PRACTICE PAPER-1

CLASS: XII

SUBJECT : PHYSICS

Time Allowed : 3 hours **Maximum Marks : 70**

General Instructions :

(1) There are 35 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. All the sections are compulsory.

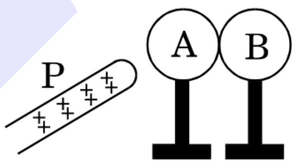
(3) Section A contains eighteen MCQ of 1 mark each, Section B contains seven questions of two marks each, Section C contains five questions of three marks each, section D contains three long questions of five marks each and Section E contains two case study based questions of 4 marks each.

(4) 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

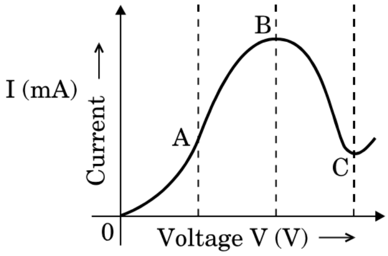
1. Two metallic spheres A and B kept on insulating stands are in contact with each other. A positively charged rod P is brought near the sphere A as shown in the figure. The two spheres are separated from each other, and the rod P is removed. What will be the nature of charges on spheres A and B ? **[1]**



(a) Sphere A will be positively charged while B negatively charged.
(b) Sphere B will be oppositely charged as that on rod.
(c) Spheres A and B will be charged due to induction.
(d) All of the above.

2. Choose the correct statement: **[1]**
(a) At a point where electric field is zero, potential also must be zero.
(b) At a point where electric potential is zero, electric field must be zero.
(c) At centre of the dipole potential is zero but electric field is not zero.
(d) Inside a charged conducting shell, electric field as well as potential, both are zero.

3. In which region of the graph shown in the figure is the resistance negative? **[1]**



(a) O to A (b) A to B (c) B to C (d) after C

4. The length of a given cylindrical wire is increased by 100%. Due to the consequent decrease in diameter, the change in the resistance of the wire will be **[1]**

(a) 200% (b) 100% (c) 50% (d) 300%

5. An electric current is passed through a circuit containing two wires of the same material, connected in parallel. If the lengths and radii of the wires are in the ratio of 4/3 and 2/3, then the ratio of the currents passing through the wires will be **[1]**

(a) 3 (b) 1/3 (c) 8/9 (d) 2

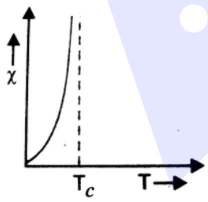
6. The magnetic field at a distance r from a long wire carrying current I is 0.4 T. The magnetic field at a distance 2r is :-

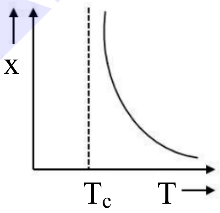
(a) 0.1 T (b) 0.2 T (c) 0.8 T (d) 1.6 T

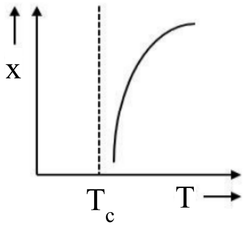
7. Two circular coils 1 and 2 are made from the same wire but the radius of the first coil is twice that of the second coil. What is the ratio of potential difference (in volt) should be applied across them, so that the magnetic field at their centres is the same? **[1]**

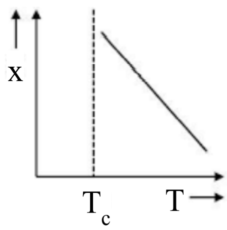
(a) 2:1 (b) 3:1 (c) 4:1 (d) 6:1

8. The variation of magnetic susceptibility with the temperature of a ferromagnetic material can be plotted as- **[1]**

(a) 

(b) 

(c 

(d) 

9. A coil having n turns and resistance R Ω is connected with a galvanometer of resistance 4R Ω. This combination is moved in time t seconds from a magnetic flux ϕ_1 weber to, ϕ_2 weber. The induced current in the circuit is- **[1]**

(a) $(\phi_1 - \phi_2)/5\,R\,n\,t$ (b) $n(\phi_1 - \phi_2)/5Rt$

(c) $[(\phi_1 - \phi_2)/Rn]t$ (d) $n(\phi_1 - \phi_2)/Rt$

10. In an LCR circuit, capacitance is changed from C to 2C. For the resonant frequency to remain unchanged, the inductance should be changed from L to **[1]**

(a) 4L (b) 2L (c) L/2 (d) L/4

11. An electromagnetic wave of frequency 3 MHz passes from vacuum into a dielectric medium with permittivity $\varepsilon_r = 4$. Then, **[1]**

(a) wavelength and frequency both remain unchanged.

(b) wavelength is doubled and the frequency remains unchanged.

(c) wavelength is doubled and the frequency becomes half.

(d) wavelength is halved and the frequency remains unchanged.

