Chem 159 Experiment #2 – Molecules and Moles

PART 1 A. *CALIBRATING YOUR PIPET*

Remember how you made your own Pasteur pipet in the glass-working experiment? Well, since everyone's pipet can be different in terms of the diameter of the tip's hole, we have to calibrate (standardize) each pipet so that we know how many drops equal to one milliliter. This is how we do it:

1. Weigh a clean 50 ml beaker _____ g
2. Add 10 drops of water from your own pipet and re-weigh _____ g
3. Calculate the mass of one drop of water _____ g

$$\frac{\text{(mass of beaker with 10 drops } H_2O\text{)} - \text{(mass of empty beaker)}}{\text{10 drops of } H_2O}$$

4. Now add 10 more drops of H_2O and weigh again: _____ g

   calculate for the mass of one drop again _____ g

$$\frac{\text{(mass of beaker with 20 drops } H_2O\text{)} - \text{(mass of beaker with 10 drops)}}{\text{10 drops of } H_2O}$$

5. Now add 10 more drops to your beaker and weigh again: _____ g

   calculate for the mass of one drop again _____ g

$$\frac{\text{(mass of beaker with 30 drops } H_2O\text{)} - \text{(mass of beaker with 20 drops)}}{\text{10 drops of } H_2O}$$

6. Now find the average mass of one drop of H_2O: _____ g

Average mass of one drop of water = (mass 1 + mass 2 + mass 3) ÷ 3

7. Finally, calculate the volume of one drop of H_2O. To do this, use the formula for density:

Density = Mass / Volume

Since the density of water is 1g/ml, the volume of one drop of H_2O is ***equivalent*** to the mass of one drop of H_2O

The ***volume***, then, of one drop of H_2O from your pipet is _____ ml

Now find out how many drops from your pipet = 1ml.

_____ drops = 1ml.

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PART 1 B. *PREPARATION OF SILVER CHLORIDE*
Now you will calculate how many grams of chlorine are in 1ml of sea water.

1. Weigh an empty centrifuge test tube: _____ g
2. Add 1ml of sea water using your pipet.
3. Add 10 drops of $AgNO_3$ (silver nitrate).
4. Add one drop of HNO_3 (nitric acid) IN THE FUME HOOD.
5. Mix well with your glass stirring rod. The white precipitate is AgCl (silver chloride).
6. Fill an identical centrifuge test tube with water to the same height as your experimental tube, balance both in the centrifuge, and spin for 30 seconds.
7. Add one more drop of $AgNO_3$. If more white precipitate forms, add a few more drops of $AgNO_3$ and centrifuge again. However, if no further precipitate is formed, remove the supernatant (liquid portion) with a pipet, add 5 drops of water to the precipitate, mix it, and re-centrifuge. This cleans and purifies your AgCl. Next, remove the supernatant, add 5 more drops of water, mix, and re-centrifuge. Repeat this procedure two more times.
8. After the supernatant is removed the last time, dry the tube in the oven for 20 minutes (put it in your "marked" 50 ml beaker). Become familiar with the following calculations while you are waiting. You may also begin part 2.
9. 20 minutes later, and after allowing the tube to cool, weigh the tube with the AgCl precipitate (using the same balance that you used previously). Subtract the mass of the empty tube from this mass.

   The mass of your AgCl precipitate is _____g

10. Calculate the concentration of Cl in 1 ml of sea water. You'll need the periodic table of the elements to find the atomic weight of Cl and molar weight of AgCl.

The atomic weight of Cl is _____g The molar weight of AgCl is _____ g

Use this formula: your mass of AgCl x $\frac{\text{atomic mass Cl}}{\text{Molar mass AgCl}}$ = mass of Cl

Now, how many grams of Cl were in your 1 ml of sea water? _____ g Cl

11. Now add to the precipitate 5 drops of ammonia, NH_4OH, in the fume hood, and stir. The precipitate will dissolve as it forms a complex with the ammonia.
12. Add 2-3 drops of HNO_3, nitric acid, in the fume hood. Test with pH paper on your watch glass. The pH is _____. Is this an acid, base, or neutral solution? _____.
13. Test for the presence of a halogen by using the Beilstein copper wire test. Is there a halogen present? _____. What is that halogen? _____.
14. Rinse the materials in the test tube with some water and dump the mixture in the waste jar in the hood marked "Silver Waste".

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PART 2. *% of H_2O IN COPPER (II) SULFATE PENTAHYDRATE*
Now you will calculate the % of H_2O in copper (II) sulfate pentahydrate by using another method.

1. Weigh an empty and clean medium-sized test tube on a balance. _____ g
2. Weigh approx. 2g of copper (II) sulfate pentahydrate on a triple beam balance using weighing paper. Place the substance in your test tube.

   What is the chemical formula for copper (II) sulfate pentahydrate? _____
   What color is it? _____
3. Re-weigh the test tube with the copper (II) sulfate pentahydrate: _____g
4. Heat the test tube sideways over a Bunsen Burner flame and watch how the vapor collects in the upper portion of the tube. Heat until most of the water has been driven out.
   Write the formula for copper (II) sulfate: _____
   What color is it now? _____
5. Once cooled, re-weigh the tube: _____g
6. Calculate the following:
   a. Weight of copper (II) sulfate pentahydrate: _____g
   b. Weight of copper (II) sulfate: _____g
   c. Weight of water: _____g
   d. Actual % of H_2O in copper (II) sulfate pentahydrate: _____%
      [(weight of water) ÷ (weight of copper (II) sulfate pentahydrate)] (100)
   e. Theoretical % of H2O in copper (II) sulfate pentahydrate: _____%
      To find this you'll need the molar weights of H_2O and copper (II) sulfate pentahydrate as found in the period table of the elements.
      [(theoretical weight of water) ÷ (theoretical weight of copper (II) sulfate pentahydrate)] (100)
   f. % difference between your result and the ideal: _____%

7. Now remove the copper (II) sulfate from the test tube. Place it on weighing paper in two piles. Add a few drops of H_2O to one of the piles. What happened?
   _____.

   Predict what will happen to the other pile as it sits in your locker for a week:
   _____.

   Why do you suppose it is economically advantageous for chemical suppliers to sell copper (II) sulfate pentahydrate rather than copper (II) sulfate?
   _____.
8. Clean up your lab station completely before leaving the lab.
9. Complete the review questions from text p. E 22