Class XII Session 2024-25

PHYSICS FULL SYLLABUS MOCK TEST – 11

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. If μ_e and μ_h are electron and hole mobility, E be the applied electric field, the current density j for intrinsic semiconductor is equal to

a) $n_i e(\mu_e + \mu_h)E$ b) $\frac{n_i e(\mu_e + \mu_h)}{E}$ c) $n_i e(\mu_e - \mu_h)E$ d) $\frac{E}{n_i e(\mu_e + \mu_h)}$

2. If the temperature of cold junction of a thermocouple is lowered, then the neutral temperature:

a) becomes zero b) increases c) decreases d) remains the same

3. The frequency of light in a material is 2×10^{14} Hz and wavelength is 5,000 Å. The refractive index of the material will be

a) 1 · 40 b) 3 · 00 c) 1 · 50 d) 1 · 33

4. A Rowland ring of mean radius 15 cm has 3500 turns of wire wound on a ferromagnetic core of relative permeability 800. What is the magnetic field B in the core for a magnetising current of 1.2A?

a) 3.48 T b) 5.48 T c) 4.08 T d) 4.48 T

5. In electrolytic capacitors positive terminal is

a) one on which aluminium oxide film is not formed
b) one on which aluminium oxide film is formed
c) none of the these
d) either of the two terminals

6. A wire of length L carrying current i is placed perpendicular to the magnetic induction B. The total force on the wire is

a) LB/i b) iL/B c) iLB d) iB/L

7. Inductance plays the role of

a) inertia b) friction c) force d) source of emf

8. The value of 1 Bohr magneton is: [Given $h = 6.62 \times 10^{-34}$ Js, $e = 1.6 \times 10^{-19}$ C and $me = 9.1 \times 10^{-31}$ kg]

a) 7.27×10^{-24} Am^2 b) 9.27×10^{-24} Am^2

c) 10.57×10^{-24} Am^2 d) 8.57×10^{-24} Am^2

9. What happens to fringe width in the Young's double slit experiment, if it is performed in glycerine instead of air?

a) The fringes shrink b) The fringes disappear

c) The fringes remain unchanged d) The fringes get enlarged

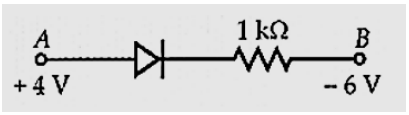
10. The attractive force between 2 charges is related to the distance between them as

a) r b) $\frac{1}{r^2}$ c) $r^{1/2}$ d) $\frac{1}{r}$

11. Consider the junction diode as ideal. The value of current flowing through AB is

a) 10^{-2} A b) 0 A

c) 10^{-1} A d) 10^{-3} A



12. Magnifying power of a microscope depends on

a) focal length of eyepiece and objective. b) colour of light.

c) focal length of objective and color of light. d) focal length of eyepiece and color of light.

13. **Assertion (A):** The photoelectrons produced by a monochromatic light beam incident on a metal surface have a spread in their kinetic energies.
Reason (R): The energy of electrons emitted from inside the metal surface, is lost in collision with the other atoms in the metal.
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:** Interference pattern is made by using yellow light instead of red light, the fringes becomes narrower.
Reason: (R) In Young's double slit experiment, fringe width is given by $\beta = \frac{\lambda D}{d}$.
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):** An alternating current of frequency 50 Hz becomes zero, 100 times in one second.
Reason (R): Alternating current changes direction and becomes zero twice in a cycle.
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]

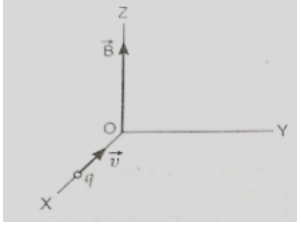
17. Gamma rays and radio waves travel with the same velocity in free space. Distinguish between them in terms of their origin and the main application.

18. A straight solenoid of length 50 cm has 1000 turns and a mean cross-sectional area of 2×10^{-4} m^2. It is placed with its axis at 30°, with a uniform magnetic field of 0.32 T. Find the torque acting on the solenoid when a current of 2A is passed through it

19. Draw the energy band diagram of (i) n-type, and (ii) p-type semiconductors at temperature T > 0 K. In the case of n-type Si-semiconductor, the donor energy level is slightly below the bottom of conduction band whereas in p-type semiconductor, the acceptor energy level is slightly above the top of valence band. Explain, giving examples, what role do these energy levels play in conduction and valence bands.

20. In the first excited state of the hydrogen atom, its radius is found to be 21.2×10^{-11} m. Calculate its Bohr radius in the ground state. Also, calculate the total energy of the atom in the second excited state.

