Achievement Standard 2.7 – Mark Schedule

<table>
<tr><th>Question number</th><th>Answer</th><th>Achievement</th><th>Achievement with Merit</th><th>Achievement with Excellence</th></tr>
<tr><td>1 (a)</td><td>i) +7
ii) +6
iii) +5
iv) +5
v) +1</td><td>4 correct</td><td></td><td></td></tr>
<tr><td>1(b)</td><td>
<table>
<tr><th></th><th>Species</th><th>Oxidation Number change</th><th>Reduction/ oxidation</th></tr>
<tr><td>i</td><td>$Cu \rightarrow Cu^{2+}$</td><td>0 ➔ 2</td><td>Oxidation</td></tr>
<tr><td></td><td>$Ag^{+} \rightarrow Ag$</td><td>1 ➔ 0</td><td>Reduction</td></tr>
<tr><td>ii</td><td>$Fe^{2+} \rightarrow Fe^{3+}$</td><td>2 ➔ 3</td><td>Oxidation</td></tr>
<tr><td></td><td>$O_2 \rightarrow O^{2-}$</td><td>0 ➔ -2</td><td>Reduction</td></tr>
<tr><td>iii</td><td>$Sn \rightarrow Sn^{2+}$</td><td>0 ➔ 2</td><td>Oxidation</td></tr>
<tr><td></td><td>$H^{+} \rightarrow H_2$</td><td>1 ➔ 0</td><td>Reduction</td></tr>
<tr><td>iv</td><td>$Al \rightarrow Al^{3+}$</td><td>0 ➔ 3</td><td>Oxidation</td></tr>
<tr><td></td><td>$Fe^{3+} \rightarrow Fe$</td><td>3 ➔ 0</td><td>Reduction</td></tr>
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</td><td>6 lines correct</td><td>All correct</td><td></td></tr>
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2 (a)	$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$ $2I^- \rightarrow I_2 + 2e^-$. $2\ MnO_4^- + 16H^+ + 10I^- \rightarrow 2\ Mn^{2+} + 8H_2O + 5I_2$ MnO_4- → Mn^{2+} Purple to colourless I^- → I_2 Colourless to brown/Orange	4 correct half equations	2 correct full equations with correct observations	3 correct full equations with correct observations for 2, linked to correct species.
2 (b)	$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$ $H_2O_2 \rightarrow O_2 + 2H^+ + 2e^-$ $2MnO_4^- + 6H^+ + 5H_2O_2 \rightarrow 2Mn^{2+} + 8H_2O + 5O_2$ MnO_4- → Mn^{2+} Purple to colourless H_2O_2 → O_2 Liquid to gas			
2 (c)	$Cl_2 + 2e^- \rightarrow 2Cl^-$ $Fe^{2+} \rightarrow Fe^{3+} + e^-$ $Cl_2 + 2Fe^{2+} \rightarrow 2Cl^- + 2Fe^{3+}$ Cl_2 → Cl^- Pale green gas to colourless liquid Fe^{2+} → Fe^{3+} Pale green to orange			
3 (a)	$Cr_2O_3 + 6H^+ + 6e^- \rightarrow 2Cr + 3H_2O$ $C + H_2O \rightarrow CO + 2H^+ + 2e^-$ $Cr_2O_3 + 3C \rightarrow 2Cr + 3CO$	Correct, but waters and hydrogen ions left in final equation	Correct final equation.	
3 (b)	$Cr^{3+} + 3e^- \rightarrow Cr$	Correct		
3 (c)	$6e^- + Cr_2O_7^{2-} + 14H^+ \rightarrow 2Cr^{3+} + 7H_2O$ $C_2H_6O + H_2O \rightarrow C_2H_4O_2 + 4H^+ + 4e^-$ $2Cr_2O_7^{2-} + 16H^+ + 3C_2H_6O \rightarrow 4Cr^{3+} + 11H_2O + 3C_2H_4O_2$		Correct half equations	Correct final equation in lowest denominations

4 (a)	Anode = (+)ve Cathode = (-)ve	Correct		
4 (b)	To attract the positive chromium cations to it so that they can pick up electrons and become chromium, coating the jewelry. The anode will slowly dissolve replacing the Cr^{3+} ions in solution. So connecting the jewelry here will cause the jewelry to dissolve.	So it will be coated with chromium	To attract the positive chromium ions to it.	Merit plus jewelry will dissolve as an anode.
4 (c)	No As there would be no mobile charge carriers to complete the circuit. There would be no Cr^{3+} ions to be attracted to the jewelry.	No. As there would be no charge carriers	Achieved plus no Cr^{3+} ions	
4 (d)	The anode gets smaller The cathode gets bigger and shinier as it is coated in chromium.	1 observation		
4 (e)	No As the chromium electrode is oxidised to Cr^{3+} ions itself and this replaces the Cr^{3+} that is reduced to Cr at the cathode.	No	Indicates an understanding that the electrode replaces it.	Full explanation including reduction and oxidation
4 (f)	**Cathode** $Cr^{3+} + 3e^- \rightarrow Cr$ *Reduction* **Anode** $Cr \rightarrow Cr^{3+} + 3e^-$ *Oxidation*	Correct equations, but reduction at Anode and vice versa	Correct	
5 (a)	• In this pH range, maximum HOCl is available to carry out its sanitizing effects. • Because below 6 chlorine is formed, which is toxic to humans.	Identifies optimum range from graph.	Comments on production of toxic Chlorine.	

5 (b)	$Cl_2 + 2e^- \rightarrow 2Cl^-$ $Fe \rightarrow Fe^{3+} + 3e^-$ $2Fe + 3Cl_2 \rightarrow 2FeCl_3$	2 half equations	Fully balanced ionic equation	
5 (c)	Oxidising agent	Correct		

Sufficiency statement:

ACHIEVED **8** opportunities out of the 14, at achieved or higher.
MERIT Achieved plus 5 opportunities out of the 10, at merit or higher.
EXCELLENCE Merit plus 2 opportunities out of the 4, at excellence.