

Circular motion

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

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

$$v = r\omega$$

$v \propto r$ 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

$$\circ \quad F_G = \frac{GM_1M_2}{r^2} \quad g = \frac{F}{m} = \frac{GM_1}{r^2}$$

When $F_c = F_g$;

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

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

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

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

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

Electric fields

- $F = \frac{k Q_1 Q_2}{r^2}$ $E = \frac{F}{q} = \frac{k Q_1}{r^2}$
- $V = \frac{k Q}{r}$
- $U = V q = k \frac{Q q}{r}$

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

- $x = x_0 \sin \omega t$ $x_{\max} = \pm x_0$
- $v = x_0 \omega \cos \omega t$ $v_{\max} = \pm x_0 \omega$
- $a = -x_0 \omega^2 \sin \omega t$ $a_{\max} = \pm x_0 \omega^2$
- $a = -\omega^2 x$
- $v = \pm \omega \sqrt{x_0^2 - x^2}$

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

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

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

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

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

Thermal physics

- $PV = nRT$ $K = ^\circ C + 273$
- $PV = NkT$
- $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$
- $P = \frac{1}{3} \rho \langle c^2 \rangle$
- $E_k = \frac{3}{2} kT$
- $Q = mc\Delta T$ $Q = mL_{v/f}$

$$Q + k = mL_f$$

\swarrow \searrow
 $p \times t$ $h \times t$

$$pt + ht = mL_f$$

$$Q - k = mL_v$$

\swarrow \searrow
 $p \times t$ $h \times t$

$$pt - ht = mL_v$$

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

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

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

$$W.D = P \Delta V$$

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

Magnetism & Electromagnetic induction.

- $nAqN = I$

- For charge: $F = Bqv \sin \theta$

- For conductor: $F = BIL \sin \theta$

- $V_H = \frac{BLv}{n+q}$

When $F_c = F_m$

$$R = \frac{mv}{Bqv}$$

- $B = \frac{\mu_0 I}{2\pi r}$


$$\text{FLUX } \phi = BA = \underbrace{(NB \sin \theta)}_{\text{FLUX linkage}}$$

$$\text{EMF} = \frac{\Delta \phi}{\Delta t} \quad \text{Faraday's law}$$

$$X_{\text{RMS}} = \frac{X_0}{\sqrt{2}}$$

$$\frac{V_s}{V_p} = \frac{N_s}{N_p}$$

QUANTUM PHYSICS

- $E = hf = \frac{hc}{\lambda}$
- $E = \phi + E_k$ 
- De-Broglie's wavelength : $\lambda = \frac{h}{p}$
- $\lambda = \frac{h}{\sqrt{2V_0 q/m}}$

COMMUNICATION

- Attenuation/gain = $10 \lg \left(\frac{P_H}{P_L} \right)$
- Signal to noise ratio = $10 \lg \left(\frac{P_{\text{min}}}{P_{\text{noise}}} \right)$

Medical Physics

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


Electronics

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

Radioactivity

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

$$\textcircled{2} \quad N = N_0 e^{-\lambda t}$$
$$A = A_0 e^{-\lambda t}$$
$$m = m_0 e^{-\lambda t}$$

$$\textcircled{3} \quad T_{1/2} = \frac{\ln 2}{\lambda} \quad \left[\text{Derivation required} \right]$$


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

↓

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

At $t = 0$: A_0

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



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