a process that changes a substance from a liquid into a gas or vapor.
18.2 The main cause of evaporation is heat from the sun
18.3 Condensation in free air occurs when warm, moist air cools down or becomes too saturated with water vapour
19.

Basis	Absolute Humidity	Relative Humidity
Meaning	The actual amount of the water vapour present in the atmosphere is known as the absolute humidity.	The percentage of moisture present in the atmosphere as compared to its full capacity at a given temperature is known as the relative humidity.
Unit	It is the weight of water vapour per unit volume of air and is expressed in terms of grams per cubic metre.	It is measured in percentage and hence is unit free.

20. The quantity of water vapour existing in the air depends upon the rate of evaporation and the temperature of the air which determines its holding capacity of water vapour. Both temperature and evaporation decreases with altitude and as a result water vapour also decreases rapidly with altitude.

21. Condensation is influenced by the volume of air, temperature, pressure and humidity. Condensation takes place:
Factors affecting condensation:– 1. When the temperature of the air is reduced to dew point with its volume remaining constant; 2. When both the volume and the temperature are reduced; 3. When moisture is added to the air through evaporation.
However, the most favourable condition for condensation is the decrease in air temperature. After condensation the water vapour or the moisture in the atmosphere takes form of dew, frost, fog and clouds.

22. The ideal conditions for its formation are clear sky, calm air, high relative humidity, and cold and long nights. For the formation of dew, it is necessary that the dew point is above the freezing point.
The ideal conditions for its formation are clear sky, calm air, high relative humidity, and cold and long nights. For the formation of dew, it is necessary that the dew point is above the freezing point.

23. Condensation: The transformation of water vapour into water is called condensation. Condensation is caused by the loss of heat. When the water vapour or the moisture in the atmosphere takes one of the following forms — dew, frost, fog and clouds. Forms of condensation can be classified on the basis of temperature and location. Condensation takes place when the dew point is lower than the freezing point as well as higher than the freezing point.

- **Dew: When the moisture is deposited in the form of water droplets on cooler surfaces of solid objects (rather than nuclei in air above the surface) such as stones, grass blades and plant leaves, it is known as dew.**
- **Frost: Frost forms on cold surfaces when condensation takes place below freezing point (CPC), i.e. the dew point is at or below the freezing point.**

24. Cloud is a mass of minute water droplets or tiny crystals of ice formed by the condensation of the water vapour in free air at considerable elevations. As the clouds are formed at some height over the surface of the earth, they take various shapes. According to their height, expanse, density and transparency or opaqueness clouds are grouped under four types :– 1. Cirrus, 2. Cumulus, 3. Stratus, 4. nimbus.

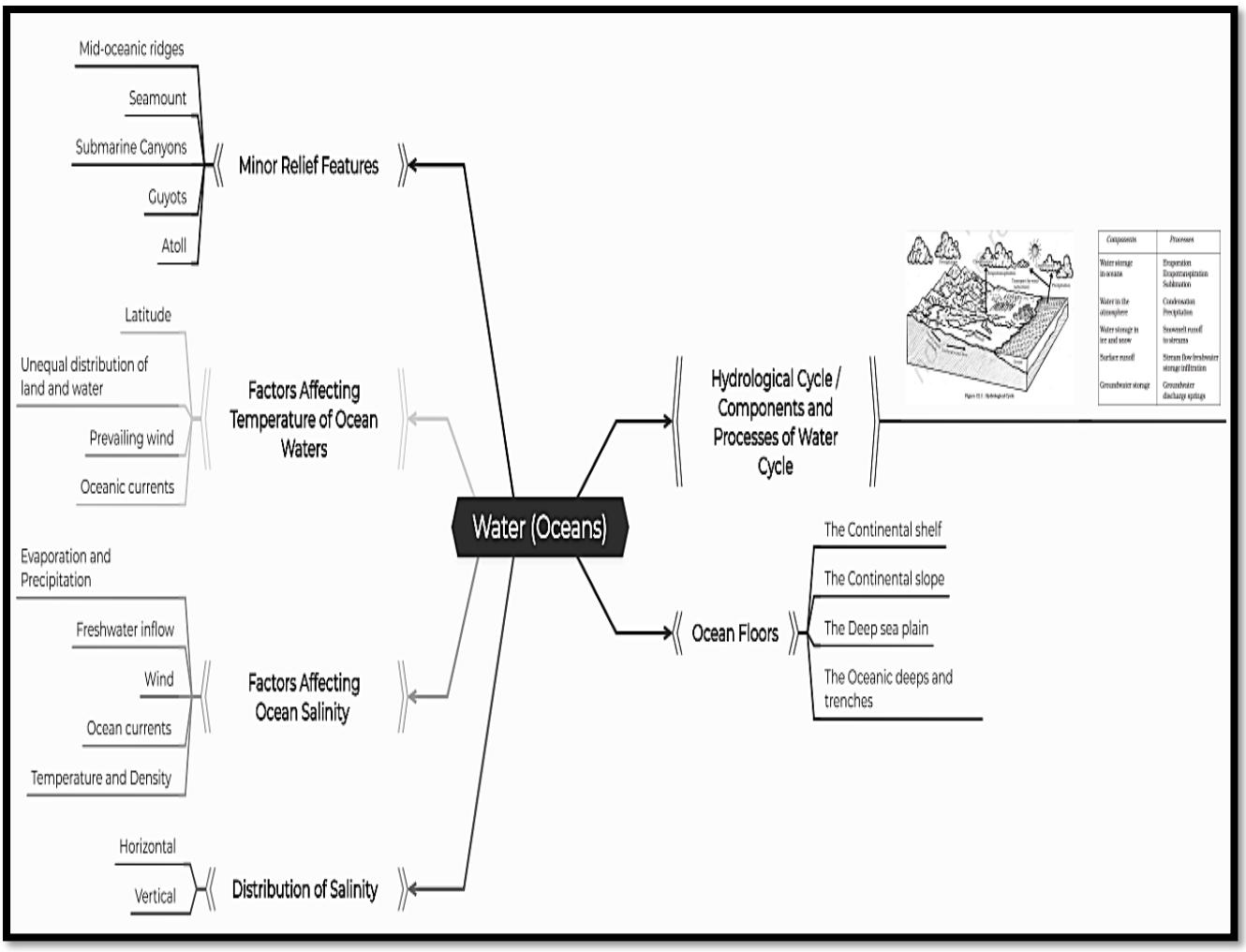
25. On the basis of rainfall received, we can classify the world into five groups.

1. **The equatorial belt, the windward slopes of the mountains along the western coasts in the cool temperate zone and the coastal areas of the monsoon land receive heavy rainfall of over 200 cm per annum.**

2. **Interior continental areas receive moderate rainfall varying from 100 – 200 cm per annum.**
3. **The coastal areas of the continents receive moderate amount of rainfall.**
4. **The central parts of the tropical land and the eastern and interior parts of the temperate lands receive rainfall varying between 50–100 cm per annum.**
5. **Areas lying in the rain shadow zone of the interior of the continents and high latitudes receive very low rainfall–less than 50 cm per annum.**

26. Rain gauge.
27. Hygrometer.
28. Frost and snow, dew, fog, mist, clouds.
29. Convectional rainfall.
30. Cyclonic rainfall.

CHAPTER – 12
WATER (OCEANS)



FILL IN THE BLANKS (1X5=5)

1. The renewable water on earth is ___ while the demand is increasing tremendously.
2. The Siberian shelf is the ___ in the world, stretching to 1,500 km.
3. The Mediterranean Sea records higher salinity due to _____.
4. The salinity of seawater is expressed in _____ or ppt.

5. The process of _____ transfers heat from the surface of the ocean to the deeper layers.

MULTIPLE CHOICE QUESTIONS **(1X17=17)**

1. Which factor affects the ocean water temperature based on latitude?
(a) Prevailing wind (b) Insolation
(c) Ocean currents (d) Land-water distribution

2. Which of these is NOT a storage location for freshwater?
(a) Atmosphere (b) Soil moisture
(c) Oceans (d) Glaciers

3. Which submarine canyon is the best-known in the world?
(a) Mariana Canyon (b) Hudson Canyon
(c) Tonga Canyon (d) Aleutian Canyon

4. Which of the following oceans has the largest number of explored oceanic deeps?
(a) Atlantic Ocean (b) Indian Ocean
(c) Pacific Ocean (d) Southern Ocean

5. What is the average width of the continental shelves?
(a) 50 km (b) 80 km
(c) 100 km (d) 150 km

6. What is the term used to describe the rapid decrease in ocean temperature with depth?
(a) Halocline (b) Thermocline
(c) Pycnocline (d) Isocline

7. What is the primary factor that affects ocean water salinity in coastal areas?
(a) Evaporation (b) Wind
(c) River water inflow (d) Ocean currents

8. In which sea is the salinity extremely low due to fresh water influx?
(a) Red Sea (b) Baltic Sea
(c) Mediterranean Sea (d) Arabian Sea

9. What is the term for the boundary layer where salinity increases sharply with depth?
(a) Thermocline (b) Halocline
(c) Pycnocline (d) Isocline

10. The salinity for normal open ocean ranges between-
(a) 15 ‰ – 22 ‰ (b) 22 ‰ – 32 ‰
(c) 33 ‰ - 37 ‰ (d) 38 ‰ – 45 ‰

MATCH THE FOLLOWING

11. Match the terms with their definitions:

TERMS	DEFINITIONS
(a) Thermocline	(i) Transfer of heat from surface to depth
(b) Halocline	(ii) Rapid increase in salinity with depth
(c) Pycnocline	(iii) Rapid decrease in temperature with depth

(d) Convection	(iv) Rapid change in density with depth

(a) (a)-(ii)(b)-(iii)(c)-(iv)(d)-(i) (b) (a)-(iii)(b)-(ii)(c)-(i)(d)-(iv)

(c) (a)-(iii)(b)-(ii)(c)-(iv)(d)-(i) (d) (a)-(ii)(b)-(i)(c)-(iii)(d)-(iv)

12. Match the following oceans with their unique salinity characteristics:

OCEANS	SALINITY CHARACTERISTICS
(a) Atlantic Ocean	(i) Salinity decreases due to Arctic water influx
(b) Pacific Ocean	(ii) Highest salinity between 20°N and 30°N
(c) Red Sea	(iii) Higher salinity in Arabian Sea than Bay of Bengal
(d) Indian Ocean	(iv) Highest salinity due to land-locked nature

(a)(a)-(iii)(b)-(ii)(c)-(iv)(d)-(i) (b) (a)-(ii)(b)-(i)(c)-(iv)(d)-(iii)

(c) (a)-(ii)(b)-(iii)(c)-(iv)(d)-(i) (d) (a)-(ii)(b)-(i)(c)-(iii)(d)-(iv)

ASSERTION AND REASONING

13. Assertion (A): Ocean floors exhibit features such as trenches, ridges, and plains.
Reason (R): These features are formed by tectonic, volcanic, and depositional processes.
(a) Both A and R are true, and R is the correct explanation of A.
(b) Both A and R are true, but R is not the correct explanation of A.
(c) A is true, but R is false.
(d) A is false, but R is true.

14. Assertion (A): Submarine canyons are often found extending from the mouths of large rivers.
Reason (R): Submarine canyons are formed due to deposition of sediments by ocean currents.
(a) Both A and R are true, and R is the correct explanation of A.
(b) Both A and R are true, but R is not the correct explanation of A.
(c) A is true, but R is false.
(d) A is false, but R is true.

15. Assertion (A): Mid-oceanic ridges are formed by volcanic activity.
Reason (R): Mid-oceanic ridges occur along tectonic plate boundaries.
(a) Both A and R are true, and R is the correct explanation of A.
(b) Both A and R are true, but R is not the correct explanation of A.
(c) A is true, but R is false.
(d) A is false, but R is true.

16. Assertion (A): The temperature of ocean water is higher near the equator compared to the poles.
Reason (R): Insolation is maximum at the poles and decreases towards the equator.
(a) Both A and R are true, and R is the correct explanation of A.
(b) Both A and R are true, but R is not the correct explanation of A.
(c) A is true, but R is false.
(d) A is false, but R is true.

17. Assertion (A): The Mediterranean Sea has higher salinity compared to the Baltic Sea.
Reason (R): The Mediterranean Sea experiences high evaporation and limited freshwater inflow.
(a) Both A and R are true, and R is the correct explanation of A.
(b) Both A and R are true, but R is not the correct explanation of A.
(c) A is true, but R is false.
d) A is false, but R is true.

SOURCE BASED QUESTIONS **(1x12=12)**

1. Read the following passage and answer the questions that follows:

The temperature-depth profile for the ocean water shows how the temperature decreases with the increasing depth. The profile shows a boundary region between the surface waters of the ocean and the deeper layers. The Antartic circles, the surface water temperatures are close to 0° C and so the temperature change with the depth is very slight. Here, only one layer of cold water exists, which extends from surface to deep ocean floor. The average temperature of surface water of the oceans is about 27°C and it gradually decreases from the equator towards the poles. The rate of decrease of temperature with increasing latitude is generally 0.5°C per latitude. The average temperature is around 22°C at 20° latitudes, 14° C at 40° latitudes and 0° C near poles. The oceans in the northern hemisphere record relatively higher temperature than in the southern hemisphere. The highest temperature is not recorded at the equator but slightly towards north of it.

The average annual temperatures for the northern and southern hemisphere are around 19° C and 16° C respectively. This variation is due to the unequal distribution of land and water in the northern and southern hemispheres. boundary usually begins around 100 – 400 m below the sea surface and extends several hundred of metres downward. This boundary region, from where there is a rapid decrease of temperature, is called the thermocline. About 90 per cent of the total volume of water is found below the thermocline in the deep ocean. In this zone, temperatures approach 0° C. The temperature structure of oceans over middle and low latitudes can be described as a three-layer system from surface to the bottom. The first layer represents the top layer of warm oceanic water and it is about 500m thick with temperatures ranging between 20° and 25° C. This layer, within the tropical region, is present throughout the year but in mid latitudes it develops only during summer. The second layer called the thermocline layer lies below the first layer and is characterised by rapid decrease in temperature with increasing depth.

The thermocline is 500 -1,000 m thick. The third layer is very cold and extends upto the deep ocean floor. In the Arctic and It is a well known fact that the maximum temperature of the oceans is always at their surfaces because they directly receive the heat from the sun and the heat is transmitted to the lower sections of the oceans through the process of convection. It results into decrease of temperature with the increasing depth, but the rate of decrease is not uniform throughout. The temperature falls very rapidly up to the depth of 200 m and thereafter, the rate of decrease of temperature is slowed down.

1.1 Why do the oceans in the northern hemisphere have relatively higher temperatures than in the southern hemisphere?
(a) Due to ocean currents
(b) Because of the unequal distribution of land and water
(c) Higher salinity in the northern hemisphere

(d) Stronger winds in the southern hemisphere

1.2 At what latitudes is the ocean temperature approximately 14°C?
(a) Equator
(b) 20° latitude
(c) 40° latitude
(d) Near the poles

1.3 What is the average temperature of the ocean's surface water?
(a) 14°C
(b) 27°C
(c) 22°C
(d) 19°C

2. Read the following passage and answer the questions that follows:

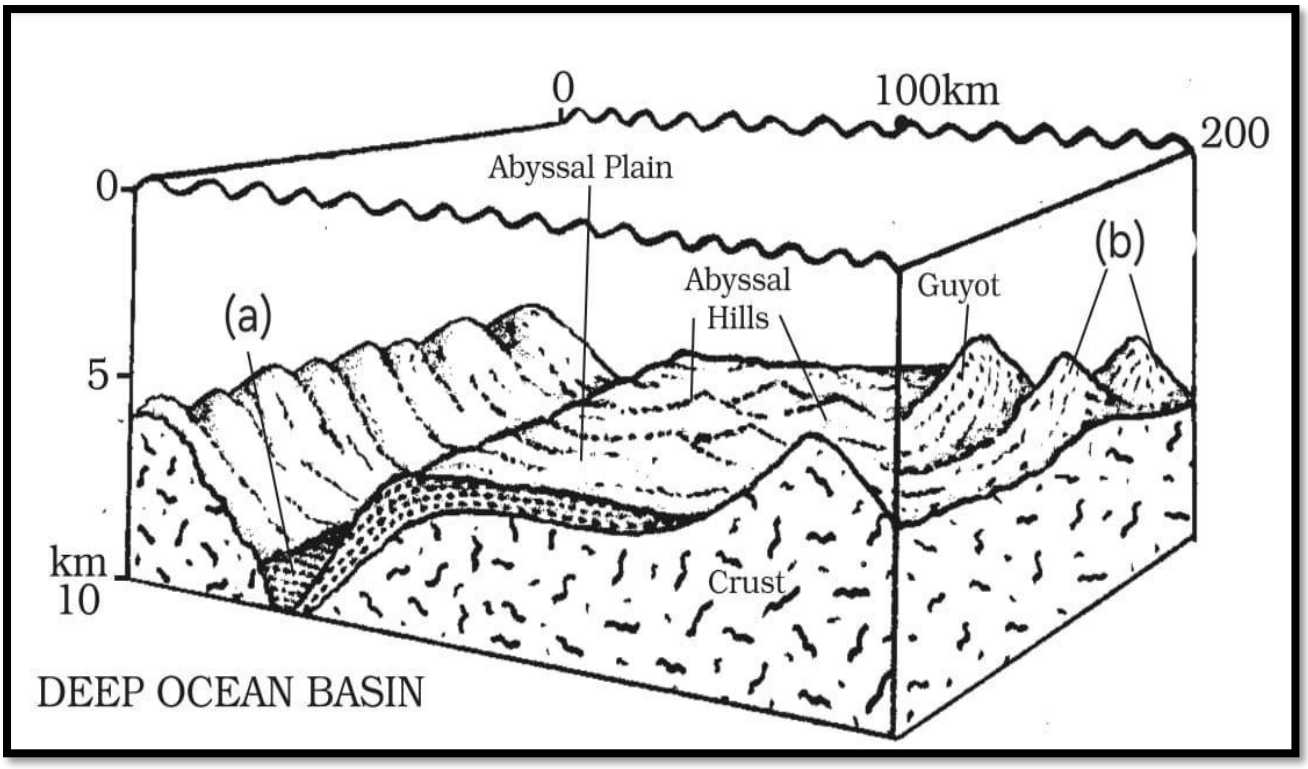
The salinity for normal open ocean ranges between 33o/oo and 37 o/oo . In the land locked Red Sea, it is as high as 41o/oo , while in the estuaries and the Arctic, the salinity fluctuates from 0 – 35 o/oo , seasonally. In hot and dry regions, where evaporation is high, the salinity sometimes reaches to 70 o/oo . The salinity variation in the Pacific Ocean is mainly due to its shape and larger areal extent. Salinity decreases from 35 o/oo – 31 o/oo on the western parts of the northern hemisphere because of the influx of melted water from the Arctic region. In the same way, after 15° – 20° south, it decreases to 33 o/oo . The average salinity of the Atlantic Ocean is around 36 o/oo. The highest salinity is recorded between 15° and 20° latitudes. Maximum salinity (37 o/oo) is observed between 20° N and 30° N and 20° W – 60° W. It gradually decreases towards the north. The North Sea, in spite of its location in higher latitudes, records higher salinity due to more saline water brought by the North Atlantic Drift. Baltic Sea records low salinity due to influx of river waters in large quantity. The Mediterranean Sea records higher salinity due to high evaporation. Salinity is, however, very low in Black Sea due to enormous fresh water influx by rivers. See the atlas to find out the rivers joining Black Sea. The average salinity of the Indian Ocean is 35 o/oo. The low salinity trend is observed in the Bay of Bengal due to influx of river water. On the contrary, the Arabian Sea shows higher salinity due to high evaporation and low influx of fresh water.

2.1 Why does the Baltic Sea record low salinity?
(a) Due to high evaporation
(b) Due to its higher latitude location
(c) Due to a large influx of river waters
(d) Due to ocean currents

2.2 Which factor contributes to higher salinity in the Arabian Sea?
(a) Influx of river water
(b) High evaporation and low freshwater influx
(c) Ocean currents
(d) Proximity to the equator

2.3 Why does the North Sea have higher salinity despite its higher latitude?
(a) High evaporation rates
(b) Its shape and areal extent
(c) More saline water brought by the North Atlantic Drift
(d) Influx of melted Arctic water

3. Based on the diagram given below answer the questions that follows:

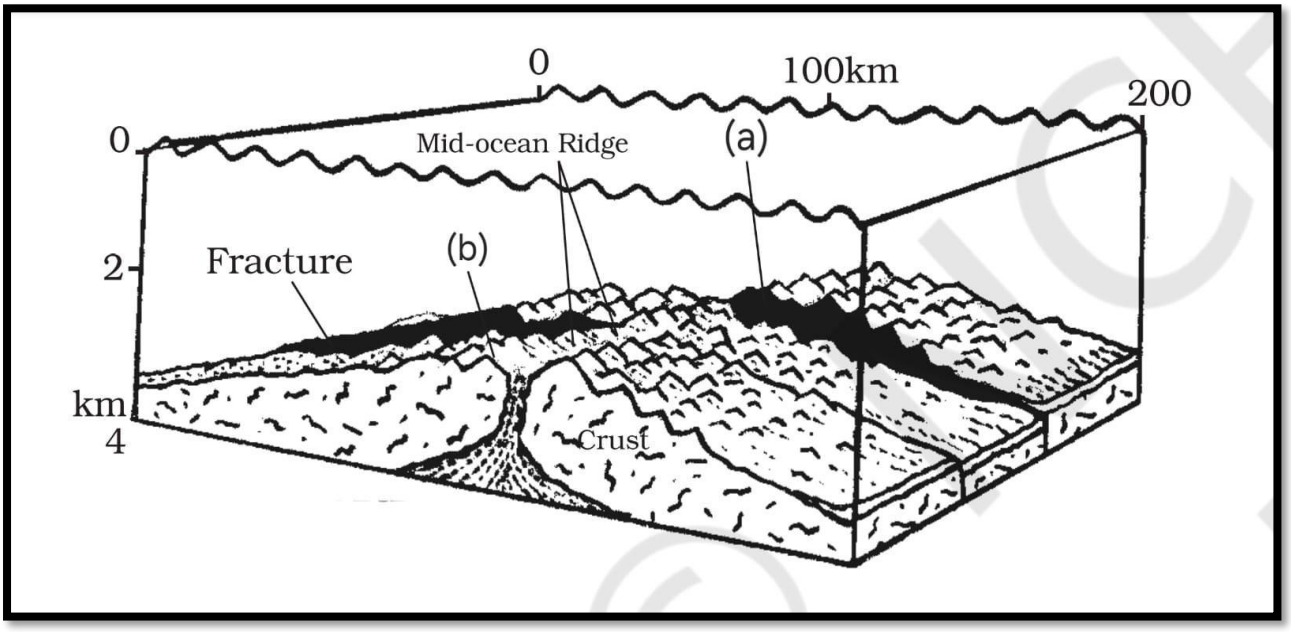


3.1 Name the Ocean relief labelled as (a) in the diagram.

3.2 Name the minor relief feature labelled as (b) in the diagram.

3.3 How much deeper are trenches compared to the surrounding ocean floor?

4. Based on the diagram given below answer the questions that follows:



4.1 Name the relief feature labelled as (a) in the diagram.
4.2 Name the relief feature labelled as (b) in the diagram.
4.3 What is a mid-oceanic ridge composed of?

SHORT ANSWER QUESTIONS **(3x5=15)**

1. Explain the process of hydrological cycle?
2. How has the water been distributed in Earth's surface?

3. Describe the three layer system of temperature structure of oceans.

OR

When you move into the ocean what thermal layers would you encounter? Why does the temperature vary with depth?
4. Mention the factors that affect the distribution of temperature of ocean water?
5. The average temperature of water on oceans floor keeps on falling from equator to poles systematically. Explain

MARKS HIGHER ORDER THINKING QUESTIONS (HOTs) (3x3=9)

1. While traveling on a cruise in the Pacific Ocean, you notice deep, steep-sided areas on the ocean floor. What could these features be?

2. An environmentalist is studying salinity variations in the Bay of Bengal and the Arabian Sea. Why does the Bay of Bengal have lower salinity compared to the Arabian Sea?

3. A geologist studying ocean floors finds flat-topped underwater mountains in the Pacific Ocean. What are these features, and how are they formed?

LONG ANSWER QUESTIONS (5x4=20)

1. Explain the minor features of the ocean floor?

2. 'Ocean seems to be water body but it has many types of landforms within it.' Justify the statement by giving some examples.

OR

Although oceans are predominantly water, they encompass a diversity of geomorphological formations. Elaborate with examples.

3. What do you know about the horizontal distribution of salinity?

4. Compare the characteristics of the continental slope and the deep-sea plain.

HIGHER ORDER THINKING QUESTIONS (HOTs) (5x3=15)

1. A coastal city is planning to develop a marine research facility. The project requires understanding the major features of the ocean floor. Explain the various divisions of the ocean floor and their significance.

2. A tourist visiting the Red Sea is curious about its high salinity levels. Explain the factors contributing to salinity variations and how they differ between open oceans and enclosed seas.