12. If wavelength of light in air is 2400×10^{-10} m, then what will the wavelength of light in glass ($\mu = 1.5$)? **[1]**

(a) 1600 Å (b) 7200 Å (c) 1080 Å (d) none of these

13. The threshold frequency for photoelectric effect on sodium corresponds to a wavelength of 5000 Å. Its work function is **[1]**

(a) 4×10^{-19} J (b) 1 J (c) 2×10^{-19} J (d) 3×10^{-19} J

14. The electron in a hydrogen atom makes a transition from an excited state to the ground state. Which of the following statements is true? **[1]**

(a) Its kinetic energy increases and its potential and total energies decreases.

(b) Its kinetic energy decreases, potential energy increases and its total energy remains the same

(c) Its kinetic and total energies decrease and its potential energy increases

(d) Its kinetic, potential and total energies decrease

15. If the binding energy per nucleon in ${}_3Li^7$ and ${}_2He^4$ nuclei are 5.60MeV and 7.06MeV respectively, then in reaction ${}_1H^1 + {}_3Li^7 \rightarrow 2\ {}_2He^4$ energy of proton must be **[1]**

(a) 28.24 MeV (b) 17.28 MeV (c)1.46 MeV (d) 39.2 MeV

ASSERTION & REASON

Two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

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

(b) Both A and R are true and R is NOT the correct explanation of A

(c) A is true but R is false

(d) A is false and R is also false

16. **Assertion:** It is not possible to have interference between the waves produced by two distinct light sources. **[1]**

Reason: For interference of two waves the phase difference between the waves must remain constant.

17. **Assertion:** The resistivity of a semiconductor increases with temperature. **[1]**

Reason: The atoms of a semiconductor vibrate with larger amplitudes at higher temperatures thereby increasing its resistivity.

18. **Assertion:** In photoelectric emission, the velocity of electron ejected from near the surface is larger than that coming from interior of metal. **[1]**

Reason: The velocity of ejected electron will be zero

SECTION – B

19. Name the constituent radiation of electromagnetic spectrum which is **[2]**

(a) used to study crystal structure

(b) suitable for radar systems used in aircraft navigation.

Write one other application of each of these radiations.

20. Two similar bars, made from two different materials P and Q, are placed one by one, in a non-uniform magnetic field. It is observed that **[2]**

(a) bar P tends to move from the weak to the strong field region.

(b) bar Q tends to move from the strong to the weak field region.

Identify the magnetic material used for making these two bars. Show with the help of diagrams, the behavior of the field lines, due to an external magnetic field, near each of these two bars.

21. Find the ratio between the wavelengths of the 'most energetic' spectral lines in the Balmer and Paschen series of the hydrogen spectrum. **[2]**

OR

The Bohr radius of Hydrogen atom is 5.3×10^{-11}m. Find its radius in the first excited state. Also calculate the total energy in this state.

22. Use the mirror equation to show that an object placed between F and 2F of a concave mirror produces a real image beyond 2F.

23. Two material bars A and B of equal area of cross-section are connected in series to a dc supply. A is made of usual resistance wire and B of an n-type semiconductor. In which bar is the drift speed of free electrons greater? Why? **[2]**

OR

Draw the energy band diagram of an n-type semiconductor. How does the energy gap of an intrinsic semiconductor vary with increase in temperature?

24. Determine the angular separation between central maximum and first order maximum of the diffraction pattern due to a single slit of width 0.25 mm when light of wavelength 5890 Å is incident on it normally. **[2]**

25. A parallel plate capacitor of capacitance 'C' is charged to a potential 'V'. It is then connected to another uncharged capacitor having the same capacitance. Find out the ratio of the energy stored in the combined system to that stored initially in the single capacitor. **[2]**

SECTION C

26. State Ampere's circuital law. Use this law to obtain the expression for magnetic field at a normal distance 'r' from an infinitely long current carrying straight wire. How will the magnetic field intensity at the centre of a current carrying circular coil change, if the current through the coil is doubled and the radius of the coil is halved ? **[3]**

27. An inductor L of reactance X_L is connected in series with a bulb B and an AC source. How would the brightness of the bulb change when

(a) The number of turns in the inductor is reduced

(b) An iron rod is inserted in the inductor and

(c) A capacitor of reactance $X_c = X_L$ is inserted in series in the circuit. Justify your answer in each case. **[3]**

OR

A capacitor of unknown capacitance, a resistor of 100Ω and an inductor of self-inductance $L = 4/\pi^2$ henry are connected in series to an ac source of 200 V and 50 Hz. Calculate the value of the capacitance and impedance of the circuit when the current is in phase with the voltage.

28. (a) State Faraday's laws of electromagnetic induction.

(b) A metallic rod of 1m length is rotated with a frequency of 50 rev/s, with one end hinged at the centre and the other end at the circumference of a circular metallic ring of radius 1m, about an axis passing through the centre and perpendicular to the plane of the ring. A constant uniform magnetic field of 1T parallel to the axis is present everywhere. What is the emf between the centre and the metallic ring? **[3]**

29. Draw a graph between the frequency of incident radiation ν and the maximum kinetic energy of the electrons emitted from the surface of a photo sensitive material. State clearly how this graph can be used to find **[3]**

(a) Planck's constant

(b) work function of the material.

