**SR GLOBAL SCHOOL**

**PRE BOARD EXAM-I (2022-2023)**

**CLASS- XII**

**SUBJECT- PHYSICS**

**Time: 3:00 Hours M.M.: 70**

**GENERAL INSTRUCTIONS:**

* **There are 35 questions in all. All questions are compulsory**
* **This question paper has five sections: Section A, Section B, Section C, Section D and Section E. All the sections are compulsory.**
* **Section A contains eighteen MCQ of 1 mark each, Section B contains seven questions of two marks each, Section C contains five questions of three marks each, section D contains three long questions of five marks each and Section E contains two case study based questions of 4 marks each.**
* **There is no overall choice. However, an internal choice has been provided in section B, C, D and E. You have to attempt only one of the choices in such questions. 5. Use of calculators is not allowed**

**SECTION-A (1mark)**

Q1. An isolated point charge produce an electric field with magnitude E at a point 2 m away from the charge a point at which the field magnitude is E/ 4 is

(a) 1 m away from the charge (b) 0.5 m away from the charge

(c) 2 meter away from the charge (d) 4 m away from the charge

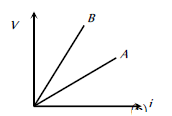
Q2. The equipotential surface associated with an isolated point charge are

(a) Radially outward from the charge (b) Vertically plane

(c) Horizontal plane (d) Concentric sphere centered at the charge

Q3. The electric field E, current density J and conductivity of a conductor are related as

(a) = E / j (b) = j E (c) = j/E (d) = 1 / jE

Q4. V-i graphs for parallel and series combination of two identical resistors are as shown in figure. Which graph represents parallel combination

(a) A (b) B (c) A and B both (d) Neither A nor B

Q5. Which of the following statement is wrong

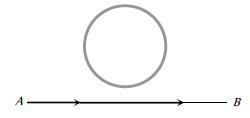
(a) Voltmeter should have high resistance

(b) Ammeter should have low resistance

(c) Ammeter is placed in parallel across the conductor in a circuit

(d) Voltmeter is placed in parallel across the conductor in a circuit

Q6. An electron moves along the line AB, which lies in the same plane as a circular loop of conducting wires as shown in the diagram. What will be the direction of current induced if any, in the loop?



(a) No current will be induced

(b) The current will be clockwise

(c) The current will be anticlockwise

(d) The current will change direction as the electron passes by

Q7. In general in an alternating current circuit

(a) The average value of current is zero

(b) The average value of square of the current is zero

(c) Average power dissipation is zero

(d) The phase difference between voltage and current is zero

**Q8. In electromagnetic waves the phase difference between electric and magnetic field vectors are**  
(a) zero (b) 𝜋/4 (c) 𝜋/2 (d) π

Q9. **The quantity represents**  
(a) speed of sound (b) speed of light in vacuum  
(c) speed of E.M. waves (d) inverse of speed of light in vacuum

Q10. The refractive indices (R.I.) of glass and water with respect to air are 3/2 and 4/3 respectively. The R.I. of glass w.r. t. water is:  
(a) 8/9 (b) 9/8 (c) 7/6 (d) 2

Q11. When light travels from one medium to another, which of the following does not change?  
(a) Frequency (b) refractive index  
(c) velocity (d) wavelength

Q12. The magnifying power of a compound microscope increases when

(a) The focal length of objective lens is increased and that of eye lens is decreased

(b) The focal length of eye lens is increased and that of objective lens is decreased

(c) Focal lengths of both objective and eye-piece are increased

(d) Focal lengths of both objective and eye-piece are decreased

Q13. Two thin lenses are in contact and the focal length of the combination is 80 cm. If the focal length of one lens is 20 cm, then the power of the other lens will be

(a) 1.66 D (b) 4.00 D (c) – 100 D (d) – 3.75

Q14. Two slits in Young’s double slit experiment have widths in the ratio 81 :1. The ratio of the amplitudes of light waves is

(a) 3 :1 (b) 3 : 2 (c) 9 :1 (d) 6:1

Q15. **When a light of suitable frequency illuminates a metal surface, electrons are emitted from the metal surface, this process is called as**

(a) Thermionic emission (b) Field emission

(c) Photoelectric emission (d) Nucleonic emission

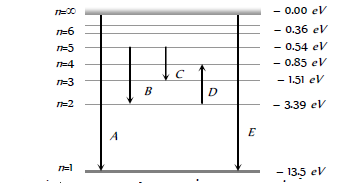
Q16.  **Which of the following statements is true about Bohr’s atomic model?**  
(a) The electron can only move in particular orbits only  
(b) An electron radiates energy only when it jumps to another orbit  
(c) An atom consists of a positively charged nucleus  
(d) All of the above

Q17. The energy levels of the hydrogen spectrum is shown in figure. There are some transitions A, B, C, D and E. Transition A, B and C respectively represent

