

Assessment Schedule – 2010**Chemistry: Describe oxidation-reduction reactions (90311)****Evidence Statement**

Q	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
ONE (a)	S = +6 Cl = 0 N = +5 Cl = -1	THREE of: • THREE correct	BOTH of:	
(b)	HCl / H ⁺ is the oxidant. An oxidant / HCl / H ⁺ oxidises other species / Zn. Oxidant / HCl / H ⁺ is itself reduced. Zn ON (increases) from 0 to 2 so is oxidised. ON of H ⁺ (decreases) from 1 to 0 so is reduced.	• Describes H ⁺ as oxidant as it is being reduced / oxidising zinc / H ⁺ is decreasing in oxidation number / Zn increases in ON.	Explains H ⁺ is the oxidant as it oxidises zinc / other species or is being reduced and links to one set of ONs.	Demonstrates an understanding of an oxidant in terms of H ⁺ oxidising zinc / other species and being reduced and links to one set of ONs.
(c)(i)	The O / H ₂ O / electrons are not balanced / have been added to the right-hand / wrong side (and so H ⁺ also added to wrong side). Both equations have been written as reduction equations. Equation Two should have been written as an oxidation equation.	• EITHER O / H ₂ O / e ⁻ are not balanced / been added to wrong side of the equat ⁿ . OR recognises that both equations are reduction.	AND	AND
(ii)	Correct half-equation: $\text{SO}_2 + 2\text{H}_2\text{O} \rightarrow \text{SO}_4^{2-} + 4\text{H}^+ + 2\text{e}^-$	• Rewrites second equation correctly.		
(iii)	Principle: Oxidation and reduction reactions must occur together / one reactant must be oxidised and the other reactant is reduced / both reactions are reduction so won't occur together. Electron transfer: Oxidation-reduction reactions involve transfer of electrons so the electrons lost by SO ₂ oxidising are gained by MnO ₄ ⁻ / when the two equations are combined the electrons have to cancel / electrons have been added to the wrong side of Eqn 2 (or are both on left) and can't cancel when equations are combined. Charge: Original Eqn 2 is incorrect as overall charge of reactants (+2) does not equal overall charge of products (-2) / overall charge must be equal on both sides of Eqn 2 / charges on Eqn 2 must be balanced by adding electrons to the right side / charges on final combined equation could not be balanced if original Eq ⁿ 2 used	• Describes oxidation and reduction in terms of principles / electron transfer / charge.	Explains oxidation and reduction in terms of two of principles / electron transfer / charge.	Discusses oxidation-reduction reactions in terms of principles, electron transfer and charge.

<p>TWO</p> <p>(a)(i)</p> <p>(ii)</p> <p>(b)</p>	<p>Cathode: zinc / Zn</p> <p>Anode: chlorine / Cl₂</p> <p>Cathode: $\text{Zn}^{2+} + 2\text{e}^- \rightarrow \text{Zn}$</p> <p>Anode: $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$</p> <p>Zn²⁺ ions are cations and move to the negative electrode (cathode), therefore a reduction reaction occurs. It is reduction, as the zinc ions are gaining electrons from the cathode. When electrons are gained, Zn metal is formed and is seen as a silver / grey metallic solid.</p> <p>Cl⁻ ions are anions and move to the positive electrode (anode), therefore oxidation occurs. It is oxidation, as the chloride ions lose electrons to the anode. When this occurs, chlorine is formed and is seen as pale green / pale yellow / colourless gas / bubbles.</p> <p>Electrons produced at the anode travel through the external circuit (the wire) to the cathode.</p>	<p>FOUR of:</p> <ul style="list-style-type: none"> • Identifies formation of zinc at cathode and chlorine at anode. • ONE correct half equation (may be incorrectly identified). • Cations / Zn²⁺ move to cathode / -ve electrode • Reduction at cathode / -ve OR Zn²⁺ are reduced. • Silver / grey substance OR deposit / plating / coating / solid OR increase in mass (on cathode) • Anions / Cl⁻ move to anode / +ve electrode • Oxidation at anode / +ve OR Cl⁻ are oxidised • Pale green / pale yellow / yellow-green / colourless gas OR bubbles OR fizzing OR pungent odour OR distinctive chlorine smell. 	<p>Correct description of reaction occurring at one electrode linked to observation, movement of one species, movement of electrons at one electrode (or around circuit), redox process, and equation.</p> <p>OR</p> <p>Any SIX of achieved points linked.</p>	<p>Discussion demonstrates understanding of the oxidation reaction of Cl⁻ occurring at the anode and reduction reaction of Zn²⁺ occurring at the cathode. This also includes observations, movement of ions and electrons.</p>
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<p>THREE</p>	<p>Dichromate / $\text{Cr}_2\text{O}_7^{2-}$ ions are reduced to chromium ions / Cr^{3+} as iron(II) / Fe^{2+} ions are oxidised to iron(III) ions / Fe^{3+}.</p> <p>Orange $\text{Cr}_2\text{O}_7^{2-}$ solution is added to very pale green / colourless Fe^{2+}. This forms green / blue / blue-green Cr^{3+} and orange / yellow-orange / orange-brown Fe^{3+}.</p> <p>The overall final colour will be orange-green (a mix of the two products).</p> <p>Dichromate / $\text{Cr}_2\text{O}_7^{2-}$ ions are reduced to chromium / Cr^{3+} ions as iodide / I^- ions are oxidised to iodine / I_2.</p> <p>Orange $\text{Cr}_2\text{O}_7^{2-}$ solution is added to colourless / white I^-. This forms green / blue / blue-green Cr^{3+} and Brown / yellow / grey / red-brown / yellow-brown / orange-brown (solution / solid) I_2.</p> <p>The overall final colour will be brown-green (a mix of the two products).</p> <p>$\text{Fe}^{2+} \rightarrow \text{Fe}^{3+} + \text{e}^-$</p> <p>$\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{e}^- \rightarrow 2\text{Cr}^{3+} + 7\text{H}_2\text{O}$</p> <p>$\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{Fe}^{2+} \rightarrow 2\text{Cr}^{3+} + 7\text{H}_2\text{O} + 6\text{Fe}^{3+}$</p> <p>$2\text{I}^- \rightarrow \text{I}_2 + 2\text{e}^-$</p> <p>$\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{e}^- \rightarrow 2\text{Cr}^{3+} + 7\text{H}_2\text{O}$</p> <p>$\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{I}^- \rightarrow 2\text{Cr}^{3+} + 7\text{H}_2\text{O} + 3\text{I}_2$</p>	<p>Describes THREE of</p> <ul style="list-style-type: none"> • Oxidation of iron (II) ions OR iron (III) ions are formed OR oxidation of iodide ions OR iodine is formed. • Reduction of dichromate OR chromium ions are formed • ONE correct half or full equation. • Observation of an initial and final colour change OR three colours identified. 	<ul style="list-style-type: none"> • Oxidation of iron (II) ions to iron (III) ions OR iodide to iodine. • Reduction of dichromate . • TWO correct half or full equations. • Observation of four initial or final colours linked to species. 	<p>The reaction of acidified dichromate with BOTH iron (II) and iodide are described with five observations linked to species, together with the half equations and overall balanced equations.</p>
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Judgement Statement

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