Circular Motion

* $\omega = \frac{\theta}{t} = \frac{2\pi}{T}$

  $\frac{s}{t} = \frac{r\theta}{t}$
* $v = r\omega$
* $a_c = r\omega^2 = \frac{v^2}{r}$
* $F_c = mr\omega^2 = \frac{mv^2}{r}$

Gravitational Fields

* $F_G = \frac{GMm}{R^2}$
* $g = \frac{F_G}{m} = \frac{GM}{R^2}$
* $E_p = -\frac{GMm}{R}$
* $K.E = \frac{1}{2}mv^2 = \frac{GMm}{2R}$
* $\phi = -\frac{GM}{R}$
* $GPE = mg\Delta h$ (when $g = 9.81 ms^{-2}$)
* $V_{orb} = \sqrt{\frac{GM}{R}}$
* $T^2 \propto R^3 \rightarrow T^2 = \frac{4\pi^2}{GM} R^3$

Swipe

Electric Fields

* $F = qE$
* $F_E = \frac{kQq}{R^2}$
* $E = \frac{F_E}{q} = \frac{1}{4\pi\varepsilon_0}\frac{Q}{R^2}$
* $E = \frac{\Delta V}{\Delta d}$
* $V = \frac{W}{Q}$
* $V = \frac{1}{4\pi\varepsilon_0}\frac{Q}{R}$ / $V = \frac{kQ}{R}$
* $W = \Delta V q$
* $v = \sqrt{\frac{2Vq}{m}}$

Coulomb's law Equation

$$F_E = \frac{1}{4\pi\varepsilon_0}\frac{Q_1 Q_2}{R^2}$$

Capacitance

* $C = \frac{Q}{V}$
* Capacitors in Series $\rightarrow C_T = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$
* 2 Capacitors in Series $= \frac{C_1 C_2}{C_1 + C_2}$
* Capacitors in parallel $\rightarrow C_T = C_1 + C_2 + C_3$
* Energy stored $(E) = \frac{1}{2}CV^2 = \frac{1}{2}QV = \frac{Q^2}{2C}$
* $\tau = RC$
* $V = V_0 e^{-t/RC}$
* $I = I_0 e^{-t/RC}$
* $Q = Q_0 e^{-t/RC}$

Thermal Physics

* $T/K = {}^{\circ}C + 273.15$
* $Q = mc\Delta T$
* $Q = mL_f = mL_v$
* $PV = nRT$
* $PV = NkT$

boltzmann constant $(k) = \frac{R}{N_A}$

* $T/{}^{\circ}C = \frac{R_T - R_0}{R_{100} - R_0} \times 100^{\circ}C$
* $PV = \frac{1}{3} Nm\langle c^2 \rangle$
* $P = \frac{1}{3} \rho \langle c^2 \rangle$
* $\langle E_k \rangle = \frac{3}{2} kT$
* $W = P\Delta V$
* $\Delta U = K.E + P.E$
* $\Delta U = q + w$

Radioactivity

* $E = \Delta mc^2$
* $A = -\lambda N$ OR $\frac{dN}{dt} = -\lambda N$
* $N = N_0 e^{-\lambda t}$
* $A = A_0 e^{-\lambda t}$
* $C = C_0 e^{-\lambda t}$
* $m = m_0 e^{-\lambda t}$
* $t_{1/2} = \frac{\ln 2}{\lambda}$

Swipe

Magnetism & Electromagnetic Induction

* $I = nAvq$
* For conductor → $F_B = BIL\sin\theta$
* For charge → $F_B = qvB\sin\theta$
* $B = \mu_0 . n . I$
* $B = \frac{F}{IL\sin\theta}$
* $r = \frac{mv}{Bq}$
* $V_H = \frac{BI}{ntq}$
* $B = \frac{\mu_0 I}{2\pi r}$
* Flux (ϕ) = $BA\sin\theta$
* Flux Linkage ($N\phi$) = $NBA\sin\theta$
* $Emf = \frac{\Delta\phi}{\Delta t} = \frac{NBA}{t}$
* $V_{RMS} = \frac{V_0}{\sqrt{2}}$
* $I_{RMS} = \frac{I_0}{\sqrt{2}}$
* $\frac{Q}{m} = \frac{v}{Br}$ [charge to mass ratio]

Quantum Physics

* $E = hf$
* $\phi = hf_0 = \frac{hc}{\lambda_0}$
* $hf = E_1 - E_2$
* De-Broglie's wavelength (λ) = $\frac{h}{p}$
* $p = \sqrt{2mVq}$
* $\lambda = \frac{h}{\sqrt{2mVq}}$

Photoelectric Equation

* $E = \phi + E_{Kmax}$
* $hf = \phi + \frac{1}{2}mv^2$

Simple Harmonic Motion

* $a = -\omega^2 x$
* $\omega = \frac{2\pi}{T} = 2\pi,$
* $v = \pm \omega \sqrt{A^2 - x^2}$
* $V_{max} = A\omega$
* $a_{max} = -\omega^2 A$
* $K.E = \frac{1}{2} m\omega^2 (A^2 - x^2)$
* $K.E_{max} = \frac{1}{2} m\omega^2 A^2$
* $P.E = \frac{1}{2} m\omega^2 x^2$.
* $P.E = \frac{1}{2} m\omega^2 A^2$
* $T.E = \frac{1}{2} m\omega^2 A^2$

Medical Physics

* $I = I_0 e^{-\mu x}$
* $Z = \rho c$
* $\alpha = \frac{I_R}{I_0} = \frac{(Z_2 - Z_1)^2}{(Z_2 + Z_1)^2}$
* $x_{1/2} = \frac{\ln 2}{\mu}$
* Reflection + transmission = 1

Astronomy & Cosmology

* Radiant Flux Intensity (F) $= \frac{L}{4\pi d^2}$

$$F_1 d_1^2 = F_2 d_2^2$$

* Luminosity (L) $= \sigma A T^4 = \sigma 4\pi R^2 T^4$

* Wein's law => $\lambda_p T = \text{constant}$

$$\lambda_p T = 2.9 \times 10^{-3}$$

* Recessional velocity (v) $= H_0 \times d$

* Doppler Red Shift → $\frac{\Delta\lambda}{\lambda} \approx \frac{\Delta f}{f} \approx \frac{v}{c}$

Derive

(1) $$g = \frac{F_g}{m} = \frac{GM}{R^2}$$

(2) Capacitors in Series → $C_T = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$

Capacitors in parallel → $C_T = C_1 + C_2 + C_3$

(3) $$PV = \frac{1}{3} Nm \langle c^2 \rangle$$

$$P = \frac{1}{3} \rho \langle c^2 \rangle$$

$$\langle E_K \rangle = \frac{3}{2} kT$$

(4) $$V_H = \frac{BI}{ntq}$$