INDIAN SCHOOL MUSCAT

FINAL EXAMINATION

FEBRUARY 2021

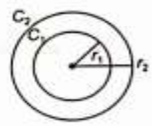
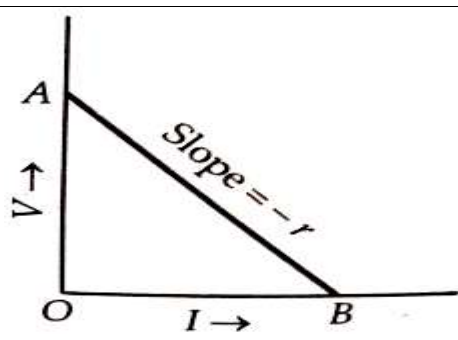
SET A

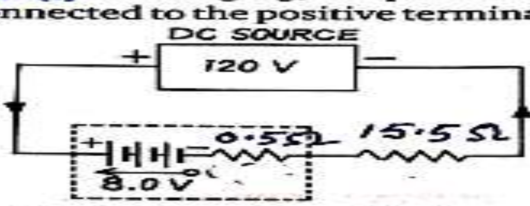
CLASS XII

Marking Scheme – PHYSICS [THEORY]

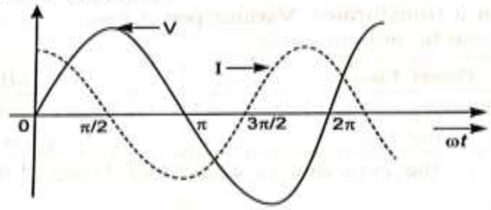
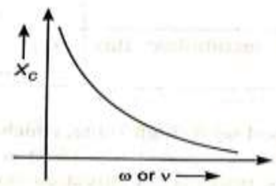
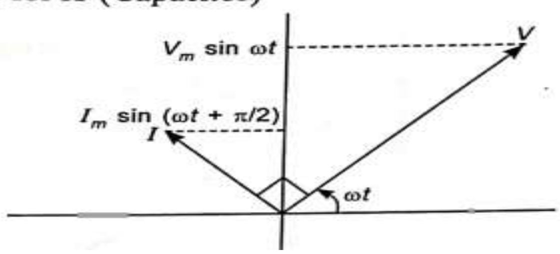
Q.NO.	Answers **SECTION-A**	Marks (with split up)
1.	Magnetic dipole moment	1
2.	$v = E_0/ B_0$ OR Gamma rays , Gamma rays are used in destroying cancer cells	1
3.	$f = Bq/ 2\pi m$ $f \alpha 1/m$ $f_e > f_p$ so electron has more frequency	1
4.	Definition of self-inductance and SI unit OR Any two losses	½ ,½
5.	$R = R_0 A^{1/3}$	1
6.	$KE = 1.6 \times 10^{-19} \times 1.5 = 2.4 \times 10^{-19}$ J	1
7.	Definition of isotopes One example of isotopes OR Two properties of nuclear force	½ ½ ½ ½
8.	Solar cell OR 100 Hz	1
9.	Reverse biased	1
10.	GaP or GaAs. They emit the maximum amount of energy in the form light	1
11.	b	1
12.	b	1

13.	d	1
14.	d	1
	SECTION-B	
15.	(1) a (2) b (3) b (4) b (5) b	4 x1 mark
16.	(1)b (2) c (3) c (4) a (5) b	4 x 1 mark
	SECTION-C	
17.	$F/l = \mu_0/2\pi$ (I_1 I_2)/r) $F/l = 2 \times 10^{-4}$ N/m	1 1
18.	Two independent sources cannot be maintained constant phase difference OR When the slit width is doubled, the width of central band will be halved. Intensity α Area of aperture Intensity of the central band will be doubled	2 1 1
19.	Derivation of $U = 1/2\ CV^2$ Diagram derivation OR $U = 1/2\ CV^2$ Energy stored in first capacitor U = 12 μJ Total charge $Q = 12 \times 10^{-8}$ C Total capacitance after connection in parallel $C = 900 \times 10^{-12}$F Common Potential V 400/3 V Total energy after connection $U' = 8$ μJ Energy loss = 12-8 = 4 μJ	 ½ 1½ ½ 1 ½
20.	Energy of incident photon E = hc/λe = 2.07 eV For detection energy of light should be greater than forbidden energy gap D_2 will detect the light	1 1
21.	Statement of Lenz's law and Explanation	½ , 1½
22.	Verification of laws of reflection by Huygen's principle Diagram Verification	 ½ 1½
23.	Energy band diagrams of a **n**-type and a **p**-type semiconductor at temperature **T > 0K**. Marking the donor and acceptor energy levels with their energies.	1 1

24.	(i) Name the three elements of the Earth's magnetic field. (ii)At Equator OR Given: $B_H = 0.4$ G or $B_E \cos 60° = 0.4$ G $B_E = \frac{0.4}{\cos 60°} \quad \left(\because \cos 60° = \frac{1}{2}\right)$ $= 0.4 \times 2 = 0.8$ G	1½ ½ 2
25.	(a) Two necessary conditions for the phenomena of total internal reflection to occur. (b) n = 1/sin C	1 1
	SECTION-D	
26.	Statement of mutual inductance Consider the two co-axial circular coils (C_1 and C_2) of radii r_1 and r_2 placed coaxially as shown in the figure ($r_1 << r_2$). Let current I be passed through the outer coil. It will produce the magnetic field B on the coil of radius r_1. This magnetic field is given by $B = \frac{\mu_0 I}{2r_2}$  The magnetic flux associated with the inner coil of radius r_1 will increase to $\phi_1 = B \times$ area of the inner coil $\phi_1 = \frac{\mu_0 I}{2r_2} \times \pi r_1^2$ $\phi_1 = \frac{\mu_0 \pi r_1^2}{2r_2} I$ Now, $M = \frac{\phi_1}{I} = \frac{\mu_0 \pi r_1^2}{2r_2}$	1 2
27.	**For point A, when I =0 $\therefore V_A = E$** **E = y – intercept** **For point B, when V =0** **$\therefore E = I_B r$** **Hence $r = \frac{E}{I_B}$r = negative slope of V- I graph**  **OR**	1 1 1

	Solution. (i) For charging, the positive terminal of the DC source is connected to the positive terminal of the battery.  Therefore, during charging, the effective emf driving the (charging) current in the circuit is $E' = 120\ V - 8.0\ V = 112\ V$. The series resistor is $R = 15.5\ \Omega$. If r be the internal resistance of the battery, the charging current is $i = \frac{E'}{R + r} = \frac{112\ V}{(15.5 + 0.5)\ \Omega} = 7.0\ A$. **(ii)** The terminal voltage across the battery of emf E during charging is $V = E + i\,r = 8.0\ V + (7.0\ A)\ (5.0\ \Omega) = 11.5\ V$. **(iii)** The chemical energy stored in the battery in 5 minutes is **= EIt = (8.0V x 7.0 A x (5 x 60 s) = 1.68 x 10^{-4} J** **The series resistor 15 Ω control the current drawn from external DC source.** **In absence of 15 Ω current in circuit will be very large** **I = 112/0.5 = 224 A**	½ 1 1 ½
28.	Derivation of Einstein's photoelectric equation. Any two features of photoelectric effect which cannot be explained by wave theory. **OR** Statement of de-Broglie hypothesis. $\because \quad \lambda_\alpha = \frac{h}{\sqrt{2m_\alpha q_\alpha V}}$ and $\quad \lambda_p = \frac{h}{\sqrt{2m_p q_p V}}$ $\because \quad m_\alpha = 4m_p$ $q_\alpha = 4q_p$ $q_p = e$ $q_\alpha = 4e$ $\frac{\lambda_\alpha}{\lambda_p} = \sqrt{\frac{m_p \cdot e}{4m_p \cdot 2e}} = \frac{1}{2\sqrt{2}}$	2 ½ .½ 1 2
29.	Derivation for the total energy of the electron in the stationary states of the hydrogen atom. KE expression PE expression Total energy expression after the substation of value of radius of orbit	 1 1 1
30.	(a)Distinguish between nuclear fission and fusion. explanation how in both these processes energy is released. (b) Calculate the energy release in MeV in the deuterium-tritium fusion reaction:	½ ½

	The energy released in the given reaction, $Q = [m(^2_1H) + m(^3_1H) - \{m(^4_2He) + m(n)\}]\ u$ or $Q = [2.014102 + 3.016049 - \{4.002603 + 1.008665\}]\ u$ $= 0.018883 \times 931.5$ MeV $[\because 1u = 931.5 \text{ MeV}]$ $= 17.59$ MeV	2
	SECTION-E	
31.	(a)Statement of Gauss's law in electrostatics. Explanation of the outward electric flux due to a point charge +q placed at the centre of a cube of side a. Why is it found to be independent of the size and shape of the surface enclosing it? (b) Calculate the electric field intensity (i) in the outer region of the plates, and (ii) in the interior region between the plates. Diagram Derivation of electric field **OR** (a) Derivation an expression for the electric **E** due to a dipole of length **' 2a'** at a point distant **r** from the centre of the dipole on the axial line. Diagram Derivation (b) graph of **E** versus **r** for **r** >> **a**. (c) If this dipole were kept in a uniform external electric field $\mathbf{E_0}$, diagrammatically represent the position of the dipole in stable and unstable equilibrium and write the expressions for the torque acting on the dipole in both the cases.	½ 1½ 1 2 ½ 1½ 1 1+1
32.	(a) Ray diagram to show refraction of ray of monochromatic light passing through a glass prism. Derivation the expression for the refractive index of glass in terms of angle of prism and angle of minimum deviation. (b) Ray diagram showing the formation of image by a reflecting type telescope. **OR** (a) Derivation a mathematical expression for the width of interference fringes obtained in Young's double slit experiment with the help of a suitable diagram. Diagram Derivation (b) Any two characteristic features which distinguish between interference and diffraction phenomena.	1 2 2 1 2 2

33.	(*a*) $\because$ Current leads the voltage by a phase angle of $\pi/2$, therefore device X is a capacitor.	½
	Reactance $X_C = \frac{1}{\omega C} = \frac{1}{2\pi\nu C}$ Here, ν = Frequency, C = Capacitance	1
	(*b*) Graphs of V and I with time. 	1
	(*c*) Reactance of a capacitor is inversely proportional to the frequency of a.c., i.e. $X_C \propto \frac{1}{\nu}$	½
		1
	(*d*) Phasor diagram for X (Capacitor) 	1
	OR	
	(a) Principle of ac generator	1
	(b) Labelled diagram and working ac generator	1,2
	(c) The coil of an ac generator having **N** turns, each of area **A**, is rotated with constant angular velocity **ω**. Derivation of the expression for the alternating emf generated in the coil.	2