PRACTICE PAPER-2

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 similar spheres having +Q and –Q charges are kept at a certain distance. F force acts between the two. If at the middle of two spheres, another similar sphere having +Q charge is kept, then it experiences a force in magnitude and direction as : **[1]**

(a) zero having no direction.
(b) 8F towards +Q charge.
(c) 8F towards –Q charge.
(d) 4F towards +Q charge.

2. If a unit positive charge is taken from one point to another over an equi-potential surface, then **[1]**

(a) work is done on the charge. (b) work is done by the charge.
(c) work done is constant. (d) no work is done.

3. Drift velocity v_d varies with the intensity of electric field as per the relation **[1]**

(a) $v_d \propto E$ (b) $v_d \propto \frac{1}{E}$
(c) v_d = constant (d) $v_d \propto E^2$

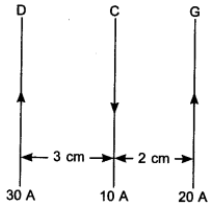
4. Magnetic moment for solenoid and corresponding bar magnet is **[1]**

(a) equal for both (b) more for solenoid
(c) more for bar magnet (d) none of these

5. A conducting circular loop of radius r carries a constant current i. It is placed in a uniform magnetic field B, such that B is perpendicular to the plane of the loop. The magnetic force acting on the loop is **[1]**

(a) irB (b) 2πriB (c) zero (d) πriB

6. Three long, straight parallel wires, carrying current are arranged as shown in the figure. The force experienced by a 10 cm length of wire C is **[1]**



(a) 10^{-3} N (b) 2.0×10^{-3} N (c) zero (d) 1.0×10^{3} N

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

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

8. In electromagnetic wave if u_e and u_m are mean electric and magnetic energy densities respectively, then **[1]**

(a) $u_e = u_m$ (b) $u_e > u_m$ (c) $u_e < u_m$ (d) $u_e^2 = \frac{1}{2}u_m^2$

9. Which of the following has maximum penetrating power ? **[1]**

(a) Ultraviolet radiation (b) Microwaves
(c) γ-rays (d) Radio waves

10. A converging lens is used to form an image on a screen. When the upper half of the lens is covered by an opaque screen. **[1]**

(a) half the image will disappear.
(b) incomplete image will be formed.
(c) intensity of image will decrease but complete image is formed.
(d) intensity of image will increase but image is not distinct.

11. Threshold wavelength for a metal having work function W_0 is λ. What is the threshold wavelength for the metal having work function $2W_0$? **[1]**

(a) 4λ (b) 2λ (c) λ/2 (d) λ/4

12. If 13.6 eV energy is required to ionise the hydrogen atom, then energy required to remove an electron from n = 2 is **[1]**

(a) 10.2 eV (b) 0 eV (c) 3.4 eV (d) 6.8 eV

13. In nuclear reaction, there is conservation of **[1]**

(a) mass only (b) energy only
(c) momentum only (d) mass, energy and momentum

14. In a series LCR circuit the voltage across an inductor, capacitor and resistor are 20 V, 20 V and 40 V respectively. The phase difference between the applied voltage and the current in the circuit is **[1]**

(a) 30° (b) 45° (c) 60° (d) 0°

15. A capacitor is charged by a battery. The battery is removed and another identical uncharged capacitor is connected in parallel. The total electrostatic energy of resulting system **[1]**

(a) increases by a factor of 4. (b) decreases by a factor of 2.
(c) remains the same. (d) increases by a factor of 2.

ASSERTION-REASON BASED QUESTIONS

16. 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. **[1]**

(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

Assertion : A pure semiconductor has negative temperature coefficient of resistance.

Reason : In a semiconductor on raising the temperature, more charge carriers are released, conductance increases and resistance decreases.

17. 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. **[1]**

(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

Assertion : No interference pattern is detected when two coherent sources are infinitely close to each other.

Reason : The fringe width is inversely proportional to the distance between the two sources.

18. 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. **[1]**

(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

Assertion : The photoelectrons produced by a monochromatic light beam incident on a metal surface have a spread in their kinetic energies.

Reason : The work function of the metal is its characteristics property.

SECTION-B

19. In a plane electromagnetic wave, the electric field oscillates sinusoidally with a frequency of 2×10^{10} Hz and amplitude 48 V/m.

(a) What is the wavelength of the em. wave?

(b) Calculate the amplitude of the oscillating magnetic field. **[2]**

20. A closely wound solenoid of 800 turns and area of cross section 2.5×10^{-4} m^2 carries a current of 3.0 A. What is its associated magnetic moment? **[2]**

21. The kinetic energy of an alpha-particle incident on gold foil is doubled then how does the distance of closest approach change? **[2]**

22. A convex lens made up of refractive index n_g is kept in a medium of refractive index n_m. Parallel rays of light are incident on the lens. Complete the path of rays of light emerging from the convex lens if (i) $n_g > n_m$ (ii) $n_g = n_m$ **[2]**

23. Explain flow of current in P-N junction diode when forward biased ? **[2]**

24. In a two slit experiment with monochromatic light, fringes are obtained on a screen placed at some distance from the slits. If the screen is moved by 5×10^{-2}m towards the slits, the change in fringe width is 3×10^{-5}m. If the distance between the slits is 10^{-3}m, calculate the wavelength of the light used. **[2]**

25. The distance between the plates of a parallel plate capacitor is d. A metal plate of thickness (d/2) is placed between the plates. What will be the effect on the capacitance? **[2]**

SECTION-C

26. Derive the expression for the magnetic force acting on a current carrying straight conductor placed in a uniform magnetic field and express it in vector form. **[3]**

27. An electron of charge e is revolving around a nucleus along a circular path of radius r and with speed v. Starting from the relation $\mu_l = IA$, where the symbols have their usual meaning, show that **[3]**

(i) $\mu_l = \frac{e\upsilon r}{2}$ **(2)** $\vec{\mu}_l = -\frac{e\vec{l}}{2m_e}$

Here *l* is the magnitude of angular momentum of the electron of mass m_e.

