



PRINCE ACADEMY

OF HIGHER EDUCATION

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CBSE SAMPLE PAPER (2024-25)

Time : 03 : 00 Hours

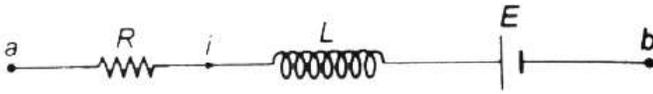
CLASS – XII PHYSICS (042)

M.M. : 70

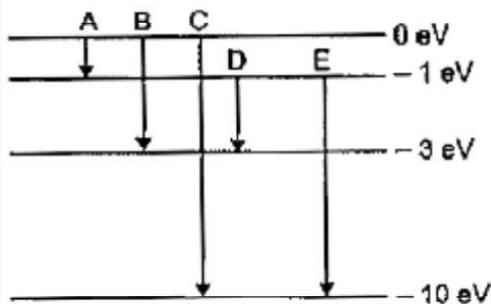
General Instructions:

- (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.
- (3) All the sections are compulsory.
- (4) 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.
- (5) 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.
- (6) Use of calculators is not allowed.

SECTION - A

1. An ammeter of resistance 0.81Ω reads upto 1 A. The value of required shunt to increase the range to 10A is-
(a) 0.9Ω (b) 0.09Ω (c) 0.03Ω (d) 0.3Ω
2. If n cells each of emf ϵ and internal resistance r are connected in parallel, then total emf and internal resistance will be-
(a) $\epsilon, r/n$ (b) ϵ, nr (c) $n\epsilon, r/n$ (d) $n\epsilon, nr$
3. In circuit diagram shown $R = 10\Omega$, $L = 5 \text{ mH}$, $E = 10\text{V}$ and $i = 1\text{A}$. The current decreasing at the rate of 10^3 A/s . Then $(V_A - V_B)$ at this instant is -

(a) 10 V (b) 15 V (c) 20 V (d) 25 V
4. In electromagnetic induction, the induced emf in a coil is independent of-
(a) Change in flux (b) Time (c) Resistance of coil (d) No. of turns in coil
5. A straight wire of mass 200 g and length 1.5 m carries a current of 2A. It is suspended in mid-air by uniform magnetic field B . The value of B is-
(a) 2 (b) 1.5 (c) 0.55 (d) 0.65

6. The ratio of radii of the nuclei with the mass number 8 and 27 would be-
 (a) $27/8$ (b) $8/27$ (c) $2/3$ (d) $3/2$
7. The value of the total electric flux due to a unit positive charge kept in vacuum is-
 (a) $\frac{1}{4\pi\epsilon_0}$ (b) ϵ_0 (c) $\frac{1}{\epsilon_0}$ (d) $4\pi\epsilon_0$
8. Two spheres A and B of radius 'a' and 'b' respectively are charged to same potential. Find the ratio of surface charge density of A to B.
 (a) b/a (b) a/b (c) $\frac{b^2}{a^2}$ (d) $\frac{a^2}{b^2}$
9. The rise in temperature causes the decrease in susceptibility of
 (a) Aluminium (b) Platinum (c) Sodium (d) all of these
10. The magnetic susceptibility of certain paramagnetic material is 1.2×10^5 at 300 K. What is new value of susceptibility at 250 K.
 (a) 1.44×10^5 (b) 1.34×10^5 (c) 1.24×10^5 (d) 1.14×10^5
11. Which transition correspond to emission of photon of wavelength 620 nm.



- (a) A (b) B (c) C (d) D
12. The direction of propagation of wave is-



- (a) \perp to \vec{E} and \vec{B} and out of the paper (b) \perp to \vec{E} and \vec{B} and into the paper
 (c) Parallel to \vec{E} (d) Parallel to \vec{B}

Question 13 to 16, two statements are given - one labelled Assertion (A) and other labelled Reason (R). Select the correct answer to these questions from the options as given below :-

- (a) If both A and R are true and R is correct explanation of A.
 (b) If both A and R are true but R is not correct explanation of A.
 (c) If A is true but R is false.
 (d) If both A and R are wrong.

13. Assertion (A) :- The work-function of a given material increases with increase in frequency of incident radiation.

Reason (R) :- As per $hf = \phi_o + K_{\max}$, work-function is directly proportional to 'f' of incident radiation.

14. Assertion (A) :- The conductivity of intrinsic semiconductor increase with increase in temperature.

Reason (R) :- Increase in temperature decrease the average time between the collision of electrons.

15. Assertion (A) :- The direction of E is always perpendicular to equipotential surface.

Reason (R) :- Work is done by electric force in moving a charge between any two points on equipotential surface is zero.

