The 'EPR' Technique

3 Steps

- **E**quation : **Equation**(s) which represent the relationship between the quantities concerned.
- **P**roportion : Quantity required (subject of the equation) is **proportional** to other quantities which vary.
- **R**atio : The **ratio** of the quantities [before vs after, system A vs system B, etc.]

Kinematics, N82/II/4 [p.36, q.48] $x = u_x t$ [1] $y = u_y t + (1/2)gt^2$ [2] substitute [1] into [2], $y = (1/2)gt^2 = (1/2)g\,(x/u_x)^2$ $y \propto x^2$ $\frac{y_2}{y_1} = \left(\frac{x_2}{x_1}\right)^2$ (D) $y_2 = \left(\frac{50}{25}\right)^2 (5.0) = 20$ mm	Forces, J83/II/3 [p.61, q.29]
Motion in a Circle, J97/I/8 [p.79, q.2]	Gravitational Field, N97/I/7 [p.91, q.42]
Temperature, J90/I/24 [p.101, q.20]	Ideal Gases, J86/I/23 [p.108, q.20]
Waves, J84/II/11 [p.152, q.10]	Interference, N95/I/12 [p.164, q.20]

Impulse = $F\,dt$

$= mv_f - mv_i$

= change m

= area under F-t graph

$\frac{\Delta m}{\Delta t} = F$

$F = \frac{dp}{dt} = \frac{d(mv)}{dt}$

when m constant, $F = m\frac{dv}{dt} = ma$

m not constant, $F = (v_f - v_i)\frac{dm}{dt}$

Free oscillation

oscillator : f_0

damping : light, critical, heavy (no os)

forced

- oscillator : f_0 (nat freq)
- driver : f_1 (dri frq)
- damp : ↑ from light to heavy
- graph am vs f_1
- resonance when $f_0 = f_1$ (max energy trasfer)

$V = w\sqrt{(x_0^2 - x^2)}$ other formulae

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phase diff $\frac{\Delta\phi}{2\pi} = \frac{\Delta x}{\lambda}$ separation : Δx

Energy carried by wave $E \propto A^2$

$E \propto f^2$ (mechanical wave)

$E \propto f$ (EM waves)

Intensity = $\frac{\text{Power}}{\text{Area}}$ sphere area = $4\pi r^2$ Intensity $\propto \frac{1}{r^2}$

$\frac{(PV)_T}{(PV)_{tr}} = \frac{T}{273.16}$

$\frac{E_1}{\theta_u - \theta_L} = \frac{E_2}{\theta - \theta_L}$

$E \propto \Delta\theta$

$\frac{R_\theta - R_L}{\theta - \theta_L} = \frac{R_u - R_l}{\theta - \theta_L}$

eg. 8, 9, 10, 11, 12

$\frac{1}{2}m\langle c^2\rangle = \frac{3}{2}kT$

$p = \frac{1}{3}\frac{Nm}{V}\langle c^2\rangle$

monatomic ideal $= \frac{3}{2}nRT$

$C_{rms} = \sqrt{\frac{3kT}{m}}$ or $\sqrt{\frac{3RT}{M_r}}$

$\sqrt{\langle c^2\rangle} \neq \langle c\rangle$

$\Delta u = q + W$

$W = -p(V_f - V_i)$

know eg 3, 4, 5, 6

Adiabatic $q = 0$

isochoric $W = 0$

isothermal $\Delta u = 0$

cyclic $\Delta u = 0$