Name_____

StdntNo_____

Chem3/FS95
Exam2

To facilitate grading, please transfer all final answers to the answer sheet.

1. What is the oxidation number of S in sulfur dioxide gas, SO_2?

2. What is the oxidation number of S in the persulfate ion, $S_2O_8^{-2}$?

3. For the reaction:

$8H^+ + MnO_4^- + 5Fe^{+2} \rightarrow Mn^{+2} + 5Fe^{+3} + 4H_2O$

Which substance is acting as a reducing agent?

4. Which of the following are redox reactions?

a. $Mg + 2HCl \rightarrow MgCl_2 + H_2$

b. $NO_2 + H_2O \rightarrow HNO_3$

c. $H_3PO_4 + 3NaOH \rightarrow Na_3PO_4 + 3H_2O$

d. $3AgNO_3 + Na_3PO_4 \rightarrow Ag_3PO_4 + 3NaNO_3$

e. two of the above

f. three of the above

5. A common surface treatment for aluminum involves the intentional surface oxidation in an electrolytic cell:

$Al(s) + O_2(g) \rightarrow Al_2O_3(s)$

This is also known as:

a. Plating
b. Galvanizing
c. Cathodic Protection
d. Anodization/Passivation
e. Enameling

6. What current, in amperes, is required to produce 1.00 lb of aluminum per minute in an industrial cell? (1 F = 96,485 C/mole e-,

1 Amp = 1 C/sec, MWt. of Al = 26.98 g/mol,
Al+3 + 3e- --> Al, 1.00 lb = 454 gm)

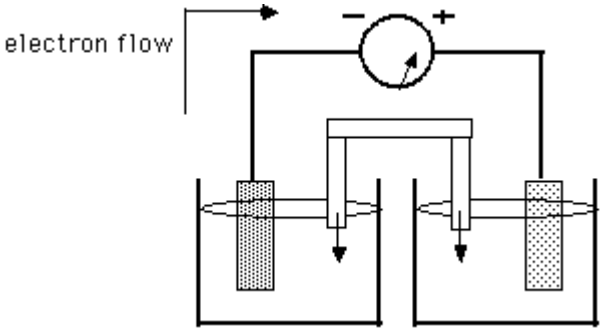
7. From the following half cell data, determine
the Ksp of PbSO4 . The Ksp expression is:
PbSO4(s) --> Pb+2(aq) + SO4-2(aq)

PbSO4(s) + 2e- --> Pb(s) + SO4-2(aq) Eo = -0.35 V

Pb+2(aq) + 2e- --> Pb(s) (Eo = -0.13 V

Starting with Pb (lead) and Al (aluminum) metal strips and 1.0 M solutions of Pb(NO3)2 and Al(NO3)3, you are to construct a battery based on the following half cell data:

Eo
Pb+2 + 2e- ---> Pb -0.13 V
Al+3 + 3e- ---> Al -1.66 V



8. Label the Cathode and Anode in the drawing above, based on the given direction of electron flow.

9. Write the overall balanced spontaneous cell reaction:

10. What is the standard cell voltage?
(1.00 M ion concentrations:)

11. Cathode (metal):

12. Cathode reaction:

13. Anode (metal):

14. Anode reaction:

15. Which electrode will gain mass as the cell reaction proceeds? (Show reaction)

16. Show the direction of ion flow through the salt bridge in the drawing above if it is filled with KNO3 solution.
(K+ and NO3- ions)

17. What is the cell voltage when the reaction reaches equilibrium?

18. What is the equilibrium constant for this reaction? (F = 96,485 C/mole e-)

19. If [Al+3] = 0.010 M and [Pb+2] = 1.00 M, calculate the Ecell

20. The main function of the salt bridge in a battery is:

a. to serve as a site for oxidation and reduction reactions
b. to provide a path for electron transfer
c. to provide a path for ion transfer
d. two of the above
e. all of the above
f. none of the above

21. A standard UV source is a mercury arc lamp, which emits primarily at 254 nm.
What is the frequency of this radiation?
(1 nm = 10-9 m, c = 3.00 x 108 m/sec)

22. What is the energy of a single photon of the above 254 nm light?
(h = 6.63 x 10-34 J sec)

23. Lithium metal requires 279.7 kJ/mole to

remove an electron. Find the maximum wavelength of light that can do this. (N = 6.022 x 1023 atoms/mole, 1 kJ = 103 J.)

24. If the 254 nm radiation from the UV source above falls on lithium metal, what is the maximum kinetic energy of the ejected electrons?

25. What is the wavelength of light corresponding to a transition from n=1 to n=2 for hydrogen?

26. Calculate the velocity of an electron with a deBroglie wavelength of 1.0 Angstrom. (1 Angstrom = 10-10 m, h = 6.63 x 10-34 J sec)

27. The quantum number which describes the different spatial orientations of degenerate orbitals is

a. principal
b. angular
c. magnetic
d. spin
e. none is correct

28. In going from left to right across a row in the periodic table, the diameter of atoms (increases/decreases) due to_____

29. In going down within a column in the periodic table, the first ionization energy (increases/decreases) due to _____

30. Write the electron configuration for a neutral nitrogen atom. How many unpaired electrons are present?

31. Write the electron configuration for a
neutral magnesium atom.

32. What type of electron configuration
would be an indication that the atom might show magnetic properties?

33. Label on the periodic table:

Noble Gases, Halogens,
Alkaline Earth Metals, Alkalai Metals,
Rare Earths, Transuranium Elements, Transition Metals

34. Show which orbitals (s, p, d, f) are being filled in the various regions of the periodic table.