PM SHRI KENDRIYA VIDYALAYA NO.1 IIT KHARAGPUR
SUBJECT- CHEMISTRY
HOLIDAY HOMEWORK
CLASS – 12

	2001 set 1
1.	Show graphically that the freezing point of a liquid will be depressed when a non volatile solute is dissolved in it. The freezing point of solution containing 0.3gm of acetic acid in 30.0 gm of benzene is lowered by 0.45^0C. Calcualte the van't Hoff factor (K_f for benzene = 5.12KKgmol$^-$).
2.	Conductivity of 0.00241M acetic acid is $7.896X10^{-5}$ Scm^{-1}. Calculate its molar conductivity and it the limiting molar conductivity of acetic acid is 390.5 Scm^2/ mol. What is its degree dissociation?
3.	Given that standard electrode potentials,of different metal ion are: K^+/K =- 2.93V, Ag^+/Ag = 0.80V, Hg^{2+}/Hg= 0.79V,Mg^{2+}/Mg =2.37V, Cr^{3+}/Cr =-0.74V Arrange these metals in their increasing order of reducing power.
	2016 all 3 sets have same type of questions
4.	Write the colligative property which is used to find the molecular mass of macromolecules.In non ideal solution what type of deviation shows the formation of minimum boiling Azeotropes. Calculate the boiling point of solution when 2g of Na_2SO_4 was dissolved in 50g of water, assuming Na_2SO_4 undergoes complete ionization
	2017 (SET I/SET II / SET – III)
5.	State Henry's law. Calculate the solubility of CO_2 in water at 298K under 760mm Hg. (K_H for CO_2 in water at 298 K is 1.25 X 10^6 mmHg)
6.	The conductivity of 0.20M KCl solution at 298K is $0.0248Scm^{-1}$. Calculate its molar conductivity.
	2023(SET I/SET II / SET – III)
7.	A cell and its emf is given below : Pt (s) H_2 (g, 1 bar) H^+ (aq, 1 M) Cu^{2+} (aq, 1M) Cu (s) emf of the cell = + 0·34 V. (i) Write the reduction half-reaction at cathode. (ii) How is standard Gibbs energy for a reaction related to equilibrium constant ? (iii) Calculate emf of the given cell : Mg (s)+ Mg^{2+} (0·1 M) → Cu^{2+} (1·0 10 M)+ Cu (s) Given : $E^\circ_{Cu^{2+}/Cu}$ = + 0·34 V, Mg^{2+}/Mg E° = 2·37 V (log 100 = 2)

8.	(i) State Kohlrausch law of independent migration of ions. (ii) How much electricity in terms of Faraday is required to produce 40 g of Al from molten Al_2O_3 ? (Given : atomic mass of Al = 27 u)
9.	Calculate log K_c for the following reaction at 298 K : $Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$ Given : Zn^{2+}/Zn E° = -0·76 V, Cu^{2+}/Cu E° = + 0·34 V
10.	Calculate log K_c for the following reaction at 298 K : $Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$ Given : Zn^{2+}/Zn E° = -0·76 V, Cu^{2+}/Cu E° = + 0·34 V
	2026
11.	What type of deviation from Raoult's law is shown by mixture of ethanol and acetone ? Give reason. What will happen to the boiling point of the solution on mixing ethanol and acetone ?
12.	(i) Why is the Equilibrium Constant (Kc) related to E^ocell and not to Ecell ? (ii) Two metals 'A' and 'B' have standard electrode potential values of –0.24 V and + 0 .80 V respectively. Which of these will liberate hydrogen gas from dil. H_2SO_4?

13.	Calculate emf and ΔG for the following cell at 298 K :
	Mg(s) / Mg2+(0.01 M) // Ag+(0.001 M) / Ag(s)
	Given : E^o Mg2+/ Mg = –2.37 V E^oAg+/ Ag = +0.80 V
	[1 F = 96500 C mol–1, log 10 = 1]

14.	When 1.5 g of a non-volatile solute was dissolved in 90 g of benzene, the boiling point of benzene got raised from 353.23 K to 353.93 K. Calculate the molar mass of the solute. (Given Kb for benzene = 2.52 K kg mol–1)
	Prepare a formula chart of Electrochemistry
	Create a mind map on *Colligative Properties. Add real-life examples (salt in ice, antifreeze).*
	ELECTROCHEMISTRY **Tabulate different types of cell like dry cell , mercury cell , lead storage battery : their uses, chemical reaction at cathode and anode taking place with their pictures.** **LEARN CHAPTER:** **Solutions and Electrochemistry**

PM SHRI Kendriya Vidyalaya No 1 IIT Kharagpur
Session 2026-27
Summer Vacation Holiday Home Work

Teacher Name **Anuj Kumar, PGT CS**

Class - 12B : Artificial Intelligence

	1.	Solve Question paper of MT-1 and Final Exam of Class 11(2026-27) only Python Programming
	2.	Complete your Notebook in all respect.
	3.	Copy should have Proper cover, Updated index, profile and certificate as per instructions.
	4.	Revise following Chapters: 1. Python Programming-1 (Class 11) 2. Python Programming-2 (Class-12) 3. Read Chapter 2: Data Science
	5.	List down imp methods of following topics: (a) String (b) List (c) Tuple (d) Dictionary
	6.	Write Short Notes on: 1. Use of Indentation 2. Use of Comments 3. Identifier Naming Rules 4. Types of Token 5. Operator Precedence and Associativity Table 6. Data Types of Python
	7.	Syntax of Following: 1. If-elif-else 2. For-loop with break and continue 3. While loop with break and continue
	8.	(a) Write a Python program to make the graph: (b) Write the program on linear regression.(from Book Chapter-1)
	9.	List down imp attributes & methods of following topics: (a) numpy (b) pandas

PM SHRI Kendriya Vidyalaya No 1 IIT Kharagpur
Session 2026-27
Summer Vacation Holiday Home Work

Teacher Name **Anuj Kumar, PGT CS**

Class-12B : Computer Science

	1.	Solve Question paper of MT-1 and Final Exam of Class 11(2026-27) only Python Programming
	2.	Solve Question from CBSE Board 1. Mar 2026 2. Mar 2025 3. Supp 2025 (Question belonging to Class 11)
	3.	Complete your Notebook in all respect.
	4.	Copy should have Proper cover, Updated index, profile and certificate as per instructions.
	5.	Revise Python revision Tour Chapter
	6.	Practice Operator precedence and associative table 5 times.
	7.	List down all functions and methods of following topics: (a) String (b) List (c) Tuple (d) Dictionary (e) **Module** : Maths (f) **Module** : Statistics (g) **Module** : Random I
	8.	Write Short Notes on: 1. Use of Indentation 2. Use of Comments 3. Identifier Naming Rules 4. Types of Token 5. Operator Precedence and Associativity Table 6. Data Types of Python, Draw the Chart.
	9.	Syntax of Following: 1. If-elif-else 2. For-loop with break and continue 3. While loop with break and continue
	10.	(a) Write a Python program to sum all the items in a list. (b) Write a Python program to get the largest number from a list. (c) Write a Python program to count the number of strings where the string length is 2 or more and the first and last character are same from a given list of strings. Sample List : ['abc', 'xyz', 'aba', '1221'] (d) Write a Python program to remove duplicates from a list. (e) Write a Python program to generate and print a list of first and last 5 elements where the values are square of numbers between 1 and 30 (both included). 21-30 MAY 2024. (f) Write a Python program to get a string from a given string where all occurrences of its first char have been changed to '$', except the first char itself. Sample String : 'restart' Expected Result : 'resta$t'

		(g) Write a python program to display the elements of a list twice if it is a number and display the element terminated with'*' if it is not a number. (h) Write a python program to read name from user and delete phone number from a dictionary phonebook on the basis of the name ,where name is the key. (i) Write a program to input employee number and name for N employees and display all employees' information in ascending order of their employee number. (j) Write a Python program to count the number of characters (character frequency) in a string. Sample String : google.com' Expected Result : {'o': 3, 'g': 2, '.': 1, 'e': 1, 'l': 1, 'm': 1, 'c': 1}

Electric Charges and Fields WS 1

CLASS 12 - PHYSICS

	Section A	
1	A cup contains 250 g of water. The number of negative charges present in the cup of water is a) 3.34×10^{7} C b) 1.34×10^{7} C c) 1.34×10^{19} C d) 1.34×10^{-19} C	**[1]**
2	Two point charges q_1 and q_2 are at separation r.The force acting between them is given by $F = K\frac{q_1 q_2}{r^2}$. The constant K depends upon a) only on the system of units b) neither on only on the system of units nor on only on medium between charges c) only on medium between charges d) both on only on the system of units andonly on medium between charges	**[1]**
3	When the distance between two charged particles is halved, the Coulomb force between them becomes a) one - fourth b) one - half c) four times. d) double	**[1]**
4	Two large conducting spheres carrying charges Q_1 and Q_2 are kept with their centres r distance apart. The magnitude of electrostatic force between them is not exactly $\frac{1}{4\pi\varepsilon_0}\frac{Q_1 Q_2}{r^2}$ because	**[1]**

	a) charges will shift towards the portions of the spheres which are closer and facing towards each other b) charges on spheres will shift towards the centres of their respective spheres c) these are not point charges d) charge distribution on the spheres is not uniform	
5	A charge Q is divided into two parts of q and Q - q. If the coulomb repulsion between them when they are separated is to be maximum, the ratio of $\frac{Q}{q}$ should be a) $\frac{1}{4}$ b) 2 c) $\frac{1}{2}$ d) 4	**[1]**
6	A tennis ball which has been covered with charges is suspended by a thread so that it hangs between two metal plates. One plate is earthed, while other is attracted to a high voltage generator. The ball a) swings backward & forward hitting each plate in turn b) is repelled by earthed plate and stays there c) is attracted to the high voltage plate and stays there d) hangs without moving	**[1]**
7	A point charge Q is placed at the mid point of a line joining two charges, 4q and q. If the net force on charge q is zero, then Q must be equal to: a) +q b) - 2q c) - q d) +4q	**[1]**
8	A long string of charge per unit length λ passes through an imaginary cube of edge **a** . The maximum flux of the electric field will be a) $\frac{a\lambda}{\epsilon_0}$	**[1]**

