

Assessment Schedule – 2009

Chemistry: Describe oxidation-reduction reactions (90311)

Evidence Statement

Q	Evidence	Achievement	Merit	Excellence
ONE (a)(i)	Brown / yellow / red-brown / yellow-brown / orange-brown (solution) turns to colourless.	TWO of:	Observations for FOUR out of SIX colours correctly linked to species.	Observations for FIVE out of SIX colours correctly linked to species (with no spectator ions).
(ii)	Brown I ₂ / iodine forms colourless I ⁻ / iodide.	Observations for FOUR out of SIX colours correct.	Observations for FOUR out of SIX colours correctly linked to species.	Observations for FIVE out of SIX colours correctly linked to species (with no spectator ions).
(iii)	I ₂ + 2e ⁻ → 2I ⁻			
(b)(i)	Orange / yellow-orange / orange-yellow paper turns to green / blue / blue-green.			
(ii)	Orange Cr ₂ O ₇ ²⁻ / dichromate turns to green Cr ³⁺ / chromium ions / chromium III / chromic.		AND	AND
(c)(i)	Purple turns to colourless / pale pink / (white (paper))			
(ii)	Purple MnO ₄ ⁻ / permanganate turns to colourless Mn ²⁺ / manganese ions / manganese II / manganous.	EITHER Oxidant causes oxidation of another species OR Oxidant is reduced OR MnO ₄ ⁻ oxidises the SO ₂	EITHER Oxidant causes oxidation of another species OR Oxidant is reduced AND linked to either MnO ₄ ⁻ or SO ₂ .	Explanation of oxidant as causing oxidation of another species AND is reduced AND linked to both MnO ₄ ⁻ and SO ₂ .
(iii)	An oxidant causes the oxidation of another species. Oxidant is reduced / removes / receives / accepts electrons (from other species). MnO ₄ ⁻ / KMnO ₄ (is the oxidant) as it (MnO ₄ ⁻) gains electrons from / oxidises the SO ₂ . The MnO ₄ ⁻ is reduced by SO ₂ .			
(iv)	SO ₂ + 2H ₂ O → SO ₄ ²⁻ + 4H ⁺ + 2e ⁻ MnO ₄ ⁻ + 8H ⁺ + 5e ⁻ → Mn ²⁺ + 4H ₂ O 2MnO ₄ ⁻ + 2H ₂ O + 5SO ₂ → 2Mn ²⁺ + 5SO ₄ ²⁻ + 4H ⁺	ONE out of the THREE half equations in (a) or (c) balanced correctly (but may be identified incorrectly).	AND TWO out of THREE half-equations balanced correctly.	AND ALL of (c) (iv) equations balanced correctly.
		2A	3M	3E

