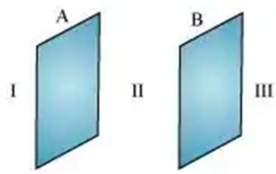
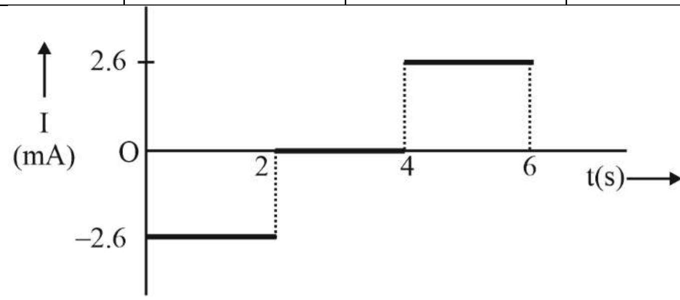
Class: XII
SESSION : 2022-2023
MARKING SCHEME
CBSE SAMPLE QUESTION PAPER (THEORY)
SUBJECT: PHYSICS

Q.no		Marks
	SECTION A	
1	(ii) $q_1q_2<0$	1
2	(iv) zero	1
3	(ii) material A is germanium and material B is copper	1
4	(iv) 6A in the clockwise direction	1
5	(iii) 4:3	1
6	(i) decreases	1
7	(ii) increase	1
8	(iv) Both electric and magnetic field vectors are parallel to each other.	1
9	(ii) the circular and elliptical loops	1
10	(iv) 0.85	1
11	(iii) 3000 Å	1
12	(iv) 4.77×10^{-10}m	1
13	(ii) The nuclear force is much weaker than the Coulomb force .	1
14	(i) 30 V	1
15	(i)	1
16	c) A is true but R is false	1
17	c) A is true but R is false	1
18	a) Both A and R are true and R is the correct explanation of A	1
	SECTION B	
19	λ_1 -Microwave λ_2 - ultraviolet λ_3- infrared Ascending order - $\lambda_2<\lambda_3<\lambda_1$	½ ½ ½ ½
20	A - diamagnetic B- paramagnetic The magnetic susceptibility of A is small negative and that of B is small positive.	½ ½ ½ ½
21	From the relation $R = R_0A^{1/3}$, where R_0 is a constant and A is the mass number of a nucleus $R_{Fe}/R_{Al} = (A_{Fe}/A_{Al})^{1/3}$ $= (125/27)^{1/3}$ $R_{Fe} = 5/3\ R_{Al}$ $=5/3 \times 3.6$ $= 6$ fermi **OR** Given short wavelength limit of Lyman series	½ ½ ½ ½

	$$\frac{1}{\lambda_L} = R\left(\frac{1}{1^2} - \frac{1}{\infty}\right)$$ $$\frac{1}{913.4\ \text{Å}} = R\left(\frac{1}{1^2} - \frac{1}{\infty}\right)$$	½
	$\lambda_L = \frac{1}{R} = 913.4$ Å	½
	For the short wavelength limit of Balmer series n_1=2, $n_2 = \infty$ $$\frac{1}{\lambda_B} = R\left(\frac{1}{2^2} - \frac{1}{\infty}\right)$$	½
	$\lambda_B = \frac{4}{R} = 4$ x 913.4 Å = 3653.6 Å	½
22	$$\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$	½
	$$\frac{1}{f} = \left(\frac{\mu_m}{\mu_w} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$ $$\frac{\mu_m}{\mu_w} = \frac{1.25}{1.33}$$	½
	$$\frac{\mu_m}{\mu_w} = 0.98$$	½
	The value of (μ – 1) is negative and 'f' will be negative. So it will behave like diverging lens.	½
23	To keep the reading of ammeter constant value of R should be **increased** as with the increase in temperature of a semiconductor, its resistance **decreases** and current tends to increase.	1 1
	OR	
	B - reverse biased	½
	In the case of reverse biased diode the potential barrier becomes higher as the battery further raises the potential of the n side.	½
	C -forward biased	½
	Due to forward bias connection the potential of P side is raised and hence the height of the potential barrier decreases.	½
24	Angular width 2φ = 2λ/d	½
	Given λ = 6000 Å In Case of new λ (assumed λ' here),	½
	angular width decreases by 30% New angular width = 0.70 (2 φ)	½
	2 λ'/d = 0.70 X (2 λ/d) ∴λ'= 4200 Å	½

