AS EQUATIONS - Unit 2

Group 2 metals – with H_2O

Mg $Mg + H_2O \rightarrow MgO + H_2$ (steam only)

Ca,Sr,Ba $Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$

Group 2 metals – with O_2 $2Mg + O_2 \rightarrow 2MgO$

Group 2 metals – with Cl_2 $Mg + Cl_2 \rightarrow MgCl2$

Group 2 Oxides – with H_2O $MgO + H_2O \rightarrow Mg(OH)_2$

Group 2 Oxides – with acids $MgO + H_2SO_4 \rightarrow MgSO_4 + H_2O$

Thermal stability

Group 1 Carbonates All stable to heat except for Li_2CO_3

Group 2 Carbonates $MgCO_3 \rightarrow MgO + CO_2$

Group 1 Nitrates Li: $2LiNO_3 \rightarrow Li_2O + 2NO_2 + ½O_2$

Na, K, Rb, Cs $NaNO_3 \rightarrow NaNO_2 + ½O_2$

Group 2 – Nitrates $Mg(NO_3)_2 \rightarrow MgO + 2NO_2 + ½O_2$

Solubility

Group 1 and 2 Sulphates Decreases down the group - $BaSO_4$ is insolubl

Group 1 and 2 Hydroxides Increases down the group **-** $Mg(OH)_2$ is insoluble

Group 7 elements – with H_2O $Cl_2 + H_2O \rightarrow HCl + HOCl$

Group 7 elements – with NaOH

In Cold Dilute Alkali: $Cl_2 + 2OH^- \rightarrow Cl^- + ClO^- + H_2O$

Reaction type - Disproportionation

In Hot Conc. Alkali: $3Cl_2 + 6OH^- \rightarrow ClO_3^- + 5Cl^- + 3H_2O$

Reaction type - Disproportionation

Group 7 – Displacement reactions $Cl_2(g) + 2Br^-(aq) \rightarrow Br_2(aq) + 2Cl^-(aq)$

Observations Green gas → orange solution

Halide ions – with conc H_2SO_4

$NaCl(s) + H_2SO_4 \rightarrow NaHSO_4(s) + HCl(g)$

Observations Steamy white fumes

$NaBr(s) + H_2SO_4 \rightarrow NaHSO_4(s) + HBr(g)$

$2HBr(g) + H_2SO_4 \rightarrow Br_2(g) + SO_2(g) + 2H_2O(l)$

Observations Steamy white fumes and orange fumes

$NaI(s) + H_2SO_4 \rightarrow$ Products $HI(g)$, $I_2(g) + H_2S(g) +$

Observations Steamy white fumes and purple fumes

Test for halide ions $Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$

Observations White ppt – soluble in dilute ammonia

Halogenoalkanes - with aqueous OH^- $CH_3CH_2Br + OH^- \rightarrow CH_3CH_2OH + Br^-$
Mechanism = Nucleophilic substitution (Sn1 or Sn2)

with ethanolic OH^- $CH_3CH_2Br + OH^- \rightarrow H_2C=CH_2 + Br^- + H_2O$
Mechanism = Elimination

Halogenoalkanes - with CN^- $CH_3CH_2Br + CN^- \rightarrow CH_3CH_2CN + Br^-$
Mechanism = Nucleophilic substitution

Halogenoalkanes - with aqueous silver nitrate
$CH_3CH_2Br + H_2O + Ag^+ \rightarrow CH_3CH_2OH + AgBr$
Fastest halogenoalkane = Iodo
Explanation = C-I bond is weaker than C-Br and C-Cl

Halogenoalkanes - with NH_3 $CH_3CH_2Br + NH_3 \rightarrow CH_3CH_2NH_2 + HBr$
Conditions Conc NH_3 / heat / closed vessel

Preparation of halogenoalkanes

Chloroalkanes from alcohols $CH_3CH_2OH + Cl^- \rightarrow CH_3CH_2Cl + OH^-$
Conditions H_2SO_4 / NaCl / heat

Bromoalkanes from alcohols $CH_3CH_2OH + Br^- \rightarrow CH_3CH_2Br + OH^-$
Conditions NaBr / H_3PO_4 / Heat

Not H_2SO_4 / NaBr / heat as Br_2 will form

Iodoalkanes from alcohols $CH_3CH_2OH + I^- \rightarrow CH_3CH_2I + OH^-$
Conditions PI_3 or P / I_2

Not H_2SO_4 / NaI / heat as I_2 will form

Alcohols – 1º Partial Oxidation $CH_3CH_2OH + [O] \rightarrow CH_3CHO + H_2O$
Conditions Distil product as it is formed

Alcohols – 1º Complete Oxidation $CH_3CH_2OH + 2[O] \rightarrow CH_3CO_2H + H_2O$
Conditions HUR

Alcohols – 2º Oxidation $CH_3CHOHCH_3 + [O] \rightarrow CH_3COCH_3 + H_2O$

Alcohols – Dehydration $CH_3CH_2OH \rightarrow H_2C=CH_2 + H_2O$
Conditions HUR / NaOH – Aqueous

Alcohols – Reaction with sodium $CH_3CH_2OH + Na \rightarrow CH_3CH_2O^-Na^+ + ½ H_2$
Observation Colourless effervescence