

ADVANCED PLACEMENT PHYSICS B EQUATIONS FOR 2008 and 2009

NEWTONIAN MECHANICS

$v = v_0 + at$	$a =$ acceleration
	$F =$ force
$x = x_0 + v_0t + \frac{1}{2}at^2$	$f =$ frequency
	$h =$ height
$v^2 = v_0^2 + 2a(x - x_0)$	$J =$ impulse
	$K =$ kinetic energy
$\Sigma \mathbf{F} = \mathbf{F}_{net} = m\mathbf{a}$	$k =$ spring constant
	$\ell =$ length
$F_{fric} \leq \mu N$	$m =$ mass
	$N =$ normal force
$a_c = \frac{v^2}{r}$	$P =$ power
	$p =$ momentum
$\tau = rF \sin \theta$	$r =$ radius or distance
	$T =$ period
$\mathbf{p} = m\mathbf{v}$	$t =$ time
$\mathbf{J} = \mathbf{F}\Delta t = \Delta\mathbf{p}$	$U =$ potential energy
	$v =$ velocity or speed
$K = \frac{1}{2}mv^2$	$W =$ work done on a system
	$x =$ position
$\Delta U_g = mgh$	$\mu =$ coefficient of friction
	$\theta =$ angle
$W = F\Delta r \cos \theta$	$\tau =$ torque
$P_{avg} = \frac{W}{\Delta t}$	
$P = Fv \cos \theta$	
$\mathbf{F}_s = -k\mathbf{x}$	
$U_s = \frac{1}{2}kx^2$	
$T_s = 2\pi\sqrt{\frac{m}{k}}$	
$T_p = 2\pi\sqrt{\frac{\ell}{g}}$	
$T = \frac{1}{f}$	
$F_G = -\frac{Gm_1m_2}{r^2}$	
$U_G = -\frac{Gm_1m_2}{r}$	

ELECTRICITY AND MAGNETISM

$F = \frac{1}{4\pi\epsilon_0} \frac{q_1q_2}{r^2}$	$A =$ area
	$B =$ magnetic field
$\mathbf{E} = \frac{\mathbf{F}}{q}$	$C =$ capacitance
	$d =$ distance
$U_E = qV = \frac{1}{4\pi\epsilon_0} \frac{q_1q_2}{r}$	$E =$ electric field
	$\mathcal{E} =$ emf
$E_{avg} = -\frac{V}{d}$	$F =$ force
	$I =$ current
$V = \frac{1}{4\pi\epsilon_0} \sum_i \frac{q_i}{r_i}$	$\ell =$ length
	$P =$ power
$C = \frac{Q}{V}$	$Q =$ charge
	$q =$ point charge
$C = \frac{\epsilon_0 A}{d}$	$R =$ resistance
	$r =$ distance
$U_c = \frac{1}{2}QV = \frac{1}{2}CV^2$	$t =$ time
	$U =$ potential (stored) energy
$I_{avg} = \frac{\Delta Q}{\Delta t}$	$V =$ electric potential or potential difference
	$v =$ velocity or speed
$R = \frac{\rho \ell}{A}$	$\rho =$ resistivity
$V = IR$	$\theta =$ angle
$P = IV$	$\phi_m =$ magnetic flux
$C_p = \sum_i C_i$	
$\frac{1}{C_s} = \sum_i \frac{1}{C_i}$	
$R_s = \sum_i R_i$	
$\frac{1}{R_p} = \sum_i \frac{1}{R_i}$	
$F_B = qvB \sin \theta$	
$F_B = BIl \sin \theta$	
$B = \frac{\mu_0 I}{2\pi r}$	
$\phi_m = BA \cos \theta$	
$\mathcal{E}_{avg} = -\frac{\Delta\phi_m}{\Delta t}$	
$\mathcal{E} = B\ell v$	

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FLUID MECHANICS AND THERMAL PHYSICS