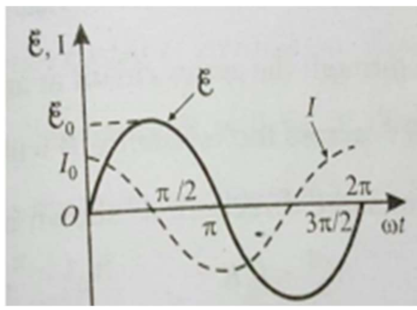
25	 Surface charge density of plate A = $+17.7 \times 10^{-22}$ C/m^2 Surface charge density of plate B = -17.7×10^{-22} C/m^2 (a) In the outer region of plate I, electric field intensity E is zero. (b)Electric field intensity E in between the plates is given by relation $$E = \frac{\sigma}{\epsilon_0}$$ Where, ϵ_0 = Permittivity of free space = 8.85×10^{-12} N^{-1} C^2 m^{-2} $$\therefore E = \frac{17.7\ x\ 10^{-22}}{8.85\ x\ 10^{-1}}$$ Therefore, electric field between the plates is 2.0×10^{-10} N/C	½ ½ ½ ½
	SECTION C	
26	Diagram Derivation The ampere is the value of that steady current which, when maintained in each of the two very long, straight, parallel conductors of negligible cross-section, and placed one metre apart in vacuum, would exert on each of these conductors a force equal to 2×10^{-7}newtons per metre of length.	½ 1 ½ 1
27	Area of the circular loop = πr^2 $= 3.14 \times (0.12)^2$ m^2 = 4.5×10^{-2} m^2 $$E = -\frac{d\varphi}{dt} = -\frac{d}{dt}(BA) = -A\frac{dB}{dt} = -A \cdot \frac{B_2 - B_1}{t_2 - t_1}$$ For $0 < t < 2$s $$E_1 = -4.5 \times 10^{-2} \times \left\{\frac{1-0}{2-0}\right\} = -2.25 \times 10^{-2} \text{ V}$$ $$\therefore \quad I_1 = \frac{E_1}{R} = \frac{-2.25 \times 10^{-2}}{8.5} \text{ A} = -2.6 \times 10^{-3} \text{ A} = -2.6 \text{ mA}$$ For $2s < t < 4s$, $$E_2 = -4.5 \times 10^{-2} \times \left\{\frac{1-1}{4-2}\right\} = 0$$ $$\therefore \quad I_2 = \frac{E_2}{R} = 0$$ For $4s < t < 6s$, $$I_3 = -\frac{4.5 \times 10^{-2}}{8.5} \times \left\{\frac{0-1}{6-4}\right\} \text{A} = 2.6 \text{ mA}$$	½ ½ ½ ½