(a) First member of Lyman series, third spectral line of Balmer series and the second spectral line of Paschen series

(b) Ionization potential of hydrogen, second spectral line of Balmer series and third spectral line of Paschen series

(c) Series limit of Lyman series, third spectral line of Balmer series and second spectral line of Paschen series

(d) Series limit of Lyman series, second spectral line of Balmer series and third spectral line of Paschen series

Q18. The Rutherford α particle experiment shows that most of the α particles pass through almost unscattered while some are scattered through large angles. What information does it give about the structure of the atom

(a) Atom is hollow

(b) The whole mass of the atom is concentrated in a small centre called nucleus

(c) Nucleus is positively charged

(d) All the above

**SECTION-B (2marks)**

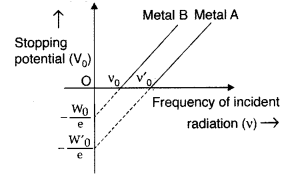
Q19.Two isolated metal spheres A and B have radii R and 2R respectively, and same charge q. Find which of the two spheres have greater capacitance and why.

Q20. The storage battery of a car has an emf of 24 V. If the internal resistance of the battery is 1.2 Ω, what is the maximum current that can be drawn from the battery?

Q21. A wheel with 10 metallic spokes each 0.5 m long is rotated with a speed of 120 rev/min in a plane normal to the horizontal component of earth’s magnetic field HE at a place. If HE = 0.4 G at the place, what is the induced emf between the axle and the rim of the wheel?

Q22 A pure inductor of 25.0 mH is connected to a source of 220 V. Find the inductive reactance and rms current in the circuit if the frequency of the source is 50 Hz.

Q23. A proton and an electron have same kinetic energy. Which one has greater de-Broglie wavelength and why?

Q24. The graph shows the variation of stopping potential with frequency of incident radiation for two photosensitive metals A and B. Which one of the two has higher value of work- function? Justify your answer.

**OR**

**Explain, with the help of a circuit diagram, the working of a p-n junction diode as a half-wave rectifier.**

**Q25.** In an electromagnetic wave, the oscillating electric field having a frequency of 3 x 1010 Hz and an amplitude of 30 V/m propagates in the positive X-direction. What is the wavelength of the electromagnetic wave? Write down the expression to represent the corresponding magnetic field.

**SECTION-C (3marks)**

Q26. Explain the term drift velocity of electrons in a conductor .Hence obtain the expression for the current through a conductor in terms of drift velocity

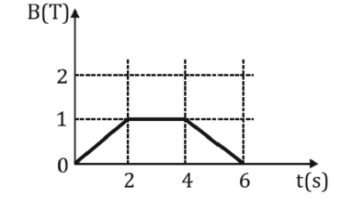
Q27. Two long straight parallel conductors carrying currents I1 and I2 are separated by a distance d. If the currents are flowing in the same direction, show how the magnetic field produced by one exerts an attractive force on the other. Obtain the expression for this force and hence define 1 ampere.

Q28. An a.c. source generating a voltage ε = ε0 sin ωt is connected to a capacitor of capacitance C. Find the expression for the current I flowing through it. Plot a graph of ε and I versus ωt to show that the current is ahead of the voltage by π/2.

Q29. (a) Define the terms,  
(i) threshold frequency and  
(ii) stopping potential in the photoelectric effect.

(b) Plot a graph of photocurrent versus anode potential for radiation of frequency v and intensities l1 and l2. (l1 < l2).

Q30. The ground state energy of hydrogen atom is -13.6 eV. The photon emitted during the transition of electron from n=3 to n=1 state, is incident on a photosensitive material of unknown work function .The photoelectrons are emitted from the material with the maximum kinetic energy of 9eV.Calculate the threshold wavelength of the material used.

**OR**

The magnetic field through a circular loop of wire, 12cm in radius and

8.5Ω resistance, changes with time as shown in the figure. The

magnetic field is perpendicular to the plane of the loop. Calculate the

current induced in the loop and plot a graph showing induced current

as a function of time.

**SECTION-D (5marks)**

Q31. (a)Draw equipotential surfaces for (i)an electric dipole and (ii) two identical positive charges placed near each other.

(b) In a parallel plate capacitor with air between the plates, each plate has an area of 5 x 10 -3 cm2and the separation between the plates is 4 mm.

(i) Calculate the capacitance of the capacitor.

(ii) If the capacitor is connected to 200V supply, what would be the the charge on each plate?

(iii) How would charge on the plate be affected if a 3 mm thick mica sheet of k=6 is inserted between the plates while the voltage supply remains connected

**OR**

Two point charges q and –q are located at points (0, 0, –a) and (0, 0, a) respectively.

(a) Find the electrostatic potential at (0, 0, z) and (x, y, 0)

(b) How much work is done in moving a small test charge from the point (5, 0, 0) to

(–7, 0, 0) along the x-axis ?

