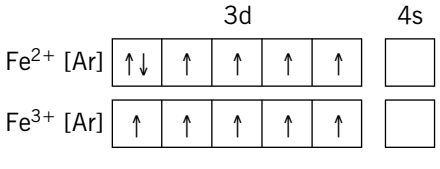
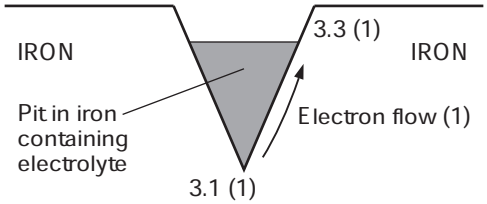
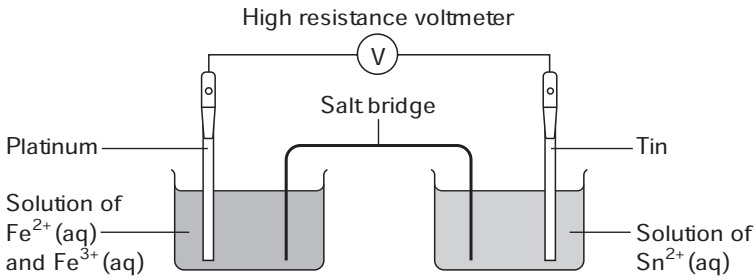
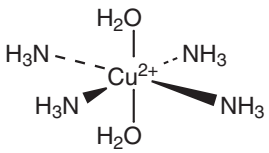
Answers to The Steel Story End of Unit Test

Q	Answer with marks	Marking suggestions
1(a)	**X** magnesium sulphide (1) **Y** calcium oxide and/or magnesium oxide (1) **Z** aluminium oxide (1)	Allow correct formulae
1(b) (i)	$P_4O_{10}/P_2O_5/SiO_2$ (1)	Allow SO_2
1(b) (ii)	Acid–base (1)	
1(b) (iii)	It can be burnt as a fuel (1); it is toxic/harmful to life (1)	Allow causes smog
1(c)	Steel containing small amount of carbon (1) flexible/can be moulded (1) use: paper clip/car bodies/wire, etc (1)	Allow about 0.1% carbon

Q	Answer with marks	Marking suggestions
2(a)	When the first pink tinge remains (1)	
2(b) (i)	$(12.9 \times 0.025)/1000$ (1); $= 3.225 \times 10^{-4}$ (1)	
2(b) (ii)	Answer to (b)(i) $\times 5 = 1.613 \times 10^{-3}$ (1)	
2(b) (iii)	Answer to (b)(ii) $\times 10 \times 56$ (1) $= 0.903$ g (1) includes unit and 2/3 sf Answer $\times 100/1.00 = 90.3\%$ (1) includes sf	
2(c)	Quote (or imply) $2H^+ + 2e^- \rightarrow H_2$; $E^\ominus = 0$ (1) When Fe/Fe^{2+} is connected to the above half-reaction in a cell, electrons flow to the half-cell with the more positive potential *or* since Fe/Fe^{2+} is more negative than H^+/H_2 (1);Fe is changed (oxidised) to Fe^{2+} (1) but Fe^{2+} cannot be changed to Fe^{3+} by H^+ (1)	ie (1) for good explanation of direction for one case. Answers just in terms of two potentials printed can score max (2) if explanation good
2(d)	 (1) each The Fe^{3+} has a half-filled set of 3d orbitals/only one electron in each d orbital/minimum electron repulsion (1); hence it is more energetically stable than Fe^{2+} (1)	
2(e)	A (dark) green (1); precipitate (1)	

Q	Answer with marks	Marking suggestions
3(a)	Water (1); Air (oxygen) (1)	
3(b)	$Sn^{2+} + Fe \rightarrow Sn + Fe^{2+}$ (1)	
3(c) (i)	$2Fe(s) + O_2(g) + 2H_2O(l) \rightarrow 2Fe^{2+}(aq) + 4OH^-(aq)$ (1) for correct species (1) for balancing (1) for state symbols if at least first mark scored	
3(c) (ii)		

3(d) (i)	 (1) for left beaker; (1) for right beaker; (1) for salt bridge; (1) for standard conditions: all solutions 1.0 mol dm^{-3}; stated temperature usually 298 K; 1 atm pressure	Ignore any connections to terminals Accept 'unreative metal' in place of platinum
3(d) (ii)	0.91 V (1)	Ignore sign
3(d) (iii)	Description (or diagram) of standard hydrogen electrode replacing left-hand electrode: hydrogen gas over platinum electrode (1) standard conditions: 1 atm pressure, 1.0 mol dm^{-3} H^+ (1)	Maximum (1) if not made clear that the hydrogen electrode replaces the Fe^{3+}/Fe^{2+} electrode

Q	Answer with marks	Marking suggestions
4(a)	Catalyst (1)	
4(b)	Colour is caused by movement of electrons within d sub-shells (1); this cannot happen in Cu^+ as d sub-shell is full (1)	
4(c) (i)	1. NH_3/H_2O/en (1) 2. CN^-/edta^{4-} (1)	
4(c) (ii)	More than one point of attachment (*or words to that effect*) to metal ion (1)	
4(c) (iii)	It indicates the stability of the complex (1); the higher the value, the more stable the complex compound compared to reactants (1)	
4(c) (iv)	$[Cu(CN)_4(H_2O)_2]^{2-}$ (1)	
4(c) (v)	 (1) for indication of octahedral structure (1) for Cu^{2+} (1) for 4 ammonia and 2 water molecules (in any positions)	
4(d) (i)	It absorbs in the red/orange (1)	
4(d) (ii)	Make up a variety of Cu^{2+} concentrations and measure their absorbance/transmittance in a colorimeter (1); using a red/orange filter (1); plot graph of absorbance/transmittance against concentration (1); from which concentration of unknown can be read from its absorbance/transmittance (1)	