12th Standard

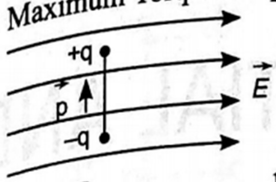
Physics(theory)

SQP Marking Scheme 2020-21

s.no.	Value Points	marks
1.	According to Gauss's law, $\phi = \oint_S \vec{E}.\vec{dS} = \frac{q_1}{\varepsilon_0}$ ...where [q_1 is the total charge enclosed by the surface S $\phi = \frac{2q-q}{\varepsilon_0} = \frac{q}{\varepsilon_0}$ $\therefore$ Electric flux, $\phi = \frac{q}{\varepsilon_0}$	1
2.	• Physical quantity whose S.I. unit is JC^{-1} is Electric potential. • It is a Scalar quantity.	1/2 ½
3.	Oersted	1
4.	Zero degree	1
5.	Conservation of energy	1
6.	Gamma rays	1

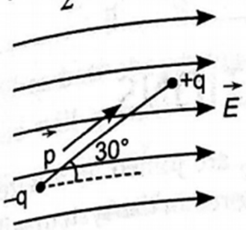
7	Total internal reflection	1
8	Frequency	1
9.	Max. K.E =charge x stopping potential =1.5 x1.6x10^-19 J =2.4 x 10^-19 J or 1.5 eV	1
10.	The angular momentum of an electron should be an integeral multiple of h/2π L=mvr=nh/2 π	1
11.	C	1
12.	B	1
13.	D	1
14.	A	1
15.	(*i*) $\vec{\tau} = \vec{p} \times \vec{E}$ or $\tau = p\,E \sin\theta$ here $p = 2aq$ (If point charges are q and $-q$ separated by a distance $2a$.) OR Torque is perpendicular to dipole moment and electric field. $\vec{\tau} \perp \vec{p}$ and $\vec{\tau} \perp \vec{E}$	1

(ii) (a) Maximum Torque $\tau = pE$ when $\theta = 90°$ 1

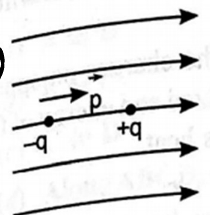


'OR'

$\tau = \frac{pE}{2}$ when, $\sin\theta = \frac{1}{2}$ *i.e.*, $\theta = 30°$ or $150°$ 1



(b)



$\because \theta = 0°$ or $180°$ 1

$\therefore \tau = pE \sin 0° = 0$

$\therefore \tau =$ minimum

16.	(i) Real, magnified and inverted image. (ii) The image produced by the objective lens should either be formed at focus of eyepiece or between focus and eyepiece. (iii) If image formed by the object is placed between focus of eyepiece and an eyepiece; then magnifying power is $m_1 = \frac{v_0}{-u_0}.\left(1+\frac{D}{f_e}\right)$ which the case of first microscope. But in case of second microscope, if image formed by objective is formed at the focus of eyepiece, then final image is seen at infinity and angular magnification produced will be $m_2 = \frac{v_0}{-u_0}.\frac{D}{f_e}$; $[\therefore m_2 < m_1]$	(1) (1) (2)

17. (a) C = 2+3+4= 9pF= 9 $\times 10^{-12}$ F (1/2)

(b) $Q_1 = C_1V = 2 \times 10^{-12} \times 100 = 2 \times 10^{-10}$ C (1/2)

Similarly $Q_2 = 3 \times 10^{-10}$ C, (1/2)

$Q_3 = 4 \times 10^{-10}$ C (1/2)

18. Resistance of shunt $r_s = \frac{I_g R_G}{I - I_g} = \frac{1.0 \times 0.80}{5.0 - 1.0} = 0.20\Omega$ (1)

Net resistance of ammeter and shunt

$R = \frac{R_G \times r_s}{R_G + r_s} = 0.16\ \Omega$ (1)

OR

BLI= mg =λLg

B= =λg/l ($1\frac{1}{2}$)

From Fleming left hand rule , magnetic field must act horizontally in a direction perpendicular to the wire carrying current. (½)

19. Magnetic declination (1)

Correct figure for horizontal compoent (1/2)

Correct relation $B_H = B_E \cos\delta$ (1/2)

OR

$$B_H = \frac{1}{\sqrt{3}} B_V \text{ or } \frac{B_V}{B_H} = \sqrt{3}$$

$$\text{Also } \frac{B_V}{B_H} = \tan\delta$$

$$\therefore \tan\delta = \sqrt{3}$$

$$\text{or } \delta = 60^0$$ (1)

(b) $$B_H = B_E \cos\delta = B_E \cos 60^0 = \frac{B_E}{2}$$

$$\therefore \frac{B_H}{B_E} = \frac{1}{2}$$ (1)

20. (a) $$M = \frac{\Phi_2}{I_1} = \frac{0.5 \times 10^{-3}\,Wb}{0.5\ A} = 10^{-3} H = 1mH$$ (1)

(a) An instantaneous emf is produced in the larger coil on account of mutual inductance. (1)

