

## CHEMISTRY FORMULAE FOR HIGHER SCHOOL CERTIFICATE

NO.	CONCEPT	FORMULAE	SYMBOLS AND UNITS
1.	Molecular formula	molecular formula=(empirical formula) <sub>n</sub>	$n = \frac{M_r \text{ of molecular formula}}{M_r \text{ of empirical formula}}$
2.	Molar mass	mass of 1 mole of an element = A <sub>r</sub> of element in grams, mass of 1 mole of a compound=M <sub>r</sub> of compound in grams	
3.	Molar volume	volume of 1 mole of any gas at r.t.p=24.0 dm <sup>3</sup> (litres) or 24000 cm <sup>3</sup> volume of 1 mole of any gas at s.t.p=22.4 dm <sup>3</sup> (litres) or 22400 cm <sup>3</sup>	
4.	Concentration		concentration in mol dm <sup>-3</sup> = $\frac{\text{concentration in g dm}^{-3}}{\text{molar mass, in g mol}^{-1}}$
5.	Number of protons in an atom	n <sub>p</sub> = n <sub>e</sub> = Z	n <sub>p</sub> =number of protons, n <sub>e</sub> =number of electrons, Z=atomic or proton number
6.	Number of neutrons in an atom	n <sub>n</sub> = A—Z	n <sub>n</sub> =number of neutrons, A=mass or nucleon number, Z=atomic or proton number
7.	Ideal gas equation	p V = n R T	p=pressure, in Pa, V=volume, in m <sup>3</sup> , n=number of moles of the gas, R=molar gas constant=8.31 J K <sup>-1</sup> mol <sup>-1</sup> , T=kelvin temperature
8.	Enthalpy change	ΔH = — m c ΔT	ΔH=enthalpy change, in J, m=mass, in kg, c=specific heat capacity, in J kg <sup>-1</sup> K <sup>-1</sup> , ΔT=temperature rise, in K
9.	Entropy change	ΔS <sup>θ</sup> = S <sup>θ</sup> <sub>final</sub> — S <sup>θ</sup> <sub>initial</sub>	ΔS <sup>θ</sup> =standard entropy change in J K <sup>-1</sup> , S <sup>θ</sup> <sub>final</sub> = standard final disorderliness of a system, in J K <sup>-1</sup> , S <sup>θ</sup> <sub>initial</sub> =standard initial disorderliness of the system in J K <sup>-1</sup>

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10.	Gibbs free energy change	$\Delta G^\ominus = \Delta H^\ominus - T \Delta S^\ominus$	$\Delta G^\ominus$ =Gibbs free energy change, in J, $\Delta H^\ominus$ =Enthalpy change in J, T=temperature, in K, $\Delta S^\ominus$ =standard entropy change, in J K <sup>-1</sup>
11.	Nernst equation	$E = E^\ominus + \frac{0.0592}{z} \log_{10} \frac{[\text{oxidised species}]}{[\text{reduced species}]}$	E=electrode potential, in V, $E^\ominus$ =standard electrode potential, in V, z=number of moles of electrons transferred in the half-equation, [oxidised species]=concentration of oxidised species, in mol dm <sup>-3</sup> , [reduced species]=concentration of reduced species, in mol dm <sup>-3</sup>
12.	Electrical charge	$Q = I t$	Q=electric charge, in C, I=current, in A, t=time, in s
13.	Avogadro constant	$F = L e$	F=Faraday constant=9.65 x 10 <sup>4</sup> C mol <sup>-1</sup> , L=Avogadro constant=6.02 x 10 <sup>23</sup> mol <sup>-1</sup> , e=magnitude of charge on an electron=1.60 x 10 <sup>-19</sup> C
14.	Equilibrium constant, $K_c$	If $a A + b B \rightleftharpoons c C + d D$ , then $K_c = \frac{[C]^c \cdot [D]^d}{[A]^a \cdot [B]^b}$	$K_c$ =equilibrium constant for the forward reaction ( $=\frac{1}{K_c}$ for the reverse reaction), [A], [B], [C] and [D]=concentrations of A, B, C and D respectively, in mol dm <sup>-3</sup> , a, b, c, and d are the respective coefficients in the stoichiometric (balanced) equation
15.	Equilibrium constant, $K_p$	If $a A(g) + b B(g) \rightleftharpoons c C(g) + d D(g)$ , then $K_p = \frac{p_C^c \cdot p_D^d}{p_A^a \cdot p_B^b}$	$K_p$ =equilibrium constant for the forward reaction, $p_A$ , $p_B$ , $p_C$ and $p_D$ are the partial pressures of gases A, B, C and D respectively, in Pa, a, b, c, and d are the respective coefficients in the stoichiometric equation
16.	pH	$\text{pH} = -\lg [\text{H}_3\text{O}^+]$	pH=hydrogen ion exponent (ranges from -1 to 14 and has no unit), [H <sub>3</sub> O <sup>+</sup> ] or simply [H <sup>+</sup> ]=concentration of hydrogen ions, in mol dm <sup>-3</sup>