	0<t<2s	2<t<4s	4<t<6s
E(V)	-0.023	0	+0.023
I(mA)	-2.6	0	+2.6



1

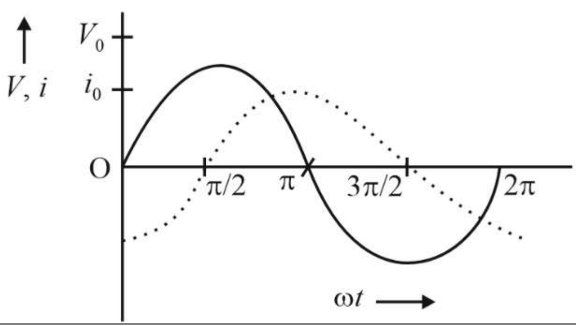
28 Derivation 2



1

OR

Derivation 2



1

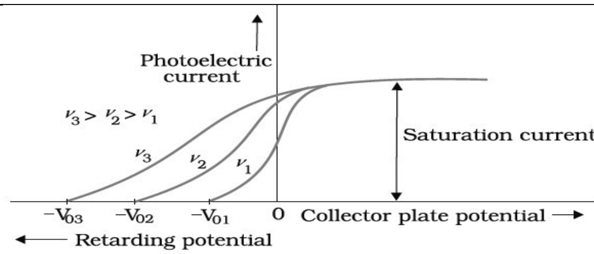
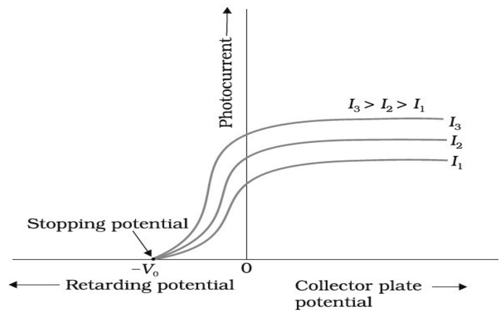
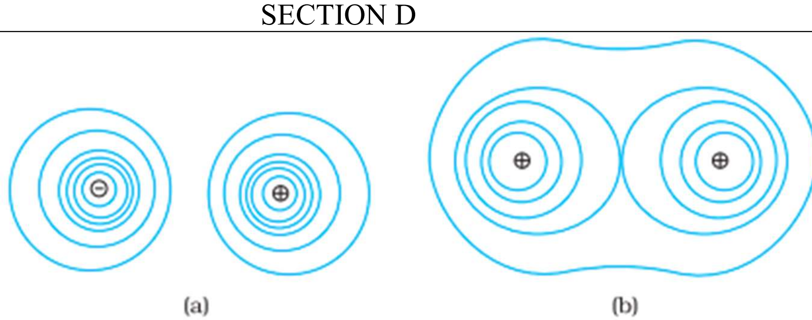
29 From the observations made (parts A and B) on the basis of Einstein's photoelectric equation, we can draw following conclusions:

1. For surface A, the threshold frequency is more than 10^{15} HZ, hence no photoemission is possible. 1
2. For surface B the threshold frequency is equal to the frequency of given radiation. Thus, photo-emission takes place but kinetic energy of photoelectrons is zero. 1
3. For surface C, the threshold frequency is less than 10^{15} Hz. So photoemission occurs and photoelectrons have some kinetic energy 1

OR

a) A - cut off or stopping potential ½

X - anode potential ½

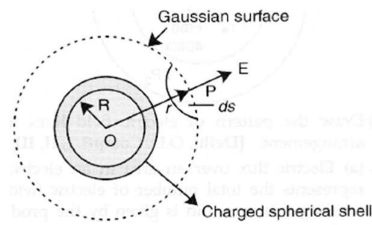
b)	 **FIGURE** Variation of photoelectric current with collector plate potential for different frequencies of incident radiation.	1
c)	 **FIGURE** Variation of photocurrent with collector plate potential for different intensity of incident radiation.	1
30	For a transition from n=3 to n =1 state, the energy of the emitted photon, hυ = E_2 –E_1 = 13.6 $[\frac{1}{1^2} - \frac{1}{3^2}]$ eV = 12.1 eV. From Einstein's photoelectric equation, hυ = K_{max} + W_0 $\therefore W_0 = h\upsilon - K_{max} = 12.1 - 9 = 3.1\ eV$ Threshold wavelength, $\lambda_{th} = \frac{hc}{W_0} = \frac{6.62x10^{-34}x3x10^8}{3.1x1.6x10^{-19}}$ = 4x10^{-7} m	1 ½ ½ 1
	SECTION D	
31(a)	 **FIGURE 2.11** Some equipotential surfaces for (a) a dipole, (b) two identical positive charges.	1 + 1
(b)	Here, A =6 x 10^{-3} m^2, d =3mm=3x10^{-3}m (i) Capacitance, C=ϵ_0A/d = (8.85x10^{-12} x 6x10^{-3}/3x10^{-3}) = 17.7x10^{-12} F (ii) Charge, Q = CV =17.7 x10^{-12}x100=17.7x10^{-10}C (iii) New charge Q'= KQ=6x17.7 x10^{-10} =1.062 x 10^{-8} C	1 1 1
(a)	**OR** Diagram	1/2

$$\frac{K(-q)Q}{x} + \frac{kQ(-q)}{x} + \frac{k(-q)(-q)}{2x} = 0$$ 1

$$\frac{-2kqQ}{x} + \frac{kq^2}{2x} = 0 \text{ or } \frac{kq^2}{2x} = \frac{2kqQ}{x}$$

$$q = 4Q \quad \text{or} \quad \frac{Q}{q} = \frac{1}{4}$$ ½

(b) Electric field due to a uniformly charged thin spherical shell:



½

(i) When point P lies outside the spherical shell: Suppose that we have calculate field at the point P at a distance r (r>R) from its centre. Draw Gaussian surface through point P so as to enclose the charged spherical shell. Gaussian surface is a spherical surface of radius r and centre O.

