Class XII Session 2024-25

PHYSICS FULL SYLLABUS MOCK TEST – 10

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. All the sections are compulsory.
3. **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.**
4. 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.
5. Use of calculators is not allowed.
6. 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. $\varepsilon_0 = 8.854 \times 10^{-12}$ C^2 N^{-1} m^{-2}

viii. Avogadro's number = 6.023×10^{23} per gram mole

SECTION – A

[16 × 1]

1. The resistivity of a semiconductor at room temperature is in between:

a) 10^{-3} to 10^6 Ω b) 10^{10} to 10^{12} Ω c) 10^{-2} to 10^{-5} Ω d) 10^6 to 10^8 Ω

2. If the percentage change in current through a resistor is 1%, then the change in power through it would be:

a) 0.5% b) 1% c) 2% d) 1.7%

3. A convex lens is dipped in a liquid whose refractive index is equal to the refractive index of the lens. Then its focal length will

a) Become infinite b) Become zero c) Reduce d) Remain same as in air

4. A frog can be levitated in a magnetic field produced by a current in a vertical solenoid placed below the frog. This is possible, because the body of the frog behaves as

a) paramagnetic b) ferromagnetic c) anti-ferromagnetic d) diamagnetic

5. Three condensers of capacity 2 μF, 4 μF and 8 μF respectively, are first connected in series and then connected in parallel. The ratio of the equivalent capacitance in the two cases will be

a) 7 : 3 b) 3 : 7 c) 4 : 49 d) 49 : 4

6. The resistance of a galvanometer is 50Ω and the current required to give full scale deflection is 100μA. In order to convert it into an ammeter for reading up to 10 A, it is necessary to put a resistance of

a) 5×10^{-2} Ω b) 5×10^{-5} Ω c) 5×10^{-4} Ω d) 5×10^{-3} Ω

7. If the rotational velocity of dynamo armature is doubled, then induced emf will become:

a) two times b) half c) unchanged d) four times

8. The susceptibility of a magnetic substance is found to depend on temperature and the strength of the magnetising field. The material is a:

a) diamagnet b) superconductor c) ferromagnet d) paramagnet

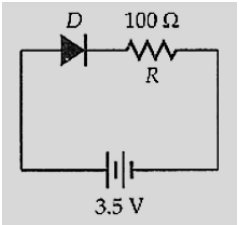
9. In Young's double-slit experiment, the intensity of light at a point on the screen where the path difference is λ is k (λ being the wavelength of light used). The intensity at a point where the path difference is $\frac{\lambda}{4}$, will be

a) k b) $\frac{k}{4}$ c) $\frac{k}{2}$ d) zero

10. A semi-circular arc of radius 'a' is charged uniformly and the charge per unit lengths is λ. The electric field at the centre is:

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) $\frac{\lambda^2}{2\,\pi\varepsilon_0\ a}$

11. In the given figure, a diode D is connected to an external resistance R = 100Ω and an emf of 3.5 V. If the barrier potential developed across the diode is 0.5 V, the current in the circuit will be



a) 40 mA b) 30 mA c) 35 mA d) 20 mA

12. How will the image formed by a convex lens be affected if the central portion of the lens is wrapped in a black paper?

a) No image is formed by the remaining portion of the lens

b) Full image will be formed but will be less bright

c) Two images will be formed

d) Central portion of the image will be absent

13. **Assertion (A):** In photo-emissive cell inert gas is used.
Reason (R): inert gas in the photoemissive cell gives greater current.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

14. **Assertion:** Positive charge always moves from a higher potential point to a lower potential point.
Reason: Electric potential is a vector quantity.
a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

15. **Assertion:** In Young's double-slit experiment if wavelength of incident monochromatic light is just doubled, number of bright fringe on the screen will increase.
Reason: (R) Maximum number of bright fringe on the screen is inversely proportional to the wavelength of light used.
a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

16. **Assertion (A):** The dc and ac both can be measured by a hot wire instrument.
Reason (R): The hot wire instrument is based on the principle of magnetic effect of current.
a) Both A and R are true and R is the correct explanation of A
b) Both A and R are true but R. is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

SECTION – B

[05 × 2]

17. Which of the following electromagnetic waves has (a) minimum wavelength, and (b) minimum frequency? Write one use of each of these two waves. Infrared waves, Microwaves, γ-rays and X-rays

