**AP Chemistry – Electrochem and Gas Laws Review Problems**

1. What volume does 20.00 grams of O2 occupy if it is at 35.00⁰C and 700.0 mm Hg?

2. How many grams of CH4 are present if 500. mL of it exerts a pressure of 0.90 atm at -10⁰C?

3. A gas has a pressure of 1.87 atm when its volume is 1.13 L. What will be the pressure in torr when

the volume is changed to 500.0 mL?

4. Explain the following occurrences using gas laws.

 a. The tires of your car go flat during winter.

b. The plastic cover of your TV dinner inflates when heated in the microwave.

c. Your lungs fill with air when your chest cavity expands.

5. 0.124g of O2 gas must be collected for during an experiment.

a. If the gas is collected in a 25mL manometer bulb at 25○C, what Δh would signify the target

amount of gas was collected?

b. If the reaction performed is the decomposition of hydrogen peroxide, what volume of 0.15M

hydrogen peroxide would be needed to create the target amount of gas?

c. The perfect amount of 0.15M hydrogen peroxide is reacted and all of the gas produced is

collected in the manometer. The final pressure in the manometer bulb is 3.99 atm. Explain this observation.

6. At a deep-sea station 200. m below the surface of the Pacific Ocean, workers live in a highly

pressurized environment.

1. How many liters of gas at STP must be compressed on the surface to fill the underwater environment with 2.00 x 107 L of gas at 20.0 atm if the researchers want a comfortable temperature of 25.3⁰C in their living quarters?
2. If the glass seal of the research station can withstand a pressure difference of 10.0 atm, what volume of air (at STP) could escape the facility and bubble to the surface before the walls collapse? The water pressure at 200. m is about 20.0 atm.
3. Which gas, nitrogen, oxygen or argon, would be lost from the facility first if there was a leak? Provide a comparison of the rate of loss for each.
4. The mixture of gasses by mass is 79% N2, 20%O2 and 1%Ar before the leak and 70%N2, 25%O2 and 5%Ar after the leak. Compare the partial pressure of oxygen before (20 atm) and after (10 atm) the leak.

e. The pressure exerted by water at a depth of 1 mile is approximately 115.00 atm. Does the air inside a steel hulled one-man craft provide a significant counter pressure to the water? Support with a calculation if the craft has a volume of 5000.0 L craft and is filed with enough gas to breathe for 3 days (217 mol of gas). Assume the craft equilibrates to water temperature, a chilly 7.2⁰C.

9.

a. What is the pressure of gas (A) in this open-ended manometer, at STP, if Δh = 65 mm?

b. If gas A is occupying 30.0 mL and the mass of the manometer increased by 0.0668 g when the

gas was collected, which is the identity of gas A: CO2, SO2, NO, or Cl2 ?

10. What is the molecular weight of a gas if 4.4 grams of it occupy 330 mL at a pressure of 745mmHg and a temperature of 75⁰C?

12. A container has 20.0 grams of N2, 110. grams of Xe, and 36.0 grams of Ar.

1. What is the total pressure in the container if the volume is 3.00 L and the temperature is 40.0⁰C?
2. What is the partial pressure of Xe?

16. Which gas in each pair would deviate most from ideality and why?

a. N2 vs. Cl2

b. CH2O vs. CH4

17. Two equal balloons are inflated; one with Helium and one with CO2. Which deflates more quickly under the same conditions and how much faster?

18. SO2 diffuses 2.3 times as fast as an unknown gas. What is the molar weight of the unknown

gas?

19. If BH3 is put into one end of a tube marked 0 cm and NO2 is put into the other end marked

100 cm, at what distance mark on the tube do they meet?

20. A sample of F2 diffuses 5.2 meters through a tube in 2.3 seconds. An unknown gas under identical conditions travels 3.0 meters in the same time. What is the identity of the unknown gas: HNO, HSO2, or P2O3?

21. Balance the following reactions.

1. Mn2+ + Cu2+ ===> Mn7+ + Cu
2. P + Cu2+ ===> Cu + H2PO41- (in acidic conditions)
3. Zn + NO3 - ===> Zn(OH)4 2- + NH3 (in basic conditions)

22)

* + - 1. Ag+(aq) + e- 🡪 Ag(s) + .80
			2. Hg2+2(aq) + 2e- 🡪 2Hg(l) + .79
			3. Sn+2(aq) + 2e- 🡪 Sn(s) - .14
			4. Ni+2(aq) + 2e- 🡪 Ni(s) - .25

a. Which metal in the table is most likely to spontaneously oxidize? \_\_\_\_\_\_\_

b. Which metal in the table is most likely to spontaneously reduce? \_\_\_\_\_\_\_

c. Which combination of half reactions would create the greatest cell potential? Ox \_\_\_\_\_\_\_\_\_

 Red \_\_\_\_\_\_\_\_

d. A cell is created with tin and silver electrodes in nitrate solutions of the same metals. Which metal electrode will gain mass and which will lose? Explain.

e. Diagram a galvanic cell from part d. Include labels for the cathode, anode, direction of e- movement, oxidation, reduction, and direction of salt bridge ion movement.

f. Which of the following would be an appropriate choice for a salt bridge solution in the diagram above? K2SO4, K3PO4, KCl. Explain your choice.

g. The tin electrode in the cell above is documented to have an initial mass of 35.50 g. Hypothesize a likely mass for the electrode after running for 8 hours and creating a current of 1.5 A.

23) a. Use the half-reactions and the reactivity series provided to write a balanced equation for the reaction that would occur if aluminum is placed into a platinum nitrate solution. Explain your reasoning.

Half – Reaction E° (V)

[PtCl4]2–(aq) + 2 e–    Pt(s) + 4 Cl–(aq) + .72

Al+3(aq) + 3e-  Al(s) - 1.66

b. If a piece of aluminum is placed into the platinum (II) nitrate solution, will it be plated by platinum? If yes, explain why. If no, explain what must be done to cause plating to occur in the platinum (II) nitrate cell.

c. Calculate the following for the plating of 25.0 g of platinum onto an electrode.

1. Coulombs of electricity necessary to deposit the platinum from the Pt(NO3)2.

1. How many minutes will take to plate out the silver using a current of 20.0A.