HL Answers to Electrochemical cells (1) (AHL) questions on standard electrode potentials

1. i. $Ni(s) + 2Ag^+(aq) \rightarrow Ni^{2+}(aq) + 2Ag(s)$

ii. Positive electrode: silver; Negative electrode: nickel (as the nickel half-cell has a more negative $E^\ominus$ value than the silver half-cell)

iii. Nickel metal is oxidized and silver ions are reduced.

iv. 1.06 V (being the difference between – 0.26 V and + 0.80 V)

v. $\Delta G^\ominus$ = – 2 (mol) x 96500 (C mol^{-1}) x 1.06 (V)= – 204580 J = – 205 kJ

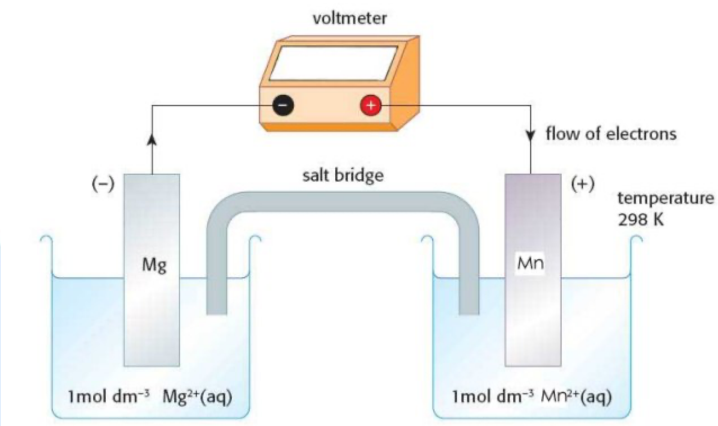
2. $Cr_2O_7^{2-}(aq) + 6I^-(aq) + 14H^+(aq) \rightarrow 2Cr^{3+}(aq) + 3I_2(aq) + 7H_2O(l)$
(Acidified dichromate are a stronger oxidizing agent than iodine so oxidize iodide ions to iodine)

3. $Sn^{4+}(aq)/Sn^{2+}(aq)$ | | $Fe^{3+}(aq)/Fe^{2+}(aq)$
$E^\ominus$ = + 0.15 V $E^\ominus$ = + 0.77 V
Electrons flow from the $Sn^{4+}(aq)/Sn^{2+}(aq)$ half-cell to the $Fe^{3+}(aq)/Fe^{2+}(aq)$ half-cell so $Sn^{2+}(aq)$ can reduce $Fe^{3+}(aq)$ and the spontaneous reaction is :

$Sn^{2+}(aq) + 2Fe^{3+}(aq) \rightarrow Sn^{4+}(aq) + 2Fe^{2+}(aq)$ $E^\ominus_{cell}$= 0.62 V

4. $Cu(s)/Cu^+(aq)$ | | $Cu^+(aq) / Cu^{2+}(aq)$
$E^\ominus$ = + 0.52 V $E^\ominus$ = + 0.15 V
Electrons flow from $Cu^+(aq) / Cu^{2+}(aq)$ to $Cu(s)/Cu^+(aq)$
Half-equations: $Cu^+(aq) \rightarrow Cu^{2+}(aq) + e^-$ and $Cu^+(aq) + e^- \rightarrow Cu(s)$
Overall redox equation: $2Cu^+(aq) \rightarrow Cu^{2+}(aq) + Cu(s)$ E^o_{cell}= 0.37 V
so the oxidation number of copper changes from +1 to 0 and +2, i.e. $Cu^+(aq)$ disproportionates.

5.



Cell potential = 1.18 V (the difference between – 2.37 V and – 1.19 V)