OR

The work function of Caesium metal is 2.14 eV. When light of frequency 6×10^{14} Hz is incident on the metal surface, photoemission of electrons occurs. What is

(a) Maximum kinetic energy of the emitted electron.

(b) Stopping potential.

(c) Maximum speed of the emitted photoelectrons.

30. Draw a schematic arrangement of Geiger-Marsden experiment. Calculate the distance of closest approach when a 7.7 MeV α-particle approaches a gold nucleus (Z = 79) **[3]**

SECTION D

31. (a) Derive an expression for the electric field 'E' due to a dipole of length '2a' at a point, distant 'r', from the centre of the dipole, on the axial line.

(b) Draw a graph of E varies 'r' for r>>a.

(c) Four equal point charges each 16 μC are placed on the four corners of a square of side 0.2m. Calculate the force on any one of the charges **[5]**

OR

(a) Using Gauss' law, deduce the expression for the electric field due to a uniformly charged spherical conducting shell of radius 'R' at a point (i) outside and (ii) inside the shell.

(b) Two charges of magnitude -2Q and +Q are located at point (a, 0) and (4a, 0) respectively. Find the electric flux due to these charges through a sphere of radius 3a with its centre at the origin.

32. (a) Draw a ray diagram to show the image formation by a combination of two thin convex lenses in contact.

(b) Obtain the expression for power of the combination in terms of focal length of the lenses.

(c) You are given the following three lenses. Which two lenses will you use as an eye piece and as an objective to construct an astronomical telescope? Give reason. **[5]**

Lenses	Power (D)	Aperture (cm)
L1	3	8
L2	6	1
L3	10	1

OR

(a) Define a wave front.

(b) Use Huygens geometrical construction to show the propagation of plane wavefront from a rarer medium to a denser medium. Hence derive Snell's law of refraction.

(c) What is the effect on the interference fringes in Young's double slit experiment, if the separation between the two slits is decreased? Justify your answer.

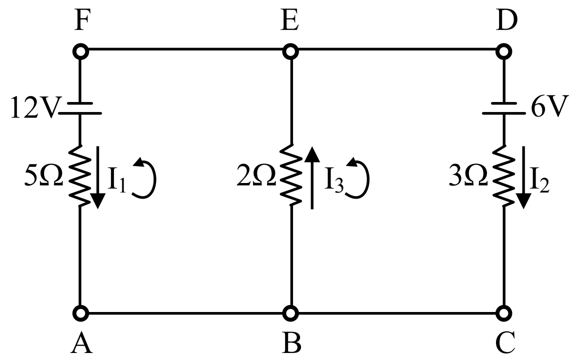
33. Define relaxation time of free electrons drifting in a conductor. How is it related to the drift velocity of free electrons? Use this relation to deduce the expression for electrical resistivity of the material. What is the effect of temperature on the relaxation time of electrons in a metal? **[5]**

OR

(a) State the two Kirchhoff's rules

(b) Obtain the balancing condition in a Wheatstone bridge

(c) Using Kirchhoff's rules, calculate the values of I_1, I_2 and I_3.



SECTION E

34. **Case Study**: Read the following paragraph and answer the questions.

Two sources of light which continuously emit light waves of same frequency (or wavelength) with a zero or constant phase difference between them, are called coherent sources. Two independent sources of light cannot act as coherent sources, they have to be derived from the same parent source. In Young's double slit experiment, two identical narrow slits S_1 and S_2 are placed symmetrically with respect to narrow slit S illuminated with monochromatic light. The interference pattern is obtained on an observation screen placed at large distance D from S_1 and S_2.

(a) Mention any 2 conditions for sustained interference.

(b) In the Young's double slit experiment using a monochromatic light of wavelength λ, what is the path difference (in terms of an integer n) corresponding to any point having half the peak intensity?

(c) Calculate the ratio of the fringe width for bright and dark fringes in YDS experiment. **[4]**

OR

(c) In Young's double slit experiment, while using a source of light of wavelength 4500 Å, the fringe width obtained is 0.4 cm. If the distance between the slits and the screen is reduced to half, calculate the new fringe width.

35. **Case Study :** Read the following paragraph and answer the questions.

A p-n junction is a single crystal of Ge or Si doped in such a manner that one half portion of it acts as p-type semiconductor and other half functions as n-type semiconductor. As soon as junction is formed, the holes from the p-region diffuse into the n-region and electrons from n-region diffuse into p-region. This results in the development of potential barrier V_B across the junction which opposes the further diffusion of electrons and holes through the junction. The small region in the vicinity of the junction which is depleted of free charge carriers and has only immobile ions is called the depletion region.

(a) Why is germanium preferred over silicon for making semiconductor devices?

(b) Which type of biasing results in a very high resistance of a p-n junction diode. Draw a diagram showing this bias.

(c) How does the width of the depletion region of a p-n junction vary, if the reverse bias applied to it decreases. **[4]**

OR

(c) Name the 2 important processes involved in the formation of a p-n junction.