Honors Chemistry
Electrochemistry Worksheet Answers

1. A 2. B 3. E 4. C 5. D 6. C 7. B 8. C 9. B 10. A 11. C 12. D

13. $Ca_{(s)} | Ca^{2+}_{(aq)} || Ni^{2+}_{(aq)} | Ni_{(s)}$
E^o_{cell} = -0.25V + (2.87V) = **2.62V**
$Ca_{(s)} \rightarrow Ca^{2+}_{(aq)} + 2e^-$
$Ni^{2+}_{(aq)} + 2e^- \rightarrow Ni_{(s)}$

14. Oxidation 15. Oxidation 16. Reduction 17. Oxidation 18. Oxidation

19. Mn goes from 4+ to 7+ and is oxidized, therefore it is the reducing agent.

20. K^+ needs to be reduced while Cl^- needs to be oxidized. Since oxidation always occurs at the anode, Cl_2 forms there.

21. C

22. Electrons would flow form the aluminum to the zinc. Zinc has a higher reduction potential.
E^o_{cell} = -0.762V + (+1.68V) = **.918V**

23. a. $Ag^+_{(aq)} + 1e^- \rightarrow Ag_{(s)}$
2.00C/s (8,700s) = 17,400C (.82) = 14,286C
14,286C / (96,480C/mol e-) = .148mol e^-
.148mol e^- (1mol Ag / 1mol e^-) = .148mol Ag .148mol Ag (107.9g/mol) = **15.96g Ag**
b. [15.96g Ag / (10.5g/cm^3)] / 6.25cm^2 = **.24cm**

24. $Ca^{2+}_{(aq)} + 2e^- \rightarrow Ca$
a. 12.0lbs (453.59g/lb) = 5,443.08g 5,443.08g / 40.08g/mol = 135.8mol Ca
135.8mol Ca (2mol e^- / 1mol Ca)(96,480 C / 1mol e^-)(3.2J/C) = 8.4×10^7J
b. [8.4×10^7J / (3.600×10^6J/kWh)](9 cents / kWh) = **$2.10**

25. SHE stands for standard hydrogen electrode. This is the 0.00V reference voltage. Standard conditions are: 1M solutions and 1atm for gases.

26. Oxidation: $2(6H_2O + Cl_2 \rightarrow 2ClO_3^- + 12H^+ + 10e^-)$
Reduction: $5(4e^- + 4H^+ + O_2 \rightarrow H_2O)$
Adding and canceling:
$2H_2O + 2Cl_2 + 5O_2 \rightarrow 4ClO_3^- + 4H^+$

27. Lead(IV)oxide (PbO_2) is reduced to lead(II)sulfate at the cathode. Lead metal is oxidized to lead(II)sulfate at the anode. Lead acid batteries can produce high current and are rechargeable; however they are very heavy and contain lead (Pb, a heavy metal) and sulfuric acid (H_2SO_4).

28. Using a more active metal as a sacrificial anode to protect a metal from corroding.

29. $Cd \rightarrow Cd(OH)_2 + 2e^-$ $(Cd^0 \rightarrow Cd^{2+})$
$Ni_2O_3 + 2e^- \rightarrow 2Ni(OH)_2$ $(Ni^{3+} \rightarrow Ni^{2+})$
$(0.175C/s)(5{,}400s) = 945C$ $945C(1mol\ e^- / 96{,}480C) = 9.79x10^{-3}$ mol e^-
It takes $2e^-$ to oxidize Cd and reduce Ni
$4.90x10^{-3}$mol Ni_2O_3 (165.38g/mol) = **.810g Ni_2O_3**
$4.90x10^{-3}$mol Cd (112.4g/mol) = **.551g Cd**

30. There will be a small voltage due to the difference in the initial concentrations (molarity) of the cupric nitrate solutions. The electrons will flow from the more dilute side (anode) to the more concentrated side (cathode) until the Cu^{2+} ion concentrations equalize. The voltage will trail back off to zero as this is occurring.