M.L. Syal's **Helix Institute**
S.C.O. 343-345, Top Floor, Sector 34-A, Chandigarh. Ph : 2624337, 2623155

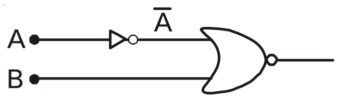
SUBJECTIVE TEST FOR XII

PHYSICS

SOLUTIONS

1. $2i = A + \delta_m$

$i = \frac{A + \delta m}{2} = \frac{60^\circ + 30^\circ}{2} = 45^\circ$

2. 

$\overline{\overline{A} + B} = \overline{\overline{A}}.\overline{B} = A.\overline{B}$

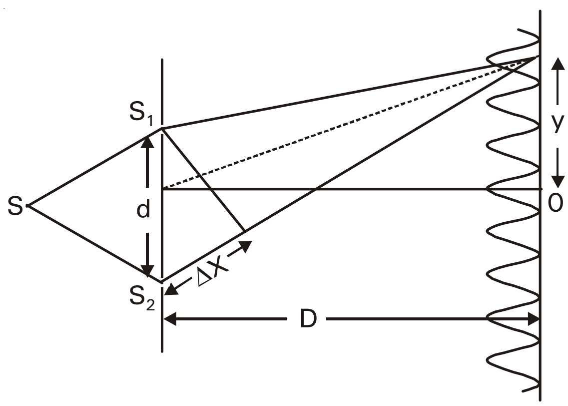
3. (c)
4. (b)
5. (d)
6. (A)
7. (A)
8. Zener - diode
A zener diode is reversed biased and is connected in parallel with load resistor. When unstabilized input voltage is given across zener diode and load resistor. When zener diode start working voltage across it remains constant. In break down region of zener diode even though the current through zener diode changes but voltage across it remains constant.
9. a. vertical - direction
b. 0° to 90°
10. $\lambda = \frac{h}{\sqrt{2mE_k}} = \frac{h}{\sqrt{2m \times \frac{3}{2}kT}} = \frac{h}{\sqrt{3mkT}}$

$= \frac{6.63 \times 10^{-34}}{\sqrt{3 \times 2 \times 1.67 \times 10^{-27} \times 1.38 \times 10^{-23} \times 300}} = 1.02\,\text{Å}$

OR

$K.E_{max} = eV_0 = 1.5eV$

11. YDSE



d is distance between slits
D is distance between slit and screen

$\Delta X = \frac{yd}{D}$ is the path difference

y– position of maxima or minima from central maximum
Fringe width is

$$\beta = \frac{\lambda D}{d}$$

12. $V' = (n)^{2/3}V = (27)^{2/3}.10$
$V' = 90$ volts.

OR

$$\frac{Kq}{x^2} = \frac{k(4q)}{(6a - x)^2}$$

taking square root on both sides after cancellation we get

$$\frac{1}{x} = \frac{2}{(6a - x)}$$

$6a - x = 2x$
$3x = 6a$
$x = 2a$

13. β-decay is the process in which electron is emitted by the nucleus, when neutron get converted into a proton. An antineutrino is emitted along with the electron to maintain the angular momentum of the process
$n \rightarrow p + e^- + \overline{\nu}$

$$N = N_0\left(\frac{1}{2}\right)^{t/t_{1/2}} = N_0\left(\frac{1}{2}\right)^2 = \frac{N_0}{4}$$

25% remain undecayed

14. $e = -Ldi/dt$

$$\text{or } L = = \frac{e}{-di/dt} = \frac{0.4}{-(-10 - 10)/0.4}$$

$$= \frac{0.4 \times 0.4}{20} = \frac{16 \times 10^{-2}}{20} = 8 \times 10^{-3}$$

$= 8mH$

OR

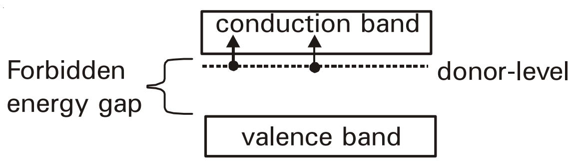
$e = Blv$
East end will be at higher potential using fleming right hand rule.

