

Transformation Tutoring

Physics for MCAT 2015

Kinematics

$$V_f = v_i + at$$

$$\Delta x = v_i t + \frac{1}{2} at^2$$

$$v_f^2 = v_i^2 + 2a\Delta x$$

$$W = Fd \cos \theta$$

$$P = W/t = Fv$$

Simple harmonic

$F = -kx$: where k is the spring constant and x is the displacement

$$PE_{\text{elastic}} = \frac{1}{2} kx^2$$

Torque

$T = F \perp r$ - r is from the point of rotation to the point of application of force

Center of mass

$$(m_1 x_1 + m_2 x_2) / (m_1 + m_2)$$

Fluids

Specific gravity = $\rho_{\text{obj}} / \rho_{\text{water}}$ (1000 kg/m^3)

$$P_{\text{gauge}} = \rho_{\text{fluid}} * g * d$$

Floating object: weight of object = F_b (force of buoyancy)

$$V_{\text{sub}} / V_{\text{total}} = \rho_{\text{obj}} / \rho_{\text{fluid}}$$

$$F_b = \rho_{\text{fluid}} * g * V_{\text{submerged}}$$

$$F_1 / A_1 = F_2 / A_2$$

$$A_1 V_1 = A_2 V_2$$

$$F(\text{flow rate}) = Av(\text{speed})$$

$$v_{\text{efflux}} = \sqrt{2gd}$$

Electrostatics

$$e = 1.6 * 10^{-19} \text{ C}$$

$$F_e = kq_1 q_2 / r^2 \text{ (Electrostatic Force)}$$

$k = 9 * 10^9 \text{ Nm}^2 / \text{C}^2$, q_1 and q_2 are charges, and r is the distance between the charges

$$E = kQ / r^2$$

$$F = qE$$

$$V = kQ / r$$

$$\Delta PE = qV = w = \Delta KE$$

E = electric field, and V = electric potential

Electricity and Magnetism

$I=Q/t$ I =current (units are Amps)

$R=\rho L/A$ where R =resistance, ρ = resistivity constant, L =length of wire, and A = cross sectional area ; Mnemonic (LA)

$V=IR$ mnemonic (IR like infrared)

$V=Ed$

$P=IV$ mnemonic (poisonous iv)

Capacitance

$C=\epsilon A/d$

$PE=1/2 QV$

$Q=VC$ mnemonic (like the tv show: qvc)

- dielectric increases C
- charge can't move through capacitor

Magnetic Force

$F_b=qvB$

Right hand rule:

V =thumb B =fingers F_b =palm

For negative charge, all the directions are opposite

Sound

$f_d = f_s (v \pm v_d) / (v \pm v_s)$

Intensity

$I=P/A$

$B=10 \log (I/I_0)$

Both ends open: $\lambda=2L/n$

One end open: $\lambda=4L/n$

-Can't travel in vacuum

- sound is longitudinal

Mirrors and Optics

+ i = virtual image, upright

- i = real image, inverted

$m = -i/o$:magnification

$1/o + 1/I = 1/f$

Chart taken from freelanceteach.com

The Lens / Mirror Chart

$i=f$ $m=0$	inverted, $m<0$ real, $i>0$ shrunk, $m<1$	inverted, $m<0$ real, $i>0$ same size, $m=1$	inverted, $m<0$ real, $i>0$ magnified, $m>1$	$i=\infty$ $m=\infty$	upright, $m>0$ virtual, $i<0$ magnified, $m>1$	upright, $m>0$ virtual, $i<0$ same size, $m=1$	upright, $m>0$ virtual, $i<0$ shrunk, $m<1$	$i=f$ $m=0$
∞		$2f$	f		location of lens or mirror		∞	
converging lens or mirror, $f>0$					diverging lens or mirror, $f<0$			

This chart describes the possible properties of the *image*, not of the object;
but the horizontal positions in the chart represent the possible locations of the *object*, not of the image.

Lenses

Concave and diverging

Convex and converging