SECOND YEAR HSE MODEL EXAM - FEB-2020

①

PHYSICS

① ⊥r

② low resistance in ∥

③ Lenz law

④ unchanged

⑤ scattering

⑥ True

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(7) ⓐ $\tau = PE\sin\theta$ $\vec{\tau} = \vec{P} \times \vec{E}$

ⓑ when $\theta = 90$ $P \perp E$

⑧ ⓐ paramagnetic

(b)(i) χ small +ve

(ii) $\mu_r > 1$ OR Any two properties

⑨ (a) dip, declination, B_H

(b) $B_H = B\cos\delta$ $\delta = 60$

$$B = \frac{B_H}{\cos 60} = \frac{0.26}{(1/2)} = 0.32G$$

⑩ (a) $\vec{F} = q(\vec{E} + \vec{V} \times \vec{B})$

(b) $\nu_c = \frac{qB}{2\pi m}$

(11) Ray diagram

(12) ⓐ when light travels from denser to rarer medium, for $\theta >$ critical angle ~~the~~ instead of refraction TIR takes place

(b) Optic fibre, Total reflecting prism.

(13) (a) $R \propto A^{1/3}$

$$\frac{R_1}{R_2} = \left(\frac{A_1}{A_2}\right)^{1/3} = \left(\frac{1}{27}\right)^{\frac{1}{3}} = \frac{1}{3}$$

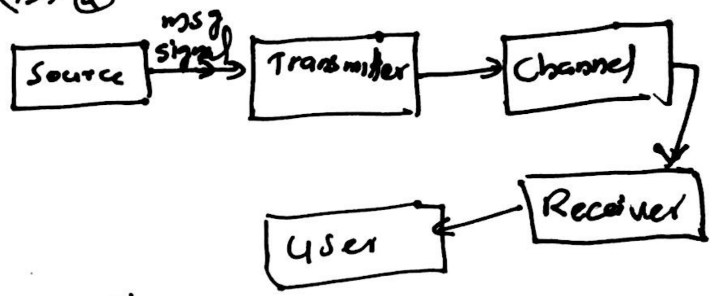
(b) charge independant
short range
strongest force

(14) a) Diagram

(b)

A	B	Y=A+B
0	0	0
1	0	1
0	1	1
1	1	1

(15) ⓐ



ⓑ sky wave
frequency ranges from 30-40MHz
signals reflected by Ionosphere

Space wave

frequency > 40MHz
signals travels from antenna to antenna or virtually reflected by satellites.

(16) (a) $\Phi_E = \frac{q}{\varepsilon}$

(b) Derivation, $E = \frac{1}{2\pi\varepsilon}\frac{\lambda}{r}$

(17) Obtain the condition.

$$\frac{P}{Q} = \frac{R}{S} \quad \text{OR} \quad \frac{R_1}{R_2} = \frac{R_3}{R_4}$$

(18) Diagram.
Explanation

⑲ It is the current due to the change in electric flux

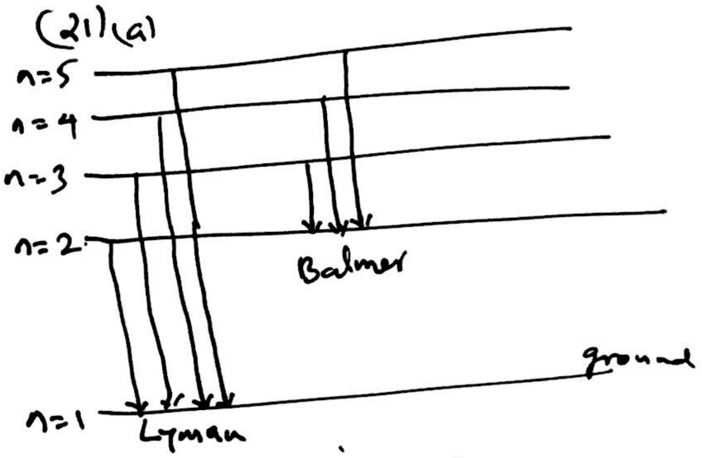
$$I_D = \frac{dq}{dt} = \varepsilon\frac{d\Phi_E}{dt}$$

(19)(b) Microwave - Radar
IR - Greenhouse
UV - sterlization
X-ray - Diagnosis

(20)a) prism derivation upto
$$\delta = i + e - A$$

b) $d = (n-1)A$
$= (1.5-1)4^\circ$
$= 2^\circ$

(21)(a)



(b) $E_{Total} = -13.6eV$

$E_{kinetic} = +13.6eV$

$E_p = 2E_T$
$= -27.2eV$

$E_K + E_p = E_T$

(22) $\frac{dN}{dt} \propto N$

$\frac{dN}{dt} = -\lambda N$

$\frac{dN}{N} = -\lambda dt$

$\int$ ing $N_0 \rightarrow N$; $0 \rightarrow t$
$(\log N)_{N_0}^{N} = -\lambda t$
$\Rightarrow N = N_0 e^{-\lambda t}$

23)(a) Energy of msg signal is very weak and the height of the antenna should be very large which is impracticable ($h \approx \lambda/4$)

(b) Amplitude of the carrier signal is varied in accordance with the instantaneous value of msg signal.

c) $\mu = \frac{A_m}{A_c} = \frac{20}{40} = 0.5$

(24)(a) Series

(b) Derivation $\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$

(c) Capacitance increases $C_m = KC_0$

(25)(a) $E = \phi_0 + KE_{max}$
$h\nu = h\nu_0 + \frac{1}{2}mv^2$
$h\nu = h\nu_0 + eV_0$

(b) $\lambda = \frac{h}{mv}$

$m = \frac{h}{\lambda v}$

$\frac{m_p}{m_e} = \frac{\lambda_e v_e}{\lambda_p \times v_p}$

$\frac{\lambda_p}{\lambda_e} = 1.813 \times 10^{-4}$

$\frac{v_p}{v_e} = 3$

$= \left(\frac{1}{1.813 \times 10^{-4}}\right)\left(\frac{1}{3}\right)$

$m_p = \frac{1}{3 \times 1.813 \times 10^{-4}} \times 9.11 \times 10^{-31}$

$= 1.67 \times 10^{-27}$ kg

26)a) $dB = \frac{\mu_0}{4\pi} \frac{I dl \sin\theta}{r^2}$

(b) Derivation.