TWO (a)	(i) 0 (ii) -3 (iii) -3 (iv) +1	TWO oxidation numbers correct – evidence may be in any part of the question AND	THREE oxidation numbers correct – evidence may be in any part of the question AND	THREE oxidation numbers correct – evidence may be in any part of the question AND
(b)(i)	$\text{NO}_2^- + \text{H}_2\text{O} \rightarrow \text{NO}_3^- + 2\text{H}^+ + 2\text{e}^-$ <p>This (nitrification reaction) is an oxidation reaction because electrons are lost, or the oxidation number of N increases from +3 (in NO_2^-) to +5 (in NO_3^-).</p>	Describes electron loss or change in oxidation number OR ONE reaction correctly identified as oxidation or reduction	Explains electron loss or increase in oxidation number from 3 to 5 AND	Explains electron loss or increase in oxidation number from 3 to 5 AND
(ii)	<p>(Nitrogen fixation): $\text{N}_2 \rightarrow \text{NH}_4^+$ is a reduction reaction because electrons are gained OR the oxidation number of N decreases from 0 (in N_2) to -3 (in NH_4^+).</p> $\text{N}_2 + 8\text{H}^+ + 6\text{e}^- \rightarrow 2\text{NH}_4^+$ <p>(Other nitrification reaction): $\text{NH}_4^+ \rightarrow \text{NO}_2^-$ is also oxidation reaction because electrons are lost OR the oxidation number of N increases from -3 (in NH_4^+) to +3 (in NO_2^-).</p> $\text{NH}_4^+ + 2\text{H}_2\text{O} \rightarrow \text{NO}_2^- + 8\text{H}^+ + 6\text{e}^-$ <p>(Denitrification): $\text{NO}_3^- \rightarrow \text{N}_2$ is reduction reaction because electrons are gained OR the oxidation number of N decreases from +5 (in NO_3^-) to 0 (in N_2).</p> $2\text{NO}_3^- + 12\text{H}^+ + 10\text{e}^- \rightarrow \text{N}_2 + 6\text{H}_2\text{O}$	AND ONE half-equation correct.	TWO reactions identified as oxidation or reduction with a correct explanation in terms of transfer of electrons or change in oxidation number or loss / gain of hydrogen or oxygen AND TWO half-equations correct.	All FOUR reactions are discussed. Reactions are identified as oxidation or reduction with a correct explanation in terms of transfer of electrons or change in oxidation number or loss / gain of hydrogen or oxygen AND THREE half-equations correct.
		3A	4M	4E

<p>THREE</p> <p>(a)(i)</p> <p>(ii)</p> <p>(b)</p>	<ul style="list-style-type: none"> + electrode is the anode - electrode is the cathode <ul style="list-style-type: none"> Cathode: $\text{Ag}^+ + \text{e}^- \rightarrow \text{Ag}$ Anode: $\text{Ag} \rightarrow \text{Ag}^+ + \text{e}^-$ <p>At the negative electrode / cathode</p> <ul style="list-style-type: none"> positive silver ions / cations / Ag^+ (from the electrolyte solution) will move / be attracted to the negative electrode / cathode / trophy. reduction of Ag^+ to Ag a silver / grey deposit / solid / coating forms (on the trophy). <p>At the positive electrode / anode</p> <ul style="list-style-type: none"> Ag / silver reacts / becomes ions and moves into the electrolyte solution. oxidation of Ag to Ag^+ the silver / Ag metal becomes smaller. <p>(Electrons are produced at the positive electrode / anode and move toward the negative electrode / cathode through the external circuit / wire).</p>	<p>Description of FOUR of:</p> <p>Both electrodes correctly labelled</p> <p>OR</p> <p>Correct balanced half-equation (may be incorrectly identified)</p> <p>OR</p> <p>Ag^+ move to cathode / negative electrode</p> <p>OR</p> <p>Reduction at cathode / negative electrode OR Ag^+ are reduced</p> <p>OR</p> <p>Silver / grey / solid deposited on cathode / trophy</p> <p>OR</p> <p>Oxidation at anode / positive electrode OR Ag is oxidised</p> <p>OR</p> <p>Ag^+ move into electrolyte / toward cathode</p> <p>OR</p> <p>Anode becomes smaller.</p> <p>1A</p>	<p>Correct explanation of reaction occurring at one electrode including</p> <ul style="list-style-type: none"> correct half-equation movement of one species redox process observation <p>OR</p> <p>Any SIX of Achievement points.</p> <p>1M</p>	<p>Discussion demonstrates understanding of the reactions at anode and cathode including movement of species, redox processes, observations and half equations.</p> <p>1E</p>
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Judgement Statement

Achievement	Achievement with Merit	Achievement with Excellence
2 A	2 M + 1 A OR 1 M + 2 A	2 E + 1 A OR 1 E + 2 M

NOTE:

Lower case **a**, **m**, **e** may be used throughout the paper to indicate contributing evidence for overall grades for questions.

Only upper case **A**, **M** and **E** grades shown at the end of each full question are used to make the final judgement.