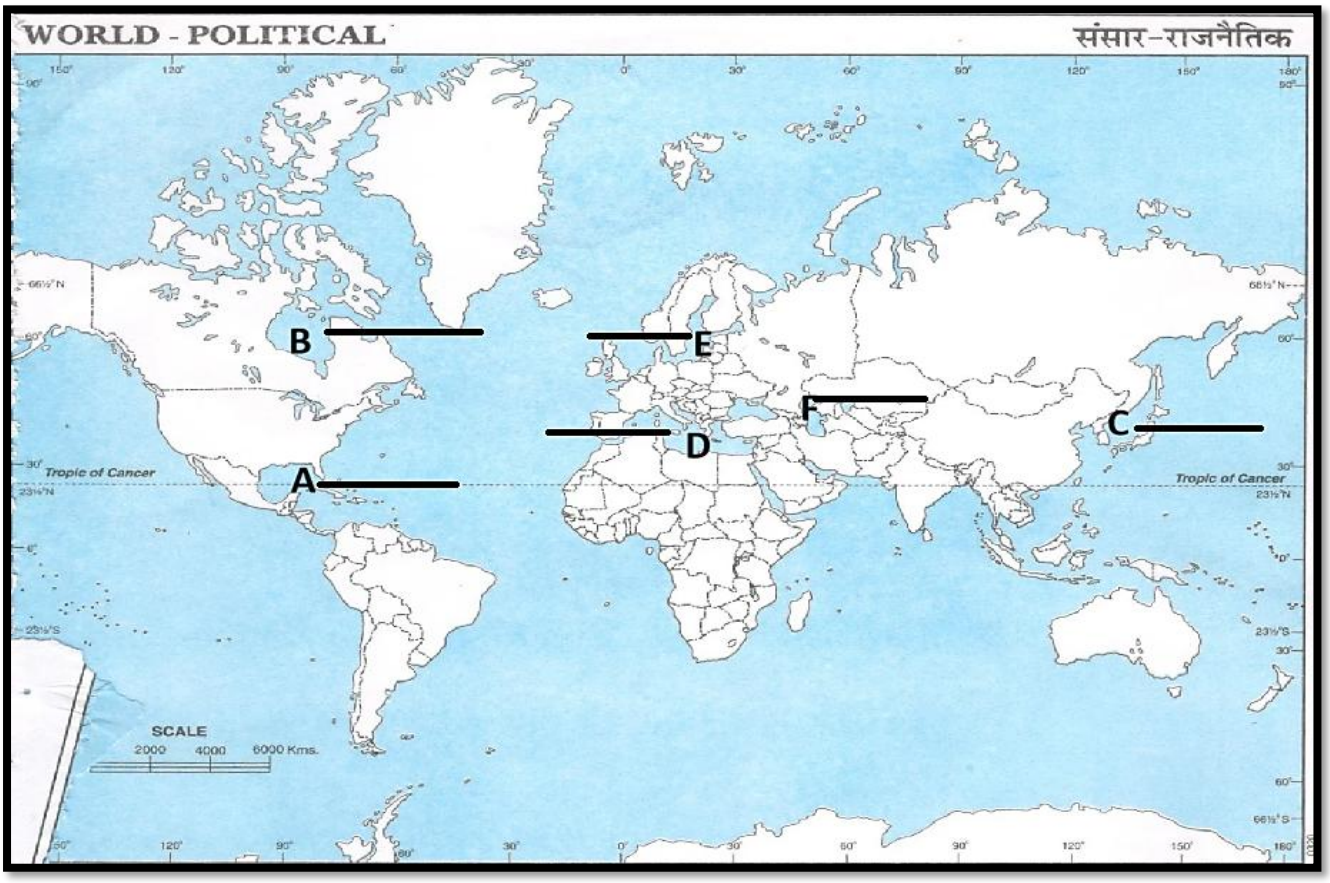
3. Climate scientists are studying the temperature distribution of the oceans to understand global warming. Explain the factors affecting ocean temperature and its vertical distribution.

MAP QUESTIONS

1. On the given political map of the world, the followings features are shown.
Identify these features and write the correct names on the lines marked each feature. 1X5=5

A. A gulf
B. A bay
C. A sea
D. A sea

E. A sea
F. A sea



ANSWER KEY

Q. NO	ANSWER	MARKS
	FILL IN THE BLANKS (5X1=5)	
1	Constant	1
2	Largest	1
3	High evaporation	1
4	Parts per thousand	1
5	Convection	1
	MULTIPLE CHOICE QUESTIONS (10X1=10)	
1	(b) Insolation	1
2	(c) Oceans	1
3	(b) Hudson Canyon	1
4	(c) Pacific Ocean	1
5	(b) 80 km	1
6	(b) Thermocline	1

7	(c) River water inflow	1
8	(b) Baltic Sea	1
9	(b) Halocline	1
10	(c) 33 ‰ - 37 ‰	1
	MATCH THE FOLLOWING (4X2=8)	
11	(C) (a)-(iii),(b)-(ii),(c)-(iv),(d)-(i)	4
12	(B) (a)-(ii),(b)-(i),(c)-(iv),(d)-(iii)	4
	ASSERTION AND REASONING (5X1=5)	
13	(a) Both A and R are true, and R is the correct explanation of A.	1
14	(b) Both A and R are true, but R is not the correct explanation of A.	1
15	(a) Both A and R are true, and R is the correct explanation of A.	1
16	(c) A is true, but R is false.	1
17	(a) Both A and R are true, and R is the correct explanation of A.	1
	SOURCE BASED QUESTIONS (4X3=12)	
1.1	(b) Because of the unequal distribution of land and water	1
1.2	(c) 40° latitude	1
1.3	(b) 27°C	1
2.1	(c) Due to a large influx of river waters	1
2.2	(b) High evaporation and low freshwater influx	1
2.3	(c) More saline water brought by the North Atlantic Drift	1
3.1	Deep-sea trench	1
3.2	Seamounts	1
3.3	3-5 km deeper than the surrounding ocean floor.	1
4.1	Fracture	1
4.2	Rift	1
4.3	Two chains of mountains separated by a large depression.	1
	SHORT ANSWER QUESTIONS	
1	➢ The hydrological cycle, is the circulation of water within the earth's hydrosphere in different forms i.e. the liquid, solid and the gaseous phases. ➢ It also refers to the continuous exchange of water between the oceans atmosphere, land surface and subsurface and the organisms.	3

- About 71 per cent of the planetary water in fond in the oceans. The remaining is held as freshwater in glaciers and icecaps, groundwater sources, lakes, soil moisture, atmosphere, streams and within life.
- Nearly 59 per cent of the water that falls on land returns to the atmosphere through evaporation from over the oceans as well as from other places. The remainder runs-off on the surface, infiltrates the ground or a part of it becomes glacier.

2 3

- The distribution of water on earth is quite uneven. Many locations have plenty of water while others have very limited quantity.
- About 71 per cent of the planetary water in fond in the oceans. The remaining is held as freshwater in glaciers and icecaps, groundwater sources, lakes, soil moisture, atmosphere, streams and within life.
- Nearly 59 per cent of the water that falls on land returns to the atmosphere through evaporation from over the oceans as well as from other places. The remainder runs-off on the surface, infiltrates the ground or a part of it becomes glacier.

3 3

- The temperature structure of oceans over middle and low latitudes can be described as a three- layer system from surface to the bottom.
- The first layer represents the top layer of warm oceanic water and it is about 500m thick with temperatures ranging between 20° and 25° C. This layer, within the tropical region, is present throughout the year but in mid latitudes it develops only during summer.
- The second layer called the thermocline layer lies below the first layer and is characterised by rapid decrease in temperature with increasing depth. The thermocline is 500-1,000 m thick.
- The third layer is very cold and extends upto the deep ocean floor. In the Arctic and Antarctic circles, the surface water temperatures are close to 0° C and so the temperature change with the depth is very slight. Here, only one layer of cold water exists, which extends from surface to deep ocean floor.

4 3

- Latitude: The temperature of surface water decreases from the equator towards the poles because the amount of insolation decreases poleward.
- Unequal distribution of land and water : The oceans in the northern hemisphere receive more heat due to their contact with larger extent of land than the oceans in the southern hemisphere.
- Prevailing wind: The winds blowing from the land towards the oceans drive warm surface water away form the coast resulting in the upwelling of cold water from below. It results into the longitudinal variation in the temperature. Contrary to this, the onshore winds pile up warm water near the coast and this raises the temperature.
- Ocean currents: Warm ocean currents raise the temperature in cold areas while the cold currents decrease the temperature in warm ocean areas. Gulf stream (warm current) raises the temperature near the eastern

coast of North America and the West Coast of Europe while the Labrador current (cold current) lowers the temperature near the north-east coast of North America.

5 ➢ The average temperature of surface water of the- oceans is about 27°C and it gradually decreases from the equator towards the poles. 3

➢ The rate of decrease of temperature with increasing latitude is generally 0.5°C per latitude.

➢ The average temperature is around 22°C at 20° latitudes, 14° C at 40° latitudes and 0° C near poles.

➢ The oceans in the northern hemisphere record relatively higher temperature than in the southern hemisphere.

➢ The highest temperature is not recorded at the equator but slightly towards north of it.

➢ The average annual temperatures for the northern and southern hemisphere are around 19°C and 16° C respectively. This variation is due to the unequal distribution of land and water in the northern and southern hemispheres.

3 MARKS HIGHER ORDER THINKING QUESTIONS (HOTs)

1 ➢ The deep, steep-sided areas on the ocean floor in the Pacific Ocean are most likely oceanic trenches. These are the deepest parts of the ocean, characterized by narrow, steep-sided basins, typically 3 to 5 kilometers deeper than the surrounding ocean floor. 3

➢ Trenches form at subduction zones, where one tectonic plate is forced beneath another, and are often associated with active volcanoes and strong earthquakes.

➢ **They are significant for several reasons:**

➢ Trenches help in understanding plate tectonics, as they are sites of intense geological activity.

➢ They contribute to the recycling of Earth's crust, where oceanic plates are subducted and melted.

➢ These areas influence marine biodiversity, providing unique habitats in extreme conditions

2 ➢ The **Bay of Bengal** has lower salinity compared to the **Arabian Sea** due to differences in freshwater inflows, precipitation, and evaporation. 3

➢ **Freshwater Inflows:** The Bay of Bengal receives substantial freshwater from major rivers like the Ganga and Brahmaputra, which dilute the salinity. In contrast, the Arabian Sea has limited river inflows.

➢ **Precipitation:** The Bay experiences high annual rainfall, further reducing salinity levels. On the other hand, the Arabian Sea, located in a relatively arid region, has lower precipitation.

- **Evaporation:** High evaporation rates in the Arabian Sea increase salinity, whereas the Bay of Bengal has lower evaporation due to its humid climate.

3 - The flat-topped underwater mountains discovered in the Pacific Ocean are known as **guyots.** 3
- These features are remnants of volcanic activity and are initially formed as seamounts—volcanic mountains that rise from the seafloor but do not reach the ocean's surface.
- Over time, these seamounts undergo **erosion** by waves and other natural forces, flattening their summits. As the ocean floor subsides due to tectonic movements, these flattened seamounts become submerged, forming guyots.
- Guyots provide critical evidence of geological processes such as plate tectonics and changes in sea level over millions of years.
- They are abundant in the Pacific Ocean, with more than 10,000 identified, and serve as habitats for unique marine species, contributing to oceanic biodiversity and research on Earth's geological history.

LONG ANSWER QUESTIONS

1 The various relief features of the ocean floor are: 5

- Mid-Oceanic Ridges: A mid-oceanic ridge is composed of two chains of mountains separated by a large depression. The mountain ranges can have peaks as high as 2,500 m and some even reach above the ocean's surface, Iceland, a part of the mid Atlantic Ridge, is an example.
- Seamount: It is a mountain with pointed summits, rising from the seafloor that does not reach the surface of the ocean. Seamounts are volcanic in origin. These can be 3,000–4,500 m tall. The Emperor Seamount, an extension of the Hawaiian Islands in the Pacific Ocean, is a good example.
- Submarine Canyons: These are deep valleys, some comparable to the Grand Canyon of the Colorado river. They are sometimes found cutting across the continental shelves and slopes, often extending from the mouths of large rivers. The Hudson Canyon is the best-known canyon in the world.
- Guyots: It is a flat topped seamount. They show evidences of gradual subsidence through stages to become flat topped submerged mountains. It is estimated that more than 10,000 seamounts and guyots exist in the Pacific Ocean alone.
- Atoll: These are low islands found in the tropical oceans consisting of coral reefs surrounding a central depression. It may be a part of the sea (lagoon), or sometimes form enclosing a body of fresh, brackish, or highly saline water

2 The statement states true. Like the surface of the Earth ocean flow is neither level or flat, it is undulating and varying. It comprises of different types of landforms. Some of them are: 5

- Continental Shelf: The continental shelf is the extended margin of each continent occupied by relatively shallow seas and gulis. It is the shallowest part of the ocean showing an average gradient of 1' or even less. The shelf typically ends at a very steep slope, called the shelf break.
- Continental Slope The continental slope connects the continental shelf and the ocean basins. It begins where the bottom of the continental shelf sharply drops off into a steep slope. The gradient of the slope region varies between 2-5. The depth of the slope region varies between 200 and 3,000 m. The slope boundary indicates the end of the continents. Canyons and trenches are observed in this region.
- Deep Sea: Plain Deep sea plains are gently sloping areas of the ocean basins. These are the flattest and smoothest regions of the world. The depths vary between 3,000 and 6.000m. These plains are covered with fine-grained sediments like clay and silt
- Sub Marine Ridges Oceanic floors have submarine narrow and elongated ridges. They resemble mountain ridges on the Earth's surface. Peak of these ridges may rise above the sea-level to form islands. For example: Philippines Ice land is a mid-Atlantic ridge.
- Oceanic deeps of sub-marine trenches: Deep narrow steep sided depression found along the abyssal plain. The depth of these trenches may vary from 6,000 to 11,000m.

3
- The salinity for normal open ocean ranges between 33o/oo and 37 o/oo . In the land locked Red Sea, it is as high as 41o/oo , while in the estuaries and the Arctic, the salinity fluctuates from 0 – 35 o/oo , seasonally. In hot and dry regions, where evaporation is high, the salinity sometimes reaches to 70 o/oo . The salinity variation in the Pacific Ocean is mainly due to its shape and larger areal extent. Salinity decreases from 35 o/oo – 31 o/oo on the western parts of the northern hemisphere because of the influx of melted water from the Arctic region. In the same way, after 15° – 20° south, it decreases to 33 o/oo . 5
- The average salinity of the Atlantic Ocean is around 36 o/oo. The highest salinity is recorded between 15° and 20° latitudes. Maximum salinity (37 o/oo) is observed between 20° N and 30° N and 20° W – 60° W. It gradually decreases towards the north.
- The North Sea, in spite of its location in higher latitudes, records higher salinity due to more saline water brought by the North Atlantic Drift. Baltic Sea records low salinity due to influx of river waters in large quantity. The Mediterranean Sea records higher salinity due to high evaporation.

- Salinity is, however, very low in Black Sea due to enormous fresh water influx by rivers. See the atlas to find out the rivers joining Black Sea.
- The average salinity of the Indian Ocean is 35 o/oo. The low salinity trend is observed in the Bay of Bengal due to influx of river water. On the contrary, the Arabian Sea shows higher salinity due to high evaporation and low influx of fresh water.

4 The continental slope and the deep-sea plain are distinct divisions of the ocean floor. 5

Continental Slope:

- The continental slope connects the continental shelf and the ocean basins
- It begins where the bottom of the continental shelf sharply drops off into a steep slope.
- The gradient of the slope region varies between 2°-5°, and the depth of the slope region varies between 200 and 3,000 meters.
- The slope boundary indicates the end of the continents. Canyons and trenches are observed in this region.

Deep-Sea Plain:

- Deep sea plains are gently sloping areas of the ocean basins.
- These are the flattest and smoothest regions of the world.
- The depths vary between 3,000 and 6,000 meters.
- These plains are covered with fine-grained sediments like clay and silt.

Comparison:

- The continental slope is a steep region connecting the shelf to the ocean basins, often featuring canyons and trenches. In contrast, the deep-sea plain is a flat, expansive region covered with fine sediments, representing the smoothest areas of the ocean floor.

5 MARKS HIGHER ORDER THINKING QUESTIONS (HOTs)

1 The ocean floor can be divided into four major divisions: 5

- Continental Shelf: The continental shelf is the extended margin of each continent occupied by relatively shallow seas and gulfs. It is the shallowest part of the ocean showing an average gradient of 1° or even less. The average width of continental shelves is about 80 km. The depth of the shelves varies, ranging from as shallow as 30 m to as deep as 600 m. Massive sedimentary deposits received over a long time by the continental shelves become the source of fossil fuels.
- Continental Slope: The continental slope connects the continental shelf and the ocean basins. It begins where the bottom of the continental shelf sharply drops off into a steep slope. The gradient of the slope region

varies between 2°-5°. The slope boundary indicates the end of the continents. Canyons and trenches are observed in this region.

- Deep-Sea Plain: Deep-sea plains are gently sloping areas of the ocean basins. These are the flattest and smoothest regions of the world. The depths vary between 3,000 and 6,000 meters. These plains are covered with fine-grained sediments like clay and silt.
- Oceanic Deeps or Trenches: These areas are the deepest parts of the oceans. They occur at the bases of continental slopes and along island arcs and are associated with active volcanoes and strong earthquakes.

2 Salinity refers to the total content of dissolved salts in seawater, expressed as parts per thousand (‰). 5

Factors Affecting Salinity:

- The salinity of water in the surface layer of oceans depends mainly on evaporation and precipitation. High evaporation increases salinity, while precipitation lowers it.
- Surface salinity is greatly influenced in coastal regions by the freshwater flow from rivers and in polar regions by the processes of freezing and thawing of ice.
- Wind also influences salinity by transferring water to other areas.
- Ocean currents contribute to salinity variations. Salinity, temperature, and density of water are interrelated.

Differences Between Open Oceans and Enclosed Seas:

- The salinity for normal open ocean ranges between 33‰ and 37‰.
- In the land-locked Red Sea, it is as high as 41‰, while in the estuaries and the Arctic, the salinity fluctuates from 0‰-35‰ seasonally.
- In enclosed seas like the Red Sea and the Mediterranean, high evaporation and limited freshwater inflow result in higher salinity.
- Conversely, regions with significant freshwater input, such as the Baltic Sea or Bay of Bengal, have lower salinity.

3 Factors Affecting Ocean Temperature: 5

- Latitude: The temperature of surface water decreases from the equator towards the poles because the amount of insolation decreases poleward.
- Land-Water Distribution: The oceans in the northern hemisphere receive more heat due to their contact with a larger extent of land than the oceans in the southern hemisphere.
- Prevailing Winds: The winds blowing from the land towards the oceans drive warm surface water away from the coast, resulting in the upwelling of cold water from below.

- Ocean Currents: Warm ocean currents raise the temperature in cold areas while the cold currents decrease the temperature in warm ocean areas.

Vertical Distribution of Temperature:

- The temperature-depth profile for the ocean water shows how the temperature decreases with increasing depth.
- The profile shows a boundary region between the surface waters of the ocean and the deeper layers.
- This boundary, usually beginning around 100-400 meters below the sea surface, is called the thermocline.
- About 90 percent of the total volume of water is found below the thermocline in the deep ocean, where temperatures approach 0°C.

1 MAP QUESTIONS 5

A- GULF OF MEXICO

B- HUDSON BAY

C- JAPAN SEA

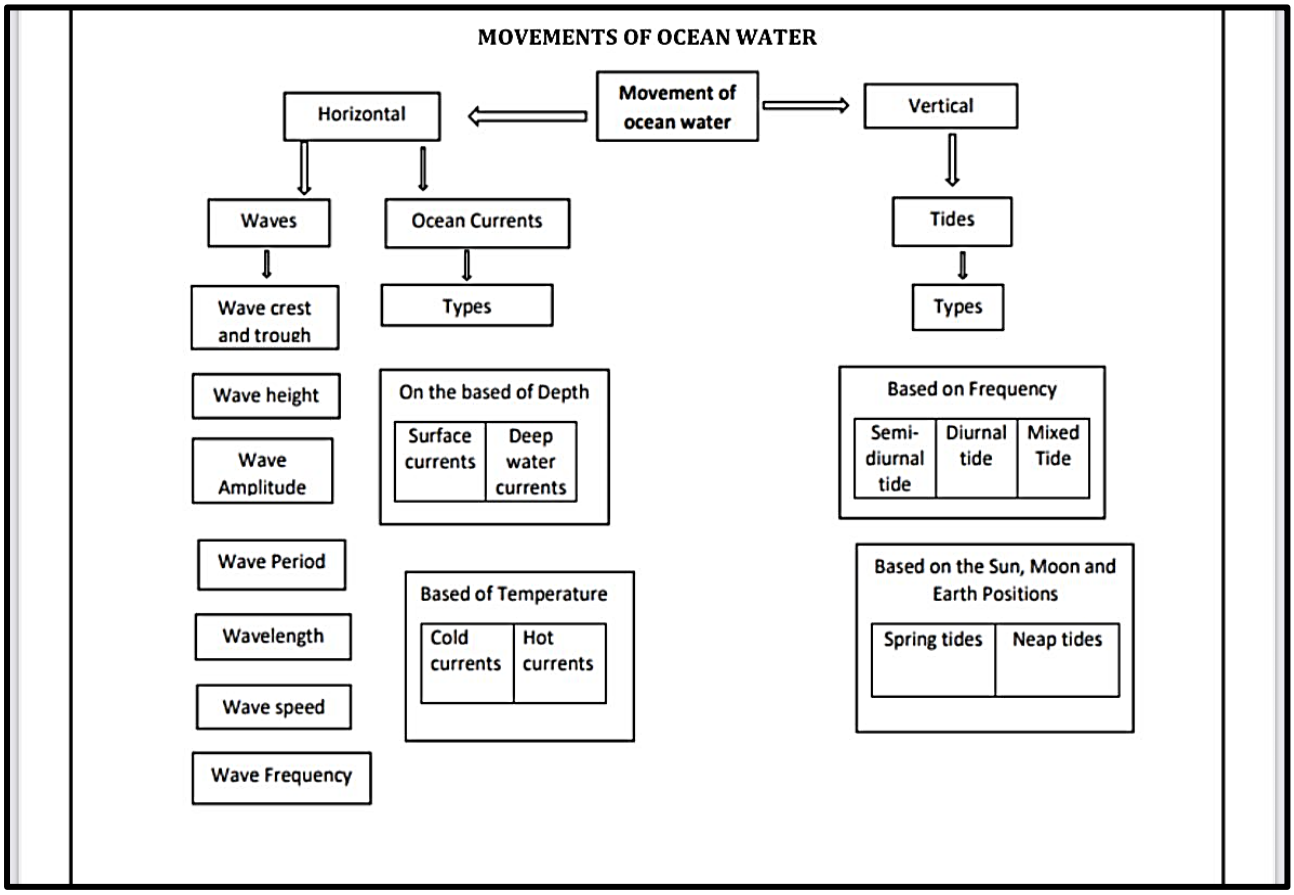
D- MEDITERRENEAN SEA

E- BALTIC SEA

F- CASPIAN SEA

CHAPTER – 13

MOVEMENT OF OCEAN WATER



Fill in the Blanks

1.The periodic rise and fall of sea level due to the gravitational pull of the Sun and Moon are called _____.
Answer: Tides

2._____ currents originate near the equator and move towards the poles, warming the regions they flow through.
Answer: Warm

3.The _____ ocean current is responsible for keeping Western Europe's climate warmer than other regions at similar latitudes.
Answer: Gulf Stream

4.The large-scale movement of ocean water due to wind, temperature differences, and the Earth's rotation is called _____.
Answer: Ocean currents

5.The highest tidal range in the world is found in the _____ Bay.
Answer: Bay of Fundy

6. A ..... actually, there is energy, not water, which move across the ocean surface.
Answer. Waves

Multiple Choice Questions (MCQs)

1.What causes tides in the ocean?
a) Wind
b) Gravitational pull of the Sun and Moon
c) Ocean currents
d) Earth's rotation
Answer: b) Gravitational pull of the Sun and Moon

2.Which of the following is a cold ocean current?
a) Gulf Stream
b) Labrador Current
c) Kuroshio Current
d) North Atlantic Drift
Answer: b) Labrador Current

3.Upwelling occurs when:
a) Warm water moves downward
b) Cold, nutrient-rich water rises to the surface
c) Ocean water evaporates quickly
d) Ocean water becomes stagnant
Answer: b) Cold, nutrient-rich water rises to the surface

4.Which current is responsible for the Atacama Desert's dryness?
a) Canary Current
b) Humboldt Current
c) Agulhas Current
d) Brazil Current
Answer: b) Humboldt Current

5.Spring tides occur when:
a) The Sun, Moon, and Earth are aligned
b) The Moon is at a right angle to the Earth
c) During the summer solstice
d) During the winter solstice
Answer: a) The Sun, Moon, and Earth are aligned

6. Which of the following oceans has a Agulhas current?
(a) Pacific Ocean
(b) Indian Ocean
(c) Atlantic Ocean
(d) Arctic Ocean
Answer. (b) Indian Ocean

Q7. The tides that fall on full moon and new moon is called
(a) Neap Tides
(b) Spring Tides
(c) Diurnal Tides
(d) Mixed Tides
Answer. (b) Spring Tides

Q8. What causes tide?
(a) Winds
(b) Curious force
(c) Solar energy
(d) Gravitational force
Answer. (d) Gravitational force

Q9. Which of the following shows the speed of water caused by climatic effects?
(a) Surges
(b) Ebbs
(c) Drift
(d) Gyres
Answer. (a) Surges

Match the Following: –

Column A	Column B
1. Gulf Stream	a. Cold current
2. Labrador Current	b. Warm current

3. Spring tide
4. Humboldt Current
5. Neap tide

c. Sun, Moon, Earth aligned
d. Upwelling
e. Sun and Moon at right angles

Answer: 1 → b, 2 → a, 3 → c, 4 → d, 5 → e

Assertion–Reason Questions:

Question 1: Assertion (A): The Gulf Stream helps moderate the climate of Western Europe.
Reason (R): The Gulf Stream is a cold ocean current that originates near the poles.
a) Both A and R are true, and R is the correct explanation of A.
b) Both A and R are true, but R is not the correct explanation of A.
c) A is true, but R is false.
d) A is false, but R is true.
Answer: c) A is true, but R is false.

Question 2: Assertion (A): Ocean currents are influenced by the Earth's rotation.
Reason (R): The Coriolis Effect deflects the direction of ocean currents.
a) Both A and R are true, and R is the correct explanation of A.
b) Both A and R are true, but R is not the correct explanation of A.
c) A is true, but R is false.
d) A is false, but R is true.
Answer: a) Both A and R are true, and R is the correct explanation of A.