	b) $\sqrt{3}\frac{a\lambda}{\epsilon_0}$ c) $\sqrt{3}\frac{a^2\lambda}{\epsilon_0}$ d) $\sqrt{2}\frac{a\lambda^2}{\epsilon_0}$	
9	An electric dipole with dipole moment $\vec{P} = P_0\hat{\imath} - P_0\hat{\jmath}$ is placed in an electric field $\vec{E} = E_1\hat{\imath} + E_2\hat{\jmath}$, where P_0, E_1 and E_2 are constants. The torque $\vec{\tau}$ acting on the dipole is: a) $P_0 (E_2 + E_1)\hat{k}$ b) $P_0 (E_2 - E_1)\hat{k}$ c) $P_0 (E_1 - E_2)\hat{k}$ d) $- P_0 (E_2 + E_1)\hat{k}$	**[1]**
10	A point charge +q, is placed at a distance **d** from an isolated conducting plane. The field at a point P on the other side of the plane is a) Directed radially away from the point charge. b) Directed perpendicular to the plane but towards the plane. c) Directed perpendicular to the plane and away from the plane. d) Directed radially towards the point charge.	**[1]**
11	Electric charges under the action of electric forces is called: a) electric field lines. b) electrostatic c) electric flux d) electric field	**[1]**
12	An electric dipole coincides on Z - axis and its midpoint is on the origin of the coordinate system. The electric field at an axial point at a distance z from the origin is E_z and the electric field at an equatorial point at a distance y from the origin is E_y. Here z = y >> α, so $\frac{\lvert E_z\rvert}{\lvert E_y\rvert}$ is equal to a) 2 b) 4	**[1]**

	c) 1 d) 3	
13	An electron is moving round the nucleus of a hydrogen atom in a circular orbit of radius r.The Coulomb force $\vec{F}$ between the two is: a) $\kappa \frac{e^2}{r^3}\vec{r}$ b) $-\kappa \frac{e^2}{r^3}\vec{r}$ c) $-\kappa \frac{e^3}{r^3}\hat{r}$ d) $\kappa \frac{e^2}{r^3}\hat{r}$	**[1]**
14	A point charge +q is placed at the mid point of a cube of side L. The electric flux emerging from the cube is a) zero b) $\frac{qL^2}{\epsilon_o}$ c) $\frac{q}{6L^2\epsilon_o}$ d) $\frac{q}{\epsilon_o}$	**[1]**
15	In a regular polygon of n sides, each corner is at a distance of r from the center. Identical charges of magnitude Q are placed at (n - 1) corners. The field at the center is a) $\frac{n-1}{n}\frac{kQ}{r^2}$ b) $\frac{kQ}{r^2}$ c) $\frac{n}{(n-1)}\frac{kQ}{r^2}$ d) $(n-1)\frac{kQ}{r^2}$	**[1]**
16	A charge Q is placed at the corner of a cube. The electric flux through all the six faces of the cube is a) $\frac{Q}{\varepsilon_0}$	**[1]**

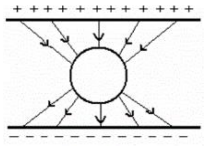
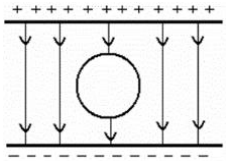
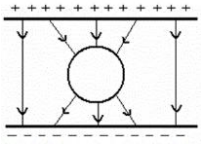
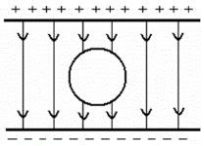
	b) $\frac{Q}{6\varepsilon_0}$ c) $\frac{Q}{8\varepsilon_0}$ d) $\frac{Q}{3\varepsilon_0}$	
17	A charge qis located at the centre of a cube. Theelectric flux through any face is a) $\frac{1}{6}\frac{4\pi q}{4\pi\varepsilon_0}$ b) $\frac{2\pi q}{6(4\pi\varepsilon_0)}$ c) $\frac{\pi q}{6(4\pi\varepsilon_0)}$ d) $\frac{q}{6(4\pi\varepsilon_0)}$	**[1]**
18	A particle of mass m and charge q is placed at rest in a uniform electric field E and then released, the kinetic energy attained by the particle after moving a distance y, will be a) q Ey b) q^2 Ey c) q E^2 y d) q Ey^2	**[1]**
19	The magnitude of electric force, F is: a) constant b) directly proportional to the product of both charges. c) directly proportional to the distance between both charges d) directly proportional to the square of the distance between both charges.	**[1]**
20	Electric lines of force: a) are imaginary b) exist everywhere c) exist only when both positive and negative charges are near one another d) exist only in the immediate vicinity of electric charges	**[1]**

21	The point charges Q and - 2Q are placed some distance apart. If the electric field at the location of Q is E, then the electric field at the location of - 2Q will be: a) - 2E b) $-\frac{3E}{2}$ c) - E d) $-\frac{E}{2}$	**[1]**
22	Let E_a be the electric field due to a dipole in its axial plane distant l and let E_q be the field in the equatorial plane distant l. The relation between E_a and E_q is: a) $E_a = 2E_q$ b) $E_a = E_q$ c) $E_q = 2E_a$ d) $E_a = 3E_q$	**[1]**
23	A body can be negatively charged by a) Giving some protons to it b) Giving excess of electrons to it c) removing some electrons from it d) Removing some neutrons from it	**[1]**
24	Two insulated charged copper spheres A and B have their centres separated by a distance of 50 cm. What is the mutual force of electrostatic repulsion if the charge on each is6.5×10^{-7}C ? The radii of A and B are negligible compared to the distance of separation. a) 3.5×10^{-2}N b) 4.5×10^{-2}N c) 1.5×10^{-2}N d) 2.5×10^{-2}N	**[1]**
25	A semi - circular arc of radius 'a' is charged uniformly and the charge per unit lengths isλ . The electric field at the centre is:	**[1]**

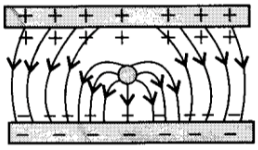
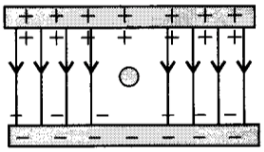
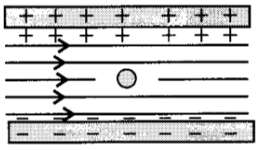
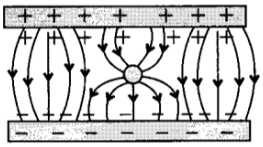
	a) $\frac{\lambda}{2\pi\varepsilon_0 a^2}$ b) $\frac{\lambda}{4\pi\varepsilon_0 a}$ c) $\frac{\lambda}{2\pi\varepsilon_0 a}$ d) $\frac{\lambda^2}{2\pi\varepsilon_0 a}$	
26	Ifσ = surface charge density, ε =electric permittivity, the dimensions of $\frac{\sigma}{\varepsilon}$ are same as a) pressure b) electric force c) electric charge d) electric field intensity	**[1]**
27	Careful measurement of the electric field at the surface of a black box indicates that the net outward flux through the surface of the box is$8.0 \times 10^3 \mathrm{Nm}^2/\mathrm{C}$ .What is the net charge inside the box? a) 0.04μC b) 0.06μC c) 0.05μC d) 0.07μC	**[1]**
28	A solid sphere of radius R is uniformly charged so that volume charge density is p. The electric field at a distance r(r < R) is a) $\frac{\rho r}{3\varepsilon_0}$ b) $\frac{\rho r^2}{3\varepsilon_0 R^3}$ c) $\frac{\rho r}{\varepsilon_0 R^2}$ d) $\frac{\rho r^2}{\varepsilon_0 R^3}$	**[1]**
29	The number of electrons for one coulomb of charge is a) 6.25×10^{19}	**[1]**

	b) 6.25×10^{23} c) 6.25×10^{21} d) 6.25×10^{18}	
30	An infinitely long uniformly charged wire produces an electric field of 18×10^{4} NC^{-1} at a distance of 1.0 cm. The linear charge density on the wire is: a) 1.12×10^{-14} Cm^{-1} b) 3.08×10^{-15} Cm^{-1} c) 1.0×10^{-9} Cm^{-1} d) 1.0×10^{-7} Cm^{-1}	**[1]**
31	There are two types of electric charges positive charges and negative charges. The property which differentiates the two types of charges is: a) field of charge b) strength of charge c) amount of charge d) polarity of charge	**[1]**
32	Two charges are at distance d apart in air. Coulomb force between them is F. If a dielectric material of dielectric constant K is placed between them, the Coulomb force now becomes a) $\frac{F}{K}$ b) $\frac{K^2}{F}$ c) FK d) $\frac{F}{K^2}$	**[1]**
33	The electric charge always resides: a) at the interior of a charged conductor b) at the centre of charged conductor c) randomly all over the charged conductor d) on the outer surface of a charged conductor	**[1]**