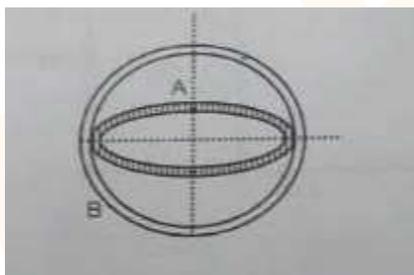
16. Assertion (A) :- The resolving power of a telescope is more if the diameter of the objective lens is more.

Reason (R) :- Objective lens of large diameter collects more light.

SECTION - B

17. A heating element using nichrome connected to a 230 V supply draws an initial current 3.2 A which settles after a few seconds to a steady value of 2.8 A. What is steady temperature of the heating element if room temperature is 27°C. ($\alpha = 1.70 \times 10^{-4} \text{ }^\circ\text{C}^{-1}$).

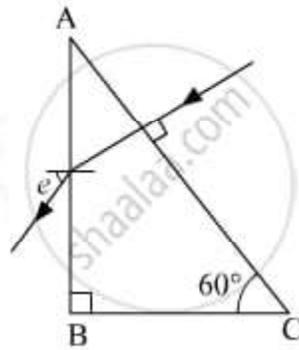
18. Two coils A and B are placed mutually perpendicular as shown in figure. When the current is changed in any of the coil, will the current induce in another coil.



19. Calculate the radius of curvature of equiconcave lens of refractive index 1.5, when it is kept in a medium of refractive index 1.4, to have a power-5D.

20. The no. of silicon atoms per m^3 is 5×10^{28} . This is doped with 5×10^{22} atoms per m^3 of Arsenic. Calculate no. of electrons & holes. (Given, $n_i = 1.5 \times 10^{16}$ per m^3).

21. Calculate angle of emergence (e) in given figure. If refractive index of glass prism is $\sqrt{3}$.

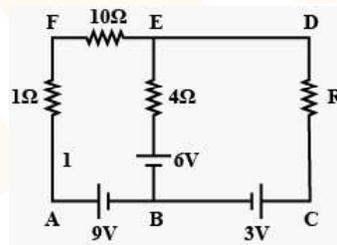


OR

In Rutherford's α – particle experiment closest approach is ' d_0 '. If α – particle is replaced by proton, how much kinetic energy in comparison to α – particle will it require to have the same distance of closest approach.

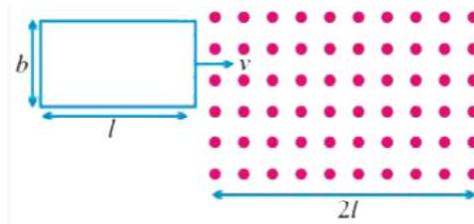
SECTION - C

22. Using kirchhoff's rule determine the value of unknown resistance R so that no current flows through 4Ω resistance.



Also find out potential difference b/w A and D.

23. (a) State the underlying principle of a moving coil galvanometer.
 (b) Give any reason to explain why a galvanometer cannot as such be used to measure the value of current in given circuit.
 (c) Define the terms-
 (i) Voltage sensitivity.
 (ii) Current sensitivity
24. (a) Define self-inductance.
 (b) A rectangular conducting loop of length ' l ' and breadth ' b ' enters in a uniform magnetic field as shown. The loop is moving at constant velocity v and at $t = 0$ it just enters the field. Sketch the following graphs for time interval $t = 0$ to $3l/v$.
 (i) Magnetic flux - time
 (ii) Induced emf - time



25. A microscope is focussed on a coin lying at the bottom of a beaker. The microscope is now raised up by 1 cm. To what depth should water be poured into the beaker so that coin is again in focus.

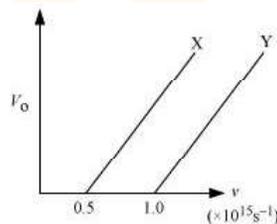
$$(\mu_w = 4/3)$$

26. (a) In a nuclear reaction, ${}^3_2\text{He} + {}^3_2\text{He} \rightarrow {}^4_2\text{He} + 2{}^1_1\text{H} + 12.86\text{MeV}$ calculate energy released by 3 kg

of ${}^3_2\text{He}$.

(b) Plot a graph of potential energy between a pair of nucleons as a function of their separation. Mark the regions where potential energy is positive and negative.

27. The following graph shows the variation of stopping potential ' V_0 ' with frequency ' ν ' of the incident radiation for two photosensitive metals x and y.

