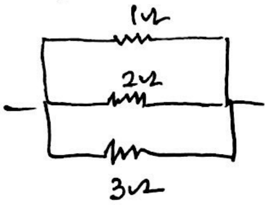
~~FIRST~~ 2^{nd} YEAR – I^{st} Terminal Examination – Aug 2019

PHYSICS

(1) Quantization

(2) $C_s = C_1 + C_2$

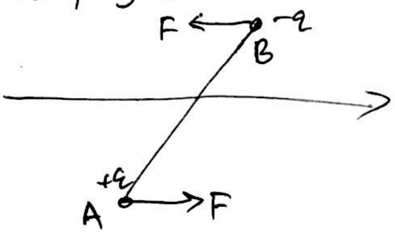
(3)



(4) ρ

(5) Statement / $\oint \vec{B}\cdot\vec{dl} = \mu_0 \Sigma I$

(6) (a)



(b) $\tau = PE\sin\theta$ or $\vec{\tau} = \vec{P}\times\vec{E}$

(7) $F = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{R^2} = \frac{1}{4\pi\varepsilon_0}\frac{q^2}{R^2}$ —(1)

In oil,

$F = \frac{1}{4\pi\varepsilon_0 K}\frac{q^2}{R'^2}$

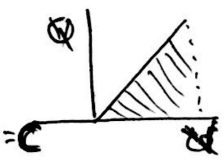
$= \frac{1}{4\pi\varepsilon_0 \times 5}\frac{q^2}{R'^2}$ —(2)

$R^2 = 5R'^2$

$R' = \frac{R}{\sqrt{5}}$ //

(8) Any 4 properties

(9) (a) $Q \propto V$



(b) (i) slope $= \frac{Q}{V} = C$

(ii) Area $= \frac{1}{2}QV$ = Energy

(10) $V = \frac{1}{4\pi\varepsilon_0}\left[\frac{q_1}{r_1} + \frac{q_2}{r_2} + \frac{q_3}{r_3} + \frac{q_4}{r_4}\right]$

$= \frac{1}{4\pi\varepsilon_0 r}\left[q_1 + q_2 + q_3 + q_4\right] = 0$

(11) Red – 2 – 10^2

Black – 0 – 10^0

White – 9 – 10^9

(12) $S = \frac{I_g G}{I - I_g}$

$I_g = 4\,mA = 4\times10^{-3}\,A$

$I = 6\,A$

$G = 15\,\Omega$

$I = \frac{4\times10^{-3}\times15}{6-4\times10^{-3}}$

$= \frac{60\times10^{-3}}{5.996}$

$= 10.006\times10^{-3}$

$= 10\,m\Omega$

(13) (a) $\vec{F} = F_e + F_m$.

$= q\vec{E} + q(\vec{v}\times\vec{B})$

$= qE\hat{j} + qvB\,(-\hat{j})$

$= (qE - qvB)\hat{j}$

(b) For undeflected $\vec{F} = 0$

$qE - qvB = 0$

$\boxed{E = vB}$

(14) (a) $P = q\times2a$; $-q$ to $+q$

(b) Derivation $E = \frac{1}{4\pi\varepsilon_0}\frac{P}{r^3}$

(15) (a) (i) $C = \frac{\varepsilon_0 A}{d}$ $C_m = \frac{\varepsilon_0 KA}{d}$

$Q_1 = Q_2$

$C_m = KC$

$= 5C$

(b) $Q_1 = Q_2 = Q$

$V_1 = \frac{Q}{C_1}$ ⟹

$V_2 = \frac{Q}{C_m}$

$C_s = \frac{C_1C_2}{C_1+C_2} = \frac{C\times5C}{6C} = \frac{5}{6}C$

$Q = C_sV = \frac{5}{6}C\times12$

$= 10C$

$V_1 = \frac{10C}{C} = 10V$

$V_2 = \frac{10C}{5C} = 2V$

OR $Q_1 = Q_2$ $V_1 + V_2 = 12$

$CV_1 = 5CV_2$

$V_1 = 5(12 - V_1)$

$V_1 = 10V$ & $V_2 = 2V$

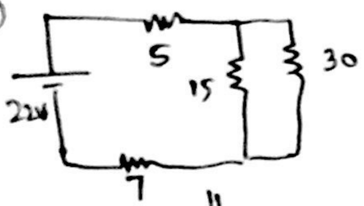
16) Diagram

$E \propto l_1$

$V \propto l_2$

$r = \left(\frac{l_1 - l_2}{l_2}\right) \times R$

17)