$P = P_0 + \rho gh$	$A = \text{area}$
$F_{\text{buoy}} = \rho Vg$	$e = \text{efficiency}$
$A_1v_1 = A_2v_2$	$F = \text{force}$
$P + \rho gy + \frac{1}{2}\rho v^2 = \text{const.}$	$h = \text{depth}$
$\Delta\ell = \alpha\ell_0\Delta T$	$H = \text{rate of heat transfer}$
$H = \frac{kA\Delta T}{L}$	$k = \text{thermal conductivity}$
$P = \frac{F}{A}$	$K_{\text{avg}} = \text{average molecular kinetic energy}$
$PV = nRT = Nk_B T$	$\ell = \text{length}$
$K_{\text{avg}} = \frac{3}{2}k_B T$	$L = \text{thickness}$
$v_{\text{rms}} = \sqrt{\frac{3RT}{M}} = \sqrt{\frac{3k_B T}{\mu}}$	$M = \text{molar mass}$
$W = -P\Delta V$	$n = \text{number of moles}$
$\Delta U = Q + W$	$N = \text{number of molecules}$
$e = \left \frac{W}{Q_H} \right $	$P = \text{pressure}$
$e_c = \frac{T_H - T_C}{T_H}$	$Q = \text{heat transferred to a system}$
	$T = \text{temperature}$
	$U = \text{internal energy}$
	$V = \text{volume}$
	$v = \text{velocity or speed}$
	$v_{\text{rms}} = \text{root-mean-square velocity}$
	$W = \text{work done on a system}$
	$y = \text{height}$
	$\alpha = \text{coefficient of linear expansion}$
	$\mu = \text{mass of molecule}$
	$\rho = \text{density}$

ATOMIC AND NUCLEAR PHYSICS

$E = hf = pc$	$E = \text{energy}$
$K_{\text{max}} = hf - \phi$	$f = \text{frequency}$
$\lambda = \frac{h}{p}$	$K = \text{kinetic energy}$
$\Delta E = (\Delta m)c^2$	$m = \text{mass}$
	$p = \text{momentum}$
	$\lambda = \text{wavelength}$
	$\phi = \text{work function}$

WAVES AND OPTICS

$v = f\lambda$	$d = \text{separation}$
$n = \frac{c}{v}$	$f = \text{frequency or focal length}$
$n_1 \sin \theta_1 = n_2 \sin \theta_2$	$h = \text{height}$
$\sin \theta_c = \frac{n_2}{n_1}$	$L = \text{distance}$
$\frac{1}{s_i} + \frac{1}{s_o} = \frac{1}{f}$	$M = \text{magnification}$
$M = \frac{h_i}{h_o} = -\frac{s_i}{s_o}$	$m = \text{an integer}$
$f = \frac{R}{2}$	$n = \text{index of refraction}$
$d \sin \theta = m\lambda$	$R = \text{radius of curvature}$
$x_m \approx \frac{m\lambda L}{d}$	$s = \text{distance}$
	$v = \text{speed}$
	$x = \text{position}$
	$\lambda = \text{wavelength}$
	$\theta = \text{angle}$

GEOMETRY AND TRIGONOMETRY

Rectangle	$A = \text{area}$
$A = bh$	$C = \text{circumference}$
Triangle	$V = \text{volume}$
$A = \frac{1}{2}bh$	$S = \text{surface area}$
Circle	$b = \text{base}$
$A = \pi r^2$	$h = \text{height}$
$C = 2\pi r$	$\ell = \text{length}$
Parallelepiped	$w = \text{width}$
$V = \ell wh$	$r = \text{radius}$

Cylinder

$$V = \pi r^2 \ell$$

$$S = 2\pi r \ell + 2\pi r^2$$

Sphere

$$V = \frac{4}{3}\pi r^3$$

$$S = 4\pi r^2$$

Right Triangle

$$a^2 + b^2 = c^2$$

$$\sin \theta = \frac{a}{c}$$

$$\cos \theta = \frac{b}{c}$$

$$\tan \theta = \frac{a}{b}$$

