CHEMISTRY LAB: SEPARATION OF A MIXTURE (long version)

WHAT TO TURN IN:
Hypothesis, Data table, Calculation (1), Error Analysis, Conclusion, Questions #1-12,
Source(s) for Questions #1-9

OBJECTIVES
- To practice measuring liquids.
- To practice filtration techniques.
- To practice separation of a mixture.

MATERIALS

beaker, 100 mL	graduated cylinder, 100 mL	scissors
ceramic tile	hotplate	sodium chloride, NaCl
crucible tongs	plastic wash bottle	spoon or scoopula
Erlenmeyer flask, 250 mL	(squeeze bottle)	stirring rod
evaporating dish	ring clamp (iron ring)	watch glass
filter paper	ring stand	
funnel	sand	

BACKGROUND INFORMATION

Liquids may contain particles of *insoluble* solids, either present as impurities or as *precipitates* formed by the interaction of the chemicals used in the experiment. Most of the clear *supernatant* liquid may be poured off without disturbing the precipitate. This method of separation is called *decanting* or *decantation*.

Mixtures with one visible phase are *homogeneous*. Mixtures with more than one visible phase are *heterogeneous.*

Fine particles, or particles that settle slowly, can be separated from a liquid by *filtration*. In this lab, students will separate sand out of a mixture by filtration, and they will boil water to recover the *soluble* salt from the *filtrate*.

PROCEDURE
1) Turn the hotplate on high.
2) Obtain a clean and dry beaker. Measure the mass to 0.01 g (two decimal places). Record in Data Table.
3) Add 50.0 mL of tap water to the beaker.
4) Zero (tare) the balance. Add 2.00-3.00 g of NaCl to the beaker. Record mass of NaCl in Data Table.
5) Zero (tare) the balance again. Add 2.00-3.00 g of sand to the beaker. Record mass of sand in Data Table.
6) Set up the ring stand with the ring clamp and funnel.
7) Fold the filter paper: SEE DIAGRAM ON PAGE 2.
   a. Fold a circular piece of filter paper along its diameter.
   b. Fold it again to form a quadrant.
   c. Separate the folds of the filter, with three thicknesses (layers) on one side and one on the other. It should resemble a cone.
   d. Place the dry filter paper into the funnel. If it is larger than the funnel itself, trin the excess with scissors.
   e. The funnel should be wet with water. Use the plastic wash bottle (squeeze bottle) to wet the funnel.   MORE →

