EXPERIMENT 4

QUANTITATIVE SEPARATION OF A MIXTURE OF SAND AND SALT

PURPOSE:

1. To understand the difference between Quantitative and Qualitative.

2. To determine the Quantitative composition of a mixture of sand and salt.

PRINCIPLES:

The composition of a mixture is determined by separating it into its components. Then determine the mass of each of the components. In the experiment, the separation is achieved by taking advantage of the solubility of salt and the insolubility of sand in water.

PROCEDURE:

1. Obtain a sample of a mixture of sand and salt of unknown composition. Record the sample number in your laboratory notebook. The sample weight should be approximately 5 grams and will be determined to the nearest 0.01 g in the following manner:

    a. Determine the mass of a clean, dry 150 ml beaker to the nearest 0.01 g. Record this mass in your laboratory notebook (NOT THIS SHEET).

    b. Empty your entire sample into the beaker and obtain the mass of the beaker with the mixture to the nearest 0.01 g. Record this mass in your laboratory notebook.

    c. Calculate the mass of the sample by taking the difference between the mass of the beaker with the sample and the mass of the beaker without the sample.

2. Add approximately 25 ml of distilled water to the beaker and stir thoroughly with a stirring rod to dissolve the salt. (Remember that the sand will not dissolve, only the salt.)

    THE VOLUMES OF WATER RECOMMENDED IN THIS PROCEDURE MUST NOT BE EXCEEDED. OR YOU Will END UP WITH TOO MUCH TOTAL VOLUME.

3. Determine the mass of both a watch glass and a piece of filter paper. Record this mass in your laboratory notebook (NOT THIS SHEET).

4. Fold the filter paper into fourth's as shown in **Figure 1**.

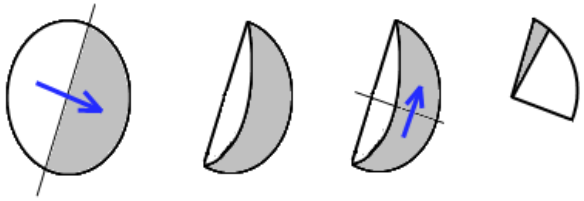

Figure 1

5. Fit the filter paper into the funnel as shown in **Figure 2**.

Figure 2

6. Moisten the filter paper with distilled water and press it to the walls of the funnel, so that it adheres. Arrange the filter funnel as shown in **Figure 3** with a 50 ml graduated cylinder is placed under the funnel.

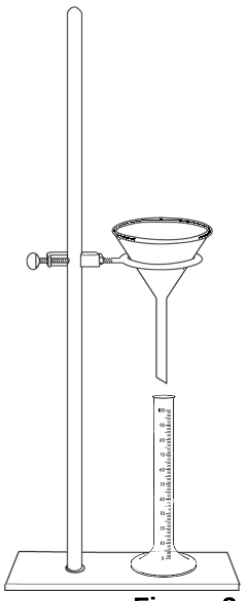

Figure 3

7. Filter the mixture by pouring it slowly down a stirring rod to guide the liquid to the center of the funnel. The liquid filtered through will be collected in the 50 ml graduated cylinder. Add new portions of liquid in such a manner as to keep the level of the liquid in the funnel more than 1/4 inch from the edge of the filter paper (Do not overfill the funnel).

8. Use two 5 ml portions of distilled water to transfer all sand remaining in the beaker to the filter paper. Your rubber policeman at the end of the stirring rod may also be used to scrape out the beaker.

9. Use three additional 5 ml portions of water to wash the material on the filter paper. (The first of these is also used to rinse the rubber policeman if one was used in transferring the sample).

   The washing is accomplished by pouring each 5 ml portion on the material on the filter paper, directing the water so that all portions of the sand are washed uniformly.

   All the wash water, as well as all the water used in transferring the sample should be collected in the graduated cylinder along with the water originally used to dissolve the salt.

   The solvent collected is called the **filtrate**.

   The total volume of liquid in the cylinder should now be slightly less than 50 ml. If necessary, add distilled water carefully to bring the contents of the cylinder to **exactly 50.0 ml**. This can most easily be done with the wash bottle.

