

KENDRIYA VIDYALAYA SANGATHAN RANCHI REGION

PRE BOARD EXAMINATION (2024-25)

CLASS XII PHYSICS (042)

Maximum Marks: 70

Time allowed: 3 hours

General Instructions:

- (1) There are 33 questions in all. All questions are compulsory.
- (2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
- (3) All the sections are compulsory.
- (4) **Section A** contains **sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, Section B** contains **five questions of two marks each, Section C** contains **seven questions of three marks each, Section D** contains **two case study-based questions of four marks each** and **Section E** contains **three long answer questions of five marks each.**
- (5) There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each CBQ in Section D and all three questions in Section E. You have to attempt only one of the choices in such questions.
- (6) Use of calculators is not allowed.
- (7) You may use the following values of physical constants where ever necessary
 - (i) $c = 3 \times 10^8$ m/s
 - (ii) $m_e = 9.1 \times 10^{-31}$ kg
 - (iii) $m_p = 1.7 \times 10^{-27}$ kg
 - (iv) $e = 1.6 \times 10^{-19}$ C
 - (v) $\mu_0 = 4\pi \times 10^{-7}$ T m A⁻¹
 - (vi) $h = 6.63 \times 10^{-34}$ J s
 - (vii) $\epsilon_0 = 8.854 \times 10^{-12}$ C² N⁻¹ m⁻²
 - (viii) Avogadro's number = 6.023×10^{23} per gram mole

[SECTION - A]

(16X1=16 marks)

Q1. A uniform electric field pointing in positive X-direction exists in a region. Let A be the origin, B be the point on the X-axis at $x = +1$ cm and C be the point on the Y-axis at $y = +1$ cm. Then the potential at points A, B and C satisfy.

- (a) $V_A < V_B$ (b) $V_A > V_B$. (c) $V_A < V_C$ (d) $V_A > V_C$

Q2. Which of the following metals is used for making standard resistors?

- (a) Copper (b) Iron (c) Manganin (d) Silver

Q3. The conversion of a moving coil galvanometer into a voltmeter is done by

- (a) introducing a resistance of large value in series.
- (b) introducing a resistance of small value in parallel.
- (c) introducing a resistance of large value in parallel.
- (d) introducing a resistance of small value in series.

Q4. Calculate the mutual inductance between two coils if a current 10 A in the primary coil changes the flux by 500 Wb per turn in the secondary coil of 200 turns.

- (a) 10 H
- (b) 10^4 H
- (c) 1000 H
- (d) 100 H

Q5. Correct match of column I with column II is

Column-I (waves)

Column-II (Production)

(1) Infra-red

P. Rapid vibration of electrons in aerials

(2) Radio

Q. Electrons in atoms emit light when they move from higher to lower energy level.

(3) Light

R. Klystron valve

(4) Microwave

S. Vibration of atoms and molecules

(a) 1-P, 2-R, 3-S, 4-Q

(b) 1-S, 2-P, 3-O, 4-R

(c) 1-Q, 2-P, 3-S, 4-R

(d) 1-S, 2-R, 3-P, 4-Q

Q6. Waves in decreasing order of their wavelength are

- (a) radio waves, ultraviolet rays, visible rays, X-rays
- (b) radio waves, visible rays, infrared rays, X-rays
- (c) radio waves, infrared rays, visible rays, X-rays
- (d) X-rays, infrared rays, visible rays, radio waves

Q7. The diffraction effect can be observed in

- (a) sound waves only
- (b) light waves only
- (c) ultrasonic waves only
- (d) sound waves as well as light waves

Q8. A point object is placed at the centre of a glass sphere of radius 6 cm and refractive index 1.5. The distance of virtual image from the surface of the sphere is

- (a) 2 cm
- (b) 4 cm
- (c) 6 cm
- (d) 12 cm

Q9. The stopping potential in an experiment on the photoelectric effect is 1.5 V. What is the maximum kinetic energy of the photo electrons emitted?