21. As shown in figure, a charge q moving along the X-axis with a velocity $\vec{v}$ is subjected to a uniform magnetic field $\vec{B}$ acting along the Z-axis as it crosses the origin O.



i. Trace its trajectory.
ii. Does the charge gain kinetic energy, as it enters the magnetic field? Justify your answer.

OR

Depict the field-line pattern due to a current-carrying solenoid of finite length.

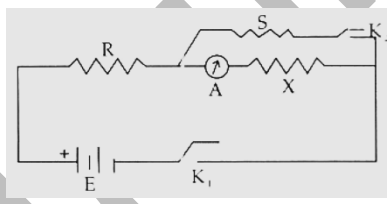
i. In what way do these lines differ from those due to an electric dipole?

ii. Why can't two magnetic field lines intersect each other?

SECTION – C

[07 × 3]

22. The reading of the (ideal) ammeter, in the circuit shown here, is equal too



i. I when key K_1 is closed but key K_2 is open.

ii. $\frac{I}{2}$ when both keys K_1 and K_2 are closed.

Find the expression of the resistance of X in terms of the resistances of R and S.

23. Draw the circuit diagram showing how a p-n junction diode is

i. forward biased,

ii. reverse biased; How is the width of depletion layer affected in the two cases?

24. Red light, however bright it is, cannot produce the emission of electrons from a clean zinc surface. But even weak ultraviolet radiation can do so. Why?

Electrons are emitted from the cathode of negligible work function, when photons of wavelength λ are incident on it. Derive the expression for the de Broglie wavelength of the electrons emitted in terms of the wavelength of the incident light.

25. i. Draw a plot showing the variation of potential energy of a pair of nucleons as a function of their separation. Mark the regions where the nuclear force is

a. attractive and b. repulsive.

ii. In the nuclear reaction ${}_0n^1 + {}^{235}_{54}U \rightarrow {}^{a}_{54}Xe + {}^{94}_{b}Sr + 2{}_0n^1$ determine the values of a and b

26. Hydrogen atom in its ground state is excited by means of monochromatic radiation of wavelength 975Å.

i. How many different lines are possible in the resulting spectrum?

ii. Calculate the longest wavelength amongst them. You may assume the ionization energy for hydrogen atom as 13.6 eV.

27. How is the spacing between fringes in a double slit experiment affected if:

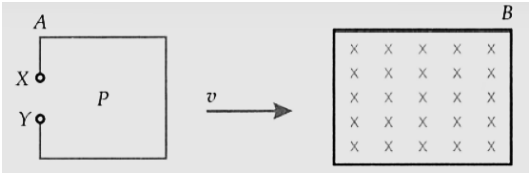
a. the slits separation is increased,

b. the colour of light used is changed from red to blue,

c. the whole apparatus is submerged in a oil of refractive index 1.2?

Justify your anwer in each case.

28. A rectangular coil P is moved from a point A to another point B with uniform velocity 'v' through a region of a uniform magnetic field acting normally inwards as shown in the figure.



Show graphically

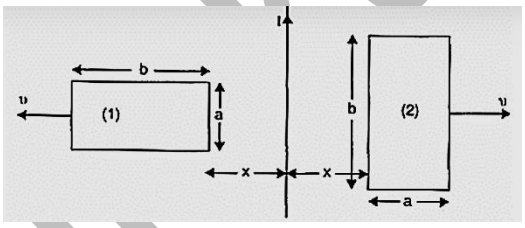
(i) the variation of magnetic flux associated with the coil with time,

(ii) the variation of induced emf across points X and Y of the coil with time.

Explain the nature of variation in magnetic flux as represented by the graph in the first case.

OR

The figure shows two identical rectangular loops (1) and (2) placed on a table along with a straight long current carrying conductor between them.



i. What will be the directions of the induced current in the loops when they are pulled away from the conductor with same velocity v?

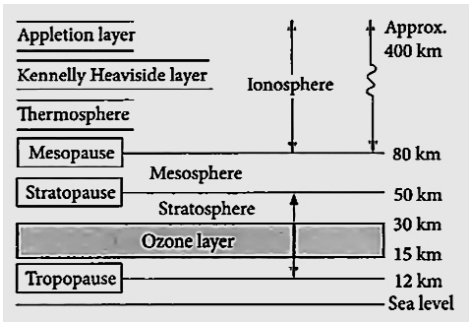
ii. Will the emf induced in the two loops be equal?

SECTION – D

[02 × 4]

29**. Case Study Based Question:**

Radio waves are produced by the accelerated motion of charges in conducting wires. Microwaves are produced by special vacuum tubes. Infrared waves are produced by hot bodies and molecules also known as heat waves. UV rays are produced by special lamps and very hot bodies like Sun.



