

OXIDATION STATES AND REDOX REACTIONS – 2

1. Sulphur and chlorine show several different oxidation states in their compounds; this is a common feature of the chemistry of p-block elements.

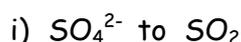
Deduce the oxidation states which are shown by sulphur or chlorine in the compounds and ions shown in the table below:

Compound or ion	Oxidation state	Compound or ion	Oxidation state	Compound or ion	Oxidation state
H ₂ SO ₃		SO ₃		MgSO ₄	
H ₂ S		SO ₂		SO ₃ ²⁻	
ClO ⁻		NaCl		ClO ₄ ⁻	
Cl ₂ O		ClO ₂ ⁻		NaClO ₃	

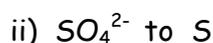
(12)

2. Concentrated sulphuric acid may act as an oxidising agent. The oxidation state which is formed as the reduction product depends on the strength of the reducing agent.

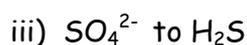
Write complete half-equations to show the reduction of sulphate ions, SO₄²⁻, as shown below:



_____ (2)



_____ (2)



_____ (2)

3. a) Bromide ions are oxidised to produce bromine when they react with concentrated sulphuric acid. Deduce the half equation for the oxidation of bromide ions.

_____ (1)

b) Iodide ions are oxidised to produce iodine when they react with concentrated sulphuric acid. Deduce the half equation for the oxidation of iodide ions.

_____ (1)

4. The reduction product of sulphuric acid when it reacts with sodium bromide is sulphur dioxide, SO₂. Combine two half- equations from those above to deduce the full ionic equation for reduction of sulphate ions by bromide ions.

 _____ (2)

5. Iodide ions are stronger reducing agents than bromide ions. When they react with concentrated sulphuric acid a mixture of reduction products are formed from the sulphuric acid.

a) Combine two half- equations from those overleaf to deduce the full ionic equation for reduction of sulphate ions to sulphur by iodide ions.

(2)

b) Combine two half- equations from those overleaf to deduce the full ionic equation for reduction of sulphate ions to hydrogen sulphide, H_2S , by iodide ions.

(2)

6. Concentrated sulphuric acid may oxidise sulphur. Both of the reactants are converted into sulphur dioxide during the reaction. Deduce the full ionic equation for the reaction by writing the two half-equations involved and combining them together.

(4)

7. Sulphite ions, SO_3^{2-} , often act as reducing agents in reactions; they are oxidised to sulphate ions, SO_4^{2-} .

a) Deduce the half-equation to show the oxidation of sulphite ions to sulphate ions.

(2)

b) Iron(III) ions are reduced to iron(II) ions by sulphite ions. Deduce the half-equation for the reduction of iron(III) ions to iron(II) ions and combine the two half-equations to derive the overall ionic equation for the reduction of iron(III) ions by sulphite ions.

(3)

Total = 35 marks