⇓

$R_1 = \frac{15 \times 30}{15+30} = 10$

$R_{eff} = 5 + 10 + 7 = 22\Omega$

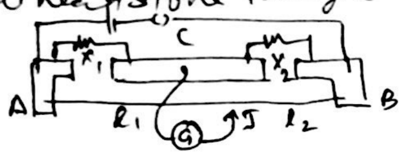
$I = \frac{V}{R} = \frac{22V}{22\Omega} = 1A$

18) (a) Wheatstone's Bridge

(b) Proof Wheatstone's principle

19) (a) Wheatstone Bridge

(b)



$\frac{R_1}{R_2} = \frac{R_3}{R_4} \Rightarrow \frac{x_1}{x_2} = \frac{l_1}{l_2}$

20) (a) Gauss law $\phi = \oint_S \vec{E} \cdot \vec{ds} = \frac{1}{\epsilon_0} q$

(b) Derivation $E = \frac{1}{2\pi\epsilon_0} \frac{\lambda}{r}$

21) (a) Area of plate, distance of separation, medium btw plates

(b) Derivation $C = \frac{\epsilon_0 A}{d}$

22) $\mu = \frac{V_d}{E} = \frac{m/s}{V/m} = m^2 V^{-1} s^{-1}$ (OR) $m C N^{-1} s^{-1}$

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

(b) $B = \frac{1}{8} B_0$

$B_0 = \frac{\mu_0}{2} \frac{NI}{R}$ —— (2)

$B = \frac{B_0}{8} = \frac{\mu_0}{4\pi} \frac{2NI \times \pi R^2}{(x^2+R^2)^{3/2}}$

$= \frac{\mu_0}{2} \frac{NIR^2}{(x^2+R^2)^{3/2}}$ —— (2)

$\frac{\mu_0}{2} \frac{NI}{R} = 8 \times \frac{\mu_0}{2} \frac{NIR^2}{(x^2+R^2)^{3/2}}$

$(x^2+R^2)^{3/2} = 8R^3$

$(x^2+R^2)^{\frac{1}{2}} = 2R$

$x^2 + R^2 = 4R^2$

$x^2 = 3R^2$

$x = \sqrt{3}R$

24) (a) Definition OR $E = F/q$

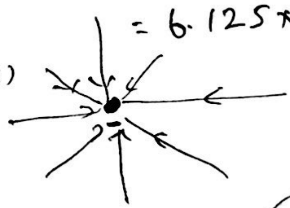
(b) For equilibrium, $qE = mg$

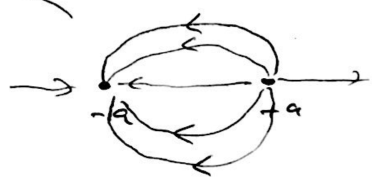
$E = \frac{mg}{q}$

$= \frac{10^{-7} \times 9.8}{1.6 \times 10^{-19}}$

$= 6.125 \times 10^{12}$ V/m

(c)



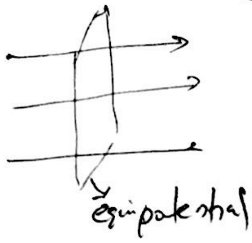


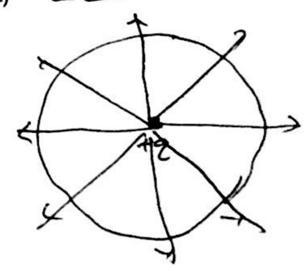
25) (a) Definition

(b) Two properties (1) workdone = 0

(2) E ⊥r surface

(c)





26(a) statements

(b) (i) $I_1 + -I_2 + -I_3 = 0$

OR $I_1 = I_2 + I_3$

(ii) $I_3R_3 + -I_2R_2 + I_3R_1 = E_1 + -E_2$

$I_3R_3 - I_2R_2 + I_3R_1 = E_1 - E_2$

(iii) $I_3R_3 + I_1R_6 + I_1R_5 + I_1R_4 + I_3R_1 = E_1 + -E_4 + E_3$

(27)(a) proton, α particle

(b) Magnetic field, Electric field

(c) $\nu_c = \dfrac{qB}{2\pi m}$

$B = \dfrac{2\pi m \nu_c}{q}$

$= \dfrac{2 \times 3.14 \times 1.67 \times 10^{-27} \times 10^{7}}{1.6 \times 10^{-19}}$

$= 6.55 \times 10^{-1}$

$= 0.655\ T$

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