(a) Solar radiation is

i. transverse electromagnetic wave

ii. longitudinal electromagnetic waves

iii. both longitudinal and transverse electromagnetic waves

iv. none of these

a) Option (i) b) Option (iv) c) Option (iii) d) Option (ii)

(b) What is the cause of greenhouse effect?

a) Ultraviolet rays b) X-rays c) Infrared rays d) Radiowaves

(c) Biological importance of ozone layer is

a) it stops ultraviolet rays b) none of these.

c) it reflects radiowaves d) It layer reduces greenhouse effect

OR

Ozone is found in

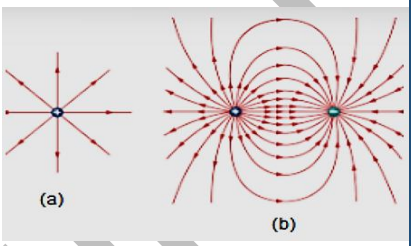
a) troposphere b) mesosphere c) ionosphere d) stratosphere

(d) Earth's atmosphere is richest in

a) ultraviolet b) infrared c) X-rays d) microwaves

30. **Case Study Based Question:**

Electric field lines as a path, straight or curved in an electric field such that tangent to it at any point gives the direction of electric field intensity at the point. Electric field lines are continuous curves they start from a positive charged body and end at the negatively charged body. (Refer image)



(a) Electric field due to a single charge is:

a) cylindrically symmetric b) symmetric

c) asymmetric d) spherically symmetric

(b) The SI unit of electric field intensity is:

a) N/C b) N c) C/m^2 d) N/m^2

(c) Pick the wrong statement.

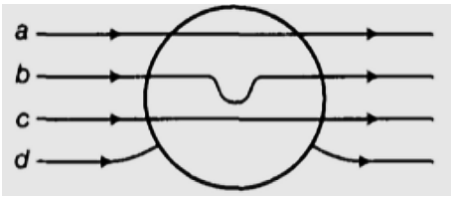
a) Electric field lines are continuous curves.

b) Electric field lines can intersect each other.

c) Electric field lines are always normal to the surface of a conductor.

d) The electrostatic field does not form a closed loop.

(d) A metallic sphere is placed in a uniform electric field as shown in the figure. Which path is followed by electric field lines?



a) path 'd'

b) path 'c'

c) path 'a'

d) path 'b'

OR

Pick the true statements about electric field lines.

a) Electric field lines provide information about the field strength.

b) Electric field lines provide information about the type of charge.

c) All of these.

d) Electric field lines provide information about the direction of the electric field.

SECTION – E

[03 ×5]

31. i. Derive lens maker's formula for a biconvex lens.

ii. A point object is placed at a distance of 12 cm on the principal axis of a convex lens of focal length 10 cm. A convex mirror is placed coaxially on the other side of the lens at a distance of 10 cm. If the final image coincides with the object, sketch the ray diagram, and find the focal length of the convex mirror. [5]

OR

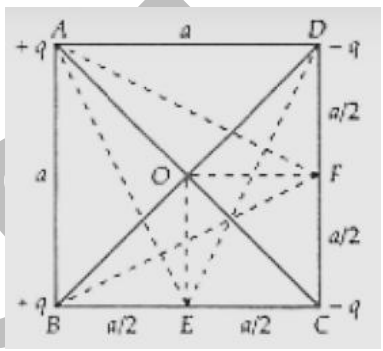
i. There are two sets of apparatus of Young's double-slit experiment. Inset A, the phase difference between the two waves emanating from the slits does not change with time, whereas in set B, the phase difference between the two waves from the slits changes rapidly with time. What difference will be observed in the pattern obtained on the screen in the two setups?

ii. Deduce the expression for the resultant intensity in both the above-mentioned setups (A and B), assuming that the waves emanating from the two slits have the same amplitude a and same wavelength λ.

32. Find the expression for the energy stored in the capacitor. Also find the energy lost when the charged capacitor is disconnected from the source and connected in parallel with the uncharged capacitor. Where does this loss of energy appear? [5]

OR

Four charges + q, + q, - q and - q are placed respectively at the corners A, B, C and D of a square of side a arranged in the given order. Calculate the electric potential at the centre O. lf A a E and F are the midpoints of sides BC and CD respectively, what will be the work done in carrying a charge e from O to E and from O to F?



33. A series L-C-R circuit is connected to an AC source. Using the phasor diagram, derive the expression for the impedance of the circuit. Plot a graph to show the variation of current with frequency of the source, explaining the nature of its variation.

OR

a. Derive an expression for the impedance of a series L-C-R circuit connected to an AC supply of variable frequency.

b. Explain briefly how the phenomenon of resonance in the circuit can be used in the tuning mechanism of a radio or a TV set?