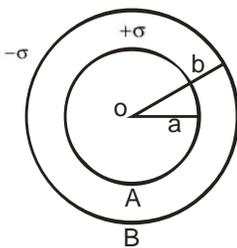


- (a) Which of the metals have larger threshold wavelength.
 (b) Explain, giving reason, which metal gives out electrons, having larger kinetic energy, for the same wavelength.
 (c) If the distance between the light source and metal x is half, how will the kinetic energy of electrons emitted from it change ?
28. Two charges $14\mu\text{C}$ and $-4\mu\text{C}$ are placed at $(-12\text{ cm}, 0, 0)$ and $(12\text{ cm}, 0, 0)$ in an external electric field

$E = \frac{B}{r^2}$, where $b = 1.2 \times 10^6 \frac{\text{Nm}^2}{\text{C}}$ and r is in meter. Calculate the electrostatic potential energy of the configuration.

OR

Two concentric hollow spheres A and B of radius a, b respectively having surface charge densities $+\sigma$ and $-\sigma$ as shown in figure. Calculate ratio of potential at surface of A and B in term of ' a ' ' b '.



SECTION - D

29. Case Study

Read the following paragraph and answer the questions that follow.

Combination of lenses

In many optical instruments two or more than two lenses are used. They may be at some distance or in contact. Different lens combinations are used in the objectives of cameras, microscopes, telescopes and other optical instruments.

When 'n' lenses of powers $P_1, P_2, P_3, \dots, P_n$ are used in contact than the power of the combination is

$$P = P_1 + P_2 + \dots + P_n$$

And the total magnification is

$$m = m_1 \times m_2 \times \dots \times m_n$$

(i) A convex lens and a concave lens, each having some focal length of 25 cm, are put in contact to form a combination of lenses. The power of the combination is

- (a) zero (b) 25 D (c) 50 D (d) infinite

(ii) We combine two lenses, one is convex and other concave having focal lengths f_1 and f_2 and their combined focal length is f . The combination of lenses will behave like concave lens, if

- (a) $f_1 > f_2$ (b) $f_1 = f_2$ (c) $f_1 < f_2$ (d) $f_1 \leq f_2$

(iii) Two identical glass ($\mu_g = 3/2$) equiconvex lenses of focal length f are kept in contact. space between the two lenses is filled with water ($\mu_w = 4/3$).

The focal length of the combination is

- (a) f (b) $\frac{f}{2}$ (c) $\frac{4f}{3}$ (d) $\frac{3f}{4}$

(iv) If two thin lenses are kept coaxially together, then their power is proportional to (R_1 and R_2 being the radii of curved surfaces)

- (a) $R_1 + R_2$ (b) $\left(\frac{R_1 R_2}{R_1 + R_2} \right)$ (c) $\left(\frac{R_1 + R_2}{R_1 R_2} \right)$ (d) None of these

30. Case Study

Read the following paragraph and answer the questions that follow.

A semiconductor has same electron and hole concentration equals to $6 \times 10^8 / \text{m}^3$. On doping the

semiconductor with certain impurity, the electron concentration becomes $9 \times 10^{12} / \text{m}^3$.

(i) Which of the following atoms are used as impurity material ?

- (a) Aluminium (b) Phosphorus (c) Carbon (d) Sodium

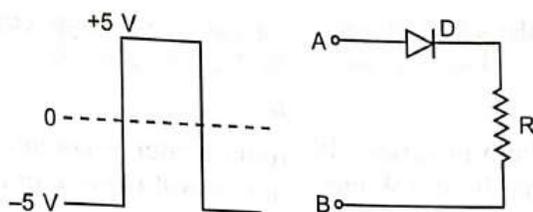
(ii) Identify the new semiconductor after doping.

- (a) p-type (b) n-type
(c) Half-wave rectifier (d) Full-wave rectifier

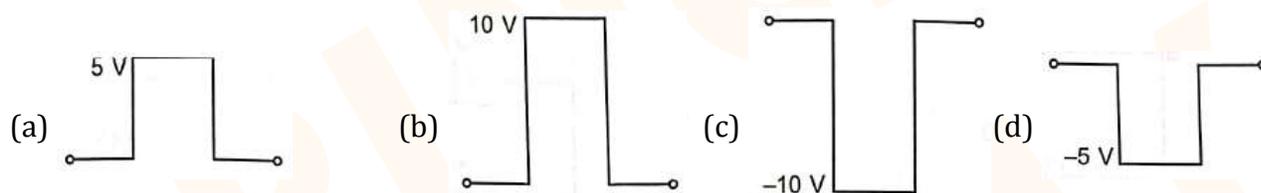
(iii) What is the new hole concentration ?

- (a) $0.4 \times 10^4 / \text{m}^3$ (b) $14 \times 10^4 / \text{m}^3$ (c) $4 \times 10^4 / \text{m}^3$ (d) $40 \times 10^4 / \text{m}^3$

(iv) A square wave (-5 V to +5 V) is applied to a p-n junction diode.