34	Two identical charged spheres suspended from a common point by two massless strings of lengths l, are initially at a distance d(d <<l) apart because of their mutual repulsion. The charges begin to leak from boththe spheres at a constant rate. As a result, the spheres approach each other with a velocity v. Then v varies as a function of the distance x between the spheres, as a) v$\propto x^{-\frac{1}{2}}$ b) v$\propto$ x $^{-1}$ c) v$\propto$ x d) v$\propto x^{\frac{1}{2}}$	**[1]**
35	The force per unit charge is known as _____. a) electric potential b) electric field c) electric current d) electric flux	**[1]**
36	Select the correct statements. Coulomb's law correctly describes the electric force that: 1. binds the electrons of an atom to its nucleus. 2. binds the protons and neutrons in the nucleus of an atom. 3. binds atoms together to form molecules. a) (i), (ii), and (iii) b) (i) and (iii) c) (ii) and (iii) d) (i) and (ii)	**[1]**
37	When air is replaced by a dielectric medium of dielectric constantκ , the maximum force of attraction between two charges separated by a distance: a) remains unchanged b) decreasesκ times c) decreasesκ^2 times	**[1]**

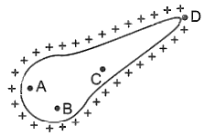
	d) increasesκ times	
38	In a certain region of space, electric field is along the z - direction throughout. The magnitude of the electric field is however not constant, but increases uniformly along the positive z - direction at the rate of 10^5 NC $^{-1}$ m $^{-1}$. The force experienced by the system having a total dipole moment equal to 10^{-7} Cm in the negative z - direction is a) - 10^{-2} N b) 10^{-2} N c) - 10^{-4} N d) 10^{-4} N	**[1]**
39	An uncharged sphere of metal is placed inside a charged parallel plate capacitor. The lines of force look like a)  b)  c)  d) 	**[1]**
40	When a negatively charged conductor is connected to earth a) Electrons flow from the earth to the conductor b) Protons flow from the conductor to the earth c) No charge flow occurs d) Electrons flow from the conductor to the earth	**[1]**

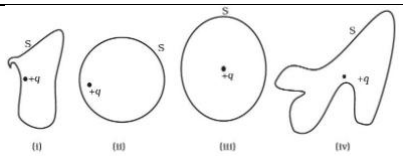
41	A point charge causes an electric flux of $-1.0 \times 10^3 \text{Nm}^2/\text{C}$ to pass through a spherical Gaussian surface of 10.0 cm radius centred on the charge.If the radius of the Gaussian surface were doubled, how much flux would pass through the surface? a) $-10^3 \text{Nm}^2/\text{C}$ b) $10^4 \text{Nm}^2/\text{C}$ c) $10^3 \text{Nm}^2/\text{C}$ d) $-10^2 \text{Nm}^2/\text{C}$	**[1]**
42	A charged cloud system produces an electric field in the air near the earth's surface. A particle of charge - 2×10^{-9} C is acted on by a downward electrostatic force of 3×10^{-6} N when placed in this field. The gravitational and electrostatic force, respectively, exerted on a proton placed in this field are a) 1.64×10^{-26} N, 1.5×10^{3} N b) 1.64×10^{-26} N, 2.4×10^{-16} N c) 1.56×10^{-18} N, 2.4×10^{-16} N d) 1.5×10^{3} N, 2.4×10^{-16} N	**[1]**
43	Which of the following is deflected by electric field? a) γ - rays b) Neutrons c) α - particles d) X - rays	**[1]**
44	A conducting sphere of radius 10 cm is charged with 10 μC. Another uncharged sphere of radius 20 cm is allowed to touch it for some time. After that if the spheres are separated, then surface density of charges on the spheres will be in the ratio of a) 1 : 1 b) 2 : 1 c) 1 : 3 d) 1 : 2	**[1]**

45	A point charge is situated at an axial point of a small electric dipole at a large distance from it. The charge experiences a force F. If the distance of the charge is doubled, the force acting on the charge will become a) $\frac{F}{2}$ b) $\frac{F}{8}$ c) 2F d) $\frac{F}{4}$	**[1]**
46	Which of the diagrams correctly represents the electric field between two charged plates if a neutral conductor is placed in between the plates? a)  b)  c)  d) 	**[1]**
47	An electron experiences a force$(1.6 \times 10^{-16}$ N)î in an electric field $\vec{E}$. The electric field $\vec{E}$ is: a) $-\left(1.0 \times 10^{-3} \frac{N}{C}\right)$ î b) $\left(1.0 \times 10^{3} \frac{N}{C}\right)$ î c) $-\left(1.0 \times 10^{3} \frac{N}{C}\right)$ î	**[1]**

	d) $\left(1.0 \times 10^{-3} \frac{\mathrm{N}}{\mathrm{C}}\right)\hat{\imath}$	
48	1 C charge is equivalent to charge on how many numbers of protons? a) 8×10^{20} b) 7×10^{18} c) 6×10^{18} d) 9×10^{20}	**[1]**
49	A hollow conducting sphere is given a positive charge of 10μ C. What will be the electric field at the centre of the sphere if its radius is 2 metres? a) 20μ C m^{-2} b) 32μ Cm^{-2} c) 5μ Cm^{-2} d) Zero	**[1]**
50	A system has two charges$q_A = 2.5 \times 10^{-7}$C and $q_B = -2.5 \times 10^{-7}$C located at points A(0, 0, - 15cm) and B(0, 0, +15cm), respectively. What are the total charge and electric dipole moment of the system? a) zero,8.5×10^{-8}Cm b) zero,6.5×10^{-8}Cm c) zero,7.5×10^{-8}Cm d) zero,5.5×10^{-8}Cm	**[1]**
51	A uniformly charged conducting sphere of 2.4 m diameter has a surface charge density of$80.0\mu C/m^2$. Find the charge on the sphere. a) 1.25×10^{-3}C b) 1.55×10^{-3}C c) 1.45×10^{-3}C d) 1.35×10^{-3}C	**[1]**
52	Point charges +4q, - q and +4q are kept on the X - axis at points x = 0, x = a and x = 2a respectively:	**[1]**

	a) all the charges are in unstable equilibrium b) all the charges are in stable equilibrium c) none of the charges is in equilibrium d) only - q is in stable equilibrium	
53	Two infinite plane parallel non conducting sheets, separated by a distance d have equal and opposite charge densitiesσ . Electric field intensity at a point between the sheets is: a) depends upon location of the point b) $\frac{\sigma}{2\varepsilon_0}$ c) zero d) $\frac{\sigma}{\varepsilon_0}$	**[1]**
54	Two small charged spheres A and B have charges 10μ C and 40 μ C respectively and are held at a separation of 90 cm from each other.At what distance from A, the electric intensity would be zero? a) 30 cm b) 22.5 cm c) 18 cm d) 36 cm	**[1]**
55	A body gets positive charge. It means that a) it has gained positrons b) it has gainedα - particles. c) it has lost electrons d) it has gained protons	**[1]**
56	If the net electric flux through a closed surface is zero, then we can infer a) no net charge is enclosed by the surface b) electric potential varies from point to point inside the surface c) charge is present inside the surface	**[1]**

	d) uniform electric field exists within the surface	
57	Under the influence of the coulomb field of charge +Q, a charge - q is moving around it in an elliptical orbit. Find out the correct statement(s). a) The linear momentum of the charge - q is constant b) The angular velocity of the charge - q is constant c) The linear speed of the charge - q is constant d) The angular momentum of the charge - q is constant	**[1]**
58	Match Column I with Column II with appropriate matching. **Column I** / **Column II** a. λ / i. $L^2\ MT^{-2}$ b. ρ / ii.electric field intensity c. Torque / iii. $\frac{q}{V}$ d.electric field / iv. $\frac{q}{L}$ a) (a) - (iii), (b) - (i), (c) - (iv), (d) - (ii) b) (a) - (iv), (b) - (i), (c) - (ii), (d) - (iii) c) (a) - (iv), (b) - (iii), (c) - (i), (d) - (ii) d) (a) - (ii), (b) - (iv), (c) - (i), (d) - (iii)	**[1]**
59	For the isolated charged conductor of given figure, the electric fields at points A, B, C and D are E_A , E_B , E_C and E_D respectively. Then:  a) $E_D > E_A = E_B = E_C = 0$ b) $E_B = 0, E_A = E_C = E_D$ c) $E_A = E_B = E_C > E_D$ d) $E_A = E_B > E_C > E_D$	**[1]**
60	The Electric flux through the surface	**[1]**

	 a) in Fig (iv) is the largest. b) in Fig. (iii) is the least c) is the same for all the figures d) in Fig. (ii) is same as Fig. (iii) but is smaller than Fig. (iv)	
61	An electric dipole of length 2 cm is placed at an angle of 30^o with an electric field 2×10^{5} N/C. If the dipole experiences a torque of 8×10^{-3} Nm, the magnitude of either charge of the dipole, is a) 8 mC b) 4μ C c) 2 mC d) 7μ C	**[1]**
62	A charged sphere of radius a is put in contact with another uncharged sphere of radius b. The ratio of original surface density to that of final surface density of charge on first sphere is a) $\frac{a}{b}$ b) $\frac{a+b}{a}$ c) $\frac{b}{a+b}$ d) $\frac{b}{a}$	**[1]**
63	A pendulum bob of mass m carrying a charge q is at rest with its string making an angleθ with the vertical in a uniform horizontal electric field E. The tension in the string is a) $\frac{qE}{cos\theta}$ b) mg c) $\frac{qE}{sin\theta}$	**[1]**

	d) $\frac{mg}{sin\theta}$	
64	The conservation of electric charge implies that a) simultaneous creation of equal and opposite charge is permissible b) charge cannot be created c) total charge of the entire universe remains constant d) charge cannot be destroyed	**[1]**
65	If electric field in a region is radially outward with magnitude E = Ar. The charge contained in a sphere of radius rcentred at the origin is: a) $4\pi\varepsilon_0 Ar^3$ b) $\frac{4\pi\varepsilon_0 A}{r^3}$ c) $\frac{1}{4\pi\varepsilon_0}\cdot\frac{A}{r^3}$ d) $\frac{1}{4\pi\varepsilon_0}Ar^3$	**[1]**
66	There are two kinds of charges - positive charge and negative charge. The property which differentiates the two kinds of charges is called a) strength of charge b) field of charge c) amount of charge d) polarity of charge	**[1]**
67	Which of the following is not true for a region with uniform electric field? a) it may contain dipoles b) it may have uniformly distributed charge c) it may have formly distributed charge d) it can have free charges	**[1]**
68	Each of the two - point charges are doubled and their distance is halved. Force of interaction becomes n times, where nis a) 1	**[1]**