Question 3: Assertion (A): Upwelling zones are rich in marine biodiversity.
Reason (R): Upwelling brings nutrient-rich water to the surface, supporting plankton growth.
a) Both A and R are true, and R is the correct explanation of A.
b) Both A and R are true, but R is not the correct explanation of A.
c) A is true, but R is false.
d) A is false, but R is true.
Answer: a) Both A and R are true, and R is the correct explanation of A.

Short Answer Questions: [3 marks]

Q.1. Explain the difference between waves and currents. [any three]

Answer. **Waves**	**Currents**
a. Water in the waves does not move ahead.	a. Water moves ahead from one place to another.
b. The motion of waves seldom affects stagnant deep bottom water of the oceans.	b. Currents are sufficiently deep to impact.
c. Wind provides energy to the waves.	c. Currents moves due to the impact of permanent winds.
d. The size of the waves depends on the depth of the water.	d. The currents are always of huge size, their areas are filled with fish.
e. The waves are permanent and destruction and construction is	e. The currents are the continuous flow of water in

an ongoing process. a definite direction.

Q.2. What is meant by tidal current?

Answer. When the tide is channelled between islands or into bays and estuaries, they are called tidal currents.

Q.3. Write a short note on the Sargasso Sea

Answer. The Sargasso Sea is a region of the north Atlantic Ocean bounded by four currents i.e. Gulf stream, north Atlantic current, Canary current, north Atlantic equatorial current forming an ocean gyre. Unlike all other regions called seas it has no land boundaries. It is distinguished from other parts of the Atlantic Ocean by its characteristic brown Sargassum seaweed and often calm blue water.

Q.4. How does tides affect navigation?

Or

How is tides related to navigation?

Answer. Tidal flows are of great importance in navigation. Tidal Heights are very important especially harbours near rivers and within estuaries having shallow bars at the entrance, which prevent ships and boats from entering the harbour. Kolkata and London ports are the examples of benefiting due to tides.

Q5.- Classify the tides based on frequency

Answer: Tides based on Frequency

1-Semi- diurnal tide- The most common tidal pattern, featuring two high tides and two low tides each

day. The successive high or low tides are approximately of the same height.

2- Diurnal tide- There is only one high tide and one low tide during each day. The successive high and low tides are approximately of the same height.

3-Mixed tide- Tides having variation in height are known as mixed tides. These types generally occur along the west coast of North America and on many Islands of the Pacific Ocean.

Q 6-How are the tides caused?

Answer- The periodical rise and fall of the sea level once or twice a day mainly due to the attraction of the Sun and the Moon is called a tide.

The moons gravitational pull primarily and to a lesser extent the sun's gravitational pull, are the major causes for the occurrence of tides. Another factor is centrifugal forces which is the force that acts to counterbalance the gravity. Together the gravitational pull and the centrifugal force are responsible for creating two major tidal bulges on the earth. On the side of the earth facing the moon, a tidal bulge occurs while on the opposite side the gravitational attraction of the moon is less as it is farther away, the centrifugal force causes tidal bulge on the other side.

Q-7. What are the types of ocean current?

Answer- Ocean currents: Based on **depth** there are 2 types of currents. [1] Surface current and [2] Deep water current. Surface currents constitute about 10% of all the water in the ocean, these waters are the upper 400 m of the ocean. Deep water currents make up the other 90% of ocean water.

Based on **temperature** there are two types of currents. Cold currents and Warm currents. Cold currents bring cold water into warm water areas. These currents are usually found on the west coast of the continents in the low and middle latitudes (true on both hemispheres) and on the east coast in the higher latitude in the Northern Hemisphere

Warm currents bring warm water into cold water areas and are usually observed on the east coast of continents in the low and middle latitudes (true on both hemispheres). In the northern hemisphere they are found on the west coast of continents in high latitudes.

Long answer type questions (5 marks)

Q1- What are the characteristics of waves?

Answer:1-Wave crest and trough: -The highest and lowest points of a wave are called the crest and trough respectively .

2- Wave height- It is the vertical distance from the bottom of a trough to the top of a crest of a wave.

3- Wave amplitude- It is one half of the wave height.

4- Wave period - It is merely the time interval between two successive wave crests or troughs as they pass a fixed point.

5- Wavelength - It is the horizontal distance between two successive crests

6- Wave speed – It is the rate at which the wave moves through the water and is measured in knots.

7- Wave Frequency-It is the number of waves passing a given point during a one second time interval.

Q2- Explain how heating of solar energy, wind, gravitation and Coriolis force effect the ocean currents?

or

Which primary forces initiate the movement of ocean currents?

Answer 1-Heating of solar energy: Heating of solar energy causes the water to rise that is why near the equator the ocean water is about 8 cm higher in level than in the middle latitude, this causes a very slight gradient, and water tends to flow down the slope.

2- Wind: Wind blowing on the surface of the ocean pushes the water to move. Friction between the wind and the water surface affects the movement of water body in its course.

3- Gravity: Gravity tends to pull the water down the pile and create gradient variation

. 4-Coriolis force: The Coriolis force intervenes and causes the water to move to the right in the northern hemisphere and to the left in southern hemisphere.

Q 3-What are the effects of Ocean currents?

Answer:The west coasts of continents are bordered by warm currents and enjoy distinct marine climate.

1-Ocean currents increase the temperature of the ocean whereas cold currents decrease the temperature of the ocean.
2-West coasts of the continents in the middle and higher latitudes are bordered by warm waters which cause a distinct marine climate
3-North Atlantic drift and the Labrador Current decreases the temperature of western Atlantic coast, while the warm Gulf Stream increases the temperature of ocean water along the western European coast.
4-The mixing of warm and cold currents favours the growth of plankton, which is the primary food for fish population. Therefore, such areas are the best fishing grounds of the world.

Source Based Questions

"The highest tide in the world occur in the Bay of Fundy in Nova Scotia, Canada. The tidal bulge is 15-16 m. Because there are two high tides and two low tides everyday (roughly a 24-hour period); then a tide must come in within about 6-hour period. As a rough estimate, the tide rises about 240cm and an hour (1440 divided by 6 hours). If you have walked down a beach with a steep cliff alongside (which is common there), make sure you watch the tides. If you walk for about an hour and then notice that the tide is coming in, the water will be over your head before you get back to where you started."

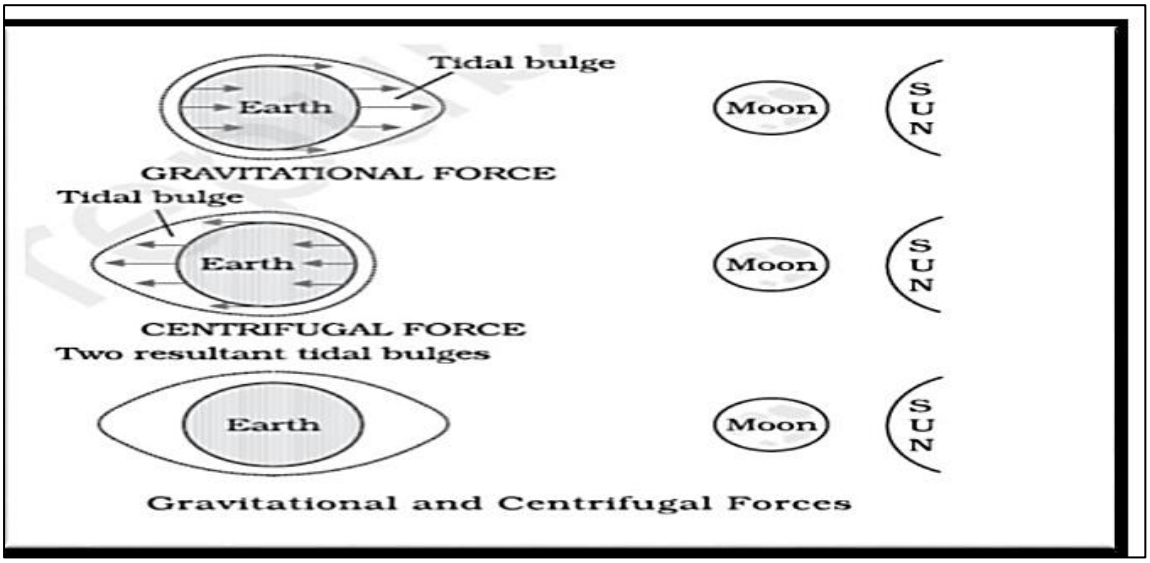
Q1-In which water body does the highest tide occur in the world?
a- Bay of Bengal b- Bay of Hudson c- Bay of Fundy d- Bay of Biscay

Q-2The bay, where the highest tide occur, is in which country?
a- Alaska b- Canada c- Norway d- USA

Q 3- The tidal bulge is 15 -16 m. Because there are----- high and low tides: -
a-Three b- One c-Two d-Four

Q 4-The tide rises about ---------- cm an hour
a- 260 cm b- 1440cm c- 240 cm d- 1460 cm

Diagram based question



Q1-Due to centrifugal force the tidal bulge occurs in which direction?
a- In the opposite direction of the Moon b- Towards the north of the Earth

c- Towards the south of the Earth d- In the direction of the Moon.

Q 2-Due to which of the following these tidal bulges occur?

a – The Sun b- The moon c- Both a and b are correct d- None of the above

Q3-Due to gravitational force the tidal bulge occurs in which direction?

a- In the direction of the Moon b- In the opposite direction of moon

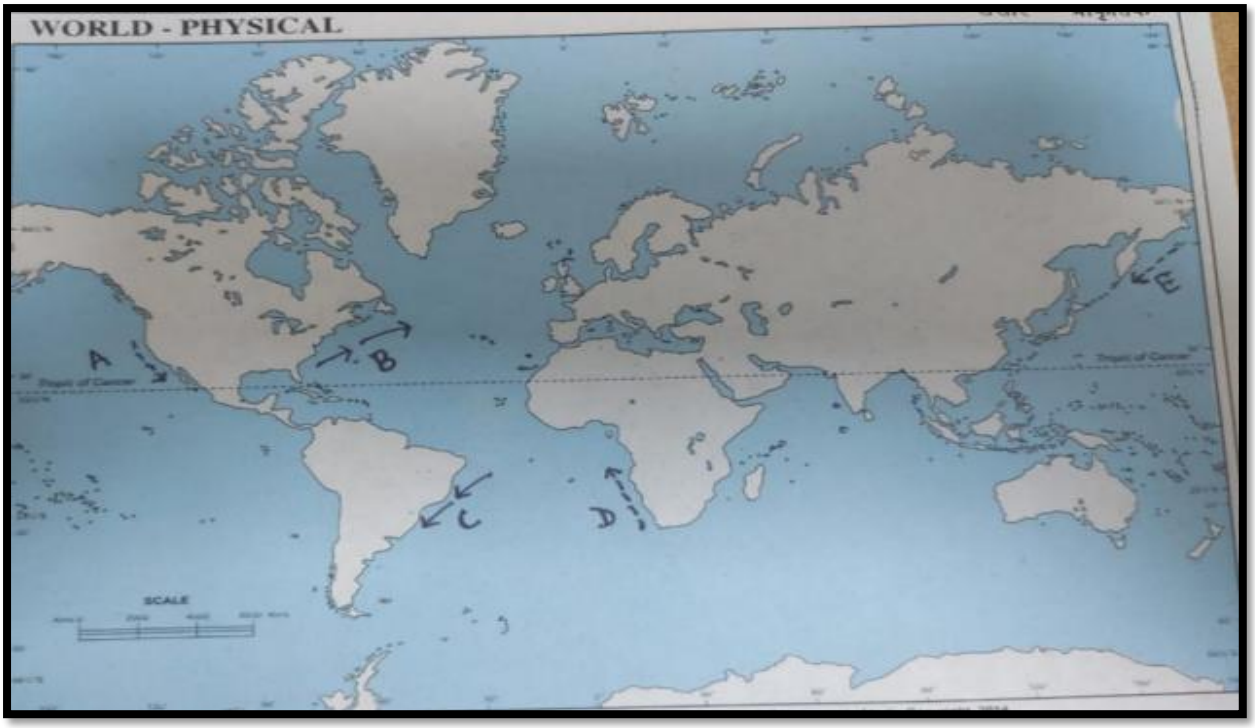
c- Both a and b are incorrect d- None of the above

Q 4- Which forces are responsible for the formation of tidal bulges?

a- Gravitational force b- Centrifugal force

c- Both of a and b are correct d- None of the above

Map based question.



In the given map five items has shown A, B, C, D and E. Identify the items and give the correct name.

A. Cold current of north Pacific Ocean.

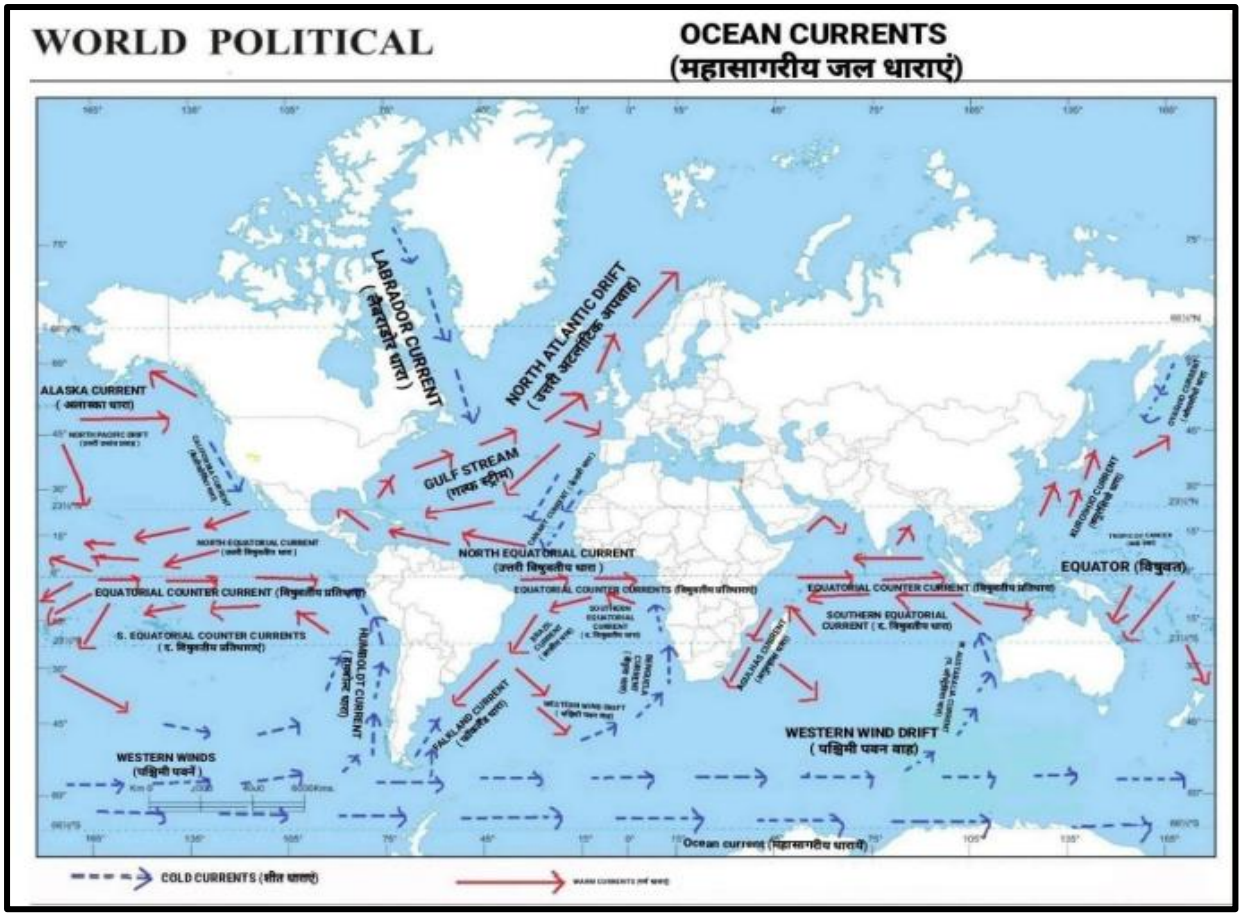
B. Warm Ocean current of north Atlantic Ocean.

C. Warm current of south Atlantic Ocean.

D. Cold current of south Atlantic Ocean.

E. Cold current of north Pacific Ocean.

Answer: A. California current B. Gulf stream C. Brazilian Current D. Benguela Current E. Oyashio Current



Critical Thinking and Problem-Solving Questions with Real-Life Situations

Q1: Explain the three main types of ocean water movements with real-life examples. How do these movements affect global trade?

Answer: The three main types of ocean water movements are:

1.**Waves**: Regular up-and-down movements of water caused by wind. Example: Waves breaking on the coast of Goa influence local fishing activities.

2.**Tides:** Periodic rise and fall of sea levels caused by the gravitational pull of the Moon and the Sun. Example: The Bay of Fundy in Canada experiences the world's highest tides, aiding tidal energy generation.

3.**Ocean Currents**: Large-scale water flows in oceans due to factors like wind, Earth's rotation, and temperature differences. Example: The Gulf Stream helps warm Europe and supports shipping routes.

Impact on Global Trade: Ocean currents and winds influence shipping routes. For instance, the Gulf Stream and North Atlantic Drift create favourable conditions for transatlantic trade by speeding up ships traveling between Europe and North America.

Q2. Question: How do tides impact human activities, particularly in coastal regions? Share a real-life example.

Answer: Tides significantly impact human activities in coastal regions by:

- Aiding fishing: Fishermen in coastal India use tides to navigate shallow waters.
- Facilitating ports: High tides help ships enter and exit harbours, such as the Kolkata Port in India, which depends on tidal flow.

- Generating energy: Tidal power plants, like the one in Kislaya Guba, Russia, utilize tidal energy to produce electricity.

Real-life Example: In Kerala, the fishing community plans trips based on tidal movements to ensure safety and maximize catch. The backwaters' tidal influence also supports inland water navigation.

Q3: Describe the difference between warm and cold ocean currents and their effects on climate. Provide a real-life scenario.

Answer:

·Warm Currents: Originate near the equator and flow toward the poles, bringing warmth. Example: The Gulf Stream warms Western Europe, making it liveable despite its high latitude.

·Cold Currents: Originate near the poles and flow toward the equator, bringing cold water. Example: The Peru Current cools the west coast of South America, creating a dry climate (Atacama Desert).

Real-life Scenario: During El Niño, the weakening of the Peru Current leads to warming of the waters off South America, causing heavy rainfall, floods, and impacting global climate patterns.

Q4: Analyse how ocean currents affect marine biodiversity. Illustrate with an example.

Answer: Ocean currents regulate nutrient distribution, influencing marine biodiversity.

·Upwelling Currents: Bring nutrient-rich waters to the surface, supporting plankton growth and fish populations. Example: The Humboldt Current near Peru supports one of the world's richest fisheries.

·Warm Currents: Provide favourable conditions for coral reefs. Example: The East Australian Current sustains the Great Barrier Reef.

Real-life Example: The collapse of the Sardine fishery in California in the mid-20th century was linked to changes in the California Current, which disrupted the nutrient supply.

Q5: Discuss the role of ocean currents in disaster management, particularly during cyclones.

Answer: Ocean currents affect the intensity and path of cyclones. Warm currents like the Gulf Stream increase sea surface temperatures, providing energy for cyclones. On the other hand, cold currents can weaken cyclones by lowering water temperatures.

Real-life Example: During Cyclone Fani (2019) in the Bay of Bengal, warm ocean waters intensified the storm, leading to massive damage. Early predictions of ocean temperature anomalies helped in issuing timely warnings and saving lives.

Q6. Sahana and her friends want to go to the beach. But they need to decide what time to go to beach so that the tide is coming in and there is water around the beach. What information will help them the most?

Answer: The location of moon with respect to Earth. The location of the moon has the highest influence in changing the effects of gravity on tides.

Q7. Arjun's uncle Shyamal stays in a village on the coast. He is a fisherman. He goes into ocean for a few days and rest of the days he works from the shore. Arjun was confused

about the different patterns of his uncle's jobs. Why do you think Shyamal goes into the ocean some days and on other days he spends on the shore?

Answer: An ocean consists of three different types of motions –waves, tides and ocean currents. Each of these occurs differently and they have different impacts on earth and people who depend on oceans for their livelihood. Shyamal goes into the ocean only for few days, because of tides which decide the navigation. When the tides are low or normal or depending on the tidal heights one can navigate in the ocean smoothly, otherwise navigation becomes very dangerous.

When he cannot go into the ocean he works from the shore. When cold and warm ocean currents are mixed, it becomes the best fishing ground. If the ocean near his village produces a mixture of cold and warm ocean currents, the best fishing ground are formed, and Shyamal can catch fish from the shore.

CHAPTER– 1
INDIA LOCATION

Geographical area	32.8 lakh sq km
Size	Seventh largest in world (2.4percent of total world area)
Location	South Asia
Latitudinal spread	8degree 4 minutesNorth to37degree 6 minutes North
Longitudinal spread	68degree 7 minutes East to 97degree 25 minutes East
Hemisphere	North hemisphere and East hemisphere
Standard meridian	82 degree 30 minutes E
Land frontier	15200 km.
Coastal frontier	7517 km.
Territorial sea	12 nautical miles
Northern most point	Indira colin siachin
Western most point	Sir creek in west of Ghuar Moti Gujrat
Easternmost point	Kibithu Arunachal Pradesh
Southern most point	Indira point great Nico bar island
Southern most point of mainland	Cape Comorin Kanya Kumari
States	28
Union territories	8

Sr. No.	Questions	Marks
1	**Fill in the blanks:–** 1. Standard Time of India is determined by _____ longitude. 2. Indian standard Time is _____ hrs. ahead of Greenwich time. 3. North South distance of India is _____ kilometres. 4. East west distance of India is _____ kilometres. 5. In India latitudinal and longitudinal difference is _____ degrees. 6. Eastern and western parts of India have _____ hours time difference.	6
2	**MCQ** 1. Which of the following country is not part of Indian subcontinent A. Pakistan B. Sri Lanka	5

C. Bhutan D. Nepal

2. Which of the following state has not common border with Pakistan

A. Gujrat B. Himachal Pradesh

C. Rajasthan D. Jammu and Kashmir

3. Which of the following state is not Himalayan State

A. Sikkim B. Uttarakhand

C. Bihar D. Himachal Pradesh

4. Which of the following state does not share its border with China

A. Assam B. Sikkim

C. Himachal Pradesh D. Arunachal Pradesh

5. largest lake of India lake Chilika is found in the following State

A. Gujrat B. West Bengal

C. Orissa D. Andhrapradesh

3 Match the following:- 12

	States	Capital
a.	Andhra Pradesh	Raipur
b.	Arunachal Pradesh	Ranchi
c.	Jharkhand	Amravati
d.	Manipur	Panaji
e.	Meghalaya	Itanagar
f.	Mizoram	Kohima
g.	Chhattisgarh	Dehradun
h.	Nagaland	Shillong
i.	Sikkim	Hyderabad
j.	Telangana	Imphal
k.	Uttarakhand	Aizawl
l.	Goa	Gangtok

4 Assertion Reasoning based Questions:- 4

1 Assertion (A)--Northern part of India is located in subtropical part and southern part of India is located in tropical zone
Reasoning R)-- tropic of Cancer passes through centre of India

A Both A and R are correct and R explain A completely

B Both A and R incorrect

C A is correct and R is not correct explain action

D A is incorrect and R is correct

2 (A) From Gujarat to Arunachal Pradesh there is a time lag of 2 hours
(R) Eastern and western ends have 30 degree longitude difference

A Both A and R are correct and R explain A completely

B Both A and R incorrect

C A is correct and R is not correct explain action

D A is incorrect and R is correct

3 3(A) all watches in Kolkata Delhi Mumbai Chennai show the same time
(R) All these places are located on standard meridian of India

A Both A and R are correct and R explain A completely

B Both A and R incorrect

C A is correct and R is not correct explain action
D A is incorrect and R is correct

4 4 (A) India has variety of climates, soil, landforms and natural vegetation
(R) It is part of Indian subcontinent
A Both A and R are correct and R explain A completely
B Both A and R incorrect
C A is correct and R is not correct explain action
D A is incorrect and R is correct

5 Source based questions:- 1×4=4

You may further appreciate that bounded by the Himalayas in the north, Hindu Kush and Sulaiman ranges in the Northwest, Purvanchal hills in the North East and by the large expense of the Indian ocean in the south, it forms a great geographic entity known as the Indian subcontinent.. It includes the countries Pakistan, Nepal, Bhutan, Bangladesh and India. The Himalayas together with other ranges have acted as a formidable physical barrier in the past, except for a few mountain passes such as the Khyber, the Bolan, the Shipkila, the Nathula, the Bomidila etc. it was difficult to cross it. it has contributed towards the evolving of a unique regional identity of the Indian subcontinent. On the basis of the above text answer the following questions:-

1.1 Which physical features mark the boundaries of Indian subcontinent
1.2 Name the major passes in the Himalayas
1.3 Which countries are part of Indian subcontinent
1.4 Give any example of unique regional identity of Indian subcontinent

6 Very Short Answer Questions:- 1×10=10

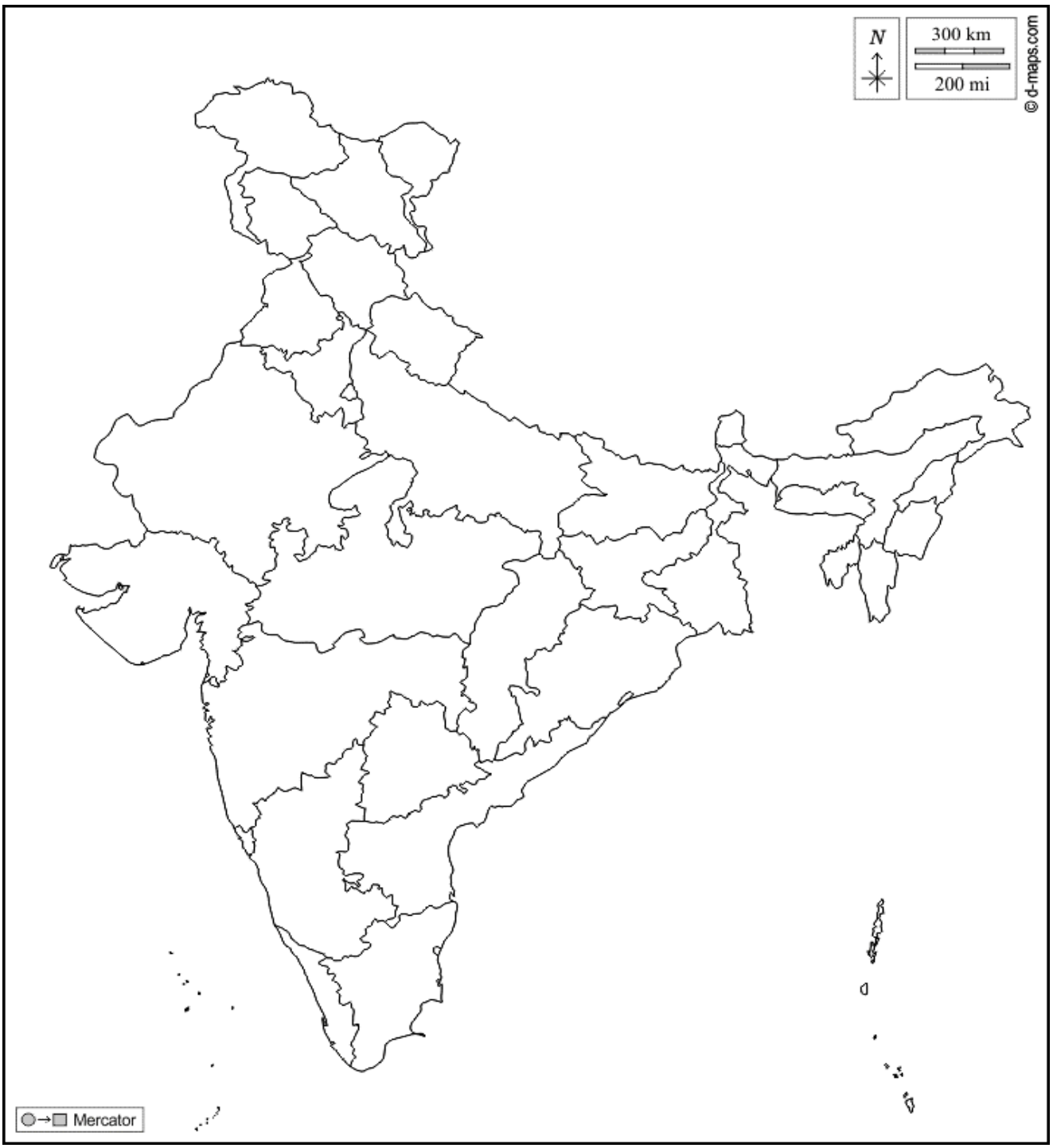
1 Name the country with which India has the longest land boundary also name the states having this international boundary.
2 Name the states having international border with Myanmar.
3 Name the largest state of India and its capital.
4 Name the smallest state of India and its capital.
5 Which gulf and strait differentiates India and Sri Lanka.
6 Which group of islands of India has coral origin and name the water body they are located in.
7 Which point of India is nearest to equator.
8 Which state of India is named as in the lap of sun.
9 Which state of India is known as abode of clouds.
10 Which state of India is referred as land of five rivers.

