

## Topic 1

$$\text{number of neutrons} = \text{mass number} - \text{atomic number}$$

$$\text{Relative atomic mass} = (\text{mass of isotope 1} \times \text{abundance of isotope 1}) + (\text{mass of isotope 2} \times \text{abundance of isotope 2}) / 100$$

## Topic 5

$$\% \text{ atom economy} = M_r \text{ of desired product} / \text{sum of } M_r \text{ of all products} \times 100$$

$$\% \text{ yield} = \text{actual mass} / \text{theoretical mass} \times 100$$

$$\text{moles} = \text{mass} / M_r$$

$$\text{moles} = \text{concentration} \times \text{volume} / 1000 \text{ (dm}^3\text{)}$$

$$\text{moles} = \text{volume} / 24 \text{ (dm}^3\text{) (gases)}$$

$$\text{moles} = \text{number of particles} / 6.02 \times 10^{23} \text{ (value in data sheet)}$$

$$\text{mol dm}^{-3} \times M_r \rightarrow \text{g dm}^{-3}$$

$$PV = nRT \text{ (gases) where } v \text{ is in m}^3, T \text{ is in K and } P \text{ is in Pa, } R \text{ (in data sheet)}$$

$$\text{percentage error} = \text{uncertainty in instrument} / \text{value} \times 100$$

## Topic 8

$$\Delta H = \text{sum of bonds broken} - \text{sum of bonds made (mean bond enthalpies)}$$

$$Q = mc \Delta T \text{ where } m = \text{mass of water, } c = 4.18 \text{ (in data sheet) and } T \text{ is in K}$$

## Topic 9

$$\text{Rate} = 1 / \text{time}$$

$$\text{Rate} = \text{gradient of concentration-time curve}$$

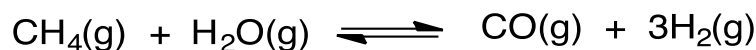
## Topic 10



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

## Topic 11

Example:



$$K_p = \frac{p(\text{CO}) \times p(\text{H}_2)^3}{p(\text{CH}_4) \times p(\text{H}_2\text{O})}$$

**Mole fraction = moles of one gas/moles of all the gases**

**Partial Pressure = mole fraction x total pressure**

**Total Pressure = sum of the partial pressures**

## Topic 12

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

$$[\text{H}^+] = 10^{-\text{pH}}$$

$$K_w = [\text{H}^+][\text{OH}^-] = 1 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6} \text{ (at room temp) (value in data sheet)}$$

$$K_w = [\text{H}^+]^2 \text{ (pure water)}$$

**Expression and use in buffer calculations:**

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

**Weak acid calculations:**

$$K_a = \frac{[\text{H}^+]^2}{[\text{HA}]}$$

$$\text{p}K_a = -\log_{10} K_a$$

$$K_a = 10^{-\text{p}K_a}$$

Half-equivalence point:  $K_a = [H^+]$  or  $pK_a = pH$

## Topic 13

$\Delta S_{\text{system}} = (\text{sum of the entropy of the products}) - (\text{sum of the entropy of the reactants})$

$$\Delta S_{\text{surroundings}} = -\Delta H/T$$

$$\Delta S_{\text{total}} = \Delta S_{\text{system}} + \Delta S_{\text{surroundings}}$$

$$\Delta G = \Delta H - T\Delta S_{\text{system}}$$

$$\Delta G = -RT \ln K$$

$$\text{min. temp.} = \Delta H / \Delta S_{\text{system}}$$

## Topic 14

$E_{\text{cell}} = E^\ominus$  of the more positive value  $- E^\ominus$  of the more negative value

or

$E_{\text{cell}} = E^\ominus$  of the species being reduced  $- E^\ominus$  of the species being oxidised

## Topic 16

For  $A + B \rightarrow C + D$

$$\text{rate} = k[A][B]$$

Arrhenius:

$$k = Ae^{-E_a/RT}$$

$$\ln k = \ln A - E_a/RT$$