	b) 18 c) 16 d) 4	
69	A charge Q is placed at the centre of a cube. The electric flux through one if its face is a) $\frac{Q}{6\varepsilon_0}$ b) $\frac{Q}{8\varepsilon_0}$ c) $\frac{Q}{\varepsilon_0}$ d) $\frac{Q}{3\varepsilon_0}$	**[1]**
70	If an electron is accelerated by $8.8\times 10^{14}\text{m/s}^2$, then electric field required for acceleration is (given specific charge of the electron = $1.76 \times 10^{11}\text{Ckg}^{-1}$) a) $52\ \text{Vcm}^{-1}$ b) $50\ \text{Vcm}^{-1}$ c) $54\ \text{Vcm}^{-1}$ d) $56\ \text{Vcm}^{-1}$	**[1]**
71	For coulomb force to be operative the least size of the atom will be a) 10^{-8} m b) 10^{-15} m c) 10^{-10} m d) 10^{-12} m	**[1]**
72	An electric dipole with dipole moment4×10^{-9} Cm is aligned at 30° with the direction of a uniform electric field of magnitude $5 \times 10^4\text{N/C}$. Calculate the magnitude of the torque acting on the dipole. a) $1.0 \times 10^{-4}\text{Nm}$ b) $1.5 \times 10^{-8}\text{Nm}$ c) $2.5 \times 10^{-4}\text{Nm}$ d) $3.5 \times 10^{-4}\text{Nm}$	**[1]**

73	Electric charge between two bodies can be produced by: a) sticking b) rubbing c) passing AC current d) oiling	**[1]**
74	Electric force between two charged spheres is 18 units. If the distance between the centres of the sphere is tripled, the electric forcewill be a) 2 units b) 54 units c) 3 units d) 6 units	**[1]**
75	Deuteron and alpha particle in air are atseparation $1\mathring{A}$. The magnitude of electric field intensity on α - particle due to deutron is a) 5.76×10^{11} N/C b) 1.44×10^{11} N/C c) zero d) 2.828×10^{11} N/C	**[1]**

Electrostatic Potential and Capacitance WS 1

CLASS 12 - PHYSICS

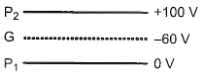
	Section A	
1	The energy stored in a capacitor of capacitance C and potential V is given by: a) $\frac{1}{2}C^2V$ b) $\frac{1}{2}$CV c) $\frac{1}{2}C^2V^2$ d) $\frac{1}{2}CV^2$	**[1]**
2	The capacitance of a parallel plate capacitor is10μF . When a dielectric plate is introduced in between the plates, its potential becomes $\frac{1}{4}$th of its original value. What is the value of the dielectric constant of the plate introduced? a) 20 b) 4 c) 40 d) 2.5	**[1]**
3	Potential energy of two equal +ve charges 1μ C each held 1 m apart in air is: a) $9 \times 10^{-3}eV$ b) $9 \times 10^{-3}J$ c) zero d) 1 J	**[1]**
4	A series combination of n_1 capacitors, each of value C_1 is charged by a source of potential difference4V. When another parallel combination of n_2 capacitors, each of value C_2 , is charged by a source of potential difference V, it has the same (total) energy stored in it, as the first combination has. The value of C_2 , in terms of C_1 , is then:	**[1]**

	a) $\frac{2C_1}{n_1 n_2}$ b) $2\frac{n_2}{n_1}C_1$ c) $16\frac{n_2}{n_1}C_1$ d) $\frac{16C_1}{n_1 n_2}$	
5	In the process of charging of a capacitor, the current produced between the plates of the capacitor is: where symbols have their usual meanings. a) $\varepsilon_0 \frac{\mathrm{d}\phi_\mathrm{E}}{\mathrm{dt}}$ b) $\mu_0 \frac{\mathrm{d}\phi_E}{\mathrm{dt}}$ c) $\frac{1}{\mu_0}\frac{\mathrm{d}\phi_E}{dt}$ d) $\frac{1}{\varepsilon_0}\frac{\mathrm{d}\phi_\mathrm{E}}{\mathrm{dt}}$	**[1]**
6	For a charged conductor of arbitrary shape, inside the conductor a) V= 0 and$\mathrm{E} \neq 0$ b) E and V are zero c) E = 0, but V is same as on the surface and non - zero d) E is non - uniform but V is zero everywhere	**[1]**
7	Which of the following is not the property of equipotential surfaces? a) They are concentric spheres for uniform electric fields. b) They can be imaginary spheres. c) They do not cross each other. d) Rate of change of potential with distance on them is zero.	**[1]**
8	The action of the dielectric to increase the capacitance is due to a) neutralization of charges b) electric polarization	**[1]**

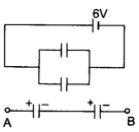
	c) movement of charges to the sides of dielectric d) dipole orienting parallel to the plates	
9	If the potential difference between the plates of a capacitor is increased by 0.1%, the energy stored in the capacitor increases by a) 0.1% b) 0.11% c) 0.2% d) 0.144%	**[1]**
10	The earth has volume V and surface area A, then capacitance would be: a) $12\pi\varepsilon_0 \frac{V}{A}$ b) $4\pi\varepsilon_0 \frac{V}{A}$ c) $4\pi\varepsilon_0 \frac{A}{V}$ d) $12\pi\varepsilon_0 \frac{A}{V}$	**[1]**
11	An electric charge 10^{-3} μ C is placed at the origin (0, 0) of the (x - y)coordinate system. Two points Aand Bare situated at ($\sqrt{2}, \sqrt{2}$) and (2, 0) respectively. The potential difference between points Aand Bwill be a) zero b) 9 volt c) 4.5 volt d) 2 volt	**[1]**
12	0.2 F capacitor is charged to 600 V by a battery, on removing the battery, it is connected with another parallel plate condenser of 1 F. the potential decreases to: a) 300 V b) 100 V c) 600 V d) 120 V	**[1]**

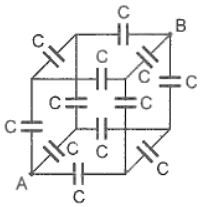
13	A large solid sphere with uniformly distributed positive charge has a smooth narrow tunnel through its centre. A small particle with a negative charge, initially at rest far from the sphere, approaches it along the line of the tunnel, reaches its surface with a speed v, and passes through the tunnel. Its speed at the centre of the sphere will be a) $\sqrt{1.5}v$ b) 0 c) $\sqrt{2}v$ d) v	**[1]**
14	The plates of a parallel plate capacitor are 10 cm apart and have area equal to 2m^2 . If the charge on each plate is $8.85 \times 10^{-10}C$, the electric field at a point a) between the plates will be zero b) outside the plates will be zero c) between the plates will be25NC^{-1} d) between the plates will change from point to point	**[1]**
15	The magnitude of the electric field in the annular region of a charged cylindrical capacitor a) varies as$\frac{1}{r^2}$ where r is the distance from the axis b) varies as$\frac{1}{r}$ where r is the distance from the axis c) is the same throughout d) is higher near the outer cylinder than near the inner cylinder	**[1]**
16	An electrolytic capacitor is marked $8\mu\text{F}$, 220 V. It can be used in a circuit where the p.d. across the capacitor may be a) 200 V b) 300 V c) 1000 V d) 500 V	**[1]**

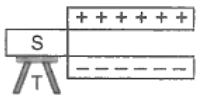
17	A long, hollow conducting cylinder is kept co - axially inside another long, hollow conducting cylinder of a larger radius. Both the cylinders are initially electrically neutral. Which of the following statements is correct based on the above - mentioned condition? a) No potential difference appears between the two cylinders when same charge density is given to both the cylinders. b) A potential difference appears between the two cylinders when a charge density is given to the outer cylinder. c) No potential difference appears between the two cylinders when a uniform line charge is kept along the axis of the cylinders. d) A potential difference appears between the two cylinders when inner cylinder is charged.	**[1]**
18	In a certain charge distribution, all points having zero potential can be joined by a circle S. Points inside S have positive potential and points outside S have negative potential. A positive charge, which is free to move, is placed inside S. a) It will remain in equilibrium b) It may move, but will ultimately return to its starting point c) It must cross S at some time d) It can move inside S, but it cannot cross S	**[1]**
19	Capacitance (in F) of a spherical conductor of radius 1 m is a) 10^{-6} b) $1 \cdot 1 \times 10^{-10}$ c) 10^{-3} d) 9×10^{-9}	**[1]**
20	A parallel plate capacitor is charged to V volt by a battery. The battery is disconnected and the separation between the plates is halved. The new potential difference across the capacitor will be a) $\frac{V}{2}$ b) 2V c) V	**[1]**

	d) $\frac{V}{4}$	
21	Following figure represents a parallel plate capacitor with a grid halfway with the voltages shown; an electron starting from plate P_1 will:  a) not be able to reach the plate P_2 b) reach P_2 with 100 eV kinetic energy c) reach P_2 with 40 eV kinetic energy d) reach P_2 with 140 eV kinetic energy	**[1]**
22	The surface charge density (in C/m^2) of the earth is about: a) 10^9 b) - 10^9 c) 10^{-9} d) - 10^{-9}	**[1]**
23	A parallel plate capacitor is charged by connecting it to a battery. Which of the following will remain constant if the distance between the plates of the capacitor is increased in this situation? a) Energy stored b) Capacitance c) Electric field d) Potential difference	**[1]**
24	Submarine cables act as a) spherical capacitor b) cylindrical capacitor with inner cylinder earthed c) parallel plate capacitor d) cylindrical capacitor with outer cylinder earthed	**[1]**
25	A metal plate of thickness half the separation between the capacitor plates of capacitance C, is inserted between the plates. The new capacitance is	**[1]**