7 Short Answer Questions:- 3×5=15

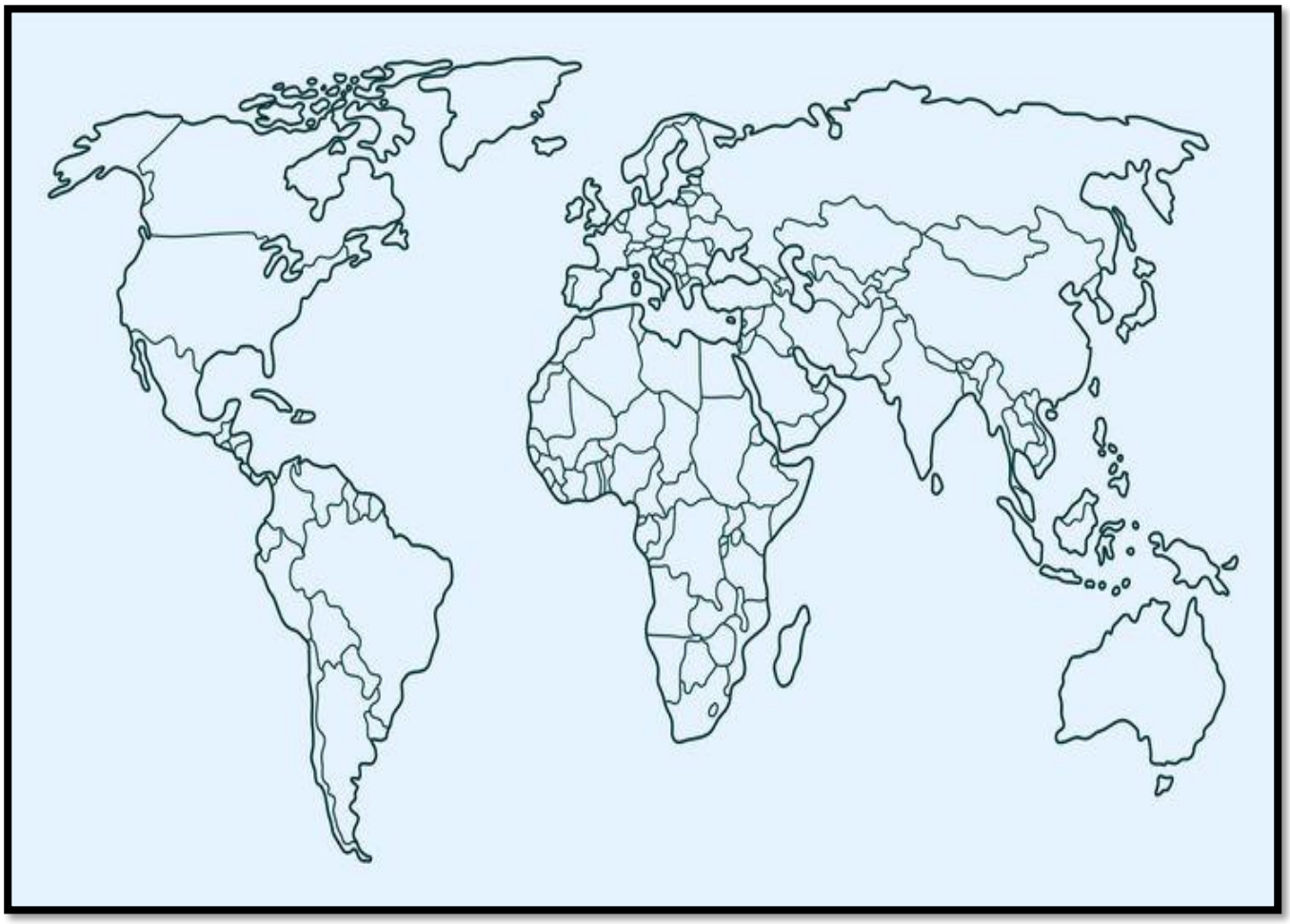
1 The sun is incline sometimes to the north and sometimes to the south at mid-Day in Hyderabad but not in New Delhi give reason.
2 Indian ocean is named after India, find some reasons.
3 The peninsular location of India has benefited us how?
4 Variety of climate, vegetation and soil has made India agricultural rich explain.
5 What is the local time difference in eastern and western ends of our country but watches show the same time.

8 Critical thinking questions:- 7×5=35

1. Eastern hemisphere has been the cradle to many civilizations find names of such civilizations and reasons.
2. West Indies has similar name as India try to find out why it has been named so.
3. How India is a great example of unity in diversity Vasudev kutumbkam.
4. India has been a great centre of trade during medieval Asian Times find some reasons.
5. What is IST how difficult our life would have been without it.
6. On the map of India Mark states and their capitals.
7. On the world map mark our neighbouring countries and major sea routes and air routes.



Question 8 (7)



INDIA LOCATION ANSWER KEY

1. Fill in the blanks

1. 82 degree 30 minutes East
2. 5 hours 30 minutes
3. 3214 km.
4. 2933 km
5. 30
6. 2 hours

2. MCQ

1. B Sri Lanka
2. B Himachal Pradesh
3. C Bihar
4. A Assam
5. C Orissa

3. Match the following

a. Andhra Pradesh Amravati
b. Arunachal Pradesh Itanagar
c. Jharkhand Ranchi
d. Manipur Imphal
e. Meghalaya Shillong

f. Mizoram Aizawl
g. Chhattisgarh Raipur
h. Nagaland Kohima
I. Sikkim Gangtok
j. Telangana Hyderabad
k. Uttarakhand Dehradun
l. Goa Panaji

4. Assertion/ Reasoning questions

1. A both are correct
2. A both are correct
3. C
4. A

5. Source based questions

1.1 Himalayas in the north ,Hindu Kush and Sulaiman in Northwest, Purvanchal hills in North East and Indian ocean in the south

1.2 The Khyber, the bolan, the shipki La ,the Nathula,the bomidila

1.3 India ,Nepal, Bhutan, Bangladesh, Pakistan

1.4 Monsoon dominated climate, Brown skin colour ,multi religion ,well built bodies ,hard working people

6. Very short Answer Questions

1 Bangladesh, West Bengal ,Assam , Meghalaya ,Tripura
2 Arunachal Pradesh ,Nagaland, Manipur ,Mizoram
3 Rajasthan Jaipur
4 Goa Panaji
5 Palk Strait and gulf of Mannar
6 Lakshadweep Arabian se a
7 Indira point
8 Arunachal Pradesh
9 Meghalay a
10 Punjab

7. Short answer Questions

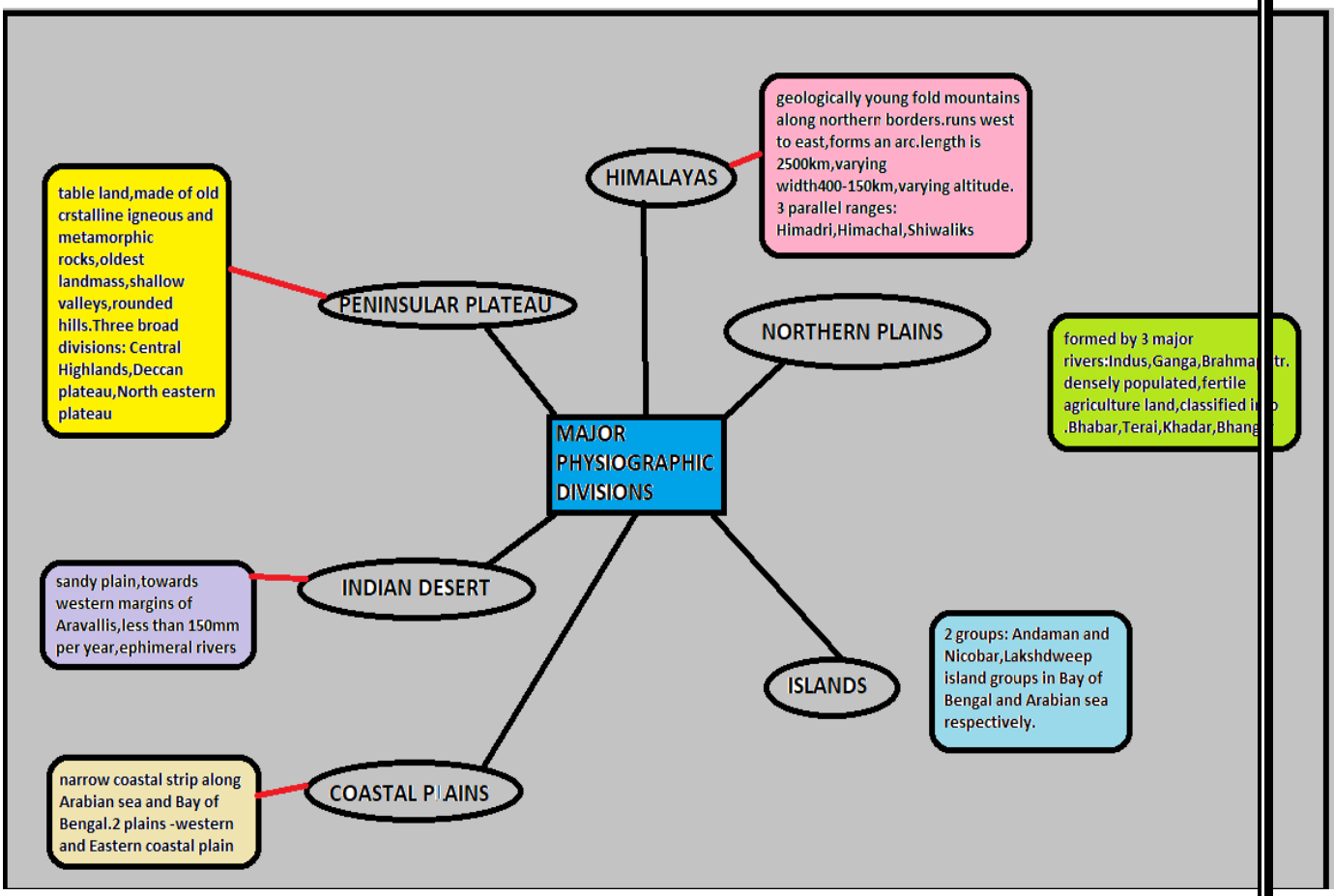
1. Hyderabad is located in between equator and tropic of Cancer so when the sun is. Northerly at the June solstice and southerly at the December solstice, it receives sun from both directions, but New Delhi is located from tropic of Cancer to Arctic circle that receives direct sunlight only from Southerly direction.
2. India has the longest coastline(7517 km.)in Indian ocean as compared to other Indian ocean countries. It is most centrally located in Indian ocean dividing it into two parts that is Arabian Sea and Bay of Bengal. It is easy to approach all Indian Ocean countries and continents from India i.e. Australia, South Asia, Eastern Africa and after Suez canal it has shortened the distance between Europe too.
3. Peninsula is a land surrounded by water from three sides. Southern part of India is surrounded by Arabian Sea, Indian Ocean and Bay of Bengal and Such situation has greatly benefited India
   - Long coastline
   - Easy to access sea minerals and fishing

- Monsoonal rainfall
- Seaports that encourage International Trade
- On major trade route of Europe, Australia Africa, South Asia

4. India is lucky to have been endowed with variety of climates soils and vegetation.
   - Long agricultural season being hot monsoonal climate helps us grow many crops in a year
   - Variations in temperature leads to variety of crops ,many fruits, vegetables and plantation crops
   - Peninsular location helps in availability of rains and moisture
   - Variety of soils –alluvial soil, black soil, red and yellow soils, laterite and dry soils support different type of crops
   - Rivers spread alluvial soils and provide water for irrigation
5. Local time is based on the local longitude of the place .Our western longitude is 68 degree 7 minutes East and Eastern longitude is 97 degree 25 minutes East. It is almost 30 degree difference. Our watches follow IST Indian Standard Time which is determined by centrally located Standard meridian I e 82degree 30 minutes East.
   Local time has 2 hours difference in East and West longitude
   As 1 degree is equal to 4 minutes
   So 30 degree is equal to 30x4. =120 minutes= 2 Hours.

CHAPTER – 2
STRUCTURE AND PHYSIOGRAPHY

MIND MAP



FILL IN THE BLANKS

1. The northeastern parts are separated by the ……..in West Bengal from the Chotanagpur plateau.
2. The states of ……and ……. form a water divide between the Indus and the Ganga river systems
3. Delhi ridge in the northwest is the extension of ……
4. ……..is the oldest and the most stable landmass of India.
5. The Eastern and the Western Ghats meet each other at the…….
6. Crescent-shaped sand dunes are called ……
7. ……..is the only significant tributary of the river Chambal that originates from the Aravalli in the west.

II MULTIPLE CHOICE QUESTIONS

1. What is the concept of watersheds related to?
   a) Plate tectonics b) Drainage system c) Mountain formation d) Soil erosion
2. Which of the following is the approximate length of the Great Himalayan range, also known as the central axial range from east to west?

a) 2300 km b) 2400 km c) 2500 km d) 2600 km

3 Which of the following is the oldest and the most stable landmass of India?
a) Himalayas b) Northern Plain c) Peninsular Plateau d) Coastal Plain

4 . It is an extension of the main peninsular plateau in the northeastern part of India. Which of the following part is this?
a) Rajmahal Hills b) Chhotanagpur c) Karbi-Anglong Plateau d) Nilgiri Hills

5 Garo, Khasi and Jaintia hills named after the tribal groups inhabiting this region from west to east are located in the:
a) ChotaNagpur plateau b) Meghalaya plateau
c) Karbi-Anglong plateau d) Rajmahal hills

6. This coast has got certain distinguish features in the form of 'Kayals' (backwaters), which
are used for fishing, inland navigation and also due to its special attraction for tourists.
a) Konkan coast b) Kathiawar coast c) Goan coast d) Malabar coast

7. Waterbody separating Andaman group of islands from Nicobar group
a . Nine degree channel b. ten degree channel
c. six degree channel d. four degree channel

8. Meghalaya plateau is rich in which of these mineral resources?
a. copper b. dolomite c. sillimanite d. thorium

III MATCH THE FOLLOWING

1

COLUMN 1	COLUMN 2
A. Narmada	i. brackish water
B. Javadi hills	ii. tectonic mountain
C. Himalayas	iii. relict mountain
D. Patland	iv. Rift valley
E. playas	v. Hazaribagh plateau

a. A-iv B-iii C-ii D-v E-i
b. A- i B ii C-iii D-iv E-v
c. A-ii B-iii C-iv D-v E-i
d. A-iii B-iv C-v D-i E-ii

IV ASSERTION AND REASONING

1 **Assertion (A**): The Western coastal plain is a narrow belt and provides natural conditions
for the development of ports and harbours.
Reason (R): The western coastal plain is an example of submerged coastal plain.
OPTIONS:
a) Only assertion is correct
b) Only reason is correct
c) Both assertion and reason are correct and reason is the correct explanation for assertion
d) Both assertion and reason are correct but reason is not the correct explanation for assertion

2 **Assertion (A):** The Meghalaya plateau has a highly eroded surface.
Reason (R): This area receives maximum rainfall from the south west monsoon.
OPTIONS:
a) Only assertion is correct
b) Only reason is correct
c) Both assertion and reason are correct and reason is the correct explanation for assertion
d) Both assertion and reason are correct but reason is not the correct explanation for assertion

3 **Assertion:** There are some streams in Thar desert which disappear after flowing for some distance and present a typical case of inland drainage.
Reason: Low precipitation and high evaporation makes it a water deficit region.

OPTIONS:
a) Only assertion is correct
b) Only reason is correct
c) Both assertion and reason are correct and reason is the correct explanation for assertion
d) Both assertion and reason are correct but reason is not the correct explanation for assertion

4 **Assertion:** The general elevation of the plateau is from the west to the east,
Reason: The pattern of the flow of rivers of the Peninsular plateau have their confluence in the Bay of Bengal.

OPTIONS:
a) Only assertion is correct
b) Only reason is correct
c) Both assertion and reason are correct and reason is the correct explanation for assertion
d) Both assertion and reason are correct but reason is not the correct explanation for assertion

5 **Assertion:** The general elevation of the Central Highlands ranges between 700–1,000 m above the mean sea level and it slopes towards the north and northeastern directions
Reason: Banas is the only significant tributary of the river Chambal that originates from the Aravalli in the west

OPTIONS:
a) Only assertion is correct
b) Only reason is correct
c) Both assertion and reason are correct and reason is the correct explanation for assertion
d) Both assertion and reason are correct but reason is not the correct explanation for assertion

V **SOURCE BASED/CASE BASED**

1 **Read the given passage carefully and answer the questions that follow:**

To the northwest of the Aravali hills lies the Great Indian desert. It is a land of undulating topography dotted with longitudinal dunes and barchans. This region receives low rainfall below 150 mm per year; hence, it has arid climate with low vegetation cover. It is because of these characteristic features that this is also known as Marusthali. It is believed that during the Mesozoic era, this region was under the sea. This can be corroborated by the evidence available at wood fossils park at Aakal and marine deposits around Brahmsar, near Jaisalmer (The approximate age of the wood-fossils is estimated to be 180 million years). Though the underlying rock structure of the desert is an extension of the peninsular plateau, yet, due to extreme arid conditions, its surface features have been carved by physical weathering and wind actions. Some of the well pronounced desert land features present here are mushroom rocks, shifting dunes and oasis (mostly in its southern part). Most of the rivers in this region are ephemeral. The Luni river flowing in the southern part of the desert is of some significance. Low precipitation and high evaporation makes it a water deficit region.

a) Why does the desert region of India known as Marusthali?
b) What are the evidences that support the fact that during Mesozoic era the Indian desert was under the sea?.
c) What are the important land features of Indian desert?

2 **Read the given passage carefully and answer the questions that follow:**

This is bordered by the Western Ghats in the west, Eastern Ghats in the east and the Satpura, Maikal range and Mahadeo hills in the north. Western Ghats are locally known by different names such as Sahyadri in Maharashtra, Nilgiri hills in Karnataka and Tamil Nadu and Anaimalai hills and Cardamom hills in Kerala. Western Ghats are comparatively higher in elevation and more continuous than the Eastern Ghats. Their average elevation is about 1,500 m with the height increasing from north to south.

a ." This is bordered by the Western Ghats in the west.....Identify the relief feature.
b. What is the height of the western ghats? also name the highest point of western ghats.
c. By what name is western ghats known in Maharashtra?

3 **Observe the picture carefully and answer the following questions:**

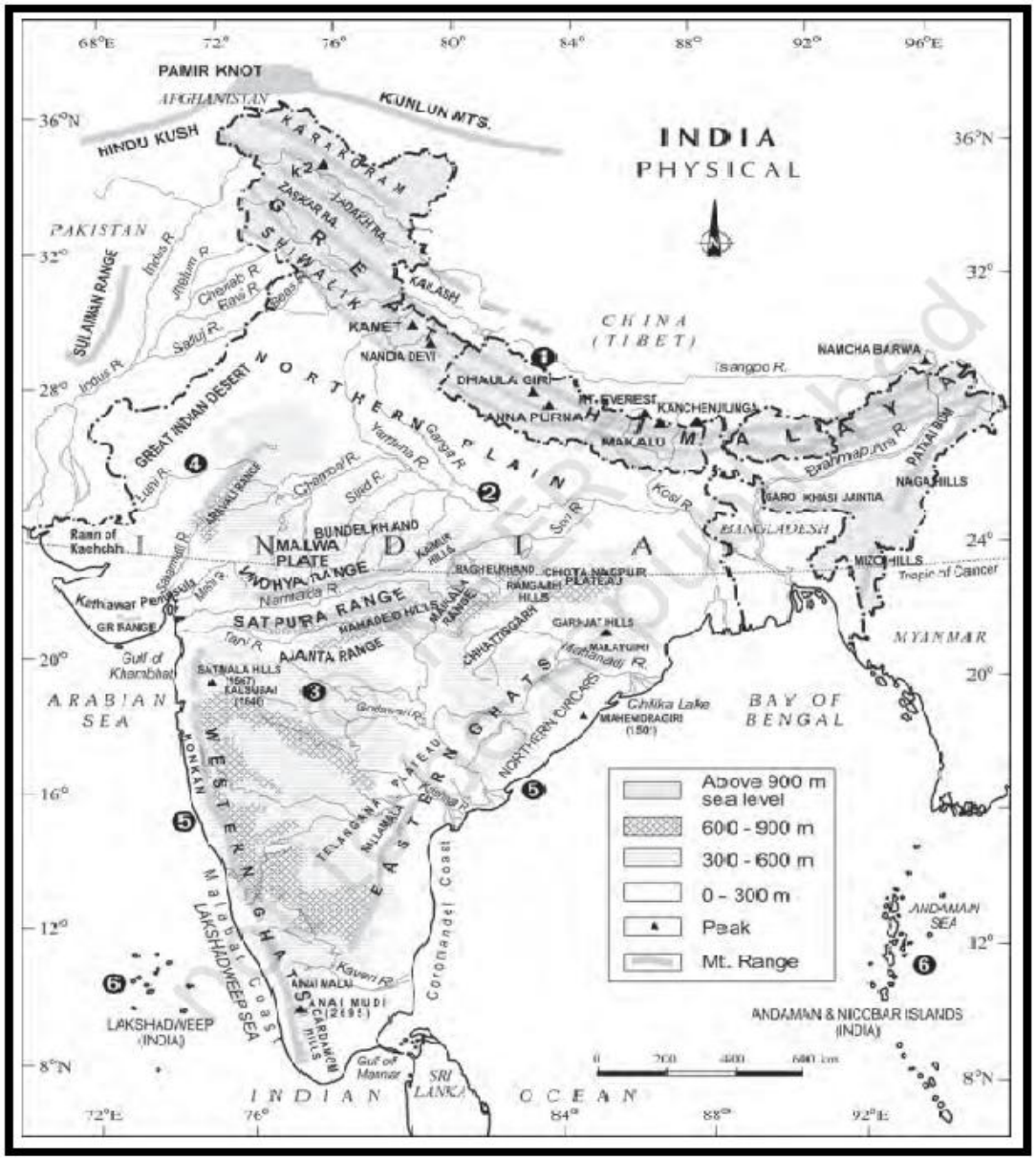
a. Identify the physiographic division shown here and also name the activity done in the above picture.

b. How is this landform formed?

c. Give the sub- divisions of the particular physiographic division

VI **MAP BASED**

1 **Observe the given map and answer the following questions:**



a. Name the physiographic division marked 2.

b. Which river is located between the Vindhya and the Satpura ranges?

c. "The general elevation of the peninsular plateau is from the west to the east, which is also proved by the pattern of the flow of rivers." Justify the statement.