- (a) 1.5 eV
- (b) 3 eV
- (c) 4.5 eV
- (d) 6 eV

Q10. Two point charges A and B, having charges +Q and -Q respectively, are placed at certain distance apart and force acting between them is F. If 25% charge of A is transferred to B, then the force between the charges becomes

- (a) $9F/16$
- (b) $16F/9$
- (c) $4F/3$
- (d) F

Q11. The ratio of the energies of the hydrogen atom in its first to second excited state is:

- (a) $1/4$
- (b) $4/9$
- (c) $9/4$
- (d) 4

Q12. The process in which two light nuclei combine to form a heavier nucleus is called:

- (a) Fission
- (b) Fusion
- (c) Radioactive decay
- (d) Beta decay

For Questions 13 to 16, two statements are given –one labeled Assertion (A) and other labeled Reason (R). Select the correct answer to these questions from the options as given below.

- A. If both Assertion and Reason are true and Reason is the correct explanation of Assertion.
 B. If both Assertion and Reason are true but Reason is not the correct explanation of assertion.
 C. If Assertion is true but Reason is false.
 D. If both Assertion and Reason are false.

Q13. Assertion (A): de Broglie's wavelength of a freely falling body keeps decreasing with time.

Reason (R): The momentum of the freely falling body increases with time.

Q14. Assertion (A): The magnetic field produced by a current - carrying solenoid is independent of its cross sectional area.

Reason (R): The magnetic field inside the solenoid is uniform.

Q15. Assertion (A): In Young's double slit experiment, the fringes width for dark fringe is same as that for bright fringes.

Reason (R): In Young's double slit experiment, when the fringes are formed with a source of white light , then only dark and bright fringes are formed.

Q16. Assertion (A): The electrical conductivity of a semiconductor increases on doping.

Reason (R): Doping always increases the number of electrons in the semiconductor.

[SECTION – B]

(5x2=10 marks)

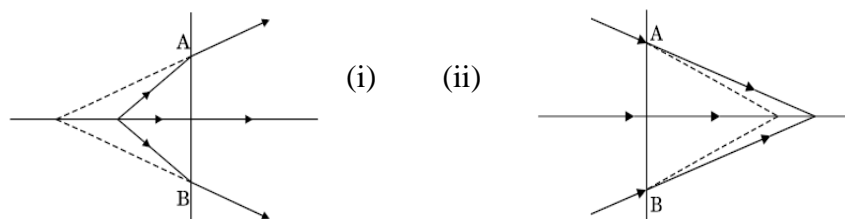
Q17. Draw a graph showing the variation of resistance of a metal wire as a function of its diameter keeping its length and material constant.

Q18. State the Lorentz's magnetic force and express it in vector form. Which pair of vectors are always perpendicular to each other ?

OR,

Two particles of equal masses have equal charges. Both these particles moving with velocities V_1 and V_2 respectively in the same direction enter the same magnetic field acting normally to the direction of their motion. If the two forces F_1 and F_2 acting on them are in the ratio of 1:2, find the ratio of their velocities.

Q19. The line AB in the ray diagram represents a lens. State with reason whether the lens is convex or concave ?



Q20. A platinum surface having work function 5.63 eV is illuminated by a monochromatic source of 1.6×10^{15} Hz. What will be the minimum wavelength associated with the ejected electron.

Q21. What are nuclear forces ? State any two characteristic properties of nuclear forces.

[SECTION – C]

(7x3=21 marks)

Q22. (i) An electric dipole is held in a uniform electric field. Using suitable diagram show that it does not undergo any translatory motion. Derive the expression for the torque acting on it.

(ii) What would happen if the field is non-uniform ?

(iii) What would happen if the external electric field is increasing

(a) parallel to **p** and (b) anti-parallel to **p** ?

Q23. Three capacitors of capacitances 2 pF, 3 pF and 4 pF are connected in parallel.

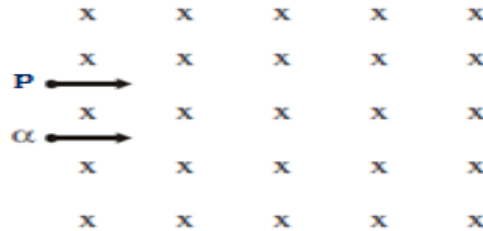
(a) Draw the circuit diagram and find the total capacitance of the combination?

(b) Determine the charge on each capacitor if the combination is connected to a 100 V supply.

Q24. An alpha particle and a proton moving with the same speed, enter the same magnetic field region at right angles to the direction of the field.

(i) Show the trajectories followed by the two particles in the region of the magnetic field.