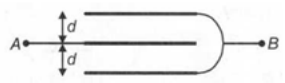
	a) $\frac{C}{2}$ b) zero c) C d) 2C	
26	The capacity of a pure capacitor is 1 farad. In DC circuit, its effective resistance will be a) infinite b) zero c) 1 ohm d) 2 ohm	**[1]**
27	The dimension of $\frac{1}{2}\varepsilon_0 E^2$ where ε_0 is the permittivity of free space and E is the electric field, is a) $ML^{-1}T^{-2}$ b) MLT^{-1} c) ML^2T^{-2} d) ML^2T^{-1}	**[1]**
28	The dielectric constant K of an insulator will be - a) 0.4 b) 4 c) - 4 d) 0	**[1]**
29	A parallel plate air capacitor has capacity C distance of separation between plates is d and potential difference V is applied between the plates. Force of attraction between the plates of the parallel plate air capacitor is a) $\frac{CV^2}{2d}$ b) $\frac{C^2V^2}{2d^2}$	**[1]**

	c) $\frac{C^2V^2}{2d}$ d) $\frac{CV^2}{d}$	
30	A parallel plate capacitor of value 1.77μF is to be designed using a dielectric material (dielectric constant 200, breakdown strength of 3×10^{-6}Vm^{-1}). In order to make such a capacitor, which can withstand a potential difference of 20 V across the plates, the separation d between the plates and the area A of the plates should be a) d = 10^{-5} m, A = 10^{-2} m^2 b) d = 10^{-4} m, A = 10^{-4} m^2 c) d = 10^{-4} m, A = 10^{-5} m^2 d) d = 10^{-6} mand A = 10^{-4} m^2	**[1]**
31	Top of the stratosphere has an electric field E (in units of V/m) nearly equal to: a) 0 b) 10 c) 100 d) 1000	**[1]**
32	Capacitance of a parallel plate capacitor can be increased by a) decreasing the area of plates. b) decreasing the distance between the plates. c) increasing the thickness of the plates. d) increasing the distance between the plates.	**[1]**
33	Two identical parallel - plate capacitors are connected in parallel and joined to a 6 - V battery. The battery is then disconnected and the two capacitors are joined in series, as shown. The potential difference between the mints A and B is  a) 24 V	**[1]**

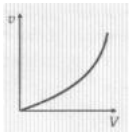
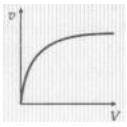
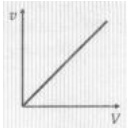
	b) 3 V c) 6 V d) 12V	
34	If a dielectric plate of thickness t is placed between the plates of a parallel plate capacitor of plate distance d, the capacitance becomes half of the original value. The dielectric constant of the plate will be a) $\frac{2t}{2d+t}$ b) $\frac{t}{d-t}$ c) $\frac{t}{d+t}$ d) $\frac{2t}{2d-t}$	**[1]**
35	The equivalent capacity between points A and B shown in the figure is:  a) $\left(\frac{5}{6}\right)C$ b) C c) 30 C d) $\left(\frac{6}{5}\right)C$	**[1]**
36	A charged particle is placed between the two plates of a charged parallel plate capacitor. It experiences a force F. If one plate is removed, then the force on the particle will be a) 2F b) $\frac{F}{2}$ c) Zero d) F	**[1]**

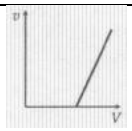
37	The potential at the centre of the sphere, if the hollow metallic sphere of radius 10 cm is charged such that the potential of its surface is 70 V, is a) 35 V b) 7 V c) 70 V d) 100 V	**[1]**
38	Four capacitors each of 25μ F are connected in parallel. The voltmeter across them shows a dc of 200 V. The charge on each plate of capacitor is: a) $\pm 2 \times 10^{-3} C$ b) $\pm 5 \times 10^{-2} C$ c) $\pm 2 \times 10^{-2} C$ d) $\pm 5 \times 10^{-3}\, C$	**[1]**
39	A frictionless dielectric slab S is placed on a frictionless table T near a charged parallel plate capacitor C having frictionless plates as shown in the diagram. The slab is held between them. When the slab is released:  a) none is true b) it would stay on the table c) it would be pulled inside and would come to rest occupying the space in between the plates d) it would be pulled by the capacitor and will move out of the other end	**[1]**
40	A parallel plate capacitor of 1μ Fcapacity is discharging through a resistor. If its energy reduces to half in one second, the value of resistance will be: a) $\frac{9}{\ln(2)}$ MΩ b) $\frac{4}{\ln(2)}$ MΩ c) $\frac{2}{\ln(2)}$ MΩ d) $\frac{16}{\ln(2)}$ MΩ	**[1]**

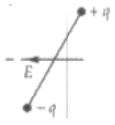
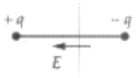
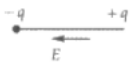
41	A capacitor of capacitance C is fully charged by a 200 V supply. It is then discharged through a small coil of resistance wire embedded in a thermally insulated block of specific heat$2.5 \times 10^2 \text{Jkg}^{-1}\text{K}^{-1}$ and of mass 0.1 kg. If the temperature of the block rises by 0.4 K, what is the value of C? a) 500μF b) 400μF c) 300μF d) 200μF	**[1]**
42	A capacitor of capacitance C_1 is charged upto potential V and then connected in parallel to an uncharged capacitor of capacitance C_2. The final potential difference across each capacitor will be: a) $\left(1+\frac{C_2}{C_1}\right)V$ b) $\left(1-\frac{C_2}{C_1}\right)V$ c) $\frac{C_1V}{C_1+C_2}$ d) $\frac{C_2V}{C_1+C_2}$	**[1]**
43	Two capacitors of capacitances 3μF and 6 μF are charged to a potential of 12 V each. They are now connected to each other, with the positive plate of each joined to the negative plate of the other. The potential difference across each will be a) 3 V b) 4 V c) 6 V d) zero	**[1]**
44	A variable capacitor and an electroscope are connected in parallel to a battery. The reading of the electroscope would be decreased by a) Decreasing the battery potential b) Increasing the area of overlapping of the plates c) Decreasing the distance between the plates d) Placing a dielectric between the plates	**[1]**

45	It is possible to have a positively charged body at a) positive potential b) negative potential c) zero potential d) all of these	**[1]**
46	The equivalent capacity of two capacitors in series is 3μ Fand in parallel is 16 μ F. Their individual capacities are a) 12, 2 b) 12, 4 c) 8, 8 d) 10, 16	**[1]**
47	Three plates of common surface area A are connected as shown in figure. The effective capacitance will be  a) 3ε0 A/D b) ε0 A/D c) $\frac{3}{2}$ ε0 A/D d) 2ε0 A/D	**[1]**
48	Three capacitors each of capacitance C and of breakdown voltage V are joined in series. The capacitance and breakdown voltage of the combination will be: a) 3C, 3V b) $\frac{C}{3}, \frac{V}{3}$ c) $\frac{C}{3}$, 3v d) 3C,$\frac{V}{3}$	**[1]**
49	With the rise in temperature, the dielectric constant K of a liquid: a) increases	**[1]**

	b) decreases c) changes erratically d) remains unchanged	
50	If the diameter of earth is128×10^2 km, then its capacitance will be a) 331μF b) 711μF c) 111μF d) 211μF	**[1]**
51	In series combination of capacitors, potential drops across the individual capacitors is a) inverse ratio of charges stored b) direct ratio of capacitors c) indirect ratio of capacitors d) inverse ratio of capacitors	**[1]**
52	If the charge on a capacitor is increased by 2 coulomb, the energy stored in it increases by 21%. The original charge on the capacitor (in coulomb) is - a) 30 b) 20 c) 40 d) 10	**[1]**
53	The work done in carrying a charge Q once round a circle of radius r with charge q at the centre of the circle is a) $\frac{1}{4\pi\varepsilon_0} \cdot \frac{Q}{r}$ b) $\frac{Q \cdot q}{2r}$ c) $\frac{Q \cdot q}{4\pi\varepsilon_0 r}$ d) zero	**[1]**
54	When a capacitor is connected to a battery,	**[1]**

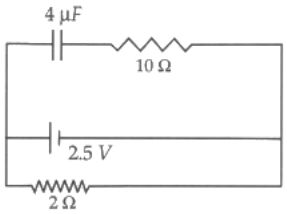
	a) a current flows in the circuit for sometime and then decreases to zero b) the current keeps on decreasing c) the current keeps on increasing d) no current flows in the circuit at all	
55	The ratio of charge to potential of a body is known as a) capacitance b) inductance c) conductance d) resistance	**[1]**
56	The effective capacitance of two capacitors of capacitances C_1 and C_2 (with $C_2 > C_1$) connected in parallel is $\frac{25}{6}$ times the effective capacitance when they are connected in series. The ratio $\frac{C_2}{C_1}$ is a) $\frac{25}{6}$ b) $\frac{5}{3}$ c) $\frac{4}{3}$ d) $\frac{3}{2}$	**[1]**
57	The velocity v acquired by an electron starting from rest and moving through potential difference V is shown by which of the following graphs? a)  b)  c) 	**[1]**

	d) 	
58	The angle between the electric lines of force and an equipotential surface: a) 45° b) 0° c) 180° d) 90°	**[1]**
59	In electrolytic capacitors positive terminal is a) one on which aluminium oxide film is not formed b) one on which aluminium oxide film is formed c) none of the these d) either of the two terminals	**[1]**
60	In a parallel plate capacitor, the distance between the plates is d and potential difference across plates is V. Energy stored per unit volume between the plates of capacitor is a) $\frac{1}{2}\varepsilon_0\frac{V^2}{d^2}$ b) $\frac{1}{2}\frac{V^2}{\varepsilon_0 d^2}$ c) $\frac{1}{2}\varepsilon_0\frac{V^2}{d}$ d) $\frac{Q^2}{2V^2}$	**[1]**
61	Across each of two capacitors of capacitance 1μ Fand 4 μ F, a potential difference of 10 V is applied. Then positive plate of one is connected to the negative plate of the other, and negative plate of one is connected tothe positive plate of the other. After contact: a) charge on each is zero b) charge on each is the same but non - zero c) charge on each is different but zero d) charge on each is different but non - zero	**[1]**