VII **VERY SHORT QUESTIONS**

1 Name the three geological divisions of India based on the variations in its geological structure and formations.

2 What are relict mountains?

3 Name the physiographic divisions of India.

4 Name the sub divisions of the Peninsular plateau.

5 Why does Meghalaya plateau have a highly eroded surface?

6. What are the two types of alluvial deposits found in the northern plains of South Asia?

VII **SHORT ANSWER QUESTIONS**

I

1 How is Bhabar different from Tarai?

2 Why are the Meghalaya and Karbi Anglong plateau stand detached from the main Peninsular Block?

3 Mention the importance of backwaters in Kerala.
4 Why are there less number ports in the Eastern Coast?
5 Mention the importance of the Brahmaputra river valley.

IX LONG ANSWER QUESTIONS

1 What are the major differences between Western Ghats and Eastern Ghats?
2 Differentiate between western coastal plain and eastern coastal plain.
3 Make a difference of the island groups of the Bay of Bengal and the Arabian Sea.
4 On the basis of the prominent relief features, the peninsular plateau can be divided into how many groups? Write down their name and describe each group in details.

X CRITICAL THINKING AND PROBLEM SOLVING WITH REAL LIFE SITUATIONS

1 Critically analyse the role of himalayas in shaping India's geography, climate, economy, and overall livelihood.
2 Exploring the potential of Coastal Tourism and Port Development for Economic Growth

XI HIGHER ORDER THINKING QUESTIONS

1 Analyze the geomorphological features of the Indian Desert and its impact on the surrounding region.

ANSWER KEY

I **FILL IN THE BLANKS**

1. Malda Fault
2. Haryana and Delhi
3.Aravallis
4.Peninsular plateau
5. Nilgiri hills
6. Barchans
7. Banas river

II **MULTIPLE CHOICE QUESTIONS**

1.b) Drainage system
2 c) 2500 km
3 c) Peninsular Plateau
4 c) Karbi-Anglong Plateau
5 b) Meghalaya plateau
6 d) Malabar coast
7 b. ten degree channel
8 c. sillimanite

III **MATCH THE FOLLOWING**

1. a. A-iv B-iii C-ii D-v E-i

IV **ASSERTION AND REASONING**

1. c) Both assertion and reason are correct and reason is the correct explanation for assertion
2. c) Both assertion and reason are correct and reason is the correct explanation for assertion
3. c) Both assertion and reason are correct and reason is the correct explanation for assertion
4. c) Both assertion and reason are correct and reason is the correct explanation for assertion

5. d) Both assertion and reason are correct but reason is not the correct explanation for assertion

V **SOURCE BASED/CASE BASED**

1.a. The desert region of India receives low rainfall below 150 mm per year. Hence, the region has arid climate with low vegetation cover. It is because of these characteristic features that this is also known as Marusthali

b. The evidence available at wood fossils park at Aakal and marine deposits around Brahmsar, near Jaisalmer support the fact that during Mesozoic era the Indian desert was under the sea

c. Some of the well pronounced desert land features present in Indian desert are mushroom rocks, shifting dunes and oasis.

2. a. Deccan plateau

b. 1500mts, Anaimudi

c. Sahyadris

3. a. Northern plain, rice cultivation

b. The northern plains are formed by the alluvial deposits brought by the rivers – the Indus, the Ganga and the Brahmaputra.

c. From the north to the south, the northern plains can be divided into three major zones: the Bhabar, the Tarai and the alluvial plains.

VI **MAP BASED**

1. .a. Northern plain

b. River Narmada

c. The general slope direction of peninsular plateau is from west to east. Consequently, most of the peninsular rivers like Godavari, Krishna, Kaveri are originated from the Western Ghats and flows towards the east to the Bay of Bengal.

VII **VERY SHORT ANSWERS**

1.Geological regions broadly follow the physical features: (i) The Penisular Block (ii) The Himalayas and other Peninuslar Mountains (iii) Indo-Ganga-Brahmaputra Plain.

2. Mountains which are old , eroded and have river valleys here are shallow with low gradients.

3. India can be divided into the following physiographic divisions: (a) The Northern and North-eastern Mountains (b) The Northern Plain (c) The Peninsular Plateau (d) The Indian Desert (e) The Coastal Plains

4. The Peninsular plateau can be divided into three broad groups: (i) The Deccan Plateau (ii) The Central Highlands (iii) The Northeastern Plateau.

5. Because this area receives maximum rainfall from the south west monsoon.

6. Bhangar (old) and Khadar (new)

VII **SHORT ANSWERS**

I 1 .**Bhabar**

* Bhabar is a narrow belt ranging between 8 and 10 km at the foothill of the Shiwalik ranges

* the streams and rivers coming from the mountains deposit heavy materials of rocks and boulders.

* at times disappear in this zone.
* The region is dry and rocky

Tarai

*Tarai belt, south of Bhabar with an approximate width of 10 to 20 km.
* In this belt, the streams that become underground and disappear in bhabar region, re-emerge without having any properly demarcated channels
* creating marshy and swampy conditions known as the Tarai.

* The region is associated with lush green forest and a wide variety of wildlife.
2. They are an extension of the main Peninsular plateau. It is believed that due to the force exerted by the northeastward movement of the Indian plate at the time of the Himalayan origin, a huge fault was created between the Rajmahal hills and the Meghalaya plateau. Later, this depression got filled up by the deposition activity of the numerous rivers and separated.

3. The Malabar coast(Kerala) has got certain distinguishing features in the form of 'Kayals' (backwaters), which are used for fishing, inland navigation and also due to its special attraction for tourists. Every year the famous Nehru Trophy Vallamkali (boat race) is held in Punnamada Kayal in Kerala.

4. * the eastern coastal plain is broader , the continental shelf extends up to 500 km into the sea.
* an example of emergent coast. There are well developed deltas here, formed by the rivers flowing eastward in to the Bay of Bengal.
* it makes it difficult for the development of good ports and harbours.

5. The river valley plains have a fertile alluvial soil cover which supports a variety of crops like wheat, rice, sugarcane and jute, and hence, supports a large population.

IX LONG ANSWER QUESTIONS

Sl. No.	Basis of difference	Western Ghats	Eastern Ghats
1	Location	Western Ghats are located along the west coast of India.	Eastern Ghats are located along the east coast of India.
2	Continuity	Western Ghats are more continuous than the Eastern Ghats.	Eastern Ghats comprising the discontinuous and low hills are highly eroded by the rivers such as the Mahanadi, the Godavari, the Krishna, the Kaveri and so on.
3	Elevation	The average height of the Western Ghats is 1500 m and it is more than the Eastern Ghats.	The average height of the Eastern Ghats is comparatively less than the Western Ghats.
4	Local hills	Western Ghats are locally known by different names such as Sahyadri in Maharashtra, Nilgiri hills in Karnataka and Tamil Nadu and Anaimalai hills and Cardamom hills in Kerala.	Some of the important ranges are Javadi hills, Palconda range, Nallamala hills and so on.
5	Highest peak	Anaimudi is the higest peak of the Western Ghats.	Mahendragiri is the highest peak of the Eastern Ghats.

(refer pg 12-13)

2.

Sl. No.	Basis of difference	Western coastal planis	Eastern coastal plains
1	Location	They lie between the Western Ghats and the Arabian sea.	They lie between the Eastern Ghats and the Bay of Bengal.
2	Type	The western coastal plains are an example of submerged coastal plain.	The western coastal plains are an example of emerged coastal plain.
3	Width	The western coastal plain is narrower than the eastern coastal plain.	The eastern coastal plain is comparatively wider than the western coastal plain.
4	Delta Formation	The rivers like Narmada, Tapi, Sabarmati, Zuari, etc. flowing through this coastal plain do not form any delta.	The rivers like Mahanadi, Godavari, Krishna, Kaveri, etc. flowing through this coastal plain have formed well developed deltas.
5	Sub division	From north to south the western coastal plains can be sub divided into following sub-divisions: i) the Kachchh and Kathiawar coast in Gujarat,	The eastern coastal plains can be sub-divided into following sub-divisions: i) the North Circars coast and ii) the Coromandel coast
		ii) the Konkan coast in Maharashtra, iii) the Goan coast in Karnataka and iv) the Malabar coast in Kerala.	

(refer page 14)

3.

Sl. No.	Basis of difference	Islands of Bay of Bengal	Islands of Arabian Sea
1	Name of islands	The islands of the Bay of Bengal include Anadaman and Nicobar Islands.	The islands of the Arabian sea include Lakshadweep and Minicoy.
2	Location	These are situated roughly between 6°°N-14°°N and 92°°E - 94°°E.	These are scattered between 8°°N-12°°N and 71°°E -74°°E longitude.
3	Number of islands	The Bay of Bengal island groups consist of about 572 islands.	The Arabian sea islands consist of approximately 36 islands.
4	Category	The entire group of island is divided into two broad categories – the Andaman in the north and the Nicobar in the south. They are separated by a water body which is called the Ten degree channel.	The entire group of islands is broadly divided by the Ten degree channel, north of which is the Amini Island and to the south of the Canannore Island.
5	Origin	It is believed that these islands are an elevated portion of submarine mountains. However, some smaller islands are volcanic in origin. Barren island, the only active volcano in India is also situated in the Nicobar islands.	The entire island group is built of coral deposits.

(refer page 15)

4 . Peninsular plateau is the oldest and the most stable landmass of India. On the basis of the
prominent relief features, the peninsular plateau can be grouped into three major sub-divisions:

I) Deccan Plateau:

a) It is bounded by the Western Ghats in the west, Eastern Ghats in the east and the Satpura,
Maikal range and Mahadeo hill in the north.

b) Western Ghats are locally known by different names such as Sahyadri in Maharashtra, Nilgiri
hills in Karnataka and Tamil Nadu and Anaimalai hills and Cardamom hills in Kerala.

c) Western Ghats are comparatively higher in elevation and more continuous than the Eastern
Ghats. Their average elevation is about 1,500 m with the height increasing from north to south.
Anaimudi (2,695 m), the highest peak of Peninsular plateau is located on the Anaimalai hills of
the Western Ghats.

d) Eastern Ghats comprising the discontinuous and low hills are highly eroded by the rivers
such as the Mahanadi, the Godavari, the Krishna, the Kaveri and so on.

e) Highest peak of Eastern Ghats is Mahendragiri. Some of the important ranges are Javadi
hills, Palconda range, Nallamala hills and so on.

f) Western Ghats and Eastern Ghats meet to each other at Nilgiri hill. Highest peak of Nilgiri hill
is Dodabetta.

II) The Central Highlands:

a) The general elevation of the Central Highlands ranges between 700–1,000 m above the
mean sea level and it slopes towards the north and northeastern directions. They are bounded
to the west and south by the Aravali and satpura ranges respectively.

b) Vindhyan and Kaimur ranges are the other two important mountain ranges in this region.
Most of the tributaries of the river Yamuna have their origin in these two ranges.

c) An eastern extension of the Central Highland is formed by the Rajmahal hills, to the south of
which lies a large reserve of mineral resources in the Chotanagpur plateau.

III) The Northeastern Plateau:

a) The Meghalaya and Karbi Anglong plateau stand detached from the main Peninsular block.
The Meghalaya plateau is further sub-divided into three: (i) The Garo Hills; (ii) The Khasi Hills;
and (iii) The Jaintia Hills, named after the tribal groups inhabiting this region. An extension of
this is also seen in the Karbi Anglong hills of Assam.

b) This area receives maximum rainfall from the south west monsoon. As a result, the Meghalaya plateau has a highly eroded surface.

(refer page 12–13)

X CRITICAL THINKING AND PROBLEM SOLVING WITH REAL LIFE SITUATIONS

1. The importance of Himalayas can be applied to real-life situations:

- **Barrier to Cold Winds**: The Himalayas act as a barrier to cold Siberian winds, ensuring a relatively warmer climate in northern India.
- **Monsoon Influence**: They intercept monsoon winds, causing heavy rainfall in the northern and northeastern regions, crucial for agriculture.
- **Source of Rivers**: The Himalayas are the origin of major rivers like the Ganga, Brahmaputra, and Yamuna. These rivers provide water for drinking, irrigation, and hydropower
- **Fertile Valleys**: Valleys like the Kashmir Valley and Doon Valley are highly fertile and ideal for horticulture.
- **Adventure and Spiritual Tourism**: The Himalayas are a hub for trekking, mountaineering, and pilgrimage (e.g., Kedarnath, Amarnath, and Vaishno Devi).
- **Biodiversity Hotspot**: The Himalayas support diverse flora and fauna, including snow leopards, red pandas, and rhododendrons.
- **Natural Defense**: The Himalayas form a natural defense barrier along India's northern borders.

  The Himalayas are a lifeline for India, influencing everything from survival and livelihoods to economic and strategic priorities.

2. India's coastal plains offer immense opportunities for both **coastal tourism** and **port development**, each playing a pivotal role in boosting the country's economic growth.

* **Tourist Attractions**: India boasts some of the world's most beautiful and diverse coastal regions, including the **Goa**, **Kerala**, **Andhra Pradesh**, **Tamil Nadu**, and **Odisha** coasts. Attractions include serene beaches, historical monuments, coral reefs, and coastal wildlife sanctuaries.**Example**: Goa, known for its pristine beaches and vibrant culture, remains one of India's top tourist destinations.

- **Backwater Tourism**: Kerala's backwaters offer unique boat tours that attract a significant number of tourists each year.
- **Eco-Tourism**: Promoting **sustainable tourism** ensures that local ecosystems (like coral reefs and mangroves) are preserved while still supporting the local economy
- India has a vast coastline of about 7,517 km, with several **major ports** like **Mumbai**, **Chennai**, **Kochi**, **Visakhapatnam**, that are vital for trade and commerce
- Ports contribute to direct employment in loading/unloading, logistics, and maritime services. Ports serve as hubs for industries such as shipbuilding, refineries, petrochemicals, and fisheries.

XI **HIGHER ORDER THINKING QUESTIONS**

The Indian Desert, also known as the Thar Desert, is a vast arid region located in northwestern India, characterized by

* low precipitation, * high evaporation rates, and unique landforms shaped by physical weathering and wind actions.

* The desert landscape features mushroom rocks, shifting dunes, and ephemeral rivers, with the Luni River being of particular significance in the southern part of the desert.

* The region experiences inland drainage, where streams disappear into lakes or playas, resulting in brackish water bodies that are a vital source of salt production.

* The desert's orientation divides it into northern and southern parts sloping towards Sindh and the Rann of Kachchh, respectively.

Impact on the Surrounding Region

*The desert region contributes to the **hot and arid climate** of northwestern India.

* **Livestock Rearing:** Due to limited agriculture, the region supports livestock like camels, goats, and sheep.

* **Mining and Salt Production:** The region is rich in minerals like gypsum, phosphorite, and salt, supporting industries and trade.

* The region faces severe water scarcity and low agricultural productivity. However, initiatives like the **Indira Gandhi Canal** have enabled limited cultivation of crops like wheat and mustard

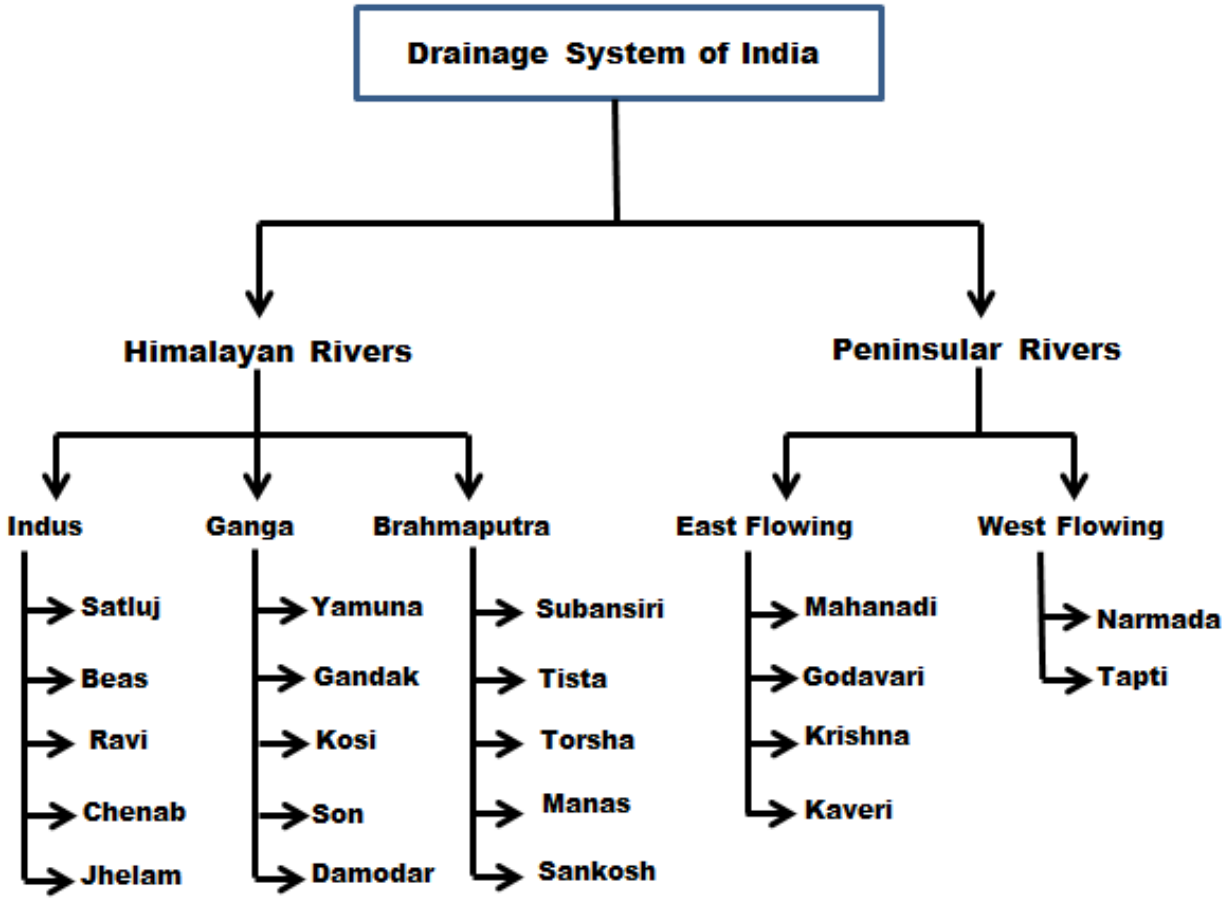
* The desert has shaped the local culture, including music, dance, and festivals like the **Jaisalmer Desert Festival**, which reflect the resilience and creativity of the communities.

* It also attracts significant tourism, boosting the regional economy.

(refer page 13-14)

CHAPTER–3
DRAINAGE SYSTEM

MIND MAP



SR. NO.	MULTIPLE CHOICE QUESTIONS (MCQS)	MARKS

Q1. Which one of the following rivers has the largest river basin in India? **1**

A) The Indus B) The Brahmaputra

C) The Ganga D) The Krishna

Q2. Match Column I with Column II and choose the correct option: **1**

COLUMN I (NAME OF THE CONFLUENCE)	COLUMN II (RIVER MERGING WITH ALAKNANDA)
I. Devprayag	1. Pindar
II. Rudra Prayag	2. Bhagirathi
III. Karna Prayag	3. Mandakini or Kali Ganga
IV. Vishnu Prayag	4. Dhauli Ganga

Options:

A) III – 1, IV – 2, II – 3, I – 4

B) III – 1, I – 2, II – 3, IV – 4

C) IV – 1, III – 2, I – 4, II – 3

D) II – 2, III – 1, IV – 4, I – 3

Q3. Read the following statements related to Satluj River and choose the correct option: **1**

I) The Satluj originates in the 'Raksas tal' near Mansarovar at an altitude of 4,555 m in Tibet where it is known as Langchen Khambab.

II) It is an antecedent river.

III) It flows through Srinagar and the Wular lake before entering Pakistan through a deep narrow gorge.

IV) It is a very important tributary as it feeds the canal system of the Bhakra Nangal project.

Options:

A) Only I, II and III are correct.

B) Only II, III and IV are correct.

C) Only I, II and IV are correct.

D) Only I, III and IV are correct.

Q4. Which of the following river is known as Sorrow of Bihar? **1**

A) Kosi B) Damodar

C) Ramganga D) Kali

Q5. Bad land topography is found in which of the following river basin? **1**

A) Chambal B) Luni

C) Son D) Gandak

Q6. Which of the following drainage patterns and their characteristics are correctly matched? **1**

(Drainage Pattern)	**(Characteristics)**
A) Dendritic –	The primary tributaries of rivers flow parallel to each other and secondary tributaries join them at right angles.
B) Radial –	The rivers originate from a hill and flow in all directions.
C) Trellis –	The rivers discharge their waters from all directions in a lake or depression.
D) Centripetal –	Resembling the branches of a tree.

Q7. Which of the following river is known as Dakshin Ganga? **1**

A) Godavari B) Kaveri

C) Krishna D) Narmada

Q8. Which of the following is **Not** a characteristic of Indian Peninsular rivers? **1**

A) Rivers Originates from central highland and Western Ghats.
B) Peninsular rivers have fixed course with well-adjusted valleys.
C) Rivers are at youthful stage.
D) Peninsular rivers are seasonal in nature and are dependent on Monsoon rainfall.

Q9. Which of the following is the largest river system of Rajasthan? **1**

A) Mandovi B) Luni
C) Mahi D) Juari

Q10. Read the following statements related to Narmada River and choose the correct option: **1**

I) The Narmada originates on the western flank of the Amarkantak plateau at a height of about 1,057 m.

II) The Penganga, the Indravati, the Pranhita, and the Manjra are its principal tributaries.

III) The Sardar Sarovar Project has been constructed on this river.

IV) It flows through a rift valley between the Satpura in the south and the Vindhyan range in the north.

Options:

A) Only I, II and III are correct.

B) Only II, III and IV are correct.

C) Only I, II and IV are correct.

D) Only I, III and IV are correct.

Q11. Match Column I with Column II and choose the correct option: **1**

COLUMN I	**COLUMN II**
(NAME OF THE RIVER)	**(PLACE OF ORIGIN)**
I. Godavari	1. Amarkantak plateau
II. Krishna	2. Brahmagiri hills
III. Kaveri	3. Mahabaleshwar in Sahyadri
IV. Narmada	4. Nasik district of Maharashtra

Options:

A) III – 1, IV – 2, II – 3, I – 4

B) III – 1, I – 2, II – 3, IV – 4

C) II – 2, III – 1, IV – 4, I – 3

D) IV – 1, III – 2, I – 4, II – 3

FILL IN THE BLANKS

Q12. An area drained by a river and its tributaries is called a _____. **1**

A) Drainage Pattern B) Drainage Basin

C) Drainage System D) Drainage Network

Q13. A river drains the water collected from a specific area, which is called its _____. **1**

A) Drainage System B) Drainage

C) Catchment Area D) Watershed

Q14. _____ river is known as 'Sorrow of Bengal'. **1**

A) Kali B) Kosi

B) Ramganga D) Damodar

Q15. The _____ is the name given to the five rivers of Punjab, namely the Satluj, the Beas, the Ravi, the Chenab and the Jhelum. **1**

A) Panjnad B) Doab

C) Prayag D) Devprayag

Q16. _____ is the largest tributary of the Indus. **1**

A) The Chenab B) The Jhelum

C) The Ravi D) The Beas

Q17. _____ river has its origin in the Chemayungdung glacier of the Kailash range near the Mansarovar lake. **1**

A) Yamuna B) Brahmaputra

C) Ganga D) Indus

ASSERTION AND REASON

Q18. Two statements are given below. They are **Assertion (A)** and **Reason (R)**. Read them carefully and choose the correct option. **1**

Assertion (A): The Brahmaputra is well-known for floods, channel shifting and bank erosion.

Reason (R): This is due to the fact that most of its tributaries are large, and bring large quantity of sediments owing to heavy rainfall in its catchment area.

Options:

A) Both (A) and (R) are correct and (R) is correct explanation of (A).

B) Both (A) and (R) are correct, but(R) is not correct explanation of (A).

C) (A) is correct, but (R) is incorrect.

D) (A) is incorrect, but (R) is correct.

Q19. Two statements are given below. They are **Assertion (A)** and **Reason (R)**. Read them carefully and choose the correct option. **1**

Assertion (A): The Peninsular drainage system is older than the Himalayan one.

Reason (R): This is evident from the broad, largely-graded shallow valleys, and the maturity of the rivers.

Options:

A) Both (A) and (R) are correct and (R) is correct explanation of (A).

B) Both (A) and (R) are correct, but(R) is not correct explanation of (A).

C) (A) is correct, but (R) is incorrect.

D) (A) is incorrect, but (R) is correct.

Q20. Two statements are given below. They are **Assertion (A)** and **Reason (R)**. Read them carefully and choose the correct option. **1**

Assertion (A): Most of the major Peninsular rivers except Narmada and Tapi flow from west to east, discharging their water in the Bay of Bengal.

Reason (R): Slight tilting of the Peninsular block from northwest to the southeastern direction gave orientation to the entire drainage system towards the Bay of Bengal.

Options:

A) Both (A) and (R) are correct and (R) is correct explanation of (A).

B) Both (A) and (R) are correct, but(R) is not correct explanation of (A).

C) (A) is correct, but (R) is incorrect.

D) (A) is incorrect, but (R) is correct.

Q21. Two statements are given below. They are **Assertion (A)** and **Reason (R)**. Read them carefully and choose the correct option. **1**

Assertion (A): The Narmada and The Tapi flow in trough faults and fill the original cracks with their detritus materials.

Reason (R): Hence, there is a lack of alluvial and deltaic deposits in these rivers.

Options:

A) Both (A) and (R) are correct and (R) is correct explanation of (A).

B) Both (A) and (R) are correct, but(R) is not correct explanation of (A).

C) (A) is correct, but (R) is incorrect.

D) (A) is incorrect, but (R) is correct.

SOURCE BASED QUESTION

Q22. Read the passage carefully and answer the questions that follows: **1×3=3**

There are difference of opinion about the evolution of the Himalayan rivers. However, geologists believe that a mighty river called Shiwalik or Indo-Brahma traversed the entire longitudinal extent of the Himalaya from Assam to Punjab and onwards to Sind, and finally discharged into the Gulf of Sind near lower Punjab during the Miocene period some 5-24 million years ago The remarkable continuity of the Shiwalik and its lacustrine origin and alluvial deposits consisting of sands, silt, clay, boulders and conglomerates support this viewpoint.