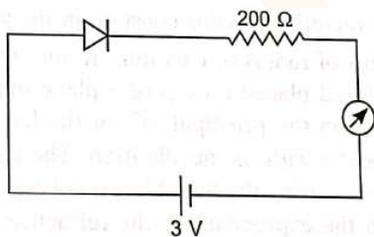


Which of the following is the output waveform across the resistor R ?



OR

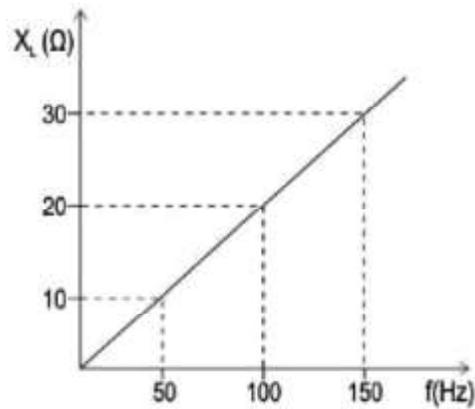
(iv) The reading of the ammeter of a silicon diode in the given circuit is



- (a) zero (b) 15 mA (c) 11.5 mA (d) 13.5 mA

SECTION - E

31. An inductor of inductance 'L' is connected to an AC source $V = 100 \sin \omega t$. The graph below represents the variation of inductive reactance (X_L) of the inductor with frequency of an alternating source.



(a) What is self-inductance of inductor ?

(b) If the source is replaced by a battery such that $V = 100\text{v}$, then what is the inductive reactance of the inductor ? Give reason.

(c) When the frequency is 50 Hz, What is average power dissipated by the inductor over a complete cycle in the circuit ? Justify your answer.

(d) This inductor is connected is connected in series with resistance of 15Ω and a capacitor of $5\mu\text{F}$. The frequency of alternating source is varied such that the power dissipated in circuit becomes maximum. Calculate the frequency and the phase difference between alternating voltage and current when the power dissipated is the maximum.

OR

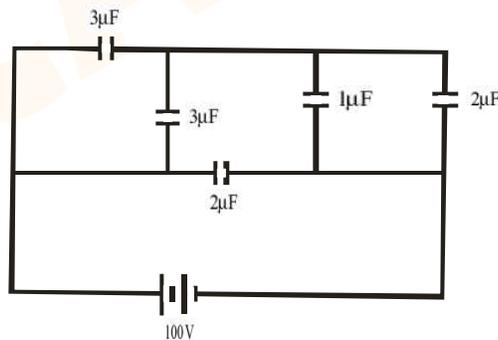
An ideal transformer having a ferromagnetic core consist of two coils having 500 turns (primary) and 50 turns (secondary) respectively.

(a) What is voltage across the secondary coil, if the rms voltage across the primary coil is 240 V?

(b) What will be the individual currents in the two coils, if the secondary has a resistive load of 20 ohms ?

32. (a) Derive an expression for the capacitance of a parallel plate capacitor with air present between the two plates.

(b) Obtain the equivalent capacitance of the network shown in figure. For 100 V supply, determine the charge on each capacitor.

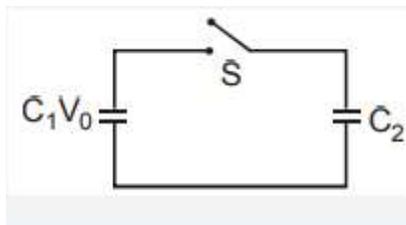


OR

(a) A dielectric slab of thickness 't' is kept between the plates of a parallel plate capacitor with separation 'd' ($t < d$). Drive the expression for the capacitance of the capacitor.

(b) A capacitor of capacity c_1 is charged to the potential of V_0 . On disconnecting with the battery, it

is connected with an uncharged capacitor of capacity C_2 . Find the ratio of energies before and after connection of switch 'S'.



33. (a) Draw a ray diagram showing the image formation by a compound microscope. Obtain the expression for total magnification when the image is formed at infinity.
- (b) How does the resolving power of a compound microscope get affected, when-
- (i) Focal length of the objective is decreased.
- (ii) Wave length of light is increased ? Give reason.

OR

- (a) In a YDSE setup, if the intensity of light passing through one of the slits is reduced, explain the changes that can be seen in the appearance of bright and dark fringes.
- (b) (i) A single slit diffraction setup is illuminated by green light of wavelength 500 nm. Calculate width of central maximum. ($D = 2\text{m}$, $a = 1\text{mm}$)
- (ii) What will happen to width of central maximum, if green light is replaced with red light ?