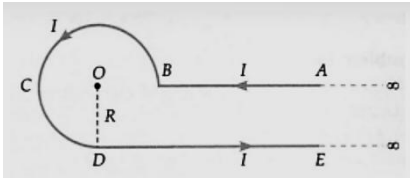
18. a. Show that the time period (T) of oscillations of a freely suspended magnetic dipole of magnetic moment (m) in a uniform magnetic field (B) is given by $T = 2\pi\sqrt{\frac{1}{mB}}$, where I is a moment of inertia of the magnetic dipole.
b. Identify the following magnetic materials:
i. A material having susceptibility $(\chi_m) = -0.00015$.
ii. A material having susceptibility $(\chi_m) = 10^{-5}$. [2]

19. Explain the variation of resistivity with temperature in pure-semiconductors.

20. Briefly explain Geiger-Marsden experiment. Show the variation of the number of particles

scattered (N) with scattering angle (θ) in this experiment. What is the main conclusion that can be inferred from this plot?

21. A current I is flowing in an infinitely long conductor bent into the shape shown in Fig. If the radius of the curved part is R, find the magnetic field at the centre O.



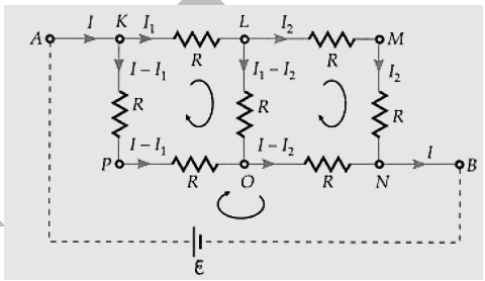
OR

A deuteron and an alpha particle having same momentum are in turn allowed to pass through a magnetic field $\vec{B}$, acting normal to the direction of motion of the particles. Calculate the ratio of the radii of the circular paths described by them.

SECTION – C

[07 × 3]

22. Find the equivalent resistance between the terminals A and B in the network shown in Figure. Given each resistor R is 10Ω.



23. With the help of a circuit diagram, explain how two p-n junction diodes along with a centre tapped transformer can be used as a full wave rectifier.

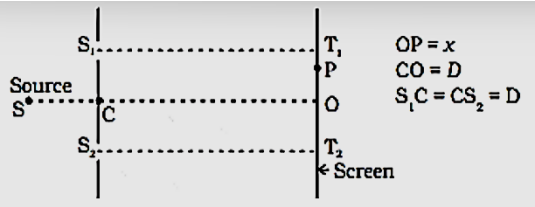
24. An alpha particle is accelerated through a potential difference of 100 V. Calculate:
i. The speed acquired by the alpha particle, and
ii. The de-Broglie wavelength associated with it. (Take mass of alpha particle = 6.4×10^{-27} kg)

25. Draw a plot showing the variation of binding energy per nucleon with mass number A. Write two important conclusions which you can draw from this plot. Explain with the help of this plot, the release in energy in the processes of nuclear fusion and fission.

26. It is found experimentally that 13.6 eV energy is required to separate a hydrogen atom into a

proton and an electron. Compute the orbital radius and the velocity of the electron in a hydrogen atom.

27. Consider a two-slit interference arrangements (Figure) such that the distance of the screen from the slits is half the distance between the slits. Obtain the value of D in terms of λ such that the first minima on the screen fall at a distance D from the center O.



28. a. A toroidal solenoid with an air core has an average radius of 0.15 m, area of cross section 12×10^{-4} m^2 and 1200 turns. Obtain the self inductance of the toroid. Ignore field variation across the cross section of the toroid.

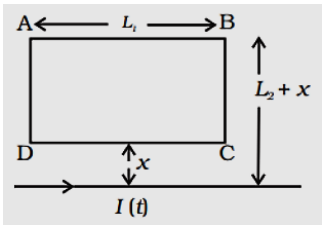
b. A second coil of 300 turns is wound closely on the toroid above. If the current in the primary coil is increased from zero to 2.0 A in 0.05 s, obtain the induced emf in the secondary coil.

OR

A rectangular loop of wire ABCD is kept close to an infinitely long wire carrying a current $I(t) = I_0 (1 - \frac{t}{T})$ for $0 \le t \le T$ and $I(0) = 0$ for $t > T$ (Figure).

Find the total charge passing through a given point in the loop, in time T.

The resistance of the loop is R.