It is opined that in due course of time Indo– Brahma river was dismembered into three main drainage systems: (i) the Indus and its five tributaries in the western part; (ii) the Ganga and its Himalayan tributaries in the central part; and (iii) the stretch of the Brahmaputra in Assam and its Himalayan tributaries in the eastern part. The dismemberment was probably due to the Pleistocene upheaval in the western Himalayas, including the uplift of the Potwar Plateau (Delhi Ridge), which acted as the water divide between the Indus and Ganga drainage systems. Likewise, the downthrusting of the Malda gap area between the Rajmahal hills and the Meghalaya plateau during the mid-pleistocene period, diverted the Ganga and the Brahmaputra systems to flow towards the Bay of Bengal.

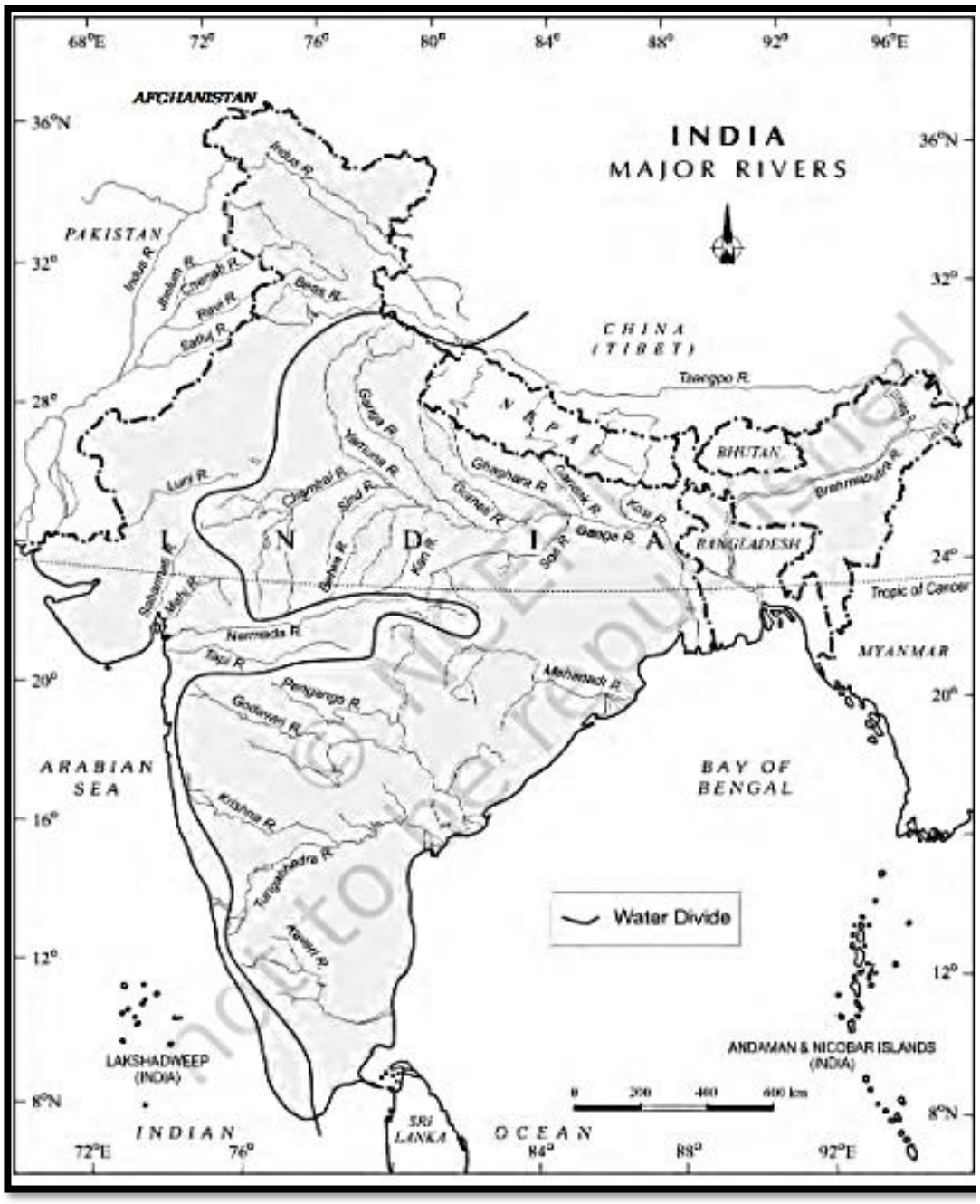
Q22.1 What was the name of the mighty river that traversed the entire longitudinal extent of the Himalaya before the existence of Himalayan rivers? **1**

Q22.2 What geological event did make the water divide between the Indus and Ganga drainage systems? **1**

Q22.3 What geological event did divert the Ganga and the Brahmaputra systems to flow towards the Bay of Bengal? **1**

DIAGRAM BASED QUESTION

Q23. Observe the given map and answer the following questions: **1×3=3**



Q23.1. By which name Brahmaputra river is known in Tibet? **1**

Q23.2. Name the two rivers which flow through the rift valley. **1**

Q23.3. What is the name of the westernmost and the longest tributary of river Ganga? **1**

SHORT ANSWER QUESTIONS (SAQS)

Q24. Why are the river basins accepted as the most appropriate micro, meso, or macro planning regions? **3**

Q25. Why do the rivers originating from the Himalayas in the northern India and the Western Ghat in the southern India flow towards the east and discharge their waters in the Bay of Bengal? Explain. **3**

Q26 "The Peninsular drainage system is older than the Himalayan one." Support this statement with suitable arguments. **3**

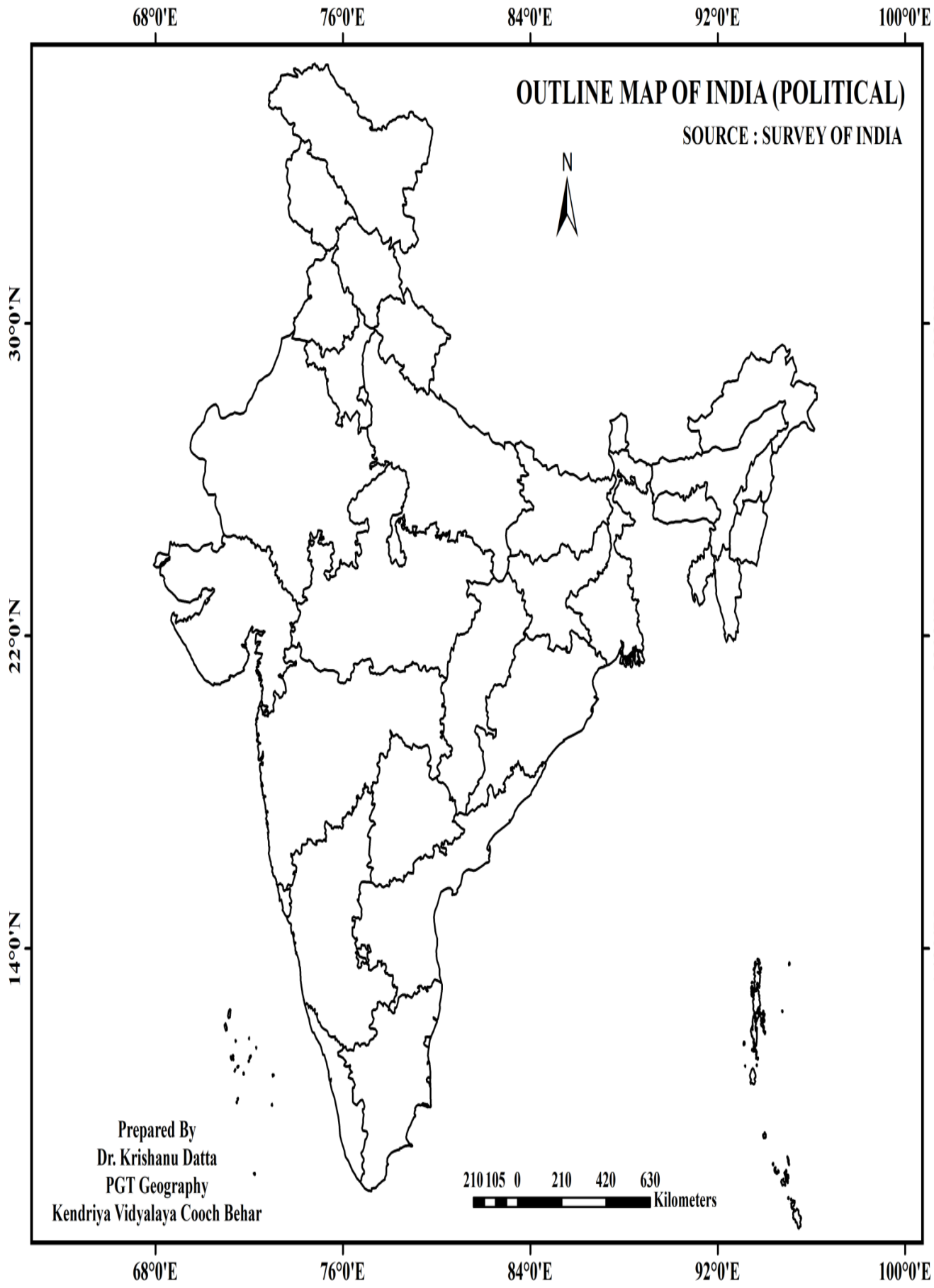
Q27.	Why does the Krishna river have comparatively less fluctuation throughout the year than the other peninsular rivers?	**3**
Q28.	Can the problems of flood and drought be solved or minimize by transferring the surplus water from one basin to the water deficit basins? Explain.	**3**

LONG ANSWER QUESTIONS (LAQS)

Q29.	"The Ganga is the most important river of India both from the point of view of its basin and cultural significance." Justify the statement with suitable arguments.	**5**
Q30.	How are the Himalayan rivers different from the Peninsular rivers? State any five points of distinction.	**5**
Q31.	What are the major objectives of 'Namami Gange Programme'?	**5**

MAP BASED QUESTIONS

Q32.	**Locate and label the following geographical features on the Political Outline map of India with appropriate symbols:**	
32.1.	The longest river in North-East India	**1**
32.2.	Indus	**1**
32.3.	Satluj	**1**
32.4.	Ganga River	**1**
32.5.	The longest tributary of Ganga River	**1**
32.6.	The river famous for Badland topography	**1**
32.7.	The major river of Odisha	**1**
32.8.	Krishna	**1**
32.9.	Kaveri	**1**
32.10.	The longest peninsular river in India.	**1**
32.11.	Narmada	**1**
32.12.	Tapti	**1**
32.13.	The largest river system of Rajasthan.	**1**
32.14.	Palk Strait	**1**
32.15.	Rann of Kachch	**1**
32.16.	Gulf of Kachch	**1**
32.17.	Gulf of Mannar	**1**
32.18.	Gulf of Khambat	**1**


OUTLINE MAP OF INDIA (POLITICAL)
SOURCE : SURVEY OF INDIA
N
68°0'E
76°0'E
84°0'E
92°0'E
100°0'E
30°0'N
22°0'N
14°0'N
Prepared By
Dr. Krishanu Datta
PGT Geography
Kendriya Vidyalaya Cooch Behar
210 105 0 210 420 630
Kilometers

ANSWER

MULTIPLE CHOICE QUESTIONS (MCQS)

Q1.	C) The Ganga **(Text Book–II, Page No. 22)**	**1**
Q2.	B) III – 1, I – 2, II – 3, IV – 4 **(Text Book–II, Page No. 21)**	**1**
Q3.	C) Only I, II and IV are correct **(Text Book–II, Page No. 21)**	**1**
Q4.	A) Kosi **(Text Book–II, Page No. 20)**	**1**
Q5.	A) Chambal **(Text Book–II, Page No. 22)**	**1**
Q6.	B) Radial - The rivers originate from a hill and flow in all directions. **(Text Book–II, Page No. 17)**	**1**
Q7.	A) Godavari **(Text Book–II, Page No. 23)**	**1**
Q8.	C) Rivers are at youthful stage **(Text Book–II, Page No. 23)**	**1**
Q9.	B) Luni **(Text Book–II, Page No. 24)**	**1**
Q10.	D) Only I, III and IV are correct **(Text Book–II, Page No. 24)**	**1**
Q11.	D) IV – 1, III – 2, I – 4, II – 3 **(Text Book–II, Page No. 23 & 24)**	**1**

FILL IN THE BLANKS

Q12.	A) Drainage Pattern **(Text Book–II, Page No. 17)**	**1**
Q13.	C) Catchment Area **(Text Book–II, Page No. 17)**	**1**
Q14.	D) Damodar **(Text Book–II, Page No. 22)**	**1**
Q15.	A) Panjnad **(Text Book–II, Page No. 20)**	**1**
Q16.	A) The Chenab **(Text Book–II, Page No. 21)**	**1**
Q17.	B) Brahmaputra **(Text Book–II, Page No. 22)**	**1**
Q18.	A) Both (A) and (R) are correct and (R) is correct explanation of (A) **(Text Book–II, Page No. 23)**	**1**
Q19.	A) Both (A) and (R) are correct and (R) is correct explanation of (A) **(Text Book–II, Page No. 23)**	**1**
Q20.	A) Both (A) and (R) are correct and (R) is correct explanation of (A) **(Text Book–II, Page No. 23)**	**1**
Q21.	B) Both (A) and (R) are correct, but(R) is not correct explanation of (A) **(Text Book–II, Page No. 23)**	**1**

SOURCE BASED QUESTION

Q22.1.	Shiwalik or Indo-Brahma was the name of the mighty river that traversed the entire longitudinal extent of the Himalaya before the existence of Himalayan rivers.	**1**

Q22.2. The Pleistocene upheaval in the western Himalayas, including the uplift of the Potwar Plateau (Delhi Ridge), which acted as the water divide between the Indus and Ganga drainage systems. **1**

Q22.3. The downthrusting of the Malda gap area between the Rajmahal hills and the Meghalaya plateau during the mid-pleistocene period diverted the Ganga and the Brahmaputra systems to flow towards the Bay of Bengal. **1**

DIAGRAM BASED QUESTION

Q23.1. Tsangpo is the name of the Brahmaputra river in Tibet. **1**

Q23.2. Narmada and Tapti are the two rivers which flow through the rift valley. **1**

Q23.4. Yamuna is the westernmost and the longest tributary of river Ganga **1**

SHORT ANSWER QUESTIONS (SAQS)

Q24. River basins and watersheds are marked by unity. What happens in one part of the basin or watershed directly affects the other parts and the unit as a whole. That is why; they are accepted as the most appropriate micro, meso or macro planning regions. **(Text Book–II, Page No. 19)** **3**

Q25. The rivers of northern India like Ganga, Brahmaputra are originating from the Himalayas and flow towards the east and discharge their waters in the Bay of Bengal. Similarly, the rivers like Godavari, Krishna, Kaveri are originating from the Western Ghats and follow the eastern direction and flow into the Bay of Bengal. Both of these cases rivers follow the general slope direction of the land that is from west to east providing orientation to these rivers towards the Bay of Bengal. **3**

(Text Book–II, Page No. 17)

Q26. The Peninsular drainage system is older than the Himalayan one. This is evident from the broad, largely-graded shallow valleys, and the maturity of the rivers. These rivers have almost fixed courses. **(Text Book–II, Page No. 23)** **3**

Q27. As the upper catchment area receives rainfall during the southwest monsoon season (summer) and the lower part during the northeast monsoon season (winter), the river Krishna carries water throughout the year with comparatively less fluctuation than the other Peninsular rivers. **(Text Book–II, Page No. 24)** **3**

Q28. During the rainy season, much of the water is wasted in floods and flows down to the sea. Similarly, when there is a flood in one part of the country, the other area suffers from drought. Through the inter-linking of rivers the **3**

problems of flood and drought can be solved or minimized by transferring the surplus water from one basin to the water deficit basins. **(Text Book–II, Page No. 24)**

Q29. I) The Ganga river system is the largest in India having a number of perennial and non-perennial rivers originating in the Himalayas in the north and the Peninsula in the south, respectively. **5**

II) It rises in the Gangotri glacier near Gaumukh (3,900 m) in the Uttarkashi district of Uttarakhand.

III) The river has a length of 2,525 km. It is shared by Uttarakhand (110 km) and Uttar Pradesh (1,450 km), Bihar (445 km) and West Bengal (520 km).

IV) Yamuna is the longest tributary of river Ganga. Some other important tributaries are Kosi, Son, Gandak, Damodar, Ramganga and so on.

V) Bhagirathi and Padma are the two distributaries of Ganga river. The Ganga river flows into Bay of Bengal after meeting with Brahmaputra. **(Text Book–II, Page No. 21 & 22)**

Q30. **5**

Sl. No.	Basis of Classification	Himalayan Rivers	Peninsular Rivers
1	Place of origin	They originate in Himalayan mountain covered with glaciers.	They originate in the Peninsular plateau and the Central Highland.
2	Nature of flow	They are perennial because they receive water from glacier and rainfall.	They are seasonal as it is dependent on monsoon rainfall.
3	Drainage Pattern	These are antecedent and consequently lead to dendritic pattern in plains.	Superimposed, rejuvenated resulting in trellis, radial and rectangular patterns.

4	Nature of river	It has long course, flowing through the rugged mountains experiencing headward erosion and river capturing; in plains it exhibits meandering and shifting of course.	It is small, fixed course with well adjusted valleys.
5	Age of the river	These rivers are young and youthful. These are active and result valley deepening.	Old rivers with graded profile and have almost reach their base levels.

(Text Book-II, Page No. 19, 20 & 23)

Q31. The Union Government has launched the 'Namami Gange Programme' in June, 2014 with the following objectives: **5**

I) Developing sewerage treatment systems in towns.

II) Monitoring of industrial effluents.

III) River-Surface Cleaning

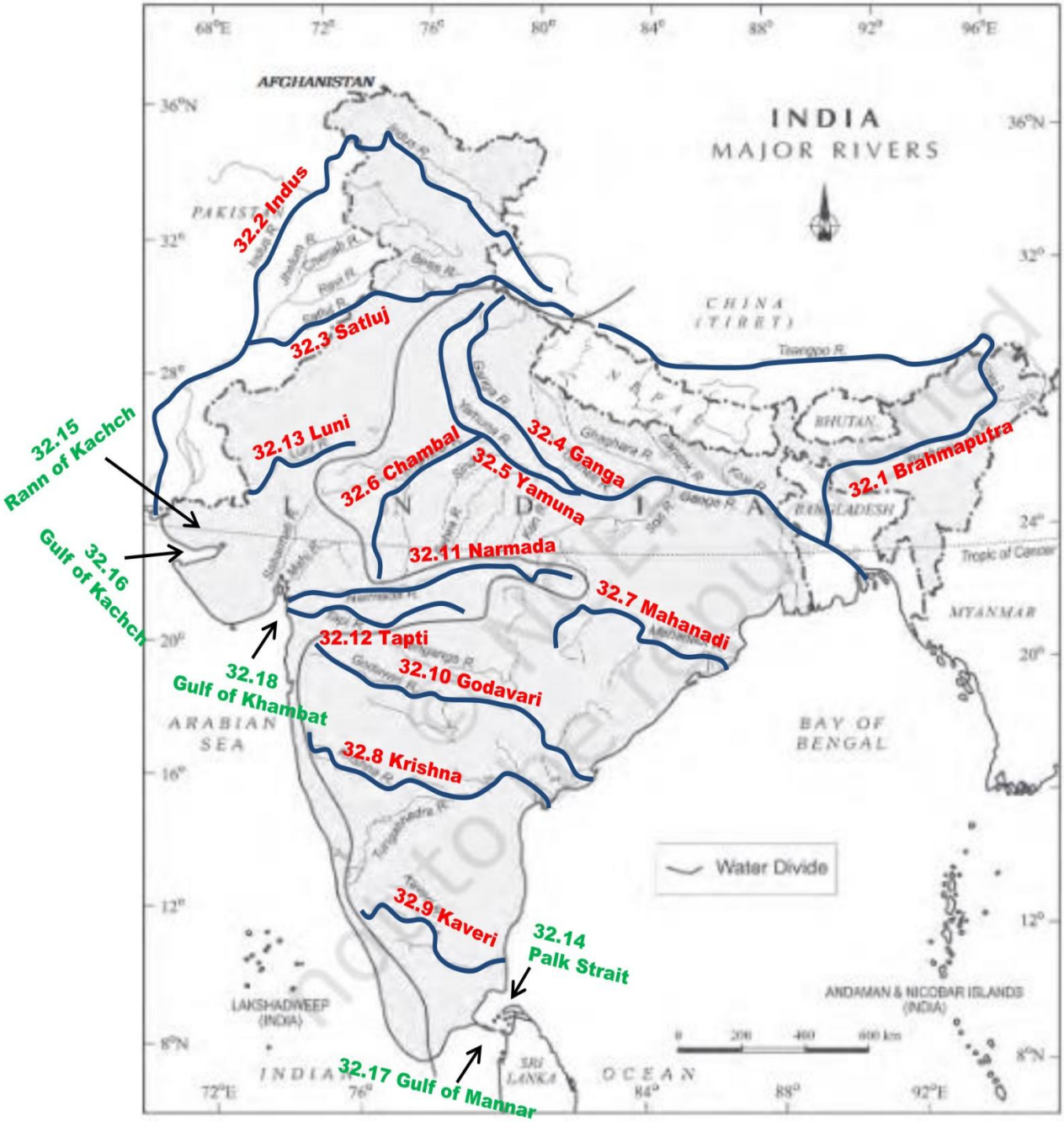
IV) River-Front development

V) Afforestation along the bank of the river.

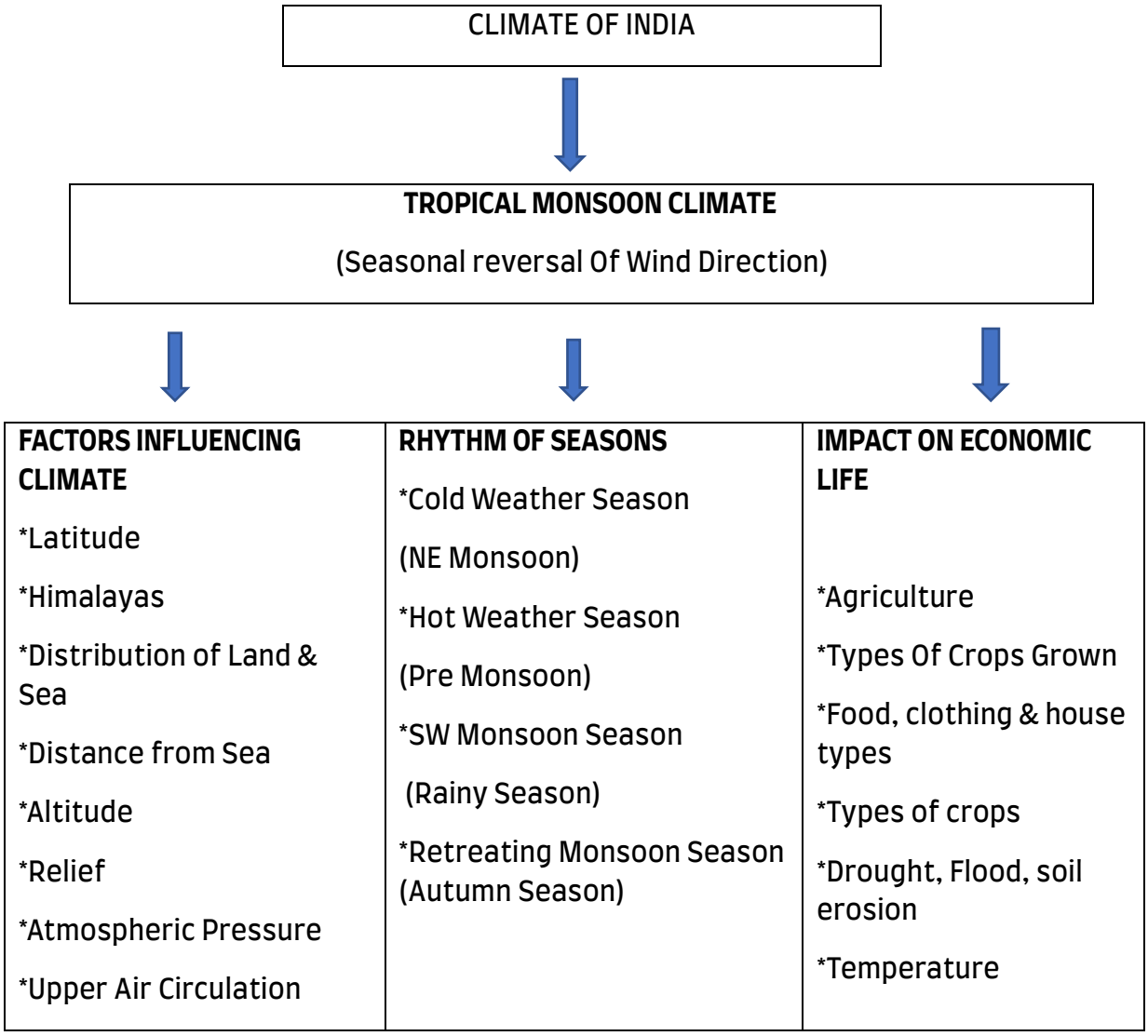
VI) Development of 'Ganga Grams' in Uttarakhand, UP, Bihar, Jharkhand and West Bengal and

VII) Creating public awareness to avoid adding pollutants in to the river even in the form of rituals. **(Text Book-II, Page No. 21)**

Q32.


