CHE 112 Electrochemistry Additional Practice Problems – Answers

1) +3

2) +6

3) $Cr_2O_7^{2-}$ because Cr's oxidation number decreased

4) NO_2^- This species is oxidized, which occurs while acting as a reducing agent.

5) $Cr_2O_7^{2-}(aq) + 14H^+(aq) + 6e^- \rightarrow 2Cr^{3+}(aq) + 7H_2O(l)$

6) $3 \times [NO_2^-(aq) + H_2O(l) \rightarrow NO_3^-(aq) + 2H^+(aq) + 2e^-]$

7) $3NO_2^-(aq) + Cr_2O_7^{2-}(aq) + 8H^+(aq) \rightarrow 3NO_3^-(aq) + 2Cr^{3+}(aq) + 4H_2O(l)$

8) +3

9) –1

10) NH_2OH because N's oxidation number increased.

11) Tl_2O_3 This species is reduced, which occurs while acting as the oxidizing agent.

12) $Tl_2O_3(s) + 3H_2O(l) + 4e^- \rightarrow 2TlOH(s) + 4OH^-(aq)$

13) $2 \times [2NH_2OH(aq) + 2OH^-(aq) \rightarrow N_2(g) + 4H_2O(l) + 2e^-]$

14) $Tl_2O_3(s) + 4NH_2OH(aq) \rightarrow 2TlOH(s) + 2N_2(g) + 5H_2O(l)$

15) $2Ag^+(aq) + Ni(s) \rightarrow 2Ag(s) + Ni^{2+}(aq)$

After balancing the half reactions, refer to the condition that the number of electrons lost must equal the number of electrons gained.

16) $Ni(s) \rightarrow Ni^{2+}(aq) + 2e^-$ Oxidation occurs at the anode.

17) Ag

18) Ni. Think of negative in this context as referring to lower potential. Electrons spontaneously flow from low to high potential. Ag is the high potential (or positive) electrode.

19) Ni to Ag

20) Cathode (Ag compartment) – to maintain the charge neutrality of the solution. As Ag^+ ions plate out, they are replaced by cations from the salt bridge.

21) 1.06 V

22) $F_2(g) + 2Cl^-(aq) \rightarrow 2F^-(aq) + Cl_2(g)$

23) 1.51 V

24) Yes, its voltage is +.

25) Al A substance acts as a reducing agent as it is oxidized. Al's oxidation potential is more positive Zn's, so Al's reaction is more spontaneous.

26) Cl_2 A substance acts as an oxidizing agent as it is reduced. Cl_2's reduction potential is more positive than Br_2's, so Cl_2's reaction is more spontaneous.

27) 0.46 V

28) 4

29) 0.46 – 0.111 = 0.35 V (Use the Nernst Equation)

30) Cathode $2Cu^{2+}(aq) + 4e^- \rightarrow 2Cu(s)$

Anode $2H_2O(l) \rightarrow O_2(g) + 4H^+(aq) + 4e^-$

Overall $2Cu^{2+}(aq) + 2H_2O(l) \rightarrow 2Cu(s) + O_2(g) + 4H^+(aq)$

31) Cathode $2H_2O(l) + 2e^- \rightarrow H_2(g) + 2OH^-(aq)$

Anode $2Cl^-(aq) \rightarrow Cl_2(g) + 2e^-$

Overall $2H_2O(l) + 2Cl^-(aq) \rightarrow H_2(g) + 2OH^-(aq) + Cl_2(g)$

32) 125g (First calculate that there are 4.10×10^5 Coulombs.)