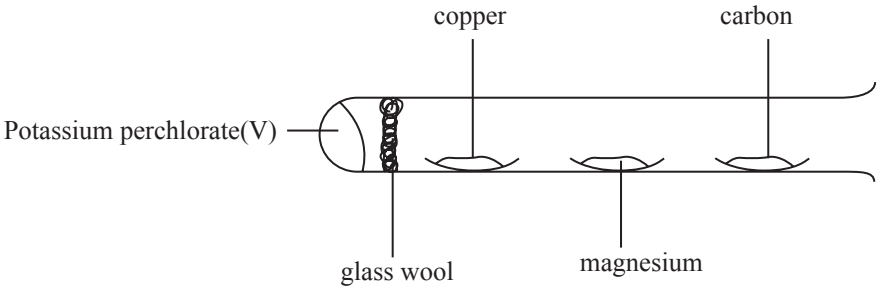
Oxidation States in Redox Reactions

The diagram below shows the setup to investigate the redox reaction for carbon, magnesium and copper. Potassium perchlorate(V) is used to provide oxygen for the reactions.



The table below shows the observations after the setup was heated.

Element	Observation	
	During heating	After heating
Carbon	Bright flame	
Magnesium	Very bright flame	White powder
Copper	Faint glow	Black powder

(a) State the observation after carbon is heated.

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(b) (i) Write the chemical equation, with state symbols, for the reaction that occurred in copper.

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(ii) State the change in oxidation number of copper for this reaction.

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(c) The residue from the heating of copper is mixed with magnesium and then heated. A redox reaction occurs.

(i) Write the chemical equation for the reaction between the black residue and magnesium.

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(ii) Explain, in terms of oxidation number, why this reaction is considered a redox reaction.

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Answers to

(a) A colourless gas which forms a white precipitate with limewater is produced.

(b) (i) $2Cu\ (s) + O_2\ (g) \rightarrow 2CuO\ (s)$

(ii) From 0 to +2

(c) (i) $CuO\ (s) + Mg\ (s) \rightarrow MgO\ (s) + Cu\ (s)$

(ii) Decrease in oxidation number of copper from +2 (CuO) to 0 (Cu). Copper is reduced. Increase in oxidation number of magnesium from 0 (Mg) to +2 (MgO). Magnesium is oxidised. Since both oxidation and reduction happened simultaneously, the reaction can be considered a redox reaction.