(ii) Find the ratio of the radii of the circular paths which the two particles may describe.



Q25. . Using Huygen's construction draw a figure showing the propagation of a plane wavefront reflecting at a plane surface. Show that the angle of incidence is equal to the angle of reflection.

OR

Derive Snell's law on the basis of Huygen's wave theory when light is travelling from a rarer to a denser medium/ Denser to rarer medium.

Q26. (i) Draw a labelled ray diagram of a compound microscope when image is formed at least distance of distinct vision.

(ii) Define its magnifying power

(iii) Deduce the expression for the magnifying power of the microscope.

Q27. The circuit shown in the figure consists of two diodes each with a forward resistance of 50Ω and infinite backward resistance. Find the current through 100Ω resistance for the given circuits.

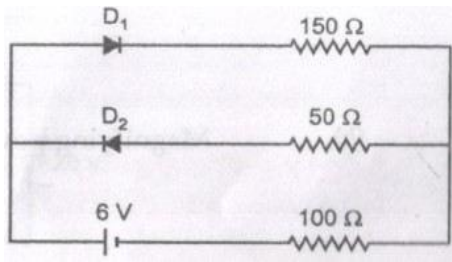


Figure 1

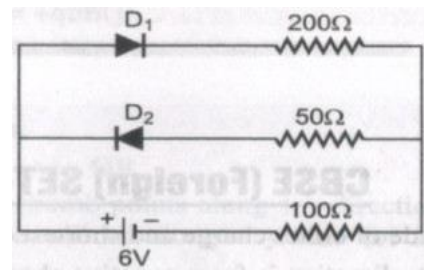


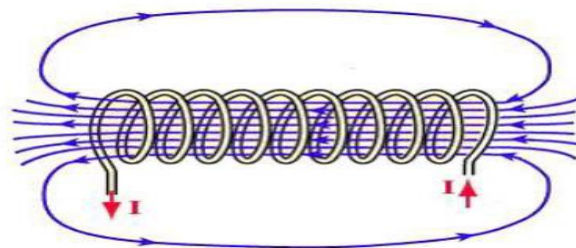
Figure 2

Q28. Draw a labeled circuit diagram of a junction diode as a full wave rectifier. Explain its underlying principle and working. Depict the input and output wave forms.

[SECTION D]

(2x4=08 marks)

Q29. As shown in the figure a solenoid where the wire is coiled around a cylinder, each wire loop in this coil acts as if it was a separate circular wire carrying the same current I , the current in the coiled wire and the dense enough array of such loops may be approximated by a cylindrical current sheet with the current density $K = I \times (N/L) = I \times L(\text{loops}) / \text{solenoid length}$. For simplicity, let's assume a long solenoid (length \gg diameter) which we approximate as infinitely long. For a long solenoid (compared to its diameter), the magnetic field inside the solenoid is approximately uniform and approximately parallel to the axis, except near the ends of the solenoid. Outside the solenoid, the magnetic field looks like the field of a physical dipole, with the North pole at one end of the solenoid and the South pole at the other end and is approximately negligible.



(i) Which of the following material can be used to make loops around the cylinder?

- (a) Plastic (b) Glass (c) Quartz (d) copper

(ii) The magnetic field inside the solenoid is :

- (a) Non-Uniform and parallel to the axis (b) Uniform and parallel to the axis
 (c) Non-uniform and perpendicular to the axis (d) Uniform and perpendicular to the axis

(iii). A proton is moving from left to right direction and outside the solenoid, then what is the direction of force on the proton?

- (a) upwards (b) downwards (c) proton will not deflect (d) inwards

(iv) How the magnetic field inside the solenoid depends upon the number of turns?

- (a) inversely proportional (b) directly proportional
 (c) proportional to the number of turns (d) none of these

OR,

The direction of magnetic field due to a solenoid can be determined by

- (a) Ohm's Law (b) Fleming's left-hand rule
(c) Ampere's Right-hand rule (d) Biot-savart's Law

Q30. Minimum energy required to emit the electron from the surface of conductor is called work function (W or ϕ_0). It is measured in eV (electron volt). 1 eV- The energy gained by an electron when it is accelerated by a potential difference of 1 volt. Methods of electron emission- (i) Thermionic emission, (ii) Field emission, (iii) Secondary emission, (iv) Photoelectric emission Work function (ϕ_0)- The minimum energy that must be supplied to liberate the most weakly bound surface electrons from a metal without giving them any velocity is called the work function of the metal. Work function is measured in electron volt (eV). Work function depends on the properties of metal and the nature of its surface.