15. a. n–type semionductor
b. $n_i^2 = n_e n_h$
$(6 \times 10^8)^2 = 9 \times 10^{12} \times n_h$

$$n_h = \frac{36 \times 10^{16}}{9 \times 10^{12}} = 4 \times 10^4/m^3$$

c. $\sigma = e[n_e \mu_e + n_h \mu_h]$

OR

c. 

16. a. Electrical device connected in series with mains of household circuit to prevent devices from damaging due to over heating
b. When live and neutral wire comes in direct contact
c. Lead and tin
d. Independent of length

17. a. $V_0 = \sqrt{2}\,V_{rms} = 200\sqrt{2}$ volt

b. $f = \dfrac{\omega}{2\pi} = \dfrac{300}{2 \times 3.14} = \dfrac{300}{6.28} = 48Hz$

c. Circuit is in resonance

$X_L = X_C$

$Z = \sqrt{R^2 + (X_L - X_L)^2} = R$

$Z = R$

OR

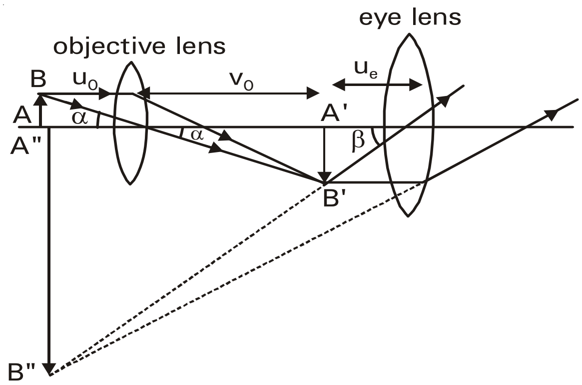
c. $P = i^2R = \dfrac{V^2}{R} = \dfrac{(200)^2}{100}$

$P = \dfrac{40000}{100} = 400W$

d. $i = \dfrac{V}{Z} = \dfrac{V}{R} = \dfrac{200}{100} = 2A$

OR

d. $\cos\phi = \dfrac{R}{Z} = \dfrac{R}{R} = 1$

18. 

$m = \dfrac{\beta}{\alpha}$

$m = m_0 m_e$

$m_0 = \dfrac{V_0}{u_0}$

$m_e = \dfrac{D}{u_e}$

$\dfrac{D}{fe} = \dfrac{D}{v_e} - \dfrac{D}{u_e}$

$\Rightarrow \dfrac{D}{u_e} = \dfrac{D}{fe} + \dfrac{D}{v_e}$

(i) $v_e = \infty$

$\dfrac{D}{u_e} = \dfrac{D}{fe} \qquad \Rightarrow m = \dfrac{v_0}{u_0}\left(\dfrac{D}{fe}\right)$

(ii) $v_e = D$

$\dfrac{D}{u_e} = 1 + \dfrac{D}{fe}$

$\Rightarrow m = \dfrac{v_0}{u_0}\left(1 + \dfrac{D}{fe}\right)$

19. a. i. Paschen series

ii. Balmer series

b. $P.E. = 2T.E = 2 \times -13.6 = -27.2eV$

c. $\frac{B.E}{A}$ is criteria for stability

Which greater for α-particle

OR

Heavy nuclei reduces their size by emitting α-particle which decreases their mass number by 4 and their atomic number by 2

${}_{Z}X^{A} \rightarrow {}_{Z-2}Y^{A-4} + {}_{2}He^{4}$

The total kinetic energy released when α particle is emitted by a heavy nuceleus is given by