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17.	Ionic product of water	$[H_3O^+][OH^-]=K_w=1.00 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6}$ $\therefore \text{pH} + \text{pOH} = 14$	$[H_3O^+]$ or simply $[H^+]$ =concentration of hydrogen ions, in $\text{mol dm}^{-3}$ , $[OH^-]$ =concentration of hydroxide ions, in $\text{mol dm}^{-3}$ , $K_w$ =ionic product, in $\text{mol}^2 \text{ dm}^{-6}$ , $\text{pH}=-\lg [H^+]$ , $\text{pOH}=-\lg [OH^-]$
18.	Acid dissociation constant	If $\text{HA}(\text{aq}) \rightleftharpoons \text{H}^+(\text{aq}) + \text{A}^-(\text{aq})$ , then $K_a = \frac{[H^+][A^-]}{[HA]}$	$K_a$ =acid dissociation constant, in $\text{mol dm}^{-3}$ , $[H^+]$ =hydrogen ion concentration, in $\text{mol dm}^{-3}$ , $[A^-]$ =concentration of $A^-$ , in $\text{mol dm}^{-3}$ , $[HA]$ =concentration of the acid HA, in $\text{mol dm}^{-3}$
19.	$\text{p}K_a$	$\text{p}K_a = -\lg K_a$	$K_a$ =acid dissociation constant, in $\text{mol dm}^{-3}$
20.	pH of acid buffer	$\text{pH} = \text{p}K_a + \lg \frac{[\text{salt}]}{[\text{acid}]}$	$\text{pH}=-\lg [H^+]$ (negative logarithm to base ten of the hydrogen ion concentration), $\text{p}K_a=-\lg K_a$ (negative logarithm to base ten of the acid dissociation constant), $[\text{salt}]$ =concentration of the salt of the acid, in $\text{mol dm}^{-3}$ , $[\text{acid}]$ =concentration of the weak acid, in $\text{mol dm}^{-3}$
21.	Solubility product	If $\text{A}_m\text{B}_n(\text{s}) \rightleftharpoons m \text{A}^{n+}(\text{aq}) + n \text{B}^{m-}(\text{aq})$ , then $K_{sp}=[A^{n+}]^m \cdot [B^{m-}]^n$	$K_{sp}$ =solubility product of the ionic solid, in $(\text{mol dm}^{-3})^{m+n}$ , $[A^{n+}]$ =concentration of $A^{n+}$ cation, in $\text{mol dm}^{-3}$ , $[B^{m-}]$ =concentration of $B^{m-}$ anion, in $\text{mol dm}^{-3}$
22.	Retention factor, $R_f$		$R_f = \frac{\text{distance moved by a component}}{\text{distance moved by solvent front}}$
23.	General rate equation	If $a \text{A} + b \text{B} \rightarrow \text{products}$ , then $\text{Rate}=k[A]^m \cdot [B]^n$	$m$ =order of the reaction with respect to A, $n$ =order of the reaction with respect to B, $(m+n)$ =overall order of the reaction
24.	Zero-order reaction graphs	Gradient = rate of reaction = $-k$	$k$ =rate constant, in $\text{mol dm}^{-3} \text{ s}^{-1}$
25.	First-order reaction graphs	$k = \frac{0.693}{t_{1/2}}$	$t_{1/2}$ =half-life of first order reaction, in s, $k$ =rate constant, in $\text{s}^{-1}$

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26.	Partition coefficient	$\frac{\text{concentration of S in U}}{\text{concentration of S in L}} = K$	K = partition coefficient, (no unit), concentrations of S in U (upper layer) and L (lower layer) should have the same units
27.	M+1 peak	$n = \frac{100 \times \text{relative abundance of M+1 peak}}{1.1 \times \text{relative abundance of M peak}}$	n=number of carbon atoms in the molecule, relative abundance of M+1 peak measured as a height or as a percentage, relative abundance of M peak measured as a height or as a percentage