28. Derive the expression for impedance of series LR circuit by using phasor diagram. **[3]**

OR

Derive a formula for power consumed in a series LCR circuit. **[3]**

29. A proton and a deuteron are accelerated through the same accelerating potential. Which one of the two has

(i) greater value of de-Broglie wavelength associated with it, and

(ii) less momentum ?

Give reasons to justify your answer. **[3]**

OR

If the Kinetic energy of a free electron is increased by two times then by how many times will the de-Broglie wavelength be changed ? **[3]**

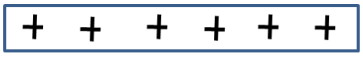
30. The ground state energy of hydrogen atom is –13.6 eV.

(i) What is the potential energy of an electron in the 3rd excited state?

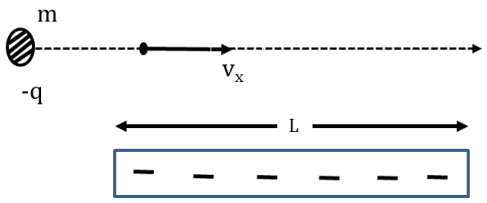
(ii) If the electron jumps to the ground state from the 3rd excited state, calculated the wavelength of the photon emitted. **[3]**

SECTION-D

31. **(i)** Apply Gauss' law to derive the expression for electric field intensity due to an infinitely long straight uniformly charged wire. What is the direction of the field intensity if it is positively charged ?



(ii)



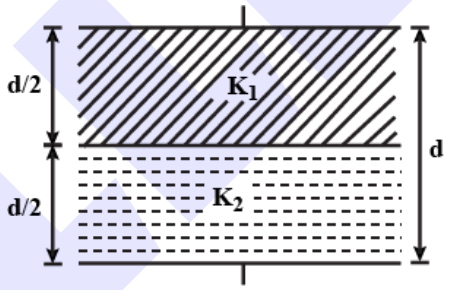
In the above diagram, a particle of mass "m" and charge (- q) initially moving along X-axis with velocity "v_x" enters the region between two charged plates. The length of the plate system is "L" and uniform electric field between the plates is "E". What is the vertical deflection of the particle at the far edge of the plate? **[5]**

OR

(i) What is a capacitor? You know that the capacitance of a parallel plate air capacitor is $C = \frac{\varepsilon_0 A}{d}$.

What will be its new capacitance C' of the capacitor if a material of dielectric K is inserted between the plates?

(ii) Calculate the capacitance of the capacitor shown below. **[5]**



32. **(i)** Two cells of emfs E_1 and E_2 are connected in series. Their internal resistances are r_1 and r_2 respectively. Compute the equivalent emf and equivalent internal resistance.

(ii) A battery of emf 10 V and internal resistance 3Ω is connected to a resistor. If the current in the circuit is 0.5A,what is the resistance of the resistor? What is the terminal voltage of the battery when the circuit is closed? **[5]**

OR

(i) 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'.

(ii) The number density of free electrons in a copper conductor estimated is 8.5×10^{28} m^{-3}. How long does an electron take to drift from one end of a wire 3.0 m long to its other end? The area of cross-section of the wire is 2.0×10^{-6} m^2 and it is carrying a current of 3.0 A. **[5]**

33. **(i)** Draw a labelled ray diagram of a refractive telescope. Deduce an expression of magnifying power of it. Write two main limitations of a refracting type telescope over a reflecting type telescope.

(ii) Light from a point source in air falls on a convex spherical glass surface of refractive index 1.5 and radius of curvature 20 cm. The distance of light source from the glass surface is 100 cm. At what position is the image formed ? **[5]**

OR

(i) Explain laws of refraction of light on the basis of Huygens wave theory.

(ii) What should be the width of each slit in order to obtain 10 maxima of the double slit pattern within the central maximum of the single slit pattern ?

SECTION-E

34. Case study:

Refraction through spherical surfaces

Refraction of light is the change in the path of light as it passes obliquely from one transparent medium to another medium. According to law of refraction $\frac{\sin i}{\sin r} = {}^1\mu_2$, where ${}^1\mu_2$ is called refractive index of second medium with respect to first medium. From refraction at a convex spherical surface, we have $\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}$. Similarly from refraction at a concave spherical when object lies in the rarer medium, we have $\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}$ and when object lies in the denser medium, we have $\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}$.

(i) A ray of light of frequency 5×10^{14} Hz is passes through a liquid. The wavelength of light measured inside the liquid is found to be 450×10^{-9} m. What is the refractive index of the liquid? **[1]**

(ii) State principle of reversibility of light. **[1]**

(iii) A ray of light is incident at an angle of 60^o on one face of a rectangular glass slab of refractive index 1.5. What is the angle of refraction? **[2]**

OR

(iii) A point object is placed at the centre of a glass sphere of radius 6 cm and refractive index 1.5. What is the distance of the virtual image from the surface of sphere? **[2]**

35. Case Study: Doping in Semiconductor

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 a p-n junction is formed, the holes from the p-region diffuse into the n-region and electron from n-region diffuse into p-region. This results in the development of V_B across the junction which opposes the further diffusion of electrons and holes through the junction.

(i) What is meant by biasing? Mention its types. **[1]**

(ii) What are the charge carriers in a pure semiconductor. **[1]**

(iii) A diode is called as a unidirectional device. **[2]**

OR

(iii) Write a short note on diffusion current across p-n junction. **[2]**