(c) How would your answer change if the path of the test charge between the same

points is not along the x-axis but along any other random path ?

(d) If the above point charges are now placed in the same positions in a uniform

external electric field E , what would be the potential energy of the charge system in its orientation of unstable equilibrium ? Justify your answer in each case.

Q32. (i) State Biot – Savart law in vector form

(ii)A charge q of mass m is moving with a velocity of v, at right angles to a uniform magnetic field B. Deduce the expression for the radius of the circular path it describes.

(iii)An alpha particle and proton are projected perpendicular to magnetic field with same K.E. find radius ratio.

**OR**

Electric current can produce a magnetic field

(a) Name the law which explains the relation between current and the magnetic field produced by the current

(b) Derive an equation showing the variation of this magnetic field with distance. (due to current carrying circular loop).

(c) Can you suggest any similarity between the magnetic field produced by electric current and electric field produced by charges.

Q33. **Define the term wavefront. Using Huygen’s wave theory, verify the law of reflection. Define the term, “refractive index” of a medium. Verify Snell’s law of refraction when a plane wavefront is propagating from a denser to a rarer medium.**

**OR**

**A beam of light consisting of two wavelengths, 650 nm and 520 nm, is used to obtain interference fringes in a Young’s double-slit experiment.**

**(a) Find the distance of the third bright fringe on the screen from the central maximum for wavelength 650 nm.**

**(b) What is the least distance from the central maximum where the bright fringes due to both the wavelengths coincide?**

**SECTION-E**

**Attempt any 4 sub parts from each question. Each question carries 1 mark.**

**Case study Question 1:**

A compound microscope is an optical instrument used for observing highly magnified images of tiny objects. Magnifying power of a compound microscope is defined as the ratio of the angle subtended at the eye by the final image to the angle subtended at the eye by the object, when both the final image and the objects are situated at the least distance of distinct vision from the eye. It can be given that: m=me x mo, where me is the magnification produced by the eye lens and mo is the magnification produced by the objective lens.

Consider a compound microscope that consists of an objective lens of focal length 2.0 cm and an eyepiece of focal length 6.25 cm separated by a distance of 15 cm.

1. The object distance for eye-piece, so that final image is formed at the least distance of distinct vision, will be  
   (a) 3.45 cm (b) 5 cm (c) 1.29 cm (d) 2.59 cm

(ii) How far from the objective should an object be placed in order to obtain the condition described in part (i)?  
(a) 4.5 cm (b) 2.5 cm (c) 1.5 cm (d) 3.0 cm

(iii) What is the magnifying power of the microscope in case of least distinct vision?  
(a) 20 (b) 30 (c) 40 (d) 50

(iv) The intermediate image formed by the objective of a compound microscope is  
(a) real, inverted and magnified (b) real, erect and magnified  
(c) virtual, erect and magnified (d) virtual, inverted and magnified

(v) The magnifying power of a compound microscope increases with  
(a) the focal length of objective lens is increased and that of eye lens is decreased.  
(b) the focal length of eye lens is increased and that of objective lens is decreased.  
(c) focal length of both objects and eye-piece are increased.  
(d) focal length of both objects and eye-piece are decreased.

**Case study Question 2:**

The flow of charge in a particular direction constitutes the electric current. Current is measured in Ampere. Quantitatively, electric current in a conductor across an area held perpendicular to the direction of flow of charge is defined as the amount of charge is flowing across that area per unit time.  
Current density at a point in a conductor is the ratio of the current at that point in the conductor to the area of cross section of the conductor of that point.  
The given figure shows a steady current flows in a metallic conductor of non uniform cross section. Current density depends inversely on area, so, here J1>J2, as A1<A2J1>J2, as A1<A2.

(i) What is the current flowing through a conductor, if one million electrons are crossing in' one millisecond through a cross-section of it ?

(a) 2.5 x 10-10 A (b) 1.6 x 10-10 A (c) 7.5 X 10-9 A (d) 8.2 x 10-11 A

(ii) Which one is not the correct statement

(a) 1volt×1 coulomb =1 joule (b) 1volt×1 ampere = 1 joule/ second

(c) 1volt×1watt = 1H.P. (d) Watt-hour can be expressed in eV

 (iii) A constant current I is flowing along the length of a conductor of variable cross-section as shown in the figure. The quantity which does not depend upon the area of cross-section is

1. electron density (b) current density (c) drift velocity (d) electric field

(iv) A steady current flows in a metallic conductor of non-uniform cross-section. Which of these quantities is constant along the conductor?

|  |  |  |  |
| --- | --- | --- | --- |
| (a) electric field (b) drift velocity (c) current (d) current density |  | (c) Current | (d) Current density |
| (v) Ohm's law is true  (a) For metallic conductors at low temperature  (b) For metallic conductors at high temperature  (c) For electrolytes when current passes through them  (d) For diode when current flows |  |  |  |
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