21. $\lambda = 589\,nm = 589 \times 10^{-9} m$

$c = 3 \times 10^{8} m/s$

(a) $\therefore$ Frequency of light $\nu = \frac{c}{\lambda} = \frac{3 \times 10^{8}}{589 \times 10^{-9}}$

$= 5.09 \times 10^{14} Hz$

$\therefore$ Frequency of refracted light $\nu' = \nu$

$= 5.09 \times 10^{14} Hz$ (1)

(b) Wavelength of refracted light $\lambda' = \frac{\lambda}{n}$

$= \frac{589}{1.33}$

$= 442.8\ nm$

(1)

22. Correct understanding of Wavefront (1)

Correct depiction diagrammatically (1)

23. Since $\beta = \frac{\lambda D}{d}$; we can write $\frac{\beta'}{\beta} = \frac{\lambda'}{\lambda}$

Here $\beta = 8.1 mm$; $\beta' = 7.2 mm$, $\lambda = 630 nm$

$\therefore \quad \lambda' = 560\ nm \qquad (2)$

24. Correct biasing (1)

Two advantages (1)

Or

Circuit diagram (1)

Characteristic curve (1)

25. Correct labelled diagram (1)

Correct input Output waveforms (1)

Section C

26. Derivation of resistivity $\rho = \frac{m}{ne^2\tau}$ (3)

27. Labelled diagram (1)

Principle (1/2)

Working (1)

Sinusoidal nature (1/2)

Or

Mutual inductance definition (1)

Derivation of $M_{21} = M_{12} = M = \frac{\mu_0 N_1 N_2 \pi r_1^2}{l}$ (2)

28. (a) Momentum of electron = Momentum of Photon

$\therefore \quad p = \frac{h}{\lambda} = \frac{6.63\times10^{-34}}{1\times10^{-9}} = 6.63\times10^{-25}$ Kg m s^{-1} (1)

(b) Energy of Photon $= \frac{hc}{\lambda} = h\cdot c = 6.63\times10^{-25}\times 3\times10^{8} = 1.99\times10^{-16}$ J

(c) K.E of electron $K = \frac{p^2}{2m} = \frac{(6.63\times10^{-25})^2}{2\times9.11\times10^{-31}} = 2.41\times10^{-19}$ J

OR

Here $\nu_0 = 3.3\times10^{14}$ Hz and $\nu = 8.2\times10^{14}$ Hz

$\because h(\nu-\nu_0) = eV_0$

$\therefore$ Cut off voltage $V_0 = \frac{h}{e}(\nu-\nu_0)$

$$\therefore V_0 = \frac{6.63\times10^{-34}\times(8.2\times10^{14}-3.3\times10^{14})}{1.6\times10^{-19}}$$

$= 2.0$ V (3)

29. According to de-Broglie's hypothesis

Total path length of orbit $= n\lambda$

or $2\pi r_n = n\lambda$ —— ①

also $\lambda = \frac{h}{p} = \frac{h}{mv_n}$

$\therefore$ eqn ① $2\pi r_n = n\cdot\frac{h}{mv_n}$

or $mv_n r_n = \frac{nh}{2\pi}$

which is Bohr's quantum condition. (1)

(b) $E_C - E_B = \frac{hc}{\lambda_1}$ ——(i)

$E_B - E_A = \frac{hc}{\lambda_2}$ ——(ii)

& $E_C - E_A = \frac{hc}{\lambda_3}$ ——(iii)

On adding eqns (i) + (ii)

$$E_C - E_A = \frac{hc}{\lambda_1} + \frac{hc}{\lambda_2}$$

or $\frac{hc}{\lambda_3} = \frac{hc}{\lambda_1} + \frac{hc}{\lambda_2}$ From eqn (iii)

or $\frac{1}{\lambda_3} = \frac{1}{\lambda_1} + \frac{1}{\lambda_2}$ (2)

30. (a) $\frac{R_1}{R_2} = \frac{R_0 A_1^{1/3}}{R_0 A_2^{1/3}} = \left(\frac{A_1}{A_2}\right)^{1/3} = \left(\frac{1}{8}\right)^{1/3}$ $(1\frac{1}{2})$

(b) $\frac{S_1}{S_2} = \frac{4\pi R_1^2}{4\pi R_2^2} = \frac{\left(R_0 A_1^{1/3}\right)^2}{\left(R_0 A_2^{1/3}\right)^2} = \left(\frac{A_1}{A_2}\right)^{2/3}$

$(1\frac{1}{2})$

31.(a) Proof of $\vec{E} = \frac{2\vec{p}}{4\pi\epsilon_0 r^3}$ (3)

(b) As $\vec{E} = 2x\hat{i}$

Electric flux is finite only for surfaces 1 and 2 shown in fig. and for all remaining surfaces flux is zero.