62	A capacitor is charged by connecting a battery across its plates. It stores energy U. Now the battery is disconnected and another identical capacitor is connected across it. Then the energy stored by both capacitors of the system will be: a) $\frac{U}{4}$ b) U c) $\frac{3U}{2}$ d) $\frac{U}{2}$	**[1]**
63	The capacitors, each of4μF are to be connected in such a way that the effective capacitance of the combination is 6μF . This can be achieved by connecting a) Two of them connected in parallel and the combination in series to the third. b) Two of them connected in series and the combination in parallel to the third. c) All three in series d) All three in parallel	**[1]**
64	In which of the states shown in the figure, is potential energy of an electric dipole maximum? a)  b)  c)  d) 	**[1]**
65	A 4μ F capacitor is charged to 400 V. If its plates are joined through a resistance of 2k Ω then heat produced in the resistance is: a) 0.16 J b) 0.64 J	**[1]**

	c) 0.32 J d) 1.28 J	
66	A tin nucleus has a charge + 50 e. If the proton is at 10^{-12} m from the nucleus, then the potential at this position is: (charge on proton = 1.6×10^{-19} Q) a) 7.2×10^{4} V b) 14.4×10^{8} V c) 1.44×10^{4} V d) 7.2×10^{8} V	**[1]**
67	A hollow metal sphere of radius 10 cm is charged such that the potential at its surface is 80 V. The potential at the centre of the sphere is: a) 80 V b) 8 V c) 800 V d) Zero	**[1]**
68	The dielectric constant for metal is: a) 100 b) infinite c) 1000 d) zero	**[1]**
69	Four - point charges - Q, - q, 2q, and 2Q are placed, one at each corner of the square. The relation between Q and q for which the potential at the centre of the square is zero is: a) $Q = -\frac{1}{q}$ b) $Q = \frac{1}{q}$ c) Q = - q d) Q = q	**[1]**
70	A point charge Q is moved along a circular path around another fixed point charge. So, the work done is	**[1]**

	a) always zero b) zero only if Q returns to it's starting position c) zero only if the two charges have the same magnitude d) zero only if the two charges have the same magnitude and opposite signs	
71	Dielectric constant of a medium is also known as: a) permeability b) relative permeability c) relative permittivity d) permittivity	**[1]**
72	In the capacitor of capacitance C, charge Q and energy W is stored. If charge is increased upto 2 Q, the energy stored will be a) 2 W b) $\frac{W}{4}$ c) 4W d) $\frac{W}{2}$	**[1]**
73	If the potential of a capacitor having capacity 8 pF is increased from 10 V to 20 V, then increase in its energy will be: a) 12×10^{-4} J b) 4×10^{-6} J c) 12×10^{-6} J d) 4×10^{-4} J	**[1]**
74	If a unit positive charge is taken from one point to another over an equipotential surface, then: a) no work is done b) work is done on the charge c) work done is constant d) work is done by the charge	**[1]**

75	A capacitor of 4μ Fis connected as shown in the circuit Figure. The internal resistance of the battery is 0.5 Ω .The amount of charge on the capacitor plates will be :  a) 8μ C b) 16μ C c) 4μ C d) 0	**[1]**

PM SHRI Kendriya Vidyalaya No 1 IIT Kharagpur
Session 2026-27
Summer Vacation Holiday Home Work

Teacher Name **Anuj Kumar, PGT CS**

Class- 12 C : Artificial Intelligence

	1.	Solve Question paper of MT-1 and Final Exam of Class 11(2026-27) only Python Programming
	2.	Complete your Notebook in all respect.
	3.	Copy should have Proper cover, Updated index, profile and certificate as per instructions.
	4.	Revise following Chapters: 4. Python Programming-1 (Class 11) 5. Python Programming-2 (Class-12) 6. Read Chapter 2: Data Science
	5.	List down imp methods of following topics: (e) String (f) List (g) Tuple (h) Dictionary
	6.	Write Short Notes on: 7. Use of Indentation 8. Use of Comments 9. Identifier Naming Rules 10. Types of Token 11. Operator Precedence and Associativity Table 12. Data Types of Python
	7.	Syntax of Following: 4. If-elif-else 5. For-loop with break and continue 6. While loop with break and continue
	8.	(c) Write a Python program to make the graph: (d) Write the program on linear regression.(from Book Chapter-1)
	9.	List down imp attributes & methods of following topics: (c) numpy (d) pandas

HOLIDAY HOME WORK FOR SUMMER BREAK

CLASS-XII (MATHS) (2026-27)

CHAPTER-1

RELATIONS AND FUNCTIONS

MULTIPLE CHOICE QUESTIONS

Q.1 Let R be a relation on the set N be defined by $R=\{(x, y) \forall x, y \in N, 2x + y = 41\}$. Then, R is

(a) Reflexive (b) Symmetric (c) Transitive (d) None of these

Q.2 For real numbers x and y, we write $x\ R\ y \leftrightarrow x - y + \sqrt{2}$ is an irrational number. Then, the relation R is

(a) Reflexive (b) Symmetric (c) Transitive (d) None of these

Q.3 The relation $R = \{(1, 1), (2, 2), (3, 3), (1, 2), (2, 3), (1, 3)\}$ on set $A = \{1, 2, 3\}$ is

(a) Reflexive but not symmetric (b) Reflexive but not transitive

(c) Symmetric and transitive (d) Neither symmetric nor transitive

Q. 4 Consider the non-empty set consisting of children in a family and a relation R defined as a R b if a is brother of b. Then R is

(a) symmetric but not transitive

(b) transitive but not symmetric

(c) neither symmetric nor transitive

(d) both symmetric and transitive

Q. 5 Let $P = \{(x, y) : x^2 + y^2 = 1, x, y \in R\}$. Then, P is

(a) Reflexive (b) Symmetric (c) Transitive (d) Anti-symmetric

Q.6 Let S be the set of all real numbers. Then, the relation $R = \{(a, b) : 1 + ab > 0\}$ on S is

(a) Reflexive and symmetric but not transitive

(b) Reflexive and transitive but not symmetric

(c) Symmetric, transitive but not reflexive

(d) Reflexive, transitive and symmetric

Q.7 Let R be the relation in the set Z of all integers defined by $R = \{(x, y) : x - y \text{ is an integer}\}$. Then R is

(a)reflexive (b) symmetric (c) transitive (d) an equivalence relation

Q.8 For the set $A = \{1, 2, 3\}$, define a relation R in the set A as follows

R = {(1, 1), (2, 2), (3, 3), (1, 3)} Then, the ordered pair to be added to R to make it the smallest equivalence relation is

(a) (1, 3) (b) (3, 1) (c) (2, 1) (d) (1, 2)

Q.9 Let A = {1, 2, 3} and R = {(1, 2), (2, 3)} be a relation in A. Then, the minimum number of ordered pairs may be added, so that R becomes an equivalence relation, is

(a) 7 (b) 5 (c) 1 (d)4

Q.10 Let A = {1, 2, 3}. Then, the number of relations containing (1, 2) and (1, 3), which are reflexive and symmetric but not transitive, is

(a) 1 (b) 2 (c) 3 (d) 4

Q.11 Let f : R → R be a function defined by f(x) =x^3+ 4, then f is

(a) Injective (b) Surjective (c) Bijective (d) None of these

Q.12 Let X = {0, 1, 2, 3} and Y = {−1, 0, 1, 4, 9} and a function f :X →Y defined by y =x^2, is

(a)one-one onto (b) one-one into (c) many-one onto (d) many-one into

Q.13 Let g:R→R g(x) = x^2– 4x – 5, then

(a) g is one-one on R (b) g is not one-one on R

(c) g is bijective on R (d) None of these

Q.14 The mapping f : N → Ngiven by f(n) = 1 +n^2 , n ∈ N when N is the set of natural numbers, is

(a) a one-one function (b) an onto function

(c) a bijection (d) neither one-one nor onto

Q.15 The function f: R → R given by f(x) = x^3 − 1 is

(a) a one-one function (b) an onto function

(c) a bijection (d) neither one-one nor onto

Q.16 A function f : X→Y is said to be onto, if for every y ∈ Y, there exists an element x in X such that

(a) f(x) = y (b) f(y) = x (c) f(x) + y = 0 (d) f(y) + x = 0

Q.17 Let R be the relation in the set {1, 2, 3, 4} given by R = {(1, 2), (2, 2), (1, 1), (4, 4), (1, 3), (3, 3), (3, 2)}.

(a) R is reflexive and symmetric but not transitive

(b) R is reflexive and transitive but not symmetric

(c) R is symmetric and transitive but not

(d) R is equivalence relation

Q.18 Let A = {1, 2, 3} and B = {a, b, c}, then the number of bijective functions from A to B are

(a) 2 (b) 8 (c) 6 (d) 4

Q.19 The number of surjective functions from A to B where A = {1, 2, 3, 4} and B = {a, b} is

(a) 14 (b) 12 (c) 2 (d) 15

Q.20 The function f : R → R defined by f (x) = (x – 1) (x – 2) (x – 3) is

(a) one-one but not onto (b) onto but not one-one

(c) both one-one and onto (d) neither one-one nor onto .

QUESTIONS FOR PRACTICE

Q.1 Find the type of relation, which is describes as the relation "less than" in the set of natural numbers.

