Name_____

Name_____

Due Date _____

Dead Date _____

Chemistry 11
Experiment on Methods of Physical Separation of Mixtures

Purpose: To examine several methods used to separate mixtures into pure substances.

Procedure: Start at one of the following stations. Follow the procedure for that station and answer the questions on this handout. When you have finished with a station, move to another one until all stations are completed.

Station 1 - Filtration

Procedure for Station 1

1. There are two bottles; one labeled SOLUTION and one labeled SUSPENSION. Fold two pieces of filter paper and place one in each of the two funnels.
2. Place each funnel over a **clean** beaker.
3. Using a pipette, place a small amount of the solution into one funnel and a small amount of the suspension into the other funnel.
4. Observe the filter papers and the beakers below the funnel.
5. Answer the questions for Station 1 below, then discard the filter papers in the garbage clean out each beaker. Move onto another station.

Questions for Station 1

1. Does filtration separate a *solution* into its components? _____
2. Considering the sizes of particles in a solution, give a possible reason for your answer to question 1.
3. Does filtration separate a *suspension* into its components? _____
4. Considering the sizes of particles in a suspension, give a possible reason for your answer to question 3.

5. In filtration, the material left in the filter paper is called the _____
6. The material which goes through the filter paper in called the _____

Station 2-Distillation

Procedure for Station 2

1. In the space below, draw a simple diagram of the apparatus. You can copy the sample diagram which is shown at this station. Label all the parts.

2. Carefully touch the top of the flask on the hot plate. Is it hot or cool? _____
3. Now touch the outside of the condenser. Is it hot or cool? _____
4. Observe the liquid in the receiving vessel. Is it the same colour as the material in the distillation flask? _____

Questions for Station 2

1. The impure liquid in the distillation flask is a solution (a homogeneous mixture) of food colouring and water. The _____ is boiling but the _____ is not. The water and the food colouring must have different _____ _____.
2. What does the condenser have circulating in it's "outer jacket"? _____
   Where does it come from? _____
3. What is happening in the glass tube on the inside of the condenser? _____
   _____

4. As well as separation of water from food colour, suggest some other common solutions that this process could be used for separating.

   _____

5. Distillation can be used for separation of any two liquids with different _____

   _____.

6. In distillation, the material ending up the receiving flask is called the _____

   If the original material was simply heated without having the condenser, what would happen to the liquid which boiled? _____

Station 3 - Chromatography

Procedure for Station 3

1. On a piece of chromatograph paper, use the black overhead projection pen to mark a "blob" about 2 cm. from the bottom of the paper.

2. Place enough water in a large test tube so the when the paper is inserted, the level of the water will be above the bottom of the paper but just below the black mark. Place the paper in the test tube so that it's bottom edge (but not the black mark) is immersed in water. Watch what happens as the water is soaked up into the paper.

3. On the Left half of the space right below, draw a simple diagram of the apparatus labeling the paper, ink mark and water just after the paper is inserted. Label as "Before".

4. After about 5 minutes draw a diagram of the apparatus and how it looks. Do it on the right half of the space just above. Label as "After". Use coloured pencils or pens to show colours in your diagram.

5. Take the paper out and let it dry so you can staple or glue it into your lab report. Rinse out the test tube and leave it in the clamp.

Questions for Station 3

1. Is the black ink a pure substance or a mixture? _____

2. What is the solvent in this experiment? _____.

3. Give a tentative explanation (hypothesis) of how the colours in the original ink are separated.

4. Suggest mixtures other than ink which might be easy to separate using paper chromatography.

5. Is this process best for small amounts or for large amounts of a sample to be separated? _____

Station 4 - Solvent Extraction

Procedure for Station 4

BE CAREFUL WITH THE IODINE CRYSTALS. DON'T GET THEM ON YOUR SKIN OR ON YOUR CLOTHES. THEY WILL STAIN BADLY! IF ANY ARE SPILLED, LET THE TEACHER KNOW IMMEDIATELY. DON'T "BRUSH UP" AGAINST THE EDGE OF THE TABLE.

1. Add water to a large (18 x 150 mm) test tube until the water level is about 2 cm. from the bottom.

2. Using tweezers, add one crystal of iodine to the water, put a rubber stopper on the test tube and shake to dissolve the iodine.

   Does the iodine appear to dissolve easily in water? _____

   What colour is the solution? _____. Dissolve as much as you can.

3. Remove the stopper and add about 3 cm. of paint thinner using a dropping pipette.

4. Put the stopper on the