Circular motion

- Linear velocity (v) = s/t 1 complete circle
- Angular velocity (ω) = θ/t = $2\pi/T$

$$\frac{s}{t} = \frac{r\theta}{t}$$

$$v = r\omega$$

$v \propto r$ if ω constant

- $F_c = \frac{mv^2}{r} = mr\omega^2 = mv\omega$
- $a_c = \frac{\text{Force}}{m} = \frac{v^2}{r}$

Gravitational field

- $F_G = \frac{GM_1M_2}{r^2}$ $\qquad g = \frac{F}{m} = \frac{GM_1}{r^2}$

when $F_c = F_g$;

$v = \sqrt{\frac{GM}{r}}$ $\qquad \omega = \sqrt{\frac{GM}{r^3}}$ $\qquad T = 2\pi\sqrt{\frac{r^3}{GM}}$

$K.E = \frac{1}{2}mv^2 = \frac{GMm}{2r}$

- $\phi = -\frac{GM}{r}$ $\qquad U = \phi \times m = -\frac{GMm}{r}$

$T.E = -\frac{GMm}{2r}$

$V_{ESC} = \sqrt{\frac{2GM}{R}} = \sqrt{2gR}$

Electric fields

- $F = \frac{K Q_1 Q_2}{r^2}$ $\qquad E = \frac{F}{q} = \frac{K Q_1}{r^2}$
- $V = \frac{KQ}{r}$
- $U = Vq = K\frac{Qq}{r}$

Capacitance

- $Q = CV$
- $E = \frac{1}{2}QV = \frac{1}{2}CV^2 = \frac{Q^2}{2C}$
- $\Delta E = \frac{1}{2}C(V_i^2 - V_f^2)$

SHM

- $x = x_0 \sin \omega t$ $\qquad x_{max} = \pm x_0$

- $v = x_0 \omega \cos \omega t$ $\qquad v_{max} = \pm x_0 \omega$

- $a = -x_0 \omega \sin \omega t$ $\qquad a_{max} = \pm x_0 \omega^2$

- $a = -\omega^2 x$

- $v = \pm \omega \sqrt{x_0^2 - x^2}$

$K.E = \frac{1}{2} m \omega^2 (x_0^2 - x^2)$

$K.E_{max} = \frac{1}{2} m \omega^2 x_0$

$P.E = \frac{1}{2} m \omega^2 x^2$

$P.E = \frac{1}{2} m \omega^2 x_0^2$

$T.E = \frac{1}{2} m \omega^2 x_0^2$

Thermal Physics

- $PV = nRT$ $\qquad K = °C + 273$
- $PV = NKT$
- $\frac{P_1 V_1}{T_2} = \frac{P_2 V_2}{T_2}$
- $P = \frac{1}{3}\rho \langle c^2 \rangle$
- $E_K = \frac{3}{2} KT$
- $Q = mc\Delta T$ $\qquad Q = ml_{v/f}$

$Q + K = ml_f$

$Px t \qquad hx t$

$Q - K = ml_v$

$Px t \qquad hx t$

$Pt + ht = ml_f$

$Pt - ht = ml_v$

$(P_1 - P_2)t = l_v(m_1 - m_2)$

$\Delta U = K.E + P.E$

$\Delta U = \Delta Q + \Delta W$

$W.D = P\Delta V$

$$\theta = \frac{R_\theta - R_0}{R_{100} - R_0}$$

Magnetism & Electromagnetic induction.

- $nAqv = I$
- For charge : $F = Bqv\sin\theta$
- For conductor : $F = BIL\sin\theta$
- $V_H = \dfrac{BL}{ntq}$
- $B = \dfrac{\mu_0 I}{2\pi r}$

when $F_c = F_m$

$R = \dfrac{mv}{Bq}$

Flux $\phi = BA = N B A \sin\theta$ → flux linkage.

$Emf = \dfrac{\Delta\phi}{\Delta t}$ Faraday's law

$X_{RMS} = \dfrac{X_0}{\sqrt{2}}$

$\dfrac{V_s}{V_P} = \dfrac{N_s}{N_P}$

Quantum Physics

- $E = hf = \dfrac{hc}{\lambda}$ $\qquad E = \overset{hf_0}{\phi} + E_K$

- De-Broglie's wavelenght : $\lambda = \dfrac{h}{p}$

$$\lambda = \frac{h}{\sqrt{2V_0 q m}}$$

Communication

- Attenuation/Gain $= 10\lg\left(P_H/P_L\right)$

- Signal to noise ratio $= 10\lg\left(P_{min}/P_{noise}\right)$

Medical Physics

- $I = I_0 e^{-\mu x}$
- $Z = \rho \times c$
- $\alpha = \frac{I_R}{I_0} = \frac{(Z_1 - Z_2)^2}{(Z_2 + Z_1)^2}$
- $I = I_0 e^{-kx}$

Electronics

- $V_{out} = Gain(V^+ - V^-)$
- inverting amplifier : $Gain = -\frac{R_f}{R_{in}}$
- Non inverting amplifier : $Gain = 1 + \frac{R_f}{R_{in}}$

Radioactivity

① $A = -\lambda N$ or $\frac{dN}{dt} = -\lambda N$

② $N = N_0 e^{-\lambda t}$

$A = A_0 e^{-\lambda t}$

$m = m_0 e^{-\lambda t}$

③ $T_{1/2} = \frac{\ln 2}{\lambda}$ [Derivation required]

At $t = 0$: A_0

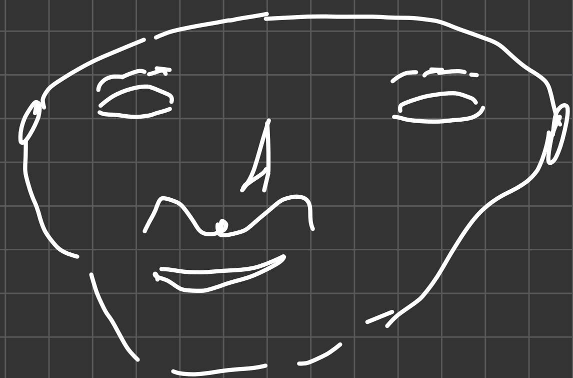
At $t = T_{1/2}$: $\frac{1}{2} A_0$

$A = A_0 e^{-\lambda t}$

$\frac{1}{2} \cancel{A_0} = \cancel{A_0} e^{-\lambda (T_{1/2})}$

$-\ln 2 = -\lambda (T_{1/2})$

$\lambda = \frac{\ln 2}{t_{1/2}}$



Hi! you unlocked a secret

CAIES 2020 MJ are cancelled in Pakistan!