Q.2 Show that the function f : N → N given by f(x) = 2x is one-one but not onto

Q.3 Show that the function: f : N → N given by f(1) = f(2) = 1 and f(x) = x -1, for every x > 2 is onto but not one-one.

Q.4 If R = {(x, y) : x + 2y = 8} is a relation in N, write the range of R.

Q.5 If the function $f{:}R{\to}A$ given by $(x){=}\frac{x^2}{x^2+1}$ is a surjection, then find A

Q.6 If the relation R is defined by aRb, if and only, if b lives within one kilometer from a, then check if the relation is reflexive, symmetric or transitive.

Q.7 The function $f{:}X{\to}Y$ defined by f(x) =sin$x$ is one-one but not onto, then find X and Y.

Q.8 Let f:R→R be defined by f(x)$=\begin{cases} x & \text{if } x > 3 \\ x^2 & \text{if } 1 < x \le 3 \\ 3x & \text{if } x \le 1. \end{cases}$,Then find the value of f(−1)+f(2)+f(4)

Q.9 On the set of integers Z, define $f{:}Z{\to}Z$ as f(n)$=\begin{cases} \frac{n}{2}\ if\ n = odd \\ 0, if\ n = even \end{cases}$ then Check whether the function is injective or surjective or none.

Qn.10 Find the maximum number of equivalence relations on the set A={1,2,3}

CASE STUDY QUESTIONS

Qn.1 Aman and Ramesh are playing Ludo at home during Covid-19.While rolling the dice, Aman's sister Lata observed and noted the possible outcomes of the throw every time belongs to set {1,2,3,4,5,6}.Let A be the set of players while B be the set of all possible outcomes. Let

A={A,R},B={1,2,3,4,5,6}.Using the information given above, answer the following:

(i) Let R:B→B be defined by R ={(x,y): y =x}is
(a)Reflexive and transitive but not symmetric
(b)Reflexive and symmetric but not transitive
(c)Reflexive but not symmetric and transitive
(d)Equivalence

(ii) Let R :B→B be defined by
R={(1,2)(2,2)(1,3)(3,4)(3,1))(4,3)(5,5)}.Then R is
(a)Symmetric (b) Reflexive
(c) Transitive (d) None of these three

(iii) Let R :B→B be defined by
R={(2,1)(1,2)(2,2)(3,3)(4,4)(5,5)(6,6)},then R is
(a)Symmetric (b) Reflexive and Transitive (c) Transitive and symmetric (d) Equivalence

(iv) Lata wants to know the number of relations possible from A to B .How many relations are possible?
a)36 (b) 64 (c) 6! (d) 2^{12}

(v) Lata wants to know the number of functions from A→B, How many numbers of functions are possible?
(a)36 (b) 64 (c) 6! (d) 2^{12}

Q.2 Ved visited the exhibition along with her family. The exhibition had a huge swing which attracted many children. Ved found that the swing traced the path of a parabola as given by y=x^2 .Answer the questions, using the above information:

(i) Let f: R→R be defined by f(x)= x^2 is ……
(a) Neither surjective nor injective (b) surjective
(c) Injective (d) Bijective

(ii) Let f: N→N be defined by f(x)= x^2 is……..
(a) Surjective but not injective (b) Surjective
(c) Injective (d) Bijective

(iii) Let f:{1,2,3,…….}→ $\{1,4,9,\ldots\}$ be defined by f(x).Then f(x)= x^2
(a) Surjective but not injective (b) Neither surjective nor injective
(c) Injective but not surjective (d) Bijective

(iv) Let f: N→R be defined by f(x)= x^2 .Then, range of the function among the following is ……

(a) $\{1,4,9,16\ldots\}$ (b) $\{1,4,8,9,10\ldots\}$
(c) $\{1,4,9,15,16,\ldots\}$ (d) $\{1,4,8,16,\ldots\}$

(v) If the function f: Z→Z be defined by f(x)= x^2 is ……
(a) Neither surjective nor injective (b) surjective
(c) Injective (d) Bijective

CHAPTER:2 (INVERSE TRIGONOMETRIC FUNCTIONS)

MULTIPLE CHOICE QUESTIONS

Q1 Which of the following is the principal value branch of $\text{cosec}^{-1}\,x$?

(a) $(-\frac{\pi}{2},\frac{\pi}{2})$ (c) $[-\frac{\pi}{2},\frac{\pi}{2}]$

(b) $(0,\pi)-\{\frac{\pi}{2}\}$ (d) $[-\frac{\pi}{2},\frac{\pi}{2}]-\{0\}$

Q2 The value of $\cos^{-1}\left[\cos\left(-\frac{\pi}{3}\right)\right]$=…..

(a) $-\frac{\pi}{3}$ (b) $\frac{\pi}{3}$ (c) $\frac{4\pi}{3}$ (d) $\frac{2\pi}{3}$

Q3 The value of $\cos^{-1}\left[\cos\left(\frac{4\pi}{3}\right)\right]$=…..

(a) $\frac{\pi}{3}$ (b) $\frac{2\pi}{3}$ (c) $\frac{4\pi}{3}$ (d) $-\frac{\pi}{3}$

Q4 The value of $\sin^{-1}\left[\sin\left(\frac{5\pi}{3}\right)\right]$=…..

(a) $-\frac{\pi}{3}$ (b) $\frac{5\pi}{3}$ (c) $\frac{\pi}{3}$ (d) $\frac{2\pi}{3}$

Q 5 Value of $\cos\left[\frac{\pi}{6}+\cos^{-1}\left(-\frac{1}{2}\right)\right]=\cdots$

(a) $-\frac{\sqrt{3}}{2}$ (b) $\frac{\sqrt{3}-1}{2\sqrt{2}}$ (c) $\frac{\sqrt{5}-1}{4}$ (d) $\frac{\sqrt{3}+1}{2\sqrt{2}}$

Q 6 Which of the following is the principal value branch of $\cos^{-1}\,x$?

(a) $\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$ (b) $(0,\pi)$ (c) $[0,\pi]$ (d) $(0,\pi)-\{\frac{\pi}{2}\}$

Q 7 $\cos\left[\tan^{-1}\left\{\cot\left(\sin^{-1}\frac{1}{2}\right)\right\}\right]=\cdots$

(a) 1 (b) $1/\sqrt{2}$ (c) $\sqrt{3}/2$ (d) $1/2$

Q 8 Domain of $\sin^{-1}x$ *is*

(a) $[0,1]$ (b) $(-\infty,\infty)$ (c) $[0,\pi]$ (d) $[-1,1]$

Q 9 $\sin\left[\tan^{-1}(-\sqrt{3})+\cos^{-1}\left(-\frac{\sqrt{3}}{2}\right)\right]=\cdots$

(a) 1 (b) -1 (c) 0 (d) 2

Q10 If $\tan^{-1} x > \cot^{-1} x$ *then* ...

(a)$x > 1$ (b)$x < 1$ (c) $x = 1$ (d)$x \in R$

Q11 $\cos\left(\frac{\pi}{3} + \cos^{-1}(-1)\right) = \cdots$

(a) $1/2$ (b)$-1/2$ (c) 1 (d)-1

Q 12 $\sin\left\{\frac{\pi}{3} - \sin^{-1}\left(\left(-\frac{1}{2}\right)\right)\right\}$

(a) 0 (b)$\frac{1}{2}$ (c) $\frac{\sqrt{3}}{2}$ (d)1

Q13 The value of $\sin^{-1}\left[\sin\left(\frac{7\pi}{6}\right)\right]$=.....

(a) $\frac{\pi}{6}$ (b)$\frac{5\pi}{6}$ (c) $-\frac{\pi}{6}$ (d)$\frac{7\pi}{6}$

Q14 $\cos^{-1}\left(\frac{\sqrt{3}}{2}\right) + 2\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$ is

(a) $\frac{5\pi}{6}$ (b)$\frac{\pi}{4}$ (c) $\frac{4\pi}{3}$ (d)$\frac{4\pi}{6}$

Q15 The value of $2\sec^{-1}(2) + \sin^{-1}\left(\frac{1}{2}\right)$ is .....

(a) $\frac{\pi}{6}$ (b) $\frac{5\pi}{6}$ (c) $\frac{7\pi}{6}$ (d) 1

Q16 The value of $\sin^{-1}\left[\cos\left(\frac{33\pi}{5}\right)\right]$ is.....

(a) $\frac{3\pi}{5}$ (b) $\frac{-7\pi}{5}$ (c) $\frac{\pi}{10}$ (d) $\frac{-\pi}{10}$

Q 17 The value of $\tan^{-1}\left[\tan\left(\frac{7\pi}{4}\right)\right]$=.....

(a) $-\frac{\pi}{4}$ (b) $\frac{\pi}{4}$ (c) $\frac{3\pi}{4}$ (d)$-\frac{3\pi}{4}$

Q 18 If $\sin^{-1} x = y, then$

(a) $-\frac{\pi}{2} < y < \frac{\pi}{2}$ (b) $-\frac{\pi}{2} \leq y \leq \frac{\pi}{2}$ (c) $0 < y < \pi$ (d) $0 \leq y \leq \pi$

Q 19 The solution set of $\sin^{-1} x \leq \cos^{-1} x$ *is*

(a) $\frac{1}{\sqrt{2}} \leq x \leq 1$ (b)$-\frac{1}{\sqrt{2}} \leq x \leq 1$

(c) $-1 \leq x \leq 1$ (d)$-\frac{1}{\sqrt{2}} \leq x \leq \frac{1}{\sqrt{2}}$

Q 20 The domain of the function $\cos^{-1}(2x - 1)$is .....