10. Remove the filter paper and sand from the funnel and place it on the watch glass. Be careful not to tear the paper or spill the sand. Open the filter paper to speed up the drying.

    At the end of the laboratory period, place the glass watch with the sand In a safe place in your locker and save It until next time to allow the sand and the filter paper to dry completely.

11. Determine the mass of an evaporating dish to the nearest 0.01 g recording the mass in your laboratory notebook.

12. Mix the solution in the graduated cylinder with a stirring rod and transfer the contents to a clean and dry Erlenmeyer flask. Stir well the contents of the Erlenmeyer flask by swirling.

13. Measure out 10.0 ml of the filtrate into your small graduated cylinder (must be clean and dry) and transfer it to the evaporating dish.

It is suggested that the remaining 40 ml of filtrate in the Erlenmeyer flask be stoppered and saved until the experiment is completed. It should be held in reserve in case the first 10 ml of sample (aliquot) is lost by spattering or spillage during the evaporation process.

14. Place the evaporating dish on wire gauze which is supported by an iron ring, and heat gently. Great care should be taken to avoid spattering as the material approaches dryness. When this point is reached, turn the flame very low and move it back and forth under the dish until all the water has evaporated.

    If you are unable to complete the evaporation process, the evaporating dish may be carefully placed in the locker and allowed to evaporate until the next laboratory.

15. If evaporation has not been completed, heating should be continued.

16. Allow the evaporating dish to cool to the room temperature and remass to the nearest 0.01 g recording the mass in your laboratory notebook.

17. Mass the watch glass with the dried filter paper and sand to the nearest 0.01 g recording the mass in your laboratory notebook.

CALCULATIONS:

1. Calculate the percent of sand in the mixture.

$$\frac{Mass\,of\ Sand}{Mass\,of\ Sample}\times 100\% = \%\,Sand\ in\ Sample$$

2. Calculate the percent salt in the mixture.

   Since the portion of filtrate evaporated represents only 1/5 of the total, it should contain only 1/5 of the salt that was originally dissolved. To get the total mass of the salt, the mass of the evaporated salt should be multiplied by 5.

$$\frac{Mass\,of\ Salt\ in\ Sample}{Mass\,of\ Sample}\times 100\% = \%\,Salt\ in\ Sample$$

or

$$\frac{\left(Mass\,of\ Salt\ in\ evaporating\ dish\right)\times 5}{Mass\,of\ Sample}\times 100\% = \%\,Salt\ in\ Sample$$

3. Percent Recovery

% Salt in the Sample + % Sand in the Sample = Percent Recovery

Since there were only two components in the mixture, the Percent Recovery should equal 100%. Any deviation of your Percent Recovery from 100% is an indication of the accuracy of your work.

EXPERIMENT #4

NAME: _____

DATE: _____

PARTNER: _____

QUANTITATIVE SEPARATION OF A MIXTURE OF SAND AND SALT

REPORT FORM

1. Unknown number _____
2. Mass of empty beaker _____ g
3. Mass of beaker and sample _____ g
4. Mass of sample *(calculated)* _____ g
5. Mass of watch glass and filter paper _____ g
6. Mass of watch glass and filter paper and sand _____ g
7. Mass of sand *(calculated)* _____ g
8. Percent of sand in mixture *(calculated)* _____ %

Show calculations below:

9. Total volume of liquid collected (filtrate) _____ ml

10. Volume of liquid evaporated *(calculated)* _____ ml

11. Fraction of total filtrate evaporated *(calculated)* _____

12. Mass of evaporating dish _____ g

13. Mass of evaporating dish and salt _____ g

14. Mass of salt obtained *(calculated)* _____ g

15. Total mass of salt in mixture *(calculated)* _____ g

    (Experimental, calculate from line 14)

16. Percent of salt in mixture *(calculated)*_____ %

    Show calculations below:

17. Total mass of mixture recovered (line 7 + line 15) *(calculated)* _____ g

18. Percent Recovery *(calculated)* _____ %

    Show calculations below: