Practice Paper – 1
Marking Scheme

Q. No.	Value Points	Marks
1	Magnetic moment, $M = iA = i(\pi r^2)$, where $l = 2\pi r$ $r = \sqrt{\dfrac{M}{\pi i}}$ $l = 2\pi\sqrt{\dfrac{M}{\pi i}} = \sqrt{\dfrac{4\pi M}{i}}$	1
2	$v_{\text{ferrite}} = \dfrac{c}{\sqrt{\mu_r \varepsilon_r}} = \dfrac{3 \times 10^8}{\sqrt{10 \times 10^{33}}} = 3 \times 10^6\ \text{ms}^{-1}$ $\lambda_{\text{ferrite}} = \dfrac{v_{\text{ferrite}}}{\nu} = \dfrac{3 \times 10^6}{90 \times 10^6} = 3.33 \times 10^{-2}\ \text{m}$ **Or** X-rays being of high energy radiations, penetrate the target and hence these are not reflected back.	1
3	$qV = \dfrac{1}{2}mv^2$ or $v = \sqrt{\dfrac{2qV}{m}}$ $Bqv = \dfrac{mv^2}{r}$ $Bq = \dfrac{mv}{r} = \dfrac{m}{r}\sqrt{\dfrac{2qV}{m}} = \dfrac{\sqrt{2qVm}}{r}$ $m = \dfrac{B^2q^2R^2}{2qV} = \dfrac{B^2qR^2}{2V}$ $m \propto R^2$ $(\therefore B, q$ and V are same) $\dfrac{m_1}{m_2} = \left(\dfrac{R_1}{R_2}\right)^2$	1

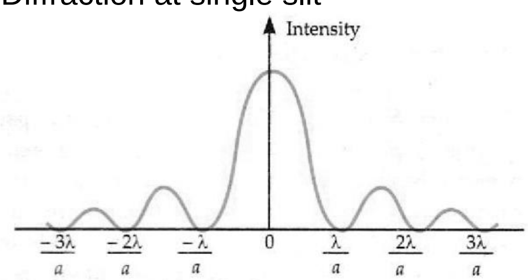
4	Q-factor of this circuit, $$Q = \frac{1}{R}\sqrt{\frac{L}{C}} = \frac{1}{10}\sqrt{\frac{2}{32 \times 10^{-5}}} = \frac{10^3}{40} = 25$$ **Or** $$e_1 = e_2$$ $$L_2\left(\frac{di_1}{dt}\right) = L_2\left(\frac{di_2}{dt}\right)$$ Integrating both sides w.r.t. t, we get $$L_1 i_1 = L_2 i_2$$ $\therefore$ $$\frac{i_1}{i_2} = \frac{L_2}{L_1}$$	1
5	Ist excited state corresponds to $n = 2$ 2nd excited state corresponds to $n = 3$ $$\frac{E_1}{E_2} = \frac{n_3^2}{n_2^2} = \frac{3^2}{2^2} = \frac{9}{4}$$	1
6	$$\frac{\lambda_p}{\lambda_\alpha} = 2\sqrt{2}$$	1
7	The original nuclei must first break up before combining with each other.	1
8	the resistance of copper will decrease, while that of germanium will increase The temperature coefficient of resistance of copper is positive and germanium is negative. **Or** The upper junction diode is forward biased and middle junction diode is reverse biased. So, effective resistance of circuit $= 10 + 10 = 20\ \Omega$ $$I = \frac{3}{20} = 0.15\ \text{A}$$	1

9	As, $I = nAev_d$ $\frac{n_e}{n_h} = \frac{I_e}{I_h} \times \frac{v_h}{v_e} = \frac{7}{4} \times \frac{4}{5} = \frac{7}{5}$	1
10	The two advantages of LED's over the conventional incandescent lamps are (i) Low operational voltage and less power. (ii) Fast action and no warm-up time required.	1
11	a) Both A and R are true and R is the correct explanation of A. When dipole is aligned along the direction of electric field, torque on it, is zero and its electrical potential energy is minimum ($U = -pE$). Hence, it is in a stable equilibrium condition.	1
12	a) Both A and R are true and R is the correct explanation of A.	1
13	d) A is false and R is also false	1
14	a) Both A and R are true and R is the correct explanation of A. The diffraction of sound is only possible when the size of opening should be of the same order as its wavelength and the wavelength of sound is of the order of 1.0 m, hence, for a very small opening no diffraction is produced in sound waves.	1
15	(i) c (ii) d (iii) d (iv) b (v) c	1 1 1 1 1 (Any 4)
16	(i) d (ii) a (iii) c (iv) c (v) b	1 1 1 1 1 (Any 4)
17	$\lvert d\mathbf{B} \rvert = \frac{\mu_0}{4\pi} \frac{I\, dl \sin\theta}{r^2}$	½

	$dl = \Delta x = 10^{-2}\,\text{m}$, $I = 10$ A, $r = 0.5$ m $= y$, $\mu_0 / 4\pi = 10^{-7}\,\frac{\text{T m}}{\text{A}}$ $\theta = 90°$; $\sin\theta = 1$ $\lvert d\mathbf{B}\rvert = \frac{10^{-7} \times 10 \times 10^{-2}}{25 \times 10^{-2}} = 4 \times 10^{-8}$ T	½ ½ ½
18	Expression of intensity Solution K/4 **OR** Correct wave front diagrams	1 1 1+1
19	Diagram Derivation **OR** Definition Zero Correct Reason	½ 1½ 1 ½ ½
20	Diagram Working	½ 1½
21	Number of turns per unit length,n = 15 turns/cm = 1500 turns/m Area of the small loop, A = 2 cm^2 = 2 x 10^{-4} m^2 Initial current, I_1 = 2A Final current, I_2 = 4A Δt = 0.1s The magnetic field associated with current I_1, $B_1 = \mu_0 n I_1$ The magnetic field associated with current I_2, $B_2 = \mu_0 n I_2$ The change in flux assosciated with change in current in solenoid, $\Delta\phi = (B_2 - B_1) A$ $= 4\pi \times 10^{-7} \times 1500 \times (4-2) \times 2 \times 10^{-4}$ $= 7.6 \times 10^{-7}$ weber	½ ½ ½