(a) $[0,1]$ (b) $[-1,1]$ (c) $[0,1/2]$ (d) $[0,\pi]$

QUESTIONS FOR PRACTICE

Q 1 Write the value of $\tan^{-1}\left[2\sin\left(2\cos^{-1}\frac{\sqrt{3}}{2}\right)\right]$

Q 2 Write the value of $\tan^{-1}[2\sin(2\cos^{-1}\frac{\sqrt{3}}{2})]$

Q 3 Prove that: $\sec^2(\tan^{-1}2) + \text{cosec}^2(\cot^{-1}3) = 15$.

Q 4 Prove that $\tan^{-1}\left[2sin\left(2\cos^{-1}\frac{\sqrt{3}}{2}\right)\right] = \frac{\pi}{3}$

Q 5 Express $\tan^{-1}\left(\frac{3x-x^3}{1-3x^2}\right)$ in simplest form.

Q 6 Write $\tan^{-1}\left[\frac{\sqrt{1+x^2}-1}{x}\right]$ in simplest form.

Q 7 Write $\tan^{-1}\left[\frac{\cos x-\sin x}{\cos x+\sin x}\right]$ in the simplest form

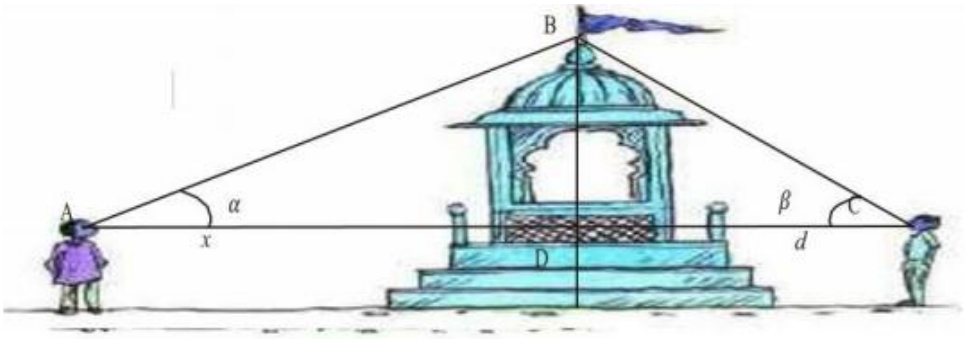
Q 8 Write the following function in the simplest form: $\tan^{-1}\left[\frac{cosx}{1+sinx}\right]$

Q 9 Find the domain of $y = \cos^{-1}(x^2 - 4)$

Q 10 $\cot^{-1}\left(\frac{\sqrt{1+\sin x}+\sqrt{1-\sin x}}{\sqrt{1+\sin x}-\sqrt{1-\sin x}}\right) = \cdots \quad (0 < x < \frac{\pi}{2})$

CASE STUDY QUESTIONS

CASE STUDY: 1



Two men on either side of a temple of 30 meters high observe its top at the angles of elevation α and β respectively. (As shown in the figure above). The distance between the two men is 40√3 meters and the distance between the first person A and the temple is 30√3 meters.

Based on the above information answer the following:

Q 1 $\angle CAB = \alpha = \ldots$

(a)$\sin^{-1}\left(\frac{2}{\sqrt{3}}\right)$ (b) $\sin^{-1}\left(\frac{1}{2}\right)$ (c)$\sin^{-1}(2)$ (d)$\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$

Q 2 $\angle CAB = \alpha = \ldots$

(a)$cos^{-1}\left(\frac{1}{5}\right)$ (b)$\cos^{-1}\left(\frac{2}{5}\right)$ (c)$cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$ (d)$cos^{-1}\left(\frac{4}{5}\right)$

Q 3 $\angle BCA = \beta = \ldots$

(a)$\tan^{-1}(\frac{1}{2})$ (b)$\tan^{-1}(2)$ (c)$\tan^{-1}\frac{1}{\sqrt{3}}$ (d)$\tan^{-1}\sqrt{3}$

Q 4 $\angle ABC =$

(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{6}$ (c) $\frac{\pi}{2}$ (d) $\frac{\pi}{3}$

Q 5 Domain and range of $cos^{-1}x =$

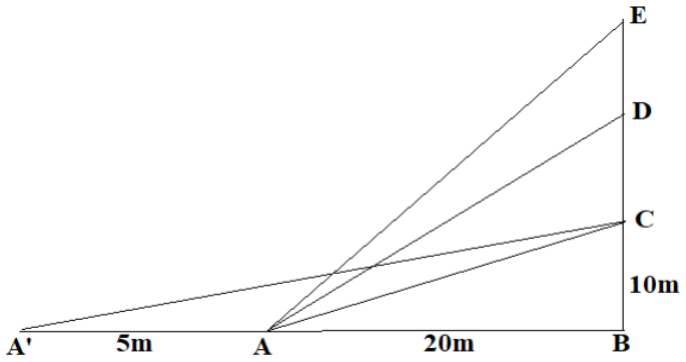
(a)$(-1,1),(0,\pi)$ (b)$[-1,1],(0,\pi)$

(c)$[-1,1],[0,\pi]$ (d)$(-1,1),\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$

CASE STUDY: 2

The Government of India is planning to fix a hoarding board at the face of a building on the road of a busy market for awareness on COVID-19 protocol. Ram, Robert and Rahim are the three engineers who are working on this project. "A" is considered to be a person viewing the hoarding board 20 metres away from the building, standing at the edge of a pathway nearby. Ram, Robert and Rahim suggested to the firm to place the hoarding board at three different locations namely C, D and E. "C" is at the height of 10 metres from the ground level. For the viewer A, the angle of elevation of "D" is double the angle of elevation of "C" The angle

of elevation of "E" is triple the angle of elevation of "C" for the same viewer.
Look at the figure given and based on the above information answer the following:



Q 1 Measure of $\angle CAB$ =

(a)$\tan^{-1} 2$ (b)$\tan^{-1}(\frac{1}{2})$ (c)$\tan^{-1} 1$ (d)$\tan^{-1} 3$

Q 2 Measure of $\angle DAB$ =

(a)$\tan^{-1} \frac{3}{4}$ (b)$\tan^{-1}(3)$ (c)$\tan^{-1} \frac{4}{3}$ (d)$\tan^{-1} 4$

Q 3 Measure of $\angle EAB$ =

(a)$\tan^{-1} 11$ (b)$\tan^{-1}(3)$ (c)$\tan^{-1} \frac{2}{11}$ (d)$\tan^{-1} \frac{11}{2}$

Q 4 A' is another viewer standing on the same line of observation across the road. If the width of the road is 5 meters, then the difference between $\angle CAB$ and $\angle CA'B$ is

(a)$\tan^{-1}\left(\frac{1}{2}\right)$ (b) $\tan^{-1}\left(\frac{1}{8}\right)$

(c)$\tan^{-1} \frac{2}{5}$ (d)$\tan^{-1} \frac{11}{21}$

Q 5 Domain and range of $\tan^{-1} x =$

(a)$R^+, \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ (b)$R^-, \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

(c)$R, \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ (d)$R, \left(0, \frac{\pi}{2}\right)$

SUMMER VACATION HOME WORK

BIOLOGY (CLASS XII)

1.Practice the following diagrams of NCERT Biology textbook 5 times in a separate notebook:

Fig. 2.3, 2.5, 2.7, 2.8, 2.13, 2.14, 2.15, 3.1, 3.2, 3.3, 3.5, 3.6, 3.7, 3.8, 3.9, 3.10, 3.11, 3.12, 6.1, 6.2, 6.3, 6.4, 6.8, 6.9, 6.10, 6.11, 6.12, 6.13, 6.14, 7.1, 7.8, 8.1, 8.4, 8.6, table 9.1, 9.2, fig. 11.1, 11.2, 11.4, 11.6, 11.7, 12.3, 13.4, 14.1, 14.5, 14.6, 14.7, 16.1, 16.2, 16.3, 16.5, 16.6, 16.7.

2. Thoroughly read, understand, learn and practise Lesson-2 Sexual Reproduction in Flowering Plants. Lesson-3 Human Reproduction,Lesson -3 Reproductive Health (Complete the udemy course for which the link will be provided. Do all quizzes and assignment.)

3. Self-study chapters Chapter-8 Human Health and diseases, Chapter-10 Microbes in human welfare, Chapter-16 Environmental Issues. Read and do the NCERT Exercise Questions. (There will be a test post summer vacation of the self-study chapters)

4. Completion of the investigatory project on any topic of Biology as per the following format-

- Certificate
- Acknowledgement
- Title
- Index
- Objectives of the Project
- Introduction
- Material Required
- Procedure
- Observation
- Result
- Conclusion
- Appendices

(Case studies/ Photographs/Reports/ log book etc.)

- Bibliography

5. Complete Biology notebook and practical file till the syllabus covered in class

6. Visit to a wildlife sanctuary/ national park/botanical garden/ biodiversity park/biosphere reserve/ sacred groove. (Any one) Write a report on the observations made during your visit.

7. Collect one news related to science, environment or climate change, biotechnology, new research in field of medical sciences, etc. once a week from the newspaper during summer vacation. Paste the newspaper cutting and write in your own words for 7-8 weeks.

8. Prepare a career trajectory for yourself. Write a brief report on your personality (SWOT-Strength, Weaknesses, Opportunities and Threats), think about your aptitude, academic achievement, interest, temperament, match them with occupations suitable to you by preparing

PM SHRI Kendriya Vidyalaya No. 1 (IIT) Kharagpur

Session: 2026-27

Summer Vacation

Holiday Home Work

Subject: Biotechnology **Class- XII C**

1. Solve extra questions of the following chapters from Student Support Material in notebook
    a. Chapter 1- Recombinant DNA Technology
    b. Chapter 2- Protein Structure and Engineering
2. Solve Monthly Test Question paper in notebook
3. Investigatory Projects- Start Literature survey and prepare your work plan
4. Complete the practical – writing.
5. Art Integration- Prepare a short explainer video on any of the topics of chapter 1or 2. You may also create an animation. Use your imagination.