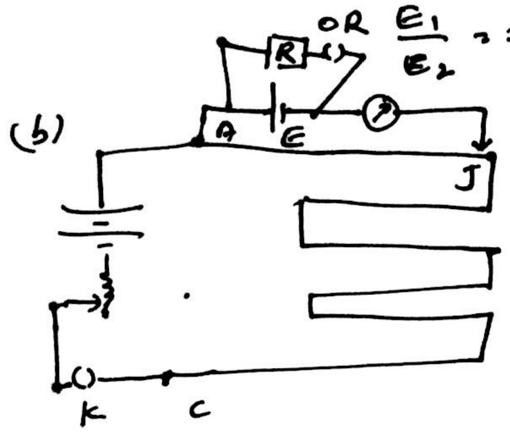
$B = \frac{\mu_0}{4\pi} \frac{2I\pi a^2}{(x^2+a^2)^{3/2}}$ | $\pi a^2 = A$ area

OR

$B = \frac{\mu_0}{2\pi} \frac{IA}{x^3}$ for $x >> a$

(27) (a) $V \propto l$ OR $E \propto l$ OR $\frac{E_1}{E_2} = \frac{l_1}{l_2}$

(b)



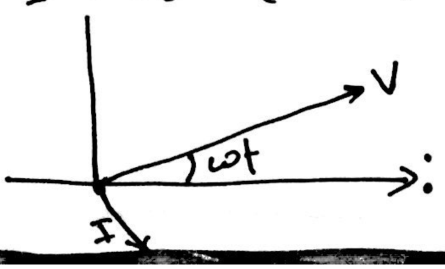
(c) potentiometer does not draw current from the cell, so it gives correct p.d or emf. Voltmeter only gives p.d

(28) a) $V = V_m \sin\omega t$

Kirchoff rule $V + {}^{-}e = 0$

$$V = e$$
$$= L\frac{dI}{dt}$$
$$V_m \sin\omega t = L\frac{dI}{dt}$$
$$dI = \frac{V_m}{L}\sin\omega t\, dt$$
$$I = \frac{V_m}{L}\int \sin\omega t\, dt$$
$$= \frac{V_m}{L} \times \frac{-\cos\omega t}{\omega}$$
$$= \frac{V_m}{L\omega} \times -\sin\left(\frac{\pi}{2} - \omega t\right)$$
$$= \frac{V_m}{X_L} \times \sin\left(\omega t - \pi/2\right)$$
$$I = I_0 \sin(\omega t - \pi/2)$$

(28) (b)



(3) (c) $\nu_c = \frac{1}{2\pi\sqrt{LC}}$

$$= \frac{1}{2\pi\sqrt{5 \times 80 \times 10^{-6}}}$$
$$= \frac{1}{2\pi \times \sqrt{4 \times 10^{-2}}}$$
$$= \frac{1}{2 \times 3.14 \times 2 \times 10^{-1}}$$
$$= 0.796\ Hz$$

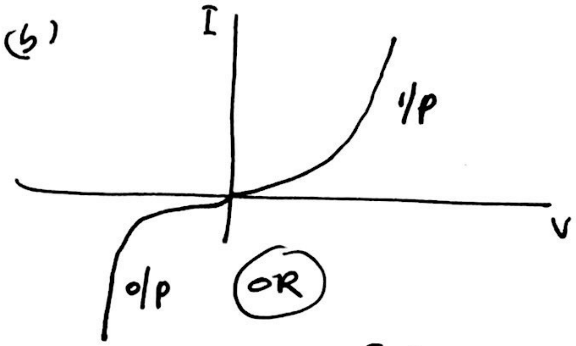
(29) (a) Same wavelength, same frequency zero or constant phase diff.

(b) $\beta = \frac{\lambda D}{d}$ derivation.

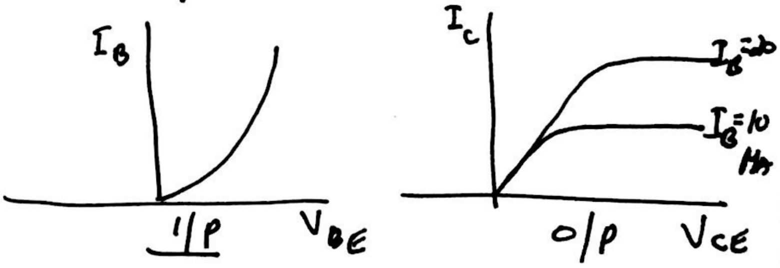
(c) statement, $\mu = \tan\theta_p$.

(30) (a) CE Configuration

(b)



OR



(c) $I_c = 1mA = 10^{-3}A$

$$\beta = 100$$
$$\beta = \frac{I_c}{I_B}$$
$$I_B = \frac{I_c}{\beta} = \frac{10^{-3}}{100} = 10^{-5}A$$

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