Let $\vec{E}$ be the electric field at point P, then the electric flux through area element of area $\overrightarrow{ds}$ is given by

$$d\varphi = \vec{E}.\overrightarrow{ds}$$ ½

Since $\overrightarrow{ds}$ is also along normal to the surface

$$d\varphi = E\,dS$$

∴ Total electric flux through the Gaussian surface is given by

$$\varphi = \oint E ds = E \oint ds$$

$$\text{Now, } \oint ds = 4\pi r^2 \quad ...(i)$$

$$= E x 4\pi r^2$$

Since the charge enclosed by the Gaussian surface is q, according to the Gauss's theorem,

$$\varphi = \frac{q}{\epsilon_0}........(ii)$$ ½

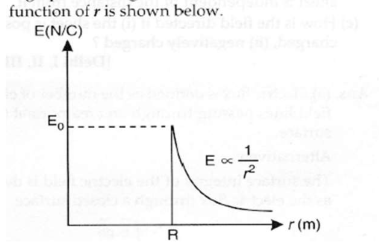
From equation (i) and (ii) we obtain

$$E \text{ x } 4\pi r^2 = \frac{q}{\epsilon_0}$$

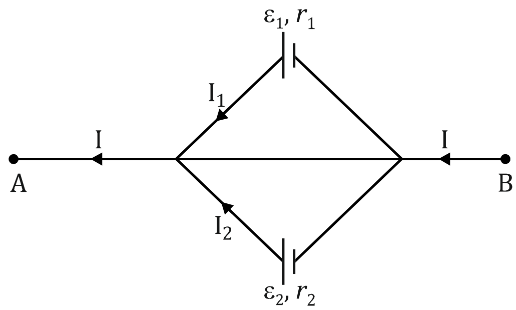
$$E = \frac{1}{4\pi\epsilon_0} \cdot \frac{q}{r^2} \quad (\text{for } r>R)$$ ½

(ii)

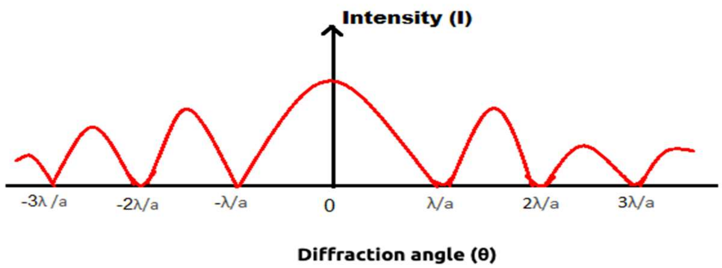
A graph showing the variation of electric field as a function of *r* is shown below.



1

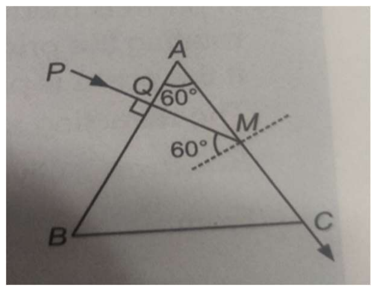
32(a)	Drift velocity: It is the average velocity acquired by the free electrons superimposed over the random motion in the direction opposite to electric field and along the length of the metallic conductor. Derivation I = ne A V_d	½ 1½
(b)	Here, $I = I_1 + I_2$ ...(*i*) Let V = Potential difference between A and B. For cell ε_1 Then, V= $\varepsilon_1 - I_1 r_1 \Rightarrow I_1 = \dfrac{\varepsilon_1 - V}{r_1}$  Similarly, for cell ε_2 $I_2 = \dfrac{\varepsilon_2 - V}{r_2}$ Putting these values in equation (*i*) $I = \dfrac{\varepsilon_1 - V}{r_1} + \dfrac{\varepsilon_2 - V}{r_2}$ or $I = \left(\dfrac{\varepsilon_1}{r_1} + \dfrac{\varepsilon_2}{r_2}\right) - V\left(\dfrac{1}{r_1} + \dfrac{1}{r_2}\right)$ or $V = \left(\dfrac{\varepsilon_1 r_2 + \varepsilon_2 r_1}{r_1 + r_2}\right) - I\left(\dfrac{r_1 r_2}{r_1 + r_2}\right)$ ...(*ii*) Comparting the above equation with the equivalent circuit of emf 'ε_{eq}' and internal resistance 'r_{eq}' then, $V = \varepsilon_{eq} - Ir_{eq}$ ...(*iii*) Then (*i*) $\varepsilon_{eq} = \dfrac{\varepsilon_1 r_2 + \varepsilon_2 r_1}{r_1 + r_2}$ (*ii*) $r_{eq} = \dfrac{r_1 r_2}{r_1 + r_2}$ (*iii*) The potential difference between A and B $V = \varepsilon_{eq} - Ir_{eq}$	3
	OR	
(a)	Junction rule: At any junction, the sum of the currents entering the junction is equal to the sum of currents leaving the junction Loop rule: The algebraic sum of changes in potential around any closed loop involving resistors and cells in the loop is zero	1 1
(b)	Derivation	3