	$|E| = \frac{\Delta\phi}{\Delta t}$ $= \frac{7.6 \times 10^{-7}}{0.1}$ $= 7.6 \times 10^{-6}V$	½
22	Distance between the slits, $d = 0.28 \times 10^{-3}$ m Distance between the slits and the screen, $D = 1.4$m Distance between the central fringe and the fourth $(n = 4)$ fringe, Y = n λD/d Calculation for λ = 600 nm	½ ½ 1
23	Any two differences	1+1
24	Definition of the terms Or Formula Substitution and solution (δ = 60°)	1+1 1+1
25	Correct diagram	2
26	Induced emf in the loop is given by $e = -B.\frac{dA}{dt}$ where A is the area of the loop. $e = -B.\frac{d}{dt}(\pi r^2) = -B\pi 2r\frac{dr}{dt}$ $r = 2\text{ cm} = 2 \times 10^{-2}\text{m}$ $dr = 2\text{ mm} = 2 \times 10^{-3}\text{m}$ $dt = 1\text{s}$ $e = -0.04 \times 3.14 \times 2 \times 2 \times 10^{-2} \times \frac{2 \times 10^{-3}}{1}V$ $= 0.32\pi \times 10^{-5}V$ $= 3.2\pi \times 10^{-6}V$ $= 3.2\pi\mu V$.	½ ½ 1 1
27	Name: Potentiometer Principle Working Sensitivity can be increased by (any method) OR Diagram Derivation	½ ½ 1½ ½ 1 1½

	Correct expression	½
28	a) Maximum Kinetic energy 0.345eV b) Stopping potential 0.345V c) Maximum speed 3.323×10^5 m/s **OR** Three properties of photons (any three) Correct explanation	1 1 1 3
29	Derivation	3
30	$\Delta m = 2\ (2.015) - (3.017 + 1.009) = 0.004$ amu Energy released = (30.004×931.5) MeV $= 3.726$ MeV Energy released per deuteron $= \frac{3.726}{2} = 1.863$ MeV Number of deuterons in 1 kg $= \frac{6.02 \times 10^{26}}{2} = 3.01 \times 10^{26}$ Energy released per kg of deuterium fusion $= (3.01 \times 10^{26} \times 1.863)$ $= 5.6 \times 10^{26}$ MeV $\approx 9.0 \times 10^{13}$ J	1 1 ½ ½
31	Derivation Force exerted on negative charge (r = 0.02 m), $F_1 = \frac{9 \times 10^9 \times 2 \times 2 \times 10^{-8} \times 4 \times 10^{-4}}{0.02} N$ = 7.2 N, acting towards the line charge Force exerted on positive charge (r = 2.2×10^{-2} m), $F_2 = \frac{9 \times 10^9 \times 2 \times 2 \times 10^{-8} \times 4 \times 10^{-4}}{2.2 \times 10^{-2}}$ = 6.5 N, acting away from the line charge Net force on the dipole, $F = F_1 - F_2 = 7.2 - 6.5$ = 0.7 N, acting towards the line charge.	3 1 1

	OR Derivation Equilibrium conditions Numerical (1:4)	 2 1 2
32	Derivation Phasor Diagram Resistance is connected to Inductor LR circuit OR Principle + Working Any two losses and ways to avoid them (i) Transformation ratio, $k = \frac{N_2}{N_1} = 100$ $\therefore N_2 = 100N_1 = 100 \times 100 = 10{,}000$ (ii) $I_1 = \frac{P_1}{\varepsilon_1} = \frac{1100}{220} = 5\text{A}$	3 1 1 ½+1 ½ + 1 2
33	Diffraction at single slit  Intensity of secondary maxima decreases with the order of the maximum. The reason is that the intensity of the central maximum is due to the constructive interference of wavelets from all parts of the slit, the first secondary maximum is due to the contribution of wavelets from one third part of the slit (wavelets from remaining two parts interfere destructively).Hence the intensity of secondary maximum decreases with the increase in the order n of the maximum. **OR** Diagram + derivation	3 1 1 2+1

	m= 20, m_e = 5, D=20cm, v_e = -20 cm $\therefore\ m = \frac{m}{m_e} = \frac{20}{5} = 4$ As the eyepiece acts as a simple microscope, so $m_e = 1 + \frac{D}{f_e}$ or 5 = 1 + $\frac{20}{f_e}$ $\therefore\ f_e = 5$ cm Also, $m_e = \frac{v_e}{u_e}$ $5 = \frac{-20}{u_e}$ u_e=-4 cm Distance between the objective and the eyepiece = 14 cm or $\lvert u_e \rvert + \lvert v_0 \rvert = 14$ or $4 + v_0 = 14$ or $v_0 = 10$cm Now, $m_0 = 1 - \frac{v_0}{f_0} \Rightarrow -4 = 1 - \frac{10}{f_0}$ $\therefore\ f_0 = 2$ cm.	1 1