INDIA
MAJOR RIVERS
AFGHANISTAN
PAKISTAN
CHINA (TIBET)
NEPAL
BHUTAN
BANGLADESH
MYANMAR
INDIA
ARABIAN SEA
BAY OF BENGAL
INDIAN OCEAN
SRI LANKA
LAKSHADWEEP (INDIA)
ANDAMAN & NICOBAR ISLANDS (INDIA)
Tropic of Cancer
Water Divide
32.1 Brahmaputra
32.2 Indus
32.3 Satluj
32.4 Ganga
32.5 Yamuna
32.6 Chambal
32.7 Mahanadi
32.8 Krishna
32.9 Kaveri
32.10 Godavari
32.11 Narmada
32.12 Tapti
32.13 Luni
32.14 Palk Strait
32.15 Rann of Kachch
32.16 Gulf of Kachch
32.17 Gulf of Mannar
32.18 Gulf of Khambat

CHAPTER–4
CLIMATE



SR. NO.	QUESTION	MARKS
	FILL IN THE BLANKS	
1	……..connotes the climate associated with seasonal reversal in the direction of winds.	1
2	……..is a low pressure zone located at the equator where trade winds converge.	1

3 The dry spells in between the period of monsoon rain are called 1

4 Hot, dry and oppressing winds blowing in the Northern and North Western plains during hot weather season is called..... 1

5 ....., located on the crest of Khasi hills, receives the highest average annual rainfall in the world. 1

MULTIPLE CHOICE QUESTIONS

6 Which of the following places receives rainfall during the winter season: 1

(a) Coastal plains of Kerala
(b) Coastal plains of Tamil Nadu
(c) Coastal Plains of Maharashtra
(d) Ganga Delta

7 This latitude passes midway through India in east west direction dividing it into tropical and subtropical zones. Identify the latitude: 1

(a) Equator
(b) Tropic Of Cancer
(c) Tropic Of Capricorn
(d) Arctic Circle

8 These winds cross the equator between 40^0 E and 60^0 E and proceed towards India as South West Monsoon: 1

(a) SE Trade Winds
(b) NE Trade Winds
(c) SW Westerlies
(d) NW Westerlies

9 There is excessive cold in North India during the cold weather season. 1

I. States like Punjab, Haryana and Rajasthan being far away from the moderating influence of sea experience continental climate.
II. The snowfall in the nearby Himalayan ranges creates cold wave situation
III. Around February, the cold winds coming from the Caspian Sea and Turkmenistan bring cold wave along with frost and fog over the north western parts of India.

IV. NE Monsoon moves from land to sea and causes abundant rainfall in North India

(a) Statement I, II, III and IV are correct

(b) Statement I, II and III are correct

(c) Statement II, III and IV are correct.

(d) Statement I, III and IV are correct

10 What causes rainfall in the coastal areas of Tamil Nadu in the beginning of winters? 1

(a) South-West monsoon

(b) North-East monsoon

(c) Temperate cyclones

(d) Local air circulation

11 Which one of the following is not a fact regarding South India? 1

(a) Diurnal range of temperature is less here.

(b) Annual range of temperature is less here.

(c) Temperatures here are high throughout the year.

(d).Extreme climatic conditions are found here.

12 Which one of the following phenomenon happens when the sun shines vertically over the Tropic of Capricorn in the southern hemisphere? 1

(a) High pressure develops over North-western India due to low temperatures.

(b) Low pressure develops over North-western India due to high temperatures.

(c) No changes in temperature and pressure occur in north-western India.

(d) 'Loo' blows in the North-western India.

MATCH THE FOLLOWING

13 Which of the following options shows the correct matches between Column A and B. 1

	A		B
I	Burst Of Monsoon	A	Oppressive weather marked by high temperature and humidity
II	Nor Westers	B	Temperate cyclones from Mediterranean Sea
III	October Heat	C	Sudden Onset of monsoon rain accompanied with thunder and lightening
IV	Western Disturbances	D	Dreaded evening thunderstorms in Bengal and Assam

(a) IA ,IIB , IIIC ,IVD

(b) IB ,IIC , IIID ,IVA

(c) IC ,IID , IIIA ,IVB

(d) ID ,IIB , IIIA ,IVD

14 Which of the following options shows the correct matches between Column A and B. 1

	A		B
I	Mango Shower	A	Pre monsoon showers in Kerala
II	Blossom Shower	B	Shower associated with coffee cultivation
III	Kalbaisakhi	C	Dreaded evening thunderstorms in West Bengal
IV	Bardoisila	D	Dreaded evening thunderstorms in Assam

(a) IA ,IIB , IIIC ,IVD

(b) IB ,IIC , IIID ,IVA

(c) IC ,IID , IIIA ,IVB

(d) ID ,IIB , IIIA ,IVD

ASSERTION REASON BASED QUESTIONS

15 **Assumption (A):** The hot weather season in south India is mild and not so intense as found in north India. 1

Reason (R): Peninsular India has moderating effect of surrounding oceans.

(a) Both A and R are correct and R explains A

(b) Both A and R are correct but R does not explain A
(c) Both A and R are incorrect
(d) A is correct but R is false

16 **Assumption (A):** El-Nino is a complex weather system that appears once every three to seven years 1

Reason (R): It brings drought, floods and other weather extremes to different parts of the world.

(a) Both A and R are correct and R explains A
(b) Both A and R are correct but R does not explain A
(c) Both A and R are incorrect
(d) A is correct but R is false

17 **Assumption (A):** Mumbai receives much higher rain than Pune **Reason (R):** 1
Pune lies in windward side of Western Ghats.

(a) Both A and R are correct and R explains A
(b) Both A and R are correct but R does not explain A
(c) Both A and R are incorrect
(d) A is correct but R is false

18 **Assumption (A):** Tamil Nadu coast remains dry during SW Monsoon season. 1

Reason (R): It lies parallel to the Bay of Bengal Branch of SW monsoon.

(a) Both A and R are correct and R explains A
(b) Both A and R are correct but R does not explain A
(c) Both A and R are incorrect
(d) A is correct but R is false

19 **Assumption (A):** The SW Monsoon approaches Indian landmass in two branches. 1

Reason (R): Relief and thermal low pressure over Indian subcontinent influences it.

(a) Both A and R are correct and R explains A
(b) Both A and R are correct but R does not explain A
(c) Both A and R are incorrect
(d) A is correct but R is false

SOURCE BASED QUESTIONS

20 Read the given passage and answer the following questions: 1+1+1

The temperature of the world is significantly increasing. Carbon dioxide produced by human activities is a major source of concern. This gas, released to the atmosphere in large quantities by burning of fossil fuel, is increasing

gradually. Other gases like methane, chlorofluorocarbons, and nitrous oxide which are present in much smaller concentrations in the atmosphere, together with carbon dioxide are known as green house gases. These gases are better absorbers of long wave radiations than carbon dioxide, and so, are more effective at enhancing the green house effect. These gases have been contributing to global warming. It is said that due to global warming the polar ice caps and mountain glaciers would melt and the amount of water in the oceans would increase.

The mean annual surface temperature of the earth in the past 150 years has increased. It is projected that by the year 2,100, global temperature will increase by about 2°C. This rise in temperature will cause many other changes: one of these is a rise in sea level, as a result of melting of glaciers and sea-ice due to warming.

(a) Define green house effect in context of global warming.

(b) Name two prominent green house gases.

(c) State the major impact of global warming.

21 Read the given passage and answer the following questions: 1+1 +1

The Inter Tropical Convergence Zone (ITCZ) is a low pressure zone located at the equator where trade winds converge, and so, it is a zone where air tends to ascend. In July, the ITCZ is located around 20°N-25°N latitudes (over the Gangetic plain), sometimes called the monsoon trough. This monsoon trough encourages the development of thermal low over north and northwest India. Due to the shift of ITCZ, the trade winds of the southern hemisphere cross the equator between 40° and 60°E longitudes and start blowing from southwest to northeast due to the Coriolis force. It becomes southwest monsoon. In winter, the ITCZ moves southward, and so the reversal of winds from northeast to south and southwest, takes place. They are called northeast monsoons.

(a) Define ITCZ.

(b) In July why does the ITCZ shift northwards?

(c) Why do the trade winds change their direction as they proceed towards India?

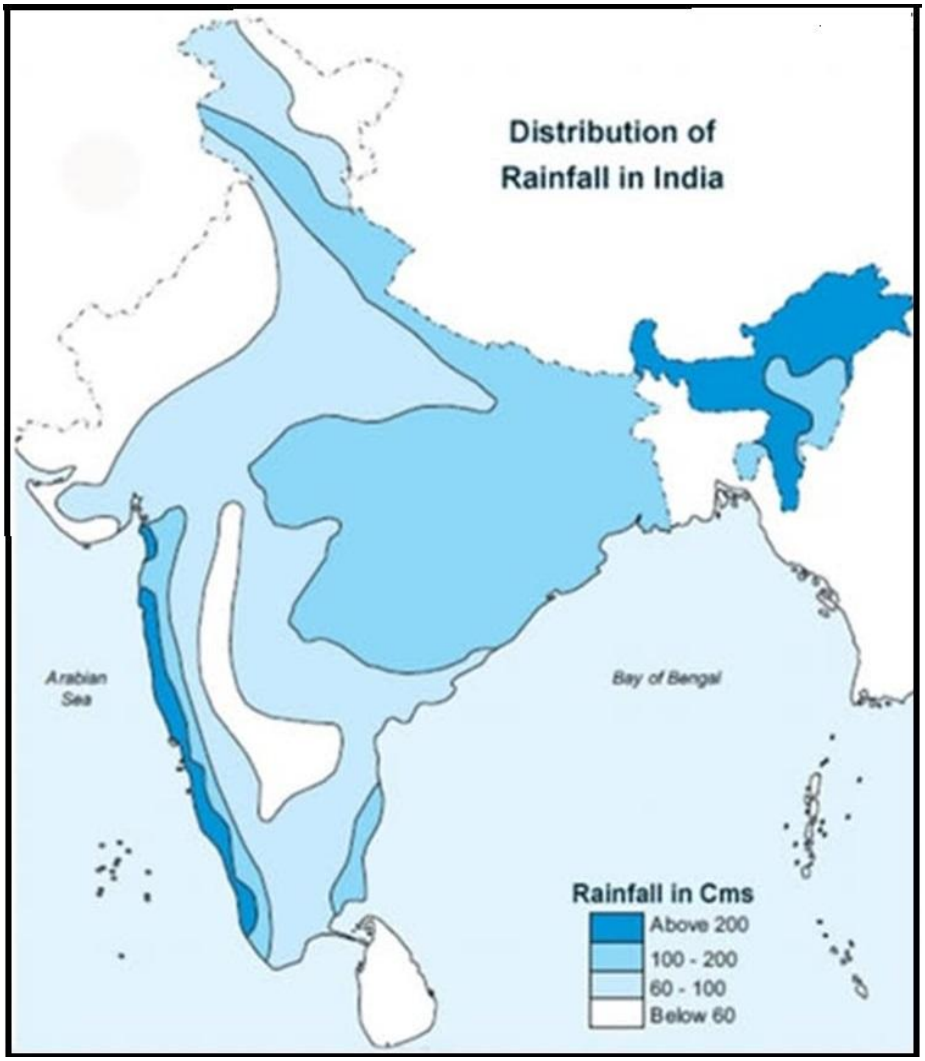
MAP BASED QUESTIONS

22 Study the given map and answer the following questions 1+1 +1

(a) Name the two rainiest regions of India.

(b) State any one reason responsible for very less rainfall in north western part of India.

(c)Rainfall shows a declining trend as we move away from the sea. Why?



SHORT ANSWER QUESTIONS

23 "Climate of India is monsoonal in rhythm and character, but regional variations do exist"- Explain with three examples. 3

24 Northern and North Western India receives partial rainfall or snowfall during winters. Why? 3

25 Mawsynram receives the heaviest rainfall in the world. Explain why? 3

26	Why are tropical cyclones common during retreating monsoon season?	3
27	State any three impacts of monsoon on economic life in India	3

LONG ANSWER QUESTIONS

28	India's climate is controlled by several factors-Explain	5
29	Explain the mechanism for onset of monsoon in Indian subcontinent.	5
30	"The climatic conditions of India can best be described in terms of an annual cycle of seasons."-Explain.	5

MAP WORK

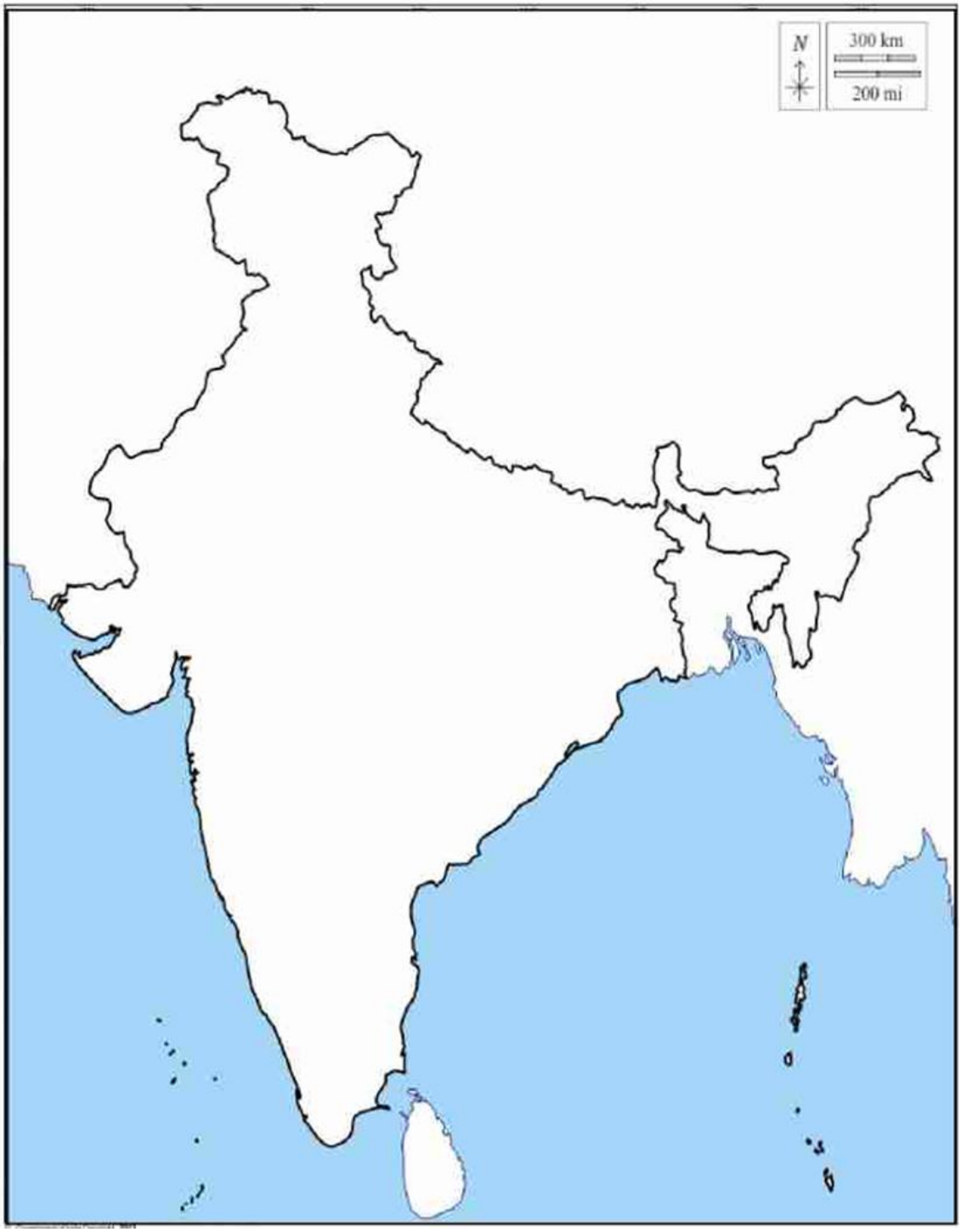
31 In the outline map of India, locate the following: 1*4

a. The hottest place of India

b. The coldest place of India

c. The driest place of India

d. The rainiest place of India



SR. NO.	EXPECTED ANSWER	MARKS
1	Monsoon	1
2	The Inter Tropical Convergence Zone (ITCZ)	1
3	Break in monsoon	1
4	Loo	1

5	Mawsynram	1
6	(b) Coastal plains of Tamil Nadu	1
7	(b)Tropic Of Cancer	1
8	(a)SE Trade Winds	1
9	(b)Statement I,II and III are correct	1
10	(b)North-East monsoon	1
11	(d) Extreme climatic conditions are found here.	1
12	(a)High pressure develops over North-western India due to low temperatures.	1
13	(c)IC, IID, IIIA, IVB	1
14	(a)IA ,IIB , IIIC ,IVD	1
15	(a)Both A and R are correct and R explains A	1
16	(b)Both A and R are correct but R does not explain A	1
17	(d)A is correct but R is false	1
18	(a)Both A and R are correct and R explains A	1
19	(a)Both A and R are correct and R explains A	1
20	(a) Allowing insolation to pass through but absorbing long wave terrestrial radiation thereby resulting in increasing temperature	1 1
	(b) Carbon di oxide, Nitrous Oxide	
	(c) Increase in mean annual surface temperature of the earth	1
21	(a)It refers to Inter Tropical Convergence Zone	1
	(b)ITCZ shifts as per apparent motion of the Sun	1
	(c)Due to Coriolis force	1
22	(a) Windward side of Western Ghats and North Eastern States	1
	(b) Lack of Orographic barrier	1

(c) Moisture content decreases with increasing distance from the sea 1

23 i. Churu in Rajasthan may record a temperature of 50°C or more on a June day while the mercury hardly touches 19°C in Tawang (Arunachal Pradesh) on the same day. 3

ii. On a December night, temperature in Drass (Ladakh) may drop down to minus 45°C while Thiruvananthapuram or Chennai on the same night records 20°C or 22°C.

iii. The annual precipitation is less than 10 cm in the northwest Himalayas and the western deserts, it exceeds 400 cm in Meghalaya. (Any other relevant example)

24 In north western India, some weak temperate cyclones from the Mediterranean sea ie Western disturbances, cause rainfall in Punjab, Haryana, Delhi and western Uttar Pradesh. They pick up moisture from Caspian Sea and Persian Gulf. After striking against Himalayas they cause rainfall or snowfall 3

25 Owing to the funnel shaped topography of the region, the monsoon winds get entrapped, are forced to rise upwards which is then followed by condensation and immense precipitation 3

26 As per the apparent motion of the Sun, the pressure conditions change in October. Low pressure areas shift from land to sea while high pressure shifts from sea to land. This shifting creates disturbance which is manifested in the form of cyclones 3

27 **Monsoons and the Economic Life in India** 3

(i) Monsoon is that axis around which revolves the **entire agricultural cycle of India**.

(ii) Except Himalayas all the parts of the country have temperature above the threshold level to **grow the crops or plants throughout the year**.

(iii) Regional variations in monsoon climate help in **growing various types of crops**.

(iv) Variability of rainfall brings **droughts or floods** every year in some parts of the country.

(v) Agricultural prosperity of India depends very much on **timely and adequately distributed rainfall.**

(vi) Sudden monsoon burst creates **problem of soil erosion** over large areas in India.

(vii) **Winter rainfall** by temperate cyclones in north India is highly beneficial for **rabi crops**.

(viii) Regional climatic variation in India is reflected in the vast **variety of food, clothes and house types**.

(Any 3 points)

28 India's climate is controlled by a number of factors. 5

Latitude : The Tropic of Cancer passes through the central part of India in east-west direction dividing India into tropical and temperate zone. The tropical zone, experiences high temperatures throughout the year with small daily and annual range. Area north of the Tropic of Cancer being away from the equator, experiences extreme climate with high daily and annual range of temperature.

The Himalayan Mountains : The lofty Himalayas in the north along with its extensions act as an effective climatic divide.

It protects the subcontinent from the cold northern winds.

The Himalayas also trap the monsoon winds, forcing them to shed their moisture within the subcontinent.

Distribution of Land and Water : India is flanked by the Indian Ocean on three sides in the south and girdled by a high and

continuous mountain-wall in the north. As compared to the landmass, water heats up or cools down slowly. This differential heating of land and sea creates different air pressure zones in different seasons in and around the Indian subcontinent. Difference in air pressure causes reversal in the direction of monsoon winds.

Distance from the Sea : With a long coastline, large coastal areas have an equable climate. Areas in the interior of India are far away from the moderating influence of the sea. Such

areas have extremes of climate.

Altitude : Temperature decreases with height. Due to thin air, places in the mountains are cooler than places on the plains.

Relief : The physiography or relief of India also affects the temperature, air pressure, direction and speed of wind and the amount and distribution of rainfall. The windward sides

of Western Ghats and Assam receive high rainfall during June-September whereas the southern plateau remains dry due to its leeward situation along the Western Ghats. (Any 5 points)

29 ****The differential heating of land and sea** during the summer sets the stage for the monsoon winds to drift towards the subcontinent. 5

During April and May the sun shines vertically over the Tropic of Cancer resulting in the formation of an intense low pressure in the north western part of the subcontinent called **monsoon trough.

Monsoon trough attracts the **southeast trades across the Equator. These winds cross the Equator between 40°E and 60°E longitudes.

The **shift in the position of the ITCZ is also related to the phenomenon of the **withdrawal of the westerly jet stream** from its position over the north Indian plain, south of the Himalayas.

The **easterly jet stream sets in along 15°N latitude only after the western jet stream has withdrawn itself from the region. This easterly jet stream is held responsible for the burst of the monsoon in India.

**The southwest monsoon sets in over the Kerala coast by 1st

June and moves swiftly to reach Mumbai and Kolkata between 10th and 13th June. By mid-July, southwest monsoon engulfs

the entire subcontinent

30	The climatic conditions of India can best be described in terms of an annual cycle of seasons. The meteorologists recognise the following four seasons : (i) the cold weather season (ii) the hot weather season (iii) the southwest monsoon season (iv) the retreating monsoon season. (Characteristics of all seasons to be explained in brief)	5
31	(a) Churu (b) Dras (c) Jaisalmer (d) Mawsynram	1*4

CHAPTER–5
NATURAL VEGETATION
MIND MAP

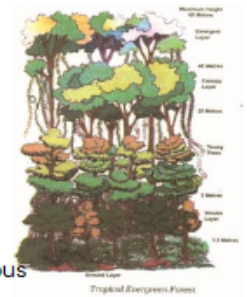
INDIA: CLIMATE VEGETATION AND WILDLIFE

Wild Life

- National animal
  - Tiger
- National Bird
  - Peacock
- Animals found
  - Asiatic lions
  - Elephants
  - Monkey
  - Wolf
  - Jackal, etc
- Birds found
  - Parrots
  - Pigeons
  - Geese
  - Bulbul, etc

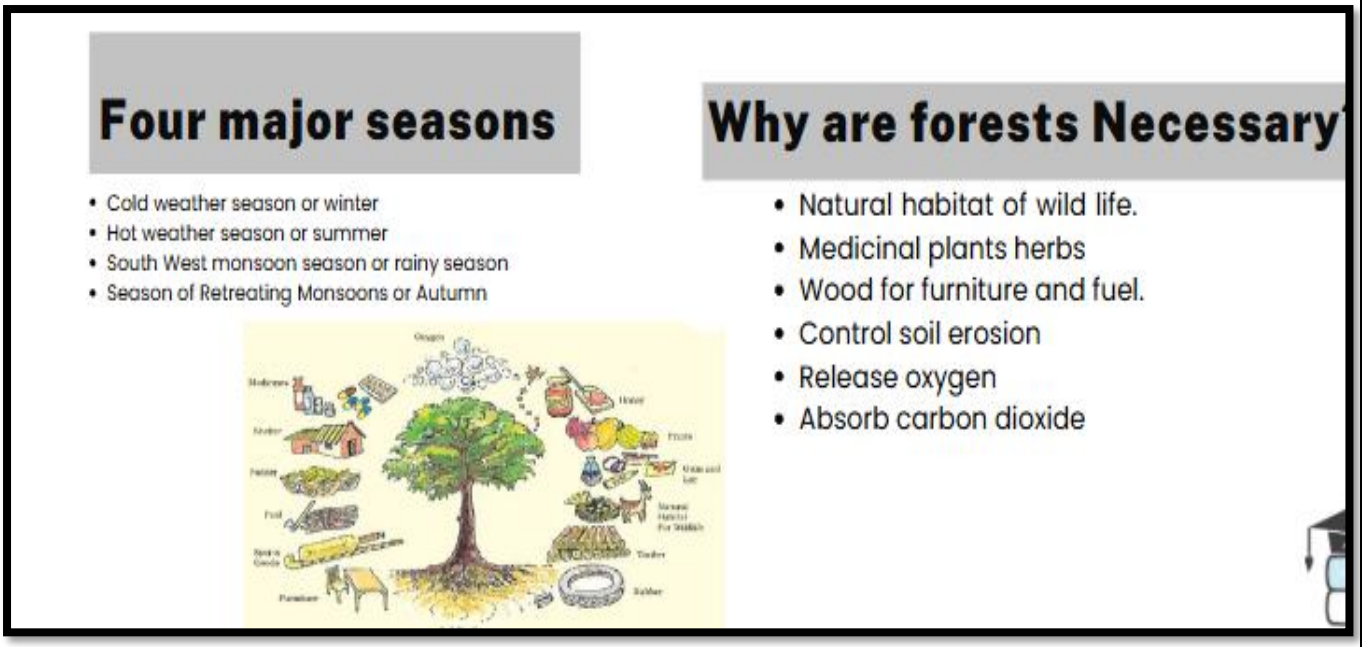
Natural Vegetation

- Tropical rainforest
  - Trees found
    - Ebony
    - Mahogany
    - Rosewood
  - Characteristics
    - Heavy rainfall
    - Very dense
- Mangrove forests
  - Trees found
    - Sundari
- Mountain Vegetation
  - Trees found
    - Chir
    - Pine
    - Deodar
- Thorny Bushes
  - Trees found
    - Khejri
    - Cactus
    - Babool
    - Keekar
- Tropical deciduous forests
  - Characteristics
    - Less dense
  - Trees found
    - Sal
    - Teak
    - Peepal
    - Neem
    - Shisham



Factors affecting climate

- Relief
- Distance from the sea
- Altitude
- Location



Multiple Choice Questions (MCQs) (One Mark Questions)

Q.1. Sandalwood is an example of:
(a) Evergreen forest
(b) Deciduous forest
(c) Deltaic forest
(d) Thorny forest.