33(a) 1



Width of central maximum is twice that of any secondary maximum 1

(b) 1



Given : $\angle A = 60^0$, $\angle i = 0^0$

At M : $\sin C = \frac{1}{\mu} = \frac{\sqrt{3}}{2} = \sin 60^0$

$\therefore \quad C = 60^0$ 1

So the ray PM after refraction from the face AC grazes along AC.

$\therefore \angle e = 90^0$

From $\quad \angle i + \angle e = \angle A + \angle \delta$

Or $\quad 0^0 + 90^0 = 60^0 + \angle \delta$

$\therefore \delta = 90^0 - 60^0 = 30^0$ 1

OR

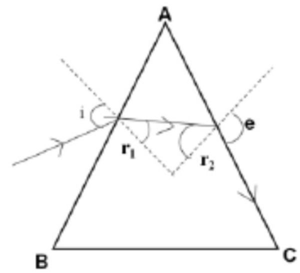
(a) (i) The interference pattern has a number of equally spaced bright and dark bands. The diffraction pattern has a central bright maximum which is twice as wide as the other maxima. The intensity falls as we go to successive maxima away from the centre, on either side. 1

(ii) We calculate the interference pattern by superposing two waves originating from the two narrow slits. The diffraction pattern is a superposition of a continuous family of waves originating from each point on a single slit. 1

(b)

(i) $\mu = \dfrac{\sin\left(\dfrac{A+\delta_m}{2}\right)}{\sin\left(\dfrac{A}{2}\right)} = \dfrac{\sin\left(\dfrac{60+30}{2}\right)}{\sin\left(\dfrac{60^o}{2}\right)} = \sqrt{2}$ 1½

Also $\mu = \dfrac{c}{\upsilon} \Rightarrow \upsilon = \dfrac{3\times10^8}{\sqrt{2}} m/s$

	(ii) At face AC, let the angle of incidence be r_2. For grazing ray, $e = 90^o$ $\Rightarrow \mu = \frac{1}{\sin r_2} \Rightarrow r_2 = \sin^{-1}\left(\frac{1}{\sqrt{2}}\right) = 45^o$ Let angle of refraction at face AB be r_1. Now $r_1 + r_2 = A$ $\therefore r_1 = A - r_2 = 60^o - 45^o = 15^o$ Let angle of incidence at this face be i $\mu = \frac{\sin i}{\sin r_1} \Rightarrow \sqrt{2} = \frac{\sin i}{\sin 15^o}$ $\therefore i = \sin^{-1}\left(\sqrt{2} . \sin 15^o\right) = 21.5^0$ 	1½
	SECTION E	
34(i)	When the image is formed at infinity, we can see it with minimum strain in the ciliary muscles of the eye.	1
(ii)	The multi-component lenses are used for both objective and the eyepiece to improve image quality by minimising various optical aberrations in lenses.	1
(iii)	(a)The compound microscope is used to observe minute nearby objects whereas the telescope is used to observe distant objects.	1
	(b) In compound microscope the focal length of the objective is lesser than that of the eyepiece whereas in telescope the focal length of the objective is larger than that of the eyepiece.	1
	OR	
(iii)	(a) The image formed by reflecting type telescope is brighter than that formed by refracting telescope.	1
	(b) The image formed by the reflecting type telescope is more magnified than that formed by the refracting type telescope.	1
35(i)	LEDs are made up of compound semiconductors and not by the elemental conductor because the band gap in the elemental conductor has a value that can detect the light of a wavelength which lies in the infrared (IR) region.	1
(ii)	1.8 eV to 3 eV	1
(iii)	LED is reversed biased that is why it is not glowing.	2
	OR	
	V-I Characteristic curves of pn junction diode in forward biasing and reverse biasing.	1+ 1