

Q8 Oxidation and reduction

[2 + 4 + 4 = 10 marks]

- a) i) Assign oxidation numbers to the atoms in the following compounds or ions:

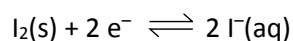
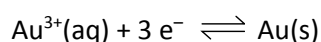
½ mark each, must have correct sign

[2 marks]

	Atom	Oxidation number	Atom	Oxidation number
MnO ₄ ²⁻	Mn	+6	O	-2
H ₃ O ⁺	H	+1	O	-2

- b) From the half equations below, determine the balanced cell reaction and the standard electrode potential:

Hint: Determine which reaction will be oxidation and which reaction will be reduction.



Data: $E^{\circ}(\text{Au}^{3+} / \text{Au}) = +1.42 \text{ V}$ and $E^{\circ}(\text{I}_2 / \text{I}^{-}) = +0.54 \text{ V}$

State the amount (measured in moles) of electrons that will be transferred in the reaction.

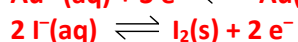
[4 marks]

The half cell with the more positive E°_{cell} is a reduction and the other half reaction reversed is oxidation:



reduction

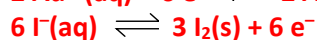
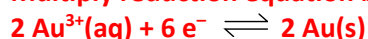
½ mark



oxidation

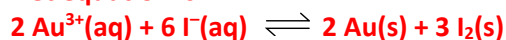
½ mark

Multiply reduction equation by 2 and oxidation equation by 3



and add the two new equations:

Net equation is:



1 mark

$$E^{\circ}_{\text{cell}} = E^{\circ}_{\text{substance reduced}} - E^{\circ}_{\text{substance oxidised}}$$

$$E^{\circ}_{\text{cell}} = E^{\circ}_{\text{reduction}} - E^{\circ}_{\text{oxidation}}$$

$$= +1.42 \text{ V} - (+0.54 \text{ V})$$

$$= +0.88 \text{ V}$$

1 mark

There will be 6 moles of electrons transferred in the reaction

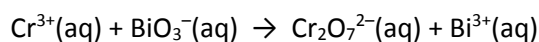
1 mark

Q8 (continued) Oxidation and reduction

[2 + 4 + 4 = 10 marks]

- c) Using half-reactions and showing your working, balance each half reaction separately for the following equation in acidic solution.

Hint: You do not need to write the overall balanced equation.



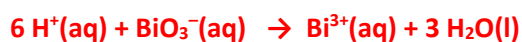
[2 + 2 = 4 marks]

Oxidation reaction



½ mark for balancing Cr, 1 mark for balancing with H₂O and H⁺, ½ mark for electrons. **Total 2 marks**

Reduction reaction



1 mark for balancing with H₂O and H⁺, 1 mark for electrons **Total 2 marks**