8) Filter out the sand: SEE DIAGRAM ON PAGE 3.
   a. The filter paper should not extend above the edge of the funnel.
   b. Place the Erlenmeyer flask under the funnel.
   c. Stir and swirl the mixture. Gently pour the mixture into the filter paper in the funnel.
   d. It is recommended to keep the level of liquid about 1 cm below the top of the funnel.
   e. Do not fill the filter all at once. The filter must never overflow.
   f. Discard the sand and filter paper in the trash.
9) Obtain a clean and dry evaporating dish and watch glass cover. Measure the mass to 0.01 g (two decimal places). Record in Data Table.
10) Pour the remaining liquid from the flask into the evaporating dish, concave side up (like a "U").
11) Using tongs, carefully place the evaporating dish on the hotplate.
12) When most of the water is gone, cover the evaporating dish with the watch glass.
13) Heat until the water is completely boiled away.
14) Remove the dish/cover from the heat and place them on the ceramic tile to cool.
15) When cool, take the mass of the dish, cover, and NaCl to 0.01 g (two decimal places). Record in Data Table.
16) Rinse contents of the evaporating dish down the sink. Dry the evaporating dish, watch glass, and beaker.
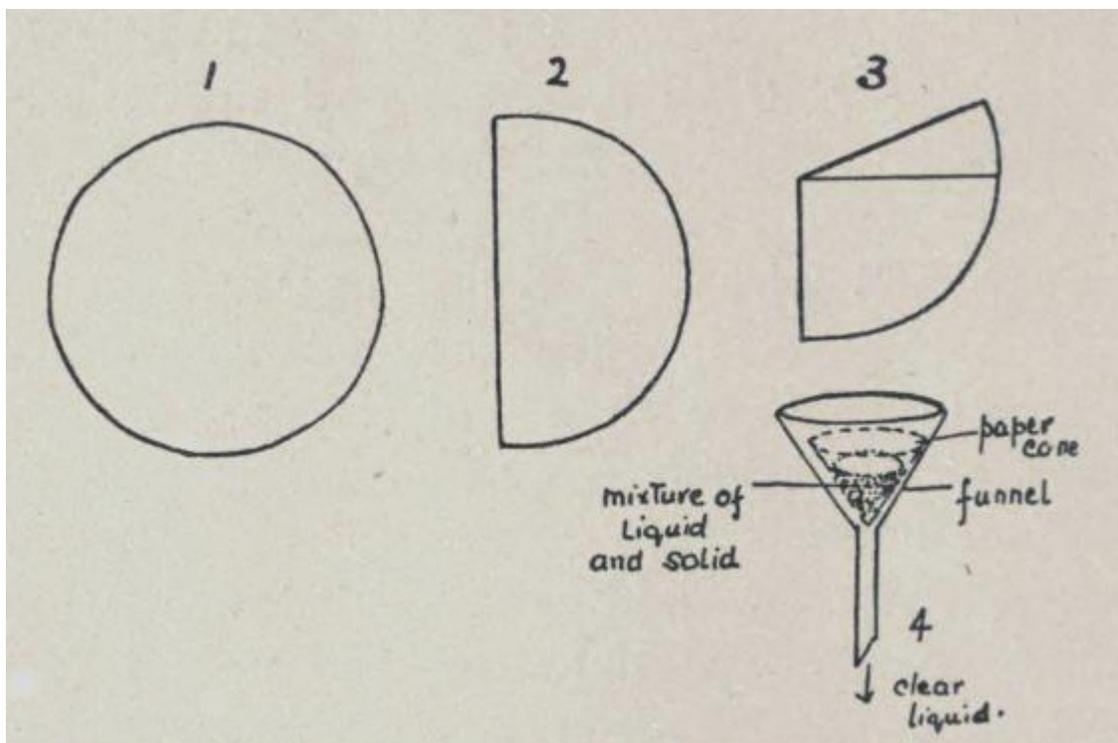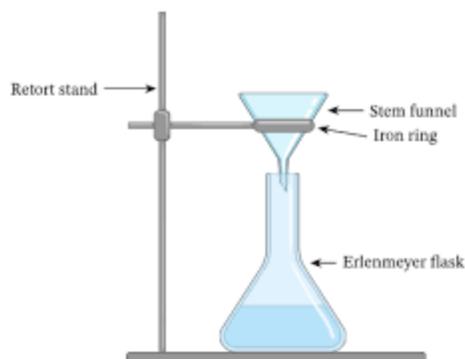
DATA TABLE

	Mass (g)	Percent Error (%)
Beaker		x
Evaporating dish and cover		x
NaCl, before heating		x
Sand, before filtering		x
Evaporating dish and cover and NaCl (after heating and cooling)		x
NaCl, after heating and cooling		x
Percent error	x	

CALCULATION of percent error of retrieval of NaCl:

$$\frac{|(NaCl \text{ before heating}) - (NaCl \text{ after heating and cooling})|}{(NaCl \text{ before heating})} \times 100 = \% \text{ error}$$

QUESTIONS

Define the following terms from the background information section in your own words, including all sources:
1) insoluble
2) precipitate
3) supernatant
4) decanting/decantation
5) homogeneous
6) heterogeneous
7) filtration
8) soluble
9) filtrate

10) What property of salt prevents it from being separated from water by filtration?
11) What is the homogeneous mixture in this lab?
12) What is the heterogeneous mixture in this lab?