**Chem Lab Pretest (a combo of last year's exam, Vanier's lab manual and a few new questions.)**

Graduated <u>beakers</u> are used to measure volumes roughly; they are containers with a precision of ±5%.

**Graduated <u>cylinders</u>** are used to measure volumes approximately; they are usually calibrated to contain volumes with the following precisions:

10 mL:	± 0.1 mL	25 mL:	± 0.2 mL
50 mL:	± 0.5 mL	100 mL:	± 0.5 mL
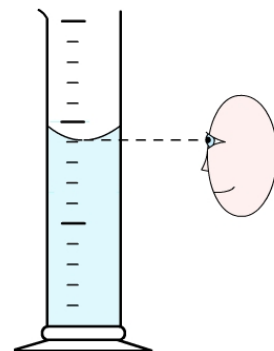
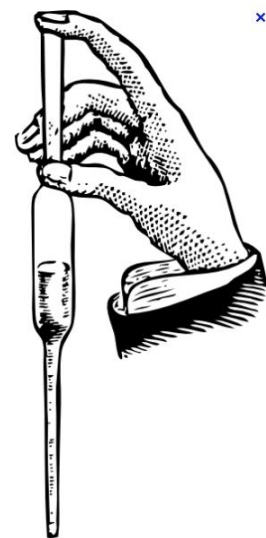**<u>Pipettes</u> and <u>burettes</u>** are used to determine volumes accurately; they are calibrated to *deliver* certain volumes and have a precision of:

1 mL pipette:	± 0.01 mL
5 mL pipette:	± 0.01 mL
10 mL pipette:	± 0.02 mL
20 mL pipette:	± 0.03 mL
25 mL pipette:	± 0.03 mL
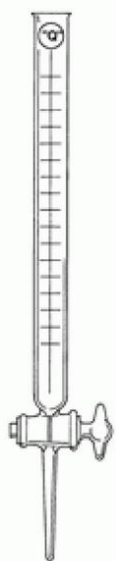
50 mL <u>burette</u> : ± 0.02 mL

A volumetric flask *contains* an accurately known volume of solution at a given temperature (often 20°C); it has a precision of :

100 mL volumetric flask:	± 0.2 mL
250 mL volumetric flask:	± 0.1 mL

1.   If you want to measure 100.0 ml of acid, which piece of glassware would you use?

The volumetric flask would be more accurate and more precise. The uncertainty is only ± 0.2 mL, whereas the graduated cylinder's uncertainty is more than twice as big. (see above data)

2.   What is the percent error associated with a 5ml pipette?

$$\frac{\pm 0.01}{5} * 100\% = 0.2\%$$

3.   a) With a pipette, you measure exactly 5 ml. How do you report the measurement?

5.00 ± 0.01 mL   Notice how the uncertainty and the measurement always have the same number of decimal places and the last decimal or figure in the measurement is an estimate

b) With a 50 ml graduated cylinder, you measure exactly 5 ml. How do you report the measurement?

50.0 ± 0.5 mL

4.   You weigh 2.00 g of Mg. The volume of hydrogen gas generated is measured at 100.22 kPa and at 298.2 K.   R = 8.31 L*kPa/(K*mole)

a)   When converting to moles of Mg should you use exactly 24 g/mole. Why or why not?

No way, Jose. All measurements have at least 3 sig figs, so the molar mass should also have at least 3 sf's: use 24.3 g/mole or more decimals.

b)   Calculate the volume of hydrogen expected (it's a 1 to 1 molar ratio) and report the answer in ml with the correct number of significant figures.

need to have 3 SF:

V= nRT/P = 2.035....L becomes 2.04 L = 2040 ml

5.   a)   Read the and report the measurement properly:

13.4 A

b) What if it was exactly on the 20 mark?

20.0 A because it needs as many decimals as a measurement that's not exactly on a line.

6. a) Students mixed powdered iron and acidified $KMnO_4$ in test tube 1. In test tube 2 they mixed acidified $KMnO_4$ with a nail.

Test tube number	observation	Time of reaction
1	purple to light brown	15.2 s
2	purple to light brown	8 minutes 49 s

Why did test tube 2 react more slowly?

It has less surface area per volume.

b) There were two other variables regarding $KMnO_4$ that had to be held constant in order to study the effect in question (a). Name the two factors.