Q.2. Which one of the following was the purpose of Project Tiger?
(a) to kill tigers
(b) to put tigers in the Zoo
(c) to protect tigers from illegal hunting
(d) to make films on tigers.

Q.3. In which one of the following states is the Nandadevi Biosphere reserve situated?
(a) Bihar
(b) Uttar Pradesh
(c) Uttarakhand
(d) Odisha.

Q.4. many of the Biosphere reserves from India are recognised by the UNESCO?
(a) One
(b) Two
(c) Three
(d) Four.

Q.5. Which one of the following proportion of area of the country was targeted to be under forest in Forest Policy of India?
(a) 33
(b) 44
(c) 55

(d) 22.

Q.6.Plants remain leafless for most of the year in
(a) Moist deciduous forest.
(b) Littoral and swamp forest.
(c) Montane forest.
(d) Tropical thorn forest.

Q.7. Which of the following was the purpose of Project Tiger?
(a) To kill tigers
(b) To protect tigers from illegal hunting
(c) To put tigers in the zoo
(d) To make films on tiger

Q.8. Khar, Neem, Khejri, Palas are:
(a) Tropical Thorn forests
(b) Tropical forests
(c) Evergreen forests
(d) Mangroves

Q.9. Farm forestry refers to the
(a) raising and management of trees on public property.
(b) raising of trees and agriculture crops on the same land.
(c) promotion of agro-forestry.
(d) farmers who grow trees for commercial and non commercial purposes.

Q.10.The world's richest region from a marine biodiversity is
(a) Nilgiri Biosphere Reserve.
(b) Sunderbans.
(c) Gulf of Myanmar.
(d) Gulf of Mannar biosphere Reserve.

Q.11.The Nanda Devi Biosphere Reserve is situated in
(a) Himachal Pradesh
(b) Kerala
(c) West Bangal
(d) Uttarakhand

Q.12.Bamboos are important raw material for making
(a) A match stick
(b) Books
(c) Musical instrument
(d) Boxes

Q.13.Monsoon or Tropical Deciduous forests are found in the areas with rainfall between
(a) 50 and 100 cm.
(b) 70 and 200 cm.
(c) 100 and 200 cm.
(d) 200 and 250 cm.

Q.14.Bamboos are grown most commonly at
(a) Great height from sea level.

(b) Medium height from sea level.
(c) A very low height from sea level.
(d) At any condition.

Q.15. Vegetation cover is very scanty in parts of Rajasthan due to
(a) Over population.
(b) Over irrigation.
(c) Deforestation.
(d) Overgrazing.

Q.16.How much part of total geographical area of India is under forests?
(a) 20 percent
(b) 21 percent
(c) 22 percent
(d) 23 percent

Q.17. State the annual rainfall required for deciduous monsoon forests.
(a) 100 – 200 cm.
(b) 100 – 150 cm.
(c) 150 – 200 cm.
(d) 200 – 250 cm.

Q.18. Where is the Forest Research Institute located?
(a) At Dehradun.
(b) At Shimla.
(c) At Haridwar.
(d) At Benares.

Q.19.What is the use of wood of chinar tree?
(a) For handicrafts.
(b) For making bottles.
(c) For making fans.
(d) None of the above

Sr.No	Answer
1	► (b)Deciduous forests
2	► (c) To protect tigers from illegal hunting
3	► (c) Uttarakhand
4	►(d) Four
5	►(a) 33.
6	►(d) Tropical thorn forest.
7	►(b) To protect tigers from illegal hunting
8	►(a) Tropical Thorn forests
9	►(d) farmers who grow trees for commercial and non commercial purposes.
10	►(d) Gulf of Mannar biosphere Reserve.
11	►(d) Uttarakhand
12	►(c) Musical instrument
13	►(b) 70 and 200 cm.
14	►(c) A very low height from sea level.
15	►(d) Overgrazing.
16	►(c) 22 percent
17	►(c) 150 – 200 cm.

18	►(a) At Dehradun.
19	►(a) For handicrafts.

Match the Following

Match the following.

(i) Walrus	**(a)** Softwood tree
(ii) Cedar	**(b)** An animal of tropical deciduous forest
(iii) Olives	**(c)** A polar animal
(iv) Elephants	**(d)** Temperate grassland in Australia
(v) Campos	**(e)** Thorny shrubs
(vi) Downs	**(f)** A citrus fruit
	(g) Tropical grassland of Brazil

Answer.

(i) Walrus	**(c)** A polar animal
(ii) Cedar	**(a)** Softwood tree
(iii) Olives	**(f)** A citrus fruit
(iv) Elephants	**(b)** An animal of tropical deciduous forest
(v) Campos	**(g)** Tropical grassland of Brazil
(vi) Downs	**(d)** Temperate grassland in Australia

Assertion and Reasoning Questions

Q.1 Assertion (A) : The dry deciduous forests are found in areas having rainfall between 90 cm and 80 cm.
Reason (R): The forests are found in the rainer parts of the peninsular plateau and the plains of Bihar and Uttar Pradesh.

a Both A and R are true and R is the correct explanation of A.
b Both A and Rare true but R is not the correct explanation of A.
c A is true but R is false.
d A is false but R is true.

Q.2 Assertion (A): The mangrove tidal forests are found in the areas of coasts influenced by tides.
Reason (R) : At higher elevations, temperate grasslands are common.

a Both A and R are true and R is the correct explanation of A.
b Both A and Rare true but R is not the correct explanation of A.
c A is true but R is false.
d A is false but R is true.

Q.3 Assertion (A) : India is also rich in its fauna.
Reason (R): It has more than 90,000 of animal species.

a Both A and R are true and R is the correct explanation of A.
b Both A and Rare true but R is not the correct explanation of A.
c A is true but R is false.
d A is false but R is true.

Q.4 Assertion (A): Thorn Forests and scrubs receive less than 70 cm of rainfall.
Reason (R): This type of vegetation is found in the north-western part of the country.

a Both A and R are true and R is the correct explanation of A.
b Both A and Rare true but R is not the correct explanation of A.
c A is true but R is false.

d A is false but R is true.

Q.5 Assertion (A) : In India almost the entire rainfall in brought in by the advancing southwest monsoon and retreating monsoons.
Reason (R) : Areas of heavy rainfall have more dense vegetation as compared to other areas of heavy rainfall.

a Both A and R are true and R is the correct explanation of A.
b Both A and Rare true but R is not the correct explanation of A.
c A is true but R is false.
d A is false but R is true.

Answer

1	d
2	b
3	a
4	c
5	d

Source-Based/Case Study-Based Questions

Read the following passage and answer the questions that follows:

In mountainous areas, the decrease in temperature with increasing altitude leads to the corresponding change in natural vegetation. As such, there is a succession of natural vegetation belts in the same order as we see from the tropical to the tundra region. The wet temperate type of forests are found between a height of 1,000 and 2,000 metres. Evergreen broad-leaf trees, such as oaks and chestnuts predominate. Between 1,500 and 3,000 metres, temperate forests containing coniferous trees, like pine, deodar, silver fir, spruce and cedar, are found. These forests cover mostly the southern slopes of the Himalayas, places having high altitude in Southern and North-East India. At higher elevations, temperate grasslands are common. At high altitudes, generally, more than 3,600 metres above the sea level, temperate forests and grasslands give way to the Alpine vegetation. Silver fir, junipers, pines and birches are the common trees of these forests.

Q 1. What is montane vegetation?
Ans. The vegetation found on high altitudes is known as montane vegetation where the decrease in temperature with increasing altitude leads to the corresponding change in natural vegetation.

Q 2. What type of forests are found between 1,500 and 3,000 metres of height?

Ans. Between 1,500 and 3,000 metres, temperate forests containing coniferous trees are found that cover mostly the Southern slope of the Himalayas.

Q.3 What kind of Vegetation found in Montane?

Ans. Alpine vegetation. Silver fir, junipers, pines and birches are the common trees of Montane.

Map-Based Questions

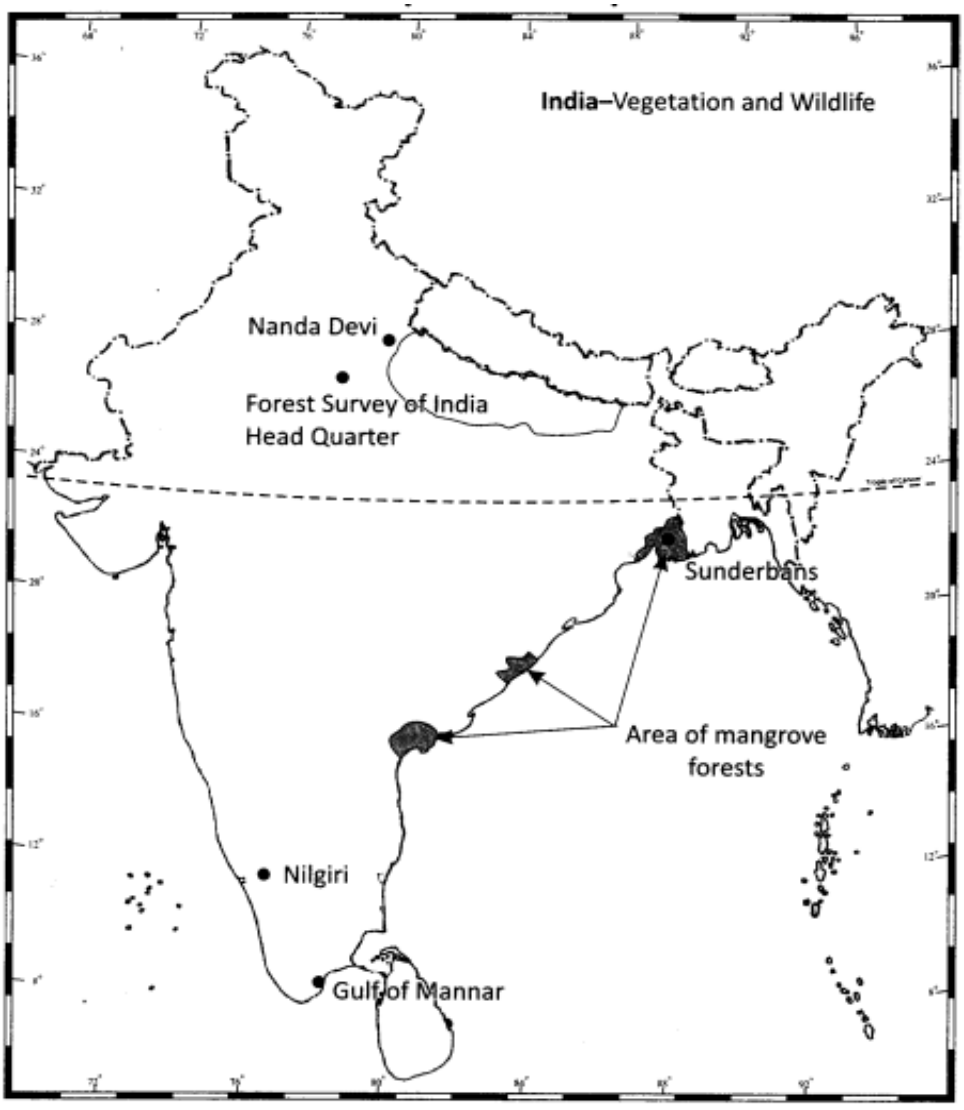
On an outline map of India, mark and label the following:

(i) Areas having Mangrove forests.

(ii) Biosphere reserves of Nanda Devi, Sunderbans, Gulf of Mannar and Nilgiri.

(iii) Mark the location of Forest Survey of India Head Quarter.

Answer:



Very Short Answer Type Questions

Question 1.
What is natural vegetation?
Answer:
Natural vegetation refers to a plant community that has been left undisturbed over a long time, so as to allow its individual species to adjust themselves to climate and soil conditions as fully as possible.

Question 2.
Where can you find natural vegetation?
Answer:
We can find natural vegetation in those areas where climate and soil are suitable for plant growth. Depending upon the variations in the climate and the soil, the vegetation of India changes from one region to another.

Question 3.
In how many categories have vegetation of Himalayas been classified?
Answer:
Vegetation of Himalayas has been classified into four groups. These are:

1. Deciduous forests
2. Wet temperate forests
3. Cold climate vegetation
4. Alpine vegetation.

Question 4.
When was National Forest Policy adopted in India?
Answer:
National Forest Policy was adopted in 1952 under which Forest Conservation Board was established. This policy was modified in 1988.

Question 5.
When was Project Tiger and Project Elephant launched?
Answer:
Project Tiger was launched in 1973 and Project Elephant was launched in 1992.

Short Answer Type Questions

Question 1.Explain the three categories of social forestry?
Answer:
Social forestry is classified into three categories Urban forestry:
It pertains to the raising and management of trees on public and privately owned land such as green belts, parts, roadside avenues, industrial and commercial green belts etc.
Rural forestry:

- It is divided into agro-forestry and community.
- Agro-forestry is the raising of trees and agriculture crops on the same land inclusive of the waste patches.

- Community forestry involves the raising of trees on public or community land such as the village pasture and temple land, roadside, canal bank, strips, along railway lines and schools, etc. providing benefits to the community as a whole.

Farm forestry:

- It is a term applied to the process under which farmers grow trees for commercial and non-commercial purposes on their farm lands.
- Commercial purposes-Forest department of various states distribute seedlings of trees free of cost to small and medium farmers. Several land such as the margins of agricultural fields grasslands and pastures, land around homes and cow sheds may be used for raising trees under non-commercial farm forestry.

Question 2.What objectives have been determined for the conservation of forests according to national forest policy?
Answer:
Objectives of new forest policy art:

- Bringing 33% of the geographical areas under forest cover.
- Maintaining environmental stability and to restore forests where ecological balance was disturbed.
- Conserving the natural heritage of the country.
- Its biological diversity and gentle pool.
- Checks soil erosion extension of the deserts land and reduction of floods and droughts.
- Increasing the forest cover through social forestry and afforestation on degraded lands.
- Increasing the productivity of forest to make timber, fuel, fodder and food available to rural population dependent on forests and encourage the substitution of wood.
- Creating massive people's movement involving women to encourage planting of trees, stop felling of trees and thus, reduce pressure on the existing forest.

Question 3.Write down the important features of thorn forest?
Answer:

- Tropical thorn forest occurs in the areas which receive rainfall less than 50 cm and consist of variety of grasses and shrubs.
- It includes semi-arid areas of south-west Punjab, Haryana, Maharashtra, Madhya Pradesh and Uttar Pradesh.
- In these forests, plants remain leafless for most part of the year and give an expression of scrub vegetation.
- Important species found are babool, khair, neem, kherjiri, palas, etc.
- Tussocky grass grows upto a height of 2m as the under growth and cactus is an important plant of these forests.
- Its main features are that they have sukleen stems which help in retaining moisture.
- They have roots which go underground upto 1 km.

- Leaves are reduced into thorn, spines which reduce transpiration.

Long Answer Type Questions

Question 1.Mention the reasons for the decline of wildlife in India?
Answer:
Important reasons for the decline of Wildlife in India are-

- Industrial and technological advancement brought about a rapid increase in the exploitation of forest resources.
- More and more lands were closed for agriculture, human settlement, roads, mining, resources, etc.
- Pressure on forests maintained due to looping for fodder and fuel, wood and removal of small timber by the local people.
- Grazing by domestic cattle caused an adverse effect on wildlife and its habitat.
- Hunting was taken up as a sport by the elite and hundreds of wild animals were killed in a single hunt. Now commercial poaching is rampant.
- Incidence of forest fire.

Question 2.According to the statistics received from state records, there are differences in forest area and actual forest cover. Explain.
Answer:

According to state records, the forest area covers 23.28 percent of the total land area of the country. It is important to note that the forest area and the actual forest cover are not the same. The forest area is the area notified and recorded as the forest land irrespective of the existence of trees, while the actual forest cover is the area occupied by forests with canopy. Forest area is based on the records of the State Revenue Department, while the actual forest cover is based on aerial photographs and satellite imageries.

According to India State of Forest Report 2011, the actual forest cover in India is only 21.05 percent. Of the forest cover, the share of dense and open forests is 12.29 and 8.75 percent respectively. Both forest area and forest cover vary from state to state. Lakshadweep has zero percent forest area; Andaman and Nicobar Islands have 86.93 percent. Most of the states with less than 10 percent of the forest area lie in the north and north western part of the country. These are Rajasthan, Gujarat, Punjab, Haryana and Delhi.

States with 10-20 percent forest area are Tamil Nadu and West Bengal. In Peninsular India, excluding Tamil Nadu, Dadra and Nagar Haveli and Goa, the area under forest cover is 20-30 percent. The north eastern states have more than 30 percent of the land under forest. Hilly topography and heavy rainfall are good for forest growth. There is a lot of variation in actual forest cover, which ranges from 9.56 percent in Jammu and Kashmir to 84.01 percent in Andaman and Nicobar Islands.

Question 3.Explain in short about four important Biospheres of India.
Answer:
Four Biosphere Reserves have been recognised by the UNESCO on World Network of Biosphere Reserves. These are as follows:

1. Nilgiri Biosphere Reserve: The Nilgiri Biosphere Reserve (NBR) is the first of the fourteen biosphere reserves of India. It was established in September 1986. It embraces the sanctuary complex of Wyanad, Nagarhole, Bandipur and Mudumalai, the entire forested hill slopes of Nilambur, the Upper Nilgiri plateau, Silent Valley and the Siruvani hills. The total area of the biosphere reserve is around 5,520 sq. km. The largest south Indian population of elephant, tiger, gaur, sambar and chital as well as a good number of endemic and endangered plants are also found in this reserve. The topography of the NBR is extremely varied, ranging from an altitude of250 m to 2,650 m. About 80 percent of the flowering plants reported from the Western Ghats occur in the Nilgiri Biosphere Reserve.

2. Nanda Devi Biosphere Reserve: The Nanda Devi Biosphere Reserve is situated in Uttarakhand. It includes parts of Chamoli, Almora, Pithoragarh and Ba'geshwar districts. The major forest types of the reserve are temperate. A few important species are silver weed and orchids like latifolie and rhododendron. The biosphere reserve has a rich fauna like the snow leopard, black bear, brown bear, musk deer, snow- cock, golden eagle and black eagle.

3. Sunderbans Biosphere Reserve: It is located in the swampy delta of the river Ganga in West Bengal. It extends over a vast area of 9,630 sq. km and consists of mangrove forests, swamps and forested islands. Sunderbans is the home of nearly 200 Royal Bengal tigers. More than 170 birds species are known to inhabit these mangrove forests. In the Sunderbans, the mangrove forests are characterised by Heritiera fomes, a species valued for its timber.

4. Gulf of Mannar Biosphere Reserve: The Gulf of Mannar Biosphere Reserve covers an area of 105,000 hectares on the south-east coast of India. It is one of the world's richest regions from a marine biodiversity perspective. The biosphere reserve comprises 21 islands with estuaries, beaches, forests of the nearshore environment, sea grasses, coral reefs, salt marshes and mangroves.

Higher Order Thinking Questions (HOTs)

Question 1."Forest and tribal are very closely related". Justify the statement.
Answer:

- To a vast number of tribal people, the forest, is a home, a livelihood, their very existence.
- It provides them food, fruits of all kinds, edible leaves, honey nourishing roots and wild game.
- It provides them with material to build their houses and items for practising their arts.

- The importance of forests in tribal economy is well-known as they are the source of sustenance and livelihood for tribal communities.
- The age old knowledge of tribals regarding forestry can be used in the development of forests.
- Rather than treating tribals as minor forest produce collectors they should be made growers of minor forest produce and encouraged to participate in conservation.

Question 2.When was comprehensive Wildlife Act enacted and what are its objectives?
Answer:
In 1972, comprehensive Wildlife Act was enacted.

- To provide protection to the endangered species listed in the schedule of the act.
- To provide legal support to the conservation areas of the country classified as national parks, sanctuaries and closed areas.
- Making punishments more stringent and has also made provisions for the protection of specified plant species and conservation of endangered species of wild animals.

Question 3.Write the objectives of Project Tiger and Project Elephant and in how many states they are implemented.
Answer:
The objectives of Project Tiger and Project Elephant are:

- Maintenance of viable population of tigers in India for scientific, aesthetic, cultural and ecological values.
- To preserve areas of biological importance as natural heritage for the benefit, education and enjoyment of the people.

The Project Tiger was launched in 1973 under which 27 tiger reserves have been set up in 17 states.
Project Elephant was launched in 1992. 14 elephant reserves have been set up during the year. Its main objective to ensure long-term survival of identified viable population of elephants in their natural habitat.

Question 4.What is Biosphere Reserve and what are its objectives?
Answer:
Biosphere Reserve is a unique and representative ecosystem of terrestrial and coastal areas which are internationally recognized within the framework of UNESCO Man and Biosphere (MAB) programme.
The main objectives of biosphere reserve are:

- Conservation: Conservation of biodiversity and ecosystem.
- Development: Association of environment with development.
- Logistics: International network for research and monitoring.

Question 5.Mangrove forests are unique in their own way. Explain.
Answer:
Mangrove forest:

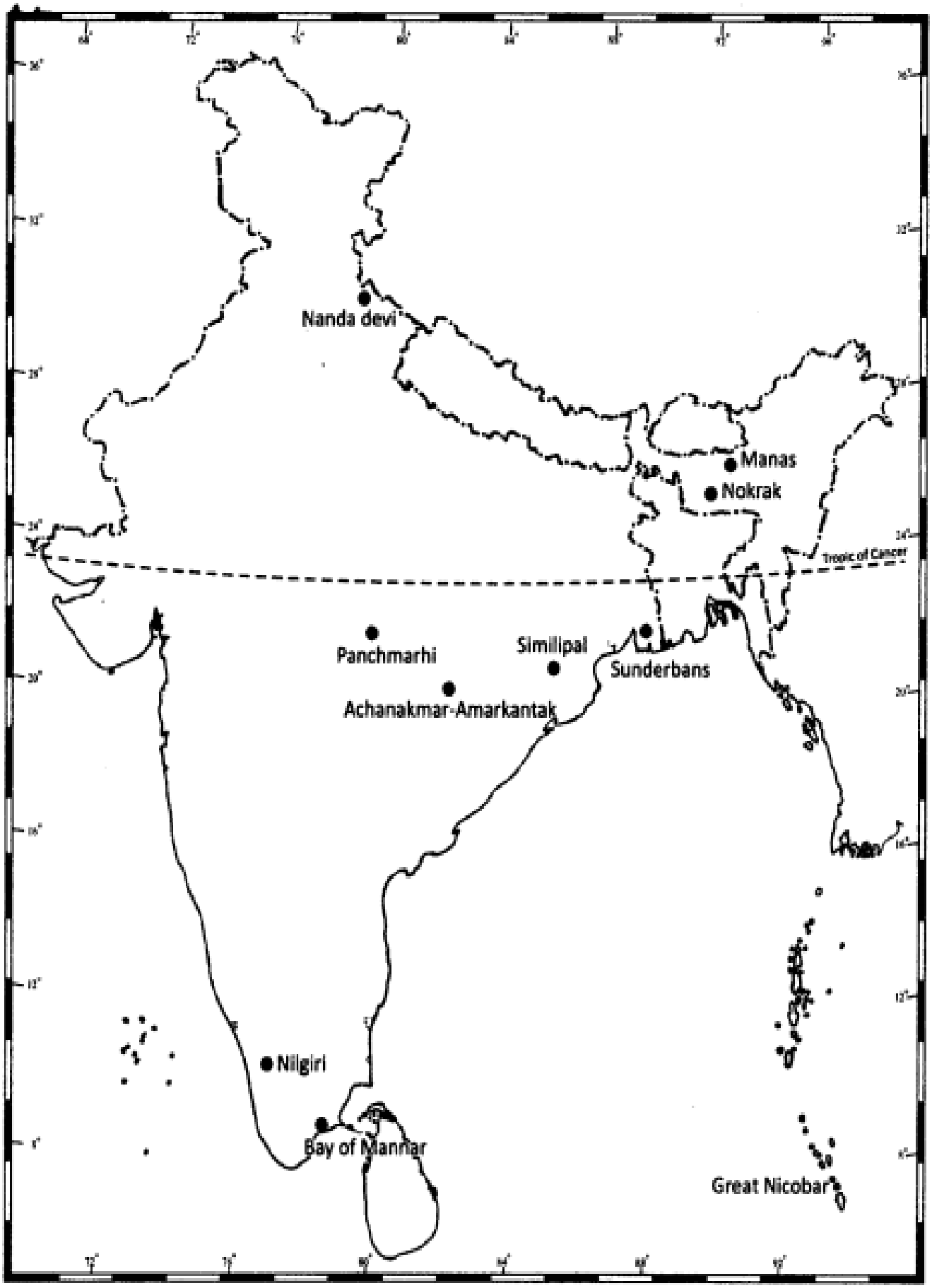
- The tidal forests are found in the areas of the coastal margins of Krishna, Kaveri, and Brahmaputra delta mainly occupying the estuaries, etc.
- They are found in the swamp and marshy areas.
- They can survive both in fresh and salty water.
- The trees have stilt like breathing or support rots, sticking out of mud and water.
- They are exposed at low tides and get submerged at high tides.
- Hot and wet climate favours their dense growth.
- Sunderi is the well known Mangrove trees. The famous Sunderban deltas are named after these trees.

MAP SKILL

Question 1.
On an outline map of India, mark and label the following:

1. Nanda devi
2. Panchmarhi
3. Manas
4. Nilgiri
5. Similipal
6. Bay of Mannar
7. Great Nicobar
8. Nokrak
9. Sunderbans
10. Achanakmar – Amarkantak.

Answer:


Nanda devi
Manas
Nokrak
Tropic of Cancer
Panchmarhi
Simlipal
Sunderbans
Achanakmar-Amarkantak
Nilgiri
Bay of Mannar
Great Nicobar