Formulasfor the OAT

Note: We do not indicate which formulas should be memorized. This is a list of most of the formulas needed for the exam; however, it may not be exhaustive. Examinees should understand these formulas, but not all of them need to be memorized. Judgement should be used in deciding which to memorize.

General Chemistry

Number of moles = mass in grams / molecular weight

PV = nRT **KE ∝ T** $v \propto \sqrt{(T/mw)}$ **$P_T = P_1 + P_2 + P_3 + ...$**

P = mole fraction of solvent x Po ΔP = mole fraction of solute x Po

$\Delta T_{BP} = k_b$ (molality of solute particles) $\Delta T_{FP} = -k_f$ (molality of solute particles)

Osmotic Pressure = RT [molarity of solute particles]

$pH = -\log_{10}[H^+]$ $pOH = -\log_{10}[OH^-]$

$K_w = [H^+][OH^-] = 10^{-14}$ (at 25°C) $pK_w = 14$

$K_a = [H^+][A^-] / [HA]$ $K_b = [HA][OH^-] / [A^-]$ $K_a K_b = K_w = 10^{-14}$

$pK_a = -\log_{10}K_a$ $pK_b = -\log_{10}K_b$ $pK_a + pK_b = pK_w = 14$ **$pH = pK_a + \log_{10}[A^-]/[HA]$**

$\Delta E = q + w$ **$\Delta G = \Delta H - T\Delta S$** $\Delta G = \Delta G° + RT\ln Q$ $K_{eq} = e^{\Delta G°/-RT}$

$E = E° - (RT/nF)\ln Q = E° - (0.026/n)\ln Q$ $K_{eq} = e^{nFE°/RT}$ $\Delta G° = -nFE°$

Moles = It/nF

0 order reaction: $dA/dt = k$ $A_t = A_0 - kt$

1st order reaction: $dA/dt = kA$ $A_t = A_0 e^{-kt}$

2nd order reaction: $dA/dt = kA^2$ $1/A_t = (1/A_0) + kt$

Physics

$v = u + at$ **$v^2 = u^2 + 2as$** **$s = ut + ½at^2$**

$F = ma$ **$F = Gm_1m_2/r^2$** **$a = v^2/r$**

Static friction = $F_N \mu_S$ Dynamic friction = $F_N \mu_D$

MA = load/effort = number of supporting ropes in a frictionless pulley system

VR = distance moved by effort / distance moved by load = number of supporting ropes

Efficiency = work out / work in

Moment = F x perpendicular distance to pivot point

Momentum = mv **Σmv before collision = Σmv after collision** **Impulse = Ft**

PE = mgh **$KE = ½mv^2$** **Work done = Fd** **Power = Fd/t**

$\Delta l = kF$ Y = stress / strain = (F/A) / (Δl/l)

S = stress / strain = (perpendicular F/A) / (Δx/l) B = stress / strain = ΔP / (ΔV/V)

$f \propto \sqrt{(k/m)}$ **$T = 2\pi\sqrt{(l/g)}$** **$\rho = m/V$**

Upward force on a body = weight of fluid displaced by that body **Hydrostatic pressure = ρgh**

$\rho_1A_1v_1 = \rho_2A_2v_2$ $P_1 + \rho gh_1 + ½\rho v_1^2 = P_2 + \rho gh_2 + ½\rho v_2^2$

Velocity of sound in a fluid, $v = \sqrt{(B/\rho)}$ $v \propto \sqrt{(T/mw)}$ Velocity of sound in a solid = $\sqrt{(Y/\rho)}$

Velocity of a wave in a taut string = √(tension/[mass/length]) $dB = 10\log_{10}(I/I_0)$

Beat frequency = difference between the two frequencies **f' = f(C±Vd / C±Vs)**

$F = kq_1q_2/r^2$ **$E = F/q$** **Between two parallel plates, E = V/d**

Concerning a point charge, $E = kq/r^2$

$V = Fd/q$ **$V = IR$** **Resistivity = RA/l**

For resistors in series, $R_T = R_1 + R_2 + R_3 + ...$ **For resistors in parallel, $1/R_T = 1/R_1 + 1/R_2 + 1/R_3 + ...$**

C = q/V = permitivity x A/d

For capacitors in series, $1/C_T = 1/C_1 + 1/C_2 + 1/C_3 + ...$ **For capacitors in parallel, $C_T = C_1 + C_2 + C_3 + ...$**

P = IV **If a.c., $P = (I_{max}/\sqrt{2})(V_{max}/\sqrt{2}) = I_{max}V_{max}/2$**

$n_1 \sin i = n_2 \sin r$ **Lens power = 1/f,** where f is the focal length in m. Lens power is measured in diopters.

1/f = 1/u + 1/v Two lenses in contact: $1/F = 1/f_1 + 1/f_2$ E = hf

$A_t = A_o e^{-kt}$ $t½ = \ln 2/k$

Biology

$p^2 + 2pq + q^2 = 1$ Number of different gamete genotypes = 2^n

Maximum number of stereoisomers with n stereogenic centers = 2^n