Temperature and the concentration of the acid and $KMnO_{4(aq)}$

c) $KMnO_4$ is purple. MnO_2 is brown and so is rust. You suspect that the acid was only a catalyst. What could you have done to verify that the acid played that role?

If you check the pH before and after the reaction and notice no change, then the acid was probably a catalyst because it was not consumed. To really make sure you would have to time the reaction with no acid.

7. How much more surface area did one of the iron forms have? Calculate, using the following data:

Test tube number	Temperature	Time of reaction
A	25.0 °C	14.0 s
B	100.1 °C	2 min 25.0 s
C	25.0 °C	9 min 12.0 s

We have to compare A to C since temperature is constant.

Since $r_A t_A = r_B t_B$

Then r_A/r_B = (9*6.0+12.0)/14.0) =39.4

So since r_A = 39.4 r_B , then A has 39.4 times more surface area.

8. Why did we wait five minutes *after the end* of the magnesium reaction before measuring the volume of hydrogen gas?

Gases expand when heated, so we had to let it cool to the room temperature that we were plugging into the ideal gas law we were testing.

9. What was the purpose of measuring the volume of hydrogen gas and then calculating the volume expected from PV = nRT?

We were testing the validity of the ideal gas law, to see if it held up fo r hydorgen gas under our conditions of pressure and temperature.

10. $NaOH_{(s)} + HCl_{(aq)} \rightarrow H_2O + NaCl_{(aq)} + heat$
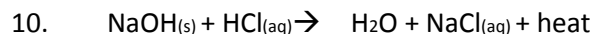
a)   TRUE? Or FALSE? The above reaction was more exothermic than the similar reaction involving aqueous sodium hydroxide instead of the solid.

TRUE. Dissolving NaOH also releases heat, so the above has two exo reactions into one.

b)   Why? Be specific and use chemical equations.

$NaOH_{(s)} \rightarrow NaOH_{(aq)} + heat_1$

$NaOH_{(aq)} + HCl_{(aq)} \rightarrow H_2O + NaCl_{(aq)} + heat_2$

Overall: $NaOH_{(s)} + HCl_{(aq)} \rightarrow H_2O + NaCl_{(aq)} + heat_{1)} + heat_2$

Equations are worth a thousand words. Too bad we can't say to politicians: "Shut up and speak in equations!"

11.   Relate this equation to **what was done in the lab** to figure out the percentage of lithium chloride in a $LICl$-KNO_3 mixture:

$xW + yZ = mc\Delta T$,
where W = J/g for LiCl
Z = = J/g for KNO_3
 x = grams of LiCl in unknown
y = grams of KNO_3 in unknown

m = mass of water
ΔT = temperature change caused by unknown

The W was obtained by measuring the temperature change for the dissolution of a known mass of LiCl in a known volume of water in an insulated cup.

The Z was obtained by measuring the temperature change for the dissolution of a known mass of KNO_3 in a known volume of water in an insulated cup. But it was endo, so Z was (-). Recall that if ΔH is (+), Q will be (-)

X and Y added up to the total mass of the unknown, which we had to measure.

12. How do you use a beaker, water, a test tube, vinegar and pure iron powder to get the percentage of oxygen in the air?

Add Fe powder to a test tube.. Coat it with vinegar. Twirl the tube and invert it into a beaker of water. As oxygen in the tube is consumed by the rusting reaction, the pressure will drop inside the test tube. This will allow atm. pressure to push water into the tube, ineffect, replacing the oxygen. The % = fraction of tube filled with water * 100%.

13. Fill in the blanks with the word "larger" or "smaller" to create a valid statement about calorimetry labs in general. (2 marks)

   a) Losing water in the transfer of solution to the calorimeter could lead to a _____temp. increase than expected.
   Larger.

   b) Losing heat to the air and calorimeter cup could lead to a _____ temp. increase than expected.
   lower

14. What is the difference between an average rate of reaction and an instantaneous one? (2 marks)

The rate continuously changes as concentration of reactants decreases as they get converted to products. So if you find the slope between any two points in time, you will only get the average rate. The instantaneous rate is the exact rate at that moment in time and is obtained either by taking the first order derivative, or because you haven't learned that great stuff yet, by finding the slope of the line tangent to that point in time.