Area of each surface is a^2; For face ① $x = 0 \therefore E_① = 0 \therefore \phi_① = 0$

$\therefore \phi_2 = \vec{E}\cdot\vec{S} = (2a\hat{i})\cdot(a^2\hat{i}) = 2a^3$

Charge enclosed $q = \phi_E \epsilon_0 = \epsilon_0 \, 2a^3 = 2\epsilon_0 a^3$

(1+1)

OR

(a) Statement Gauss's law **(1)**

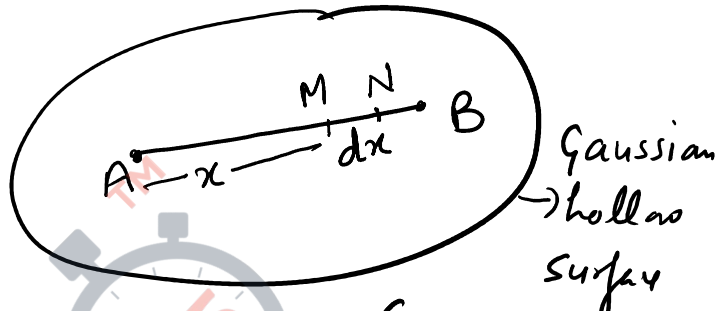
Derivation of electric field due to long straight conductor **(2)**

(b)

Charge on element MN

$dq = \lambda \, dx$

$= kx \, dx$



Total charge on wire AB $= q = \int_L dq$

$= \int_0^L kx \, dx$

$= \frac{1}{2} kL^2$

$\therefore$ Total electric flux through enclosed Gaussian hollow surface $\phi_E = \frac{q}{\epsilon_0} = \frac{kL^2}{2\epsilon_0}$ **(2)**

32. (a) Labelled diagram of Transformer **(1)**

(b)Principle **(1)**

(c) $V_p = -N_p \frac{d\phi_B}{dt}$ and $V_s = -N_s \frac{d\phi_B}{dt}$

$\therefore \frac{V_s}{V_p} = \frac{N_s}{N_p}$ — 1

Also $P_{in} = P_{out}$

$\therefore V_p I_p = V_s I_s$

or $V_s / V_p = I_p / I_s$ — 2

From equations 1 and 2

$$\frac{V_s}{V_p} = \frac{I_p}{I_s} = \frac{N_s}{N_p} = K \qquad \textbf{(1)}$$

(b) Here $V_p = 220V$; $V_s = 110V$ and $P_{out} = 550W$

$\because$ Input Power = Output Power

$\therefore P_{in} = P_{out} = P(\text{say}) = V_p I_p = 550W$

$\therefore$ Current drawn $I_p = \frac{P}{V_p} = \frac{550}{220}$

$= 2.5A$

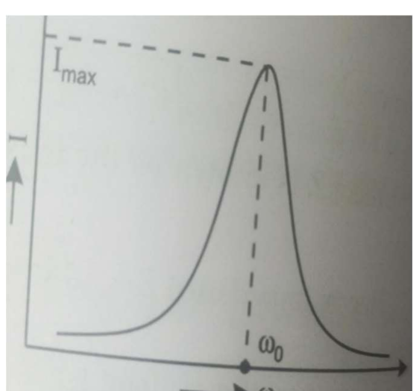
(2)

OR

Correct derivation of impedance $Z = \sqrt{R^2 + (X_L - X_C)^2}$

(3)

Correct graph **(1)**



Correct explanation : **We vary the capacitance of a capacitor in the tunning circuit so that the resonant frequency of the circuit becomes almost equal to the frequency of radio signal of a particular station.** **(1)**

33. (a) The observed phenomenon is diffraction of light. **(1)**

(b) There is significant fall in intensity of the secondary maxima in compared to central maxima because in central maxima only constructive interference is taking place while in secondary maxima constructive as well as destructive interferences are taking place. **(2)**

(c) When width of the slit 'a' (say) is doubled angular width 'θ' **(consequently linear width too) of central maxima given by**

$\theta = \pm \frac{\lambda}{a}$ **is reduced to one half of its previous value means size of central maxima will be reduced to half of its previous value.** **(2)**

OR

(a) **Brief description of diffraction at a single slit , clear figure with condition for the angular width of secondary maxima and secondary minima**. (3)

(b) Given $\lambda_1 = 590 nm = 590 \times 10^{-9} m$

$\lambda_2 = 596 nm = 596 \times 10^{-9} m$

slit width $a = 2 \times 10^{-6} m$ and

$D = 1.5 m$

Let first maxima obtained at distance x such that

$$a \sin\theta = \frac{ax}{D} = \frac{3\lambda}{2}$$

$$\Rightarrow \quad x = \frac{3\lambda D}{2a}$$

$\therefore$ Separation between the positions of first maximas

$$\Delta x = x_2 - x_1$$

$$= \frac{3D}{2a}(\lambda_2 - \lambda_1)$$

$$= \frac{3 \times 1.5}{2 \times 2 \times 10^{-6}}(596 \times 10^{-9} - 590 \times 10^{-9})$$

$$= 6.75 \times 10^{-3}\,m \text{ or } 6.75\,mm$$

(2)