CHE3 Useful Equations sheet – sorted by topic. The ones given to you from 2018 onwards are highlighted.

Aqueous Solution Chemistry AS 91392

Equation	Units	Notes
$K_s = s^2$ $K_s = 4s^3$	none	K_s is the solubility constant for a sparingly soluble salt
		$K_s = s^2$ for an AB salt type and $K_s = 4s^3$ for an AB_2 or A_2B type of salt
$s = \sqrt{K_s}$ and $s = \sqrt[3]{Ks}/4$	mol L^{-1}	To convert mol L^{-1} to g L^{-1} multiply by M. To convert g L^{-1} to mol L^{-1} divide by M.
$pH = -\log[H_3O^+]$	none	Can only use if $[H_3O^+]$ is known.
$[H_3O^+] = 10^{-pH}$	mol L^{-1}	
$K_w = [H_3O^+][OH^-] = 1 \times 10^{-14}$ at 25°C	none	Ionic product of water is 1×10^{-14} @25°C Enter this in calculator as 1 EXP (-) 14
$[H_3O^+] = K_w/[OH^-]$ and $[OH^-] = K_w/[H_3O^+]$	mol L^{-1}	Rearrange to find either $[H_3O^+]$ or $[OH^-]$ which will have units of mol L^{-1}
$K_a = [H_3O^+]^2/[HA]$	none	K_a is the acidity constant - the bigger it is the stronger the acid.
(from HA + $H_2O \rightleftharpoons H_3O^+ + A^-$)		$[HA]$ is the initial [ ] of the weak acid in solution (assume very, very little reacts in the equilibrium as K_a has a small value)
$K_a = \dfrac{[H_3O^+][A^-]}{[HA]}$		
$K_a \times K_b = K_w$ (= 10^{-14})	none	K_b is the constant for a weak base.
$pK_a + pK_b = pK_w$ (= 14)		Calculate if K_a for the conjugate acid is known by rearranging i.e. $K_b = K_w / K_a$
$pK_a = -\log K_a$ $K_a = 10^{-pKa}$	none	
pH of a buffer solution is given by	none	A buffer consists of a weak acid (with a K_a value) and a solution of the conjugate base
$pH = pK_a + \log \dfrac{[base]}{[acid]}$		Eg Acidic buffer: CH_3COOH and CH_3COO^-, and Basic buffer: NH_4^+ and NH_3
During titrations – halfway to the equivalence point, pH = pK_a of the acid		Refer to titration curve examples to see exactly how this point is determined.
$c = n/V$ and $n=cV$ for acid-base titration calculations	Yes ☺	c has units of mol L^{-1}
		n has units of mol
		V has units of L

ASB and Thermochemistry AS 91390

Equation	Units	Notes
E = mcΔT or **q = mcΔT**	J or kJ	Calculate energy released or absorbed into water in a coffee cup calorimeter or when a fuel burns to heat water in a can.
		Use this value to determine enthalpy changes in chemical reactions.
		Be prepared to rearrange to solve for m or c or ΔT
Hess's Law including application of **$\Delta_rH=\Sigma\Delta_fH(products) -\Sigma\Delta_fH(reactants)$** $\Delta H_1 + \Delta H_2 = \Delta H_3$	J or kJ	Used to solve Hess Enthalpy problems when supplied with appropriate data.
		Defining and writing equations representing these enthalpy changes $\Delta_cH°$ $\Delta_fH°$ $\Delta_rH°$ $\Delta_{vap}H°$ $\Delta_{sub}H°$ $\Delta_{fus}H$
n=m/M	mol	The amount of a substance is the mass (in g) divided by the molar mass (in g mol^{-1}).
		Be prepared to rearrange to solve for m (mass) or M (molar mass) from the supplied data.
		Used in enthalpy calculation to convert heat released or absorbed in to heat per mol.

When calculating values

- Know how to actually use your calculator and practice using it!
- Show your working at each step of the calculation.
- Retain all figures in the calculator and round up or down at the end.
- Write down your final answer to 3 significant figures (sometimes 4 for Scholarship).
- Check your units.
- If you forget something in the exam – look at the question as often the data supplied will have the unit that you are looking for!

For more help on significant figures try this site http://www.sciencegeek.net/Chemistry/taters/Unit0SigFigCounting.htm which has rules for determining how many significant figures there are and some tutorial problems with online answers.

Organic Chemistry AS 91390 – no equations!