(i) Photoelectric emission occurs only when the incident light has more than a certain
(a) power (b) wavelength (c) intensity (d) none of these

(ii) Light of wavelength λ falls on a metal having work function hc/λ_0 . Photoelectric effect will take place only if:

- (a) $\lambda \geq \lambda_0$ (b) $\lambda \geq 2\lambda_0$ (c) $\lambda \leq \lambda_0$ (d) $\lambda = 4\lambda_0$

(iii) radio transmitter operates at a frequency 880 kHz and a power of 10 kW. The number of photons emitted per second

- (a) 1.72×10^{31} (b) 1.327×10^{25} (c) 1.327×10^7 (d) 1.327×10^{45}

(iv) The threshold wavelength for photoelectric emission for a material is 3900 \AA Photo-electrons will emitted when this material is illuminated with monochromatic radiation from:

- (a) 50 W infrared lamp (b) 1 W infrared lamp
(c) 1W ultraviolet lamp (d) none of these

OR,

1 eV is the energy gained by an electron when it is accelerated by a potential difference of 1 volt. Its value in joule is

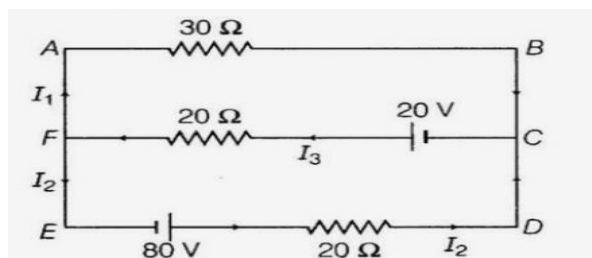
- (a) 1.6×10^{-15} (b) 1.6×10^{-19} (c) 2.6×10^{-19} (d) none of these

[SECTION E]

(3X5 = 15)

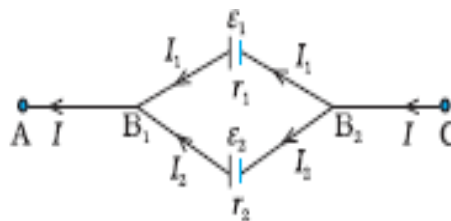
Q.31 (i) State Kirchoff's rules in electrostatics and explain on what basis they are justified ?

(ii) Determine the values of I_1 , I_2 and I_3 in the circuit given below.



OR,

- (i) Define internal resistance of a cell. Write any two factors on which it depends.
(ii) Two cells of emfs E_1 and E_2 and internal resistances r_1 and r_2 are connected in parallel as shown in the figure.



- (iii) Deduce an expression for the
(a) equivalent emf of the combination
(b) equivalent internal resistance of the combination
(c) potential difference between the points A and C

Q32. (i) Explain with the help of a labelled diagram, the principle and working of an ac generator and obtain expression for the emf generated in the coil.

- (ii) Draw a schematic diagram showing the nature of the alternating emf generated by the rotating coil in the magnetic field during one cycle.

OR,

- (i) Draw a schematic diagram of a step up/step down transformer. Explain its working principle. Deduce the expression for the secondary to primary voltage in terms of the number of turns in the two coils.
(ii) Describe briefly any two energy losses, giving the reason of their occurrence in actual transformer. How are these reduced?

Q33.(i) Derive expression for the lens maker's formula using necessary ray diagrams. Also state the assumptions in deriving the above relation and the sign conventions used.

- (ii) A double convex lens is made of a glass of refractive index 1.55, with both faces of the same radius of curvature. Find the radius of curvature required, if the focal length is 20 cm.

OR,

- (i) Draw a labelled ray diagram of an astronomical telescope when the final image is formed at least distance of distinct vision.
(ii) Define its magnifying power and deduce the expression for the magnifying power of telescope.
(iii) You are given the following three lenses. Which two lenses will you use as an eyepiece and as an objective to construct an astronomical telescope? Give reason.

Lenses	Power (D)	Aperture (cm)
L_1	3	8
L_2	6	1
L_3	10	1