UWorld GRAD SCHOOL

MCAT® Physics Equations

Work, Energy, and Power

Work $= W = Fd\cos\theta$

Kinetic Energy $= KE = \frac{1}{2}mv^2$

Work Energy Theorem $= W_{net} = \Delta KE$

Power $= P = \frac{W}{t} = Fv$

Gravitational Potential Energy $= PE = mgh$

Total Mechanical Energy $= E = KE + PE$

Gravity

$F_g = mg$

$g \simeq 10\frac{m}{s^2}$

Circular Motion

Centripetal Acceleration $= \frac{v^2}{r}$

Centripetal Force $= F_c = ma_c = m\frac{v^2}{r}$

Projectile Motion

Horizontal Component

$x = v_{x0}t$

$v_x = v_{x0}$

$a_x = 0$

Vertical Component

$y = v_{y0}t - \frac{1}{2}gt^2$

$v_y = v_{y0} - gt$

$a_y = -g$

Kinematics

Constant Acceleration

$v = v_0 + at$

$d = v_0t + \frac{1}{2}at^2$

Friction

$F_s \leq \mu_s F_N$

$F_k = \mu_k F_N$

Torque

$\tau = rF\sin\theta$

Magnetism

Magnetic Force $= F = qvB\sin\theta$

Thermodynamics

First Law $= \Delta E = Q - W$

Work $= P \cdot \Delta V$

Heat Capacity $= Q = C \cdot \Delta T$

Specific Heat Capacity $= Q = mc \cdot \Delta T$

Fluids

Density $= \rho = \frac{mass}{volume} = \frac{m}{V}$

Specific Gravity $= SG = \frac{\rho}{\rho_{water}}$

Pressure $= P = \frac{F}{A}$

Pascal's Law $= \frac{F_1}{A_1} = \frac{F_2}{A_2}$

Continuity Equation $= A_1v_1 = A_2v_2$

Flow Rate $= Q = Av$

Archimedes' Principle $= F_{bouyant} = \rho_{fluid} \cdot V_{submerged} \cdot g$

Inclined Plane

θ = angle of incline

$F_{g\ parallel} = mg\sin\theta$

$F_{g\ perpendicular} = mg\cos\theta$

Circuits and Electrostatics

Ohms Law $= V = IR$

Power $= P = IV = I^2R = \frac{V^2}{R}$

Series Resistors $= R_{Total} = R_1 + R_2 + \ldots + R_n$

Parallel Resistors $= \frac{1}{R_{Total}} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots + \frac{1}{R_n}$

Current $= I = \frac{Q}{t}$

Resistance $= R = \rho\frac{L}{A}$

Coulomb's Law $= F_E = \frac{kq_1q_2}{r}$

Force by an Electric Field $= F_E = qE$

Lights and Optics

$E = hf = \frac{hc}{\lambda}$

$c = 3 \times 10^8 \frac{m}{s}$

Index of Refraction $= n = \frac{c}{v}$

Snell's Law $= n_1\sin\theta_1 = n_2\sin\theta_2$

Lens Equation $= \frac{1}{o} + \frac{1}{i} = \frac{1}{f}$

Magnification $= M = -\frac{i}{o}$

Lens Strength $= S = \frac{1}{f}$

Capacitors

Capacitance $= C = \frac{Q}{V}$

Capacitance $= \kappa\varepsilon_0\frac{A}{d}$

Compacitor Electric Field $= E = \frac{v}{d}$

Compacitor Energy $= U = \frac{1}{2}QV$

Series Capacitors $= \frac{1}{C_{Total}} = \frac{1}{C_1} + \frac{1}{C_2} + \ldots + \frac{1}{C_n}$

Parallel Capacitors $= C_{Total} = C_1 + C_2 + \ldots + C_n$

Waves and Oscillations

$f = \frac{1}{T}$, where f is frequency and T is period

Velocity $= v = \lambda f$

Hooke's Law $= F_{el} = -kx$

Harmonics for Open Pipes $= f_n = \frac{nv}{2L}$

Harmonics for Pipes Closed at One End $= f_n = \frac{n_{odd}v}{4L}$

Sound

Velocity $= v = \lambda f$

Intensity $= I = \frac{Power}{Area}$

Intensity in Decibels $= \text{dB} = 10\log_{10}\frac{I}{I_0}$

Doppler Effect $= f = \frac{v \pm v_o}{v \mp v_s} f_s$

UWorld | GRAD SCHOOL

MCAT® Chemistry Equations

Mole, Concentration, and Dilution Relationships

Moles $= \frac{mass\ (g)}{molecular\ weight\ (MW)}$

Avogadro's Number

$1\ mole = 6.022 \times 10^{23}\ particles$

Mole Fraction $= X_A = \frac{moles\ of\ A}{total\ moles}$

Molarity $= M = \frac{moles}{L}$

Molality $= M = \frac{moles}{kg}$

Dilution Equation $= M_1V_1 = M_2V_2$

Gases

Standard Temperature and Pressure (STP)

$T = 0\ ^{\circ}C = 273\ K;$
$P = 1\ atm = 760\ torr = 760\ mmHg$

Ideal Gas Law $= PV = nRT$

Dalton's Law of Partial Pressures $= P_{Total} = P_1 + P_2 + \ ...\ P_n$

Graham's Law of Effusion $= \frac{v^1}{v^2} = \sqrt{\frac{MW_2}{MW_1}}$

Atomic Chemistry

Formal Charge

$FC = \#\ valence\ electrons - \#\ bonds - \#\ lone\ pair\ electrons$

Electrochemistry

$F = 96{,}000\ \frac{c}{mole^-}$

$\Delta G = -\ nFE_{cell}$

Thermodynamics

$T_K = T_{^{\circ}C} + 273$

$q = mc\Delta T$

$q = n\Delta H_{fusion/vaporization}$

$\Delta H^{\circ}_{rxn} = \Sigma n\Delta H^{\circ}_{f,products} - \Sigma n\Delta H^{\circ}_{f,reactants}$

Gibbs Free Energy

$\Delta G = \Delta H - T\Delta S$

$\Delta G^{\circ} = -\ RTlnK$

Acids and Bases

$pH = -\ log\,[H^+]$

$pOH = -\ log\,[OH^-]$

$pH + pOH = 14$

$K_a = \frac{[H^+][A^-]}{[HA]}$

$pK_a = -\ logK_a$

$K_b = \frac{[OH^-][HB^+]}{[B]}$

$pK_b = -\ logK_b$

$K_aK_b = K_w = 1 \times 10^{-14}$

$K_w = [H^+][OH^-] = 1 \times 10^{-14}$ at 25 °C

Henderson-Hasselbach Equation

$pH = pK_a + log\ \frac{[A^-]}{[HA]}$

Kinetics

Rate Law $=$ Rate $= k[A]^a[B]^b$

Arrhenius Equation $= k = Ae^{\frac{-E_a}{RT}}$

Equililbrium

$aA + bB \leftrightarrow cC + dD$

Equilibrium Constant $= K_{eq} = \frac{[C]^c[D]^d}{[A]^a[B]^b}$

Products and reactants at equilibrium

Reaction Quotient $= Q = \frac{[C]^c[D]^d}{[A]^a[B]^b}$