Assessment Schedule – 2006

Chemistry: Describe oxidation–reduction reactions (90311)

Evidence Statement

Q	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
1(a)(i) (ii)	• MnO_4^- or permanganate (ion) • Mn^{2+} / manganous ion or manganese(II) ion • I_2 / Iodine	Two correct answers.		
(b)(i)	• oxidant is SO_2 or S of SO_2 • reductant is H_2S or S of H_2S	Both correct.		
(ii) (iii)	oxidation: $H_2S \rightarrow S + 2H^+ + 2e^-$ (if H_2O included pull back 1 level) (may have been x by 2) reduction: $SO_2 + 4H^+ + 4e^- \rightarrow S + 2H_2O$ Overall: $SO_2 + 2H_2S \rightarrow 3S + 2H_2O$	One half-equation correct and identified **OR** Overall equation correct. **OR** One half equation and overall equation correct **OR** Both half equations balanced but incorrectly identified, overall equation incorrect.	Both half equations correct, and identified correctly as oxidation or reduction **OR** Overall balanced equation with incorrectly identified oxidation and reduction equations.	Half-equations and overall equation correctly balanced.
2(a) (b)	$Cr_2O_3 = +3$ $CrO_4^{2-} = +6$ (or +3, 3, etc) $Cr_2O_7^{2-} = +6$ $Cr^{3+} = +3$ $Cr_2O_7^{2-} \rightarrow Cr^{3+}$ circled The oxidation number of (Cr) decreases **OR** decreased from +6 to +3 oxidation numbers above must be correct **OR** Cr loses oxygen.	Two correct answers from Q2(a).	Three answers fromQ2(a) correct **PLUS** Q2(b) correct. Justification includes either a decrease in oxidation state **or** Cr loses oxygen. Oxidation numbers of Cr in $Cr_2O_7^{2-}$ and Cr^{3+} are correct.	
(c)	$Cr_2O_3 + 5H_2O \rightarrow 2CrO_4^{2-} + 10H^+ + 6e^-$	Atoms balanced but charge not balanced.	Half-equation correctly balanced.	
(d)(i)	$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$	Correct equation or observation	Correct equation and colour	

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(ii)	Solution changes colour from orange to green or blue. The orange is due to the $Cr_2O_7^{2-}$ (dichromate) ion, and the green or blue is due to the (chromium) Cr^{3+} ion.	of orange to green.	change correct, and linked to species involved.	
3(a)(i) (ii)	0 or Zero Total anion charge is –4 as CO_3^{2-} is –2 and each OH^- is –1. Species is neutral so total cation charge is +4. So each Cu has an oxidation number of +2.	(i) Cu = 0 and (ii) Cu = +2 **OR** (ii) Cu = +2 and clear working.	Both (i) and (ii) correct with clear working shown for (ii).	
(iii)	There is a total charge of –4 on the sulfide ions So there is a total cation charge of +4. Therefore either Cu = +1 and Fe = +3 or Cu = +2 and Fe = +2.	One possible set of oxidation numbers identified for Cu and Fe and no additional error. **OR** Cu can be +1 or +2 and Fe can be +2 or +3. **OR** 2 sets correct, 1 set incorrect, no reasons.	One possible set of oxidation numbers identified for Cu and Fe, with reasons. **OR** Two sets correct but no reasons provided. **OR** Cu can be +1 or +2 and Fe can be +2 or +3.	Both possible sets of oxidation numbers for Cu and Fe identified, with accompanying reasons. Answers imply that +4 will be sum of ON of Cu and Fe. "Words" are included in the discussion. ON of S is used. Terminology must be correct.
(b)(i) (ii)	S circled. Oxidation number increases. **OR** Changes from –2 to +4 **OR** S gains oxygen.	S circled – could be as reactant or product formed. CuS circled but reason clearly relates to S.	S circled and correct reason provided.	
(iii)	Oxidation number increase is oxidation, oxidation number decrease is reduction. Oxidation number (Cu) decreases from +2 to 0 so Cu is reduced, and Oxidation number (C) increases from 0 to +2 so C is oxidised.	Change in oxidation number for Cu and C identified by oxidation states for each. **OR** C increase oxid number and Cu decrease oxid number.	Oxidation recognised as increase in oxidation number, and reduction as decrease in oxidation number. Actual oxidation states are required.	

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4(a)(i)	Cathode equation: $Cu^{2+} + 2e^- \rightarrow Cu$ Anode equation: $2Cl^- \rightarrow Cl_2 + 2e^-$	One half-equation correct. **OR** Equations correct but at wrong electrodes.	Both half-equations correct and at correct electrodes.	
(b)	Electrolysis occurs when electricity is passed through a solution, or liquid, and a reaction is forced to occur. Electricity is the flow of charge, ions conduct in solution, electrons carry the charge in the wire. Cu^{2+} are cations and are attracted to the negative cathode and Cl^- (chloride) ions are anions and are attracted to the positive anode where reduction, gain of e^-s, occurs at the cathode and Cu^{2+} ions are reduced to Cu metal and oxidation, loss of e^-s, occurs at anode and Cl^- ions are oxidised to Cl_2 gas.	Two clear ideas that include both "aspects" Eg • Cu^{2+} is cation • cation moves to cathode • cathode is negative • reduction at cathode • Cu^{2+} ions gain electrons to form Cu.	Three clear ideas. Actual example is used in answer rather than just general principles.	Full discussion. All key words are used and all terms must be used correctly. Actual species involved identified. For instance, Cu^{2+}/Cu and Cl^-/Cl_2 Names of species are correct.

Judgement Statement

Chemistry: Describe oxidation-reduction reactions (90311)

Achievement	Achievement with Merit	Achievement with Excellence
SEVEN questions answered correctly ***or*** SIX questions answered correctly, including at least 4 at Merit level. Minimum of $7 \times A$ ***or*** $4 \times M + 2 \times A$	EIGHT questions answered correctly, including at least SIX at Merit level. Minimum of $6 \times M + 2 \times A$	EIGHT questions answered correctly, with at least FOUR at Merit level and TWO at Excellence level. Minimum of $2 \times E + 4 \times M + 2 \times A$