$Q = (m_i - m_f - m_\alpha)c^2$

m_i–intial mass of nucleus

$m_f = m_y$–final mass of nucleus

m_α–mass of α-particle

From law of conservation of energy

$$\frac{1}{2} m_\alpha v_\alpha^2 + \frac{1}{2} m_y v_y^2 = Q$$

From law of conservation of linear momentum

$m_y v_y = m_\alpha v_\alpha$

$$\Rightarrow \frac{1}{2} m_\alpha v_\alpha^2 + \frac{1}{2} m_y \left(\frac{m_\alpha v_\alpha}{m_y}\right)^2 = Q$$

$$\frac{1}{2} m_\alpha v_\alpha^2 \left[1 + \frac{m_\alpha}{m_y}\right] = Q$$

$$KE_\alpha = \left(\frac{m_y}{m_y + m_\alpha}\right) Q$$

$$= \left[\frac{A-4}{A-4+4}\right] Q = \left[\frac{A-4}{A}\right] Q$$

$$KE_\alpha = \left[\frac{A-4}{A}\right] Q$$

20. a. $\tau = PE \sin\theta$

$$= PE \sin 60^\circ = \frac{\sqrt{3}PE}{2}$$

$W = PE(\cos\theta_1 - \cos\theta_2)$

$W = PE(\cos 0^\circ - \cos 60^\circ)$

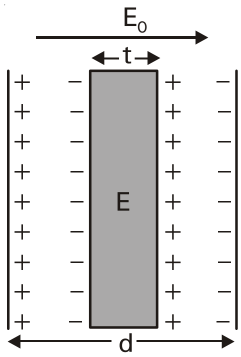
$$\sqrt{3} = PE\left(1 - \frac{1}{2}\right)$$

$$\sqrt{3} = \frac{PE}{2}$$

$$\Rightarrow PE = 2\sqrt{3}$$

$$\Rightarrow \tau = \frac{\sqrt{3} \times 2\sqrt{3}}{2} = 3 \text{ N-m}$$

b. Dielectric slab between parallel plate capacitor



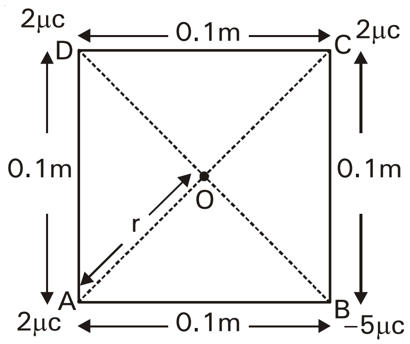
$V = E_0(d-t) + Et$

$$\frac{C}{C_0} = \frac{V_0}{V} = \frac{E_0 d}{E_0(d-t) + Et} = \frac{d}{(d-t) + Et/E_0}$$

$$\frac{C}{C_0} = \frac{d}{(d-t) + t/k} = \frac{\varepsilon_0 A}{(d-t) + t/k} \qquad \left[\text{where } C_0 = \frac{\varepsilon_0 A}{d}\right]$$

OR

a.



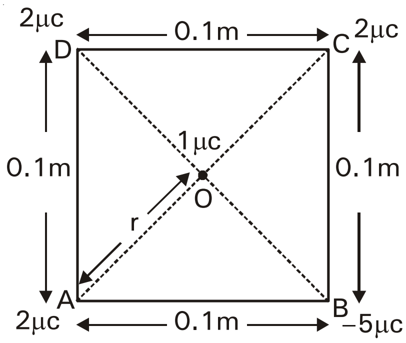
$$r = \frac{\sqrt{(0.1)^2 + (0.1)^2}}{2}$$

$$r = \frac{\sqrt{0.02}}{2} = 0.07$$

$$V_0 = \frac{9 \times 10^9}{7 \times 10^{-2}}[2 \times 10^{-6} + 2 \times 10^{-6} + 10^{-6} + 2 \times 10^{-6} - 5 \times 10^{-6}]$$

$$V_0 = \frac{9 \times 10^9 \times 1 \times 10^{-6}}{7 \times 10^{-2}} = 1.28 \times 10^5 \text{ volts}$$

b.



$$\frac{9\times10^{9}\times2\times10^{-6}\times1\times10^{-6}}{(7\times10^{-2})^{2}}+\frac{9\times10^{9}\times5\times10^{-6}\times1\times10^{-6}}{(7\times10^{-2})}$$

$$=\frac{18}{49}\times\frac{10^{-3}}{10^{-4}}+\frac{45\times10^{-3}}{49\times10^{-4}}$$

$$=\frac{180}{49}+\frac{450}{49}$$

$=3.67+9.18$

$=12.85$ N towards B

*****