[02 × 4]

SECTION – D

29. **Case Study Based Question:**

In an electromagnetic wave both the electric and magnetic fields are perpendicular to the direction of propagation, that is why electromagnetic waves are transverse in nature. Electromagnetic waves carry energy as they travel through space and this energy is shared equally by the electric and magnetic fields. Energy density of an electromagnetic waves is the energy in unit volume of the space through which the wave travels.

(a) The electromagnetic waves propagated perpendicular to both $\vec{E}$ and $\vec{B}$. The electromagnetic waves travel in the direction of

a) $\vec{E} \cdot \vec{B}$ b) $\vec{B} \cdot \vec{E}$ c) $\vec{E} \times \vec{B}$ d) $\vec{B} \times \vec{E}$

(b) Fundamental particle in an electromagnetic wave is

a) photon b) phonon c) electron d) proton

(c) Electromagnetic waves are transverse in nature is evident by

a) diffraction b) interference c) polarisation d) reflection

OR

The electric and magnetic fields of an electromagnetic waves are

a) in opposite phase and parallel to each other

b) in phase and parallel to each other.

c) in phase and perpendicular to each other

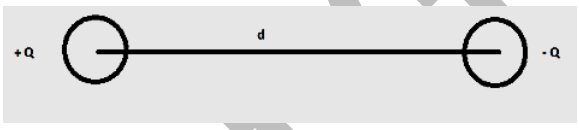
d) in opposite phase and perpendicular to each other

(d) For a wave propagating in a medium, Name the property that is independent of the others.

a) frequency b) wavelength c) velocity d) all these depend on each other

30. **Case Study Based Question:**

Electric dipole consist of a pair of equal and opposite point charges separated by a small distance and its strength is measured by the dipole moment. The field around the dipole in which the electric effect of the dipole can be experienced is called the dipole field.



(a) The electric dipole moment is:

a) a scalar quantity b) neither scalar nor vector quantity

c) a vector quantity d) A Plane quantity

(b) Electric field due to the electric dipole is

a) cylindrically symmetric b) spherically symmetric

c) symmetric d) asymmetric

(c) The SI unit of dipole moment is:

a) C/m b) C-m c) c /m^2 d) Cm^2

(d) Charges $\pm$20 nC are separated by 5mm. calculate the magnitude of dipole moment:-

a) 10^{-7} C - m b) 10^{10} C - m c) 10^{-10} C-m d) 10^{-8} - m

OR

When an electric dipole is placed in a uniform electric field, it experiences

a) Neither any force nor any torque b) Force but no torque

c) Force as well as torque d) Torque but no net force

SECTION – E

[03 ×5]

31. Draw a ray diagram to show the formation of real image of the same size as that of the object placed in front of a converging lens. Using this ray diagram establish the relation between u, v and f for this lens. [5]

OR

You have learned in the text how Huygens' principle leads to the laws of reflection and refraction. Use the same principle to deduce directly that a point object placed in front of a plane mirror produces a virtual image whose distance from the mirror is equal to the object distance from the mirror.

32. A capacitor of capacitance C_1 is charged to a potential V_1 while another capacitor of capacitance C_2 is charged to a potential difference V_2. The capacitors are now disconnected from their respective charging batteries and connected in parallel to each other.

i. Find the total energy stored in the two capacitors before they are connected.

ii. Find the total energy stored in the parallel combination of two capacitors.

iii. Explain the reason for the difference of energy in parallel combination in comparison to the total energy before they are connected [5]

OR

Define the terms (i) capacitance of a capacitor (ii) dielectric strength of a dielectric. When a dielectric is inserted between the plates of a charged parallel plate capacitor, fully occupying the intervening region, how does the polarization of the dielectric medium affect the net electric field? For linear dielectrics, show that the introduction of a dielectric increases its capacitance by a factor κ, characteristic of the dielectric.

33. a. Derive the expression for the current flowing in an ideal capacitor and its reactance when connected to an ac source of voltage $V = V_o \sin \omega t$.

b. Draw its phasor diagram.

c. If resistance is added in series to capacitor what changes will occur in the current flowing in the circuit and phase angle between voltage and current.

OR

i. An ac source generating a voltage $V = V_0 \sin \omega t$ is connected to a capacitor of capacitance C. Find the expression of the current I flowing through it. Plot a graph of V and I versus ωt to show that the current is $\frac{\pi}{2}$ ahead of the voltage.

ii. A resistor of 200Ω and a capacitor of 15 μF are connected in series to a 220 V, 50 Hz ac source. Calculate the current in the circuit and the rms voltage across the resistor and the capacitor. Why the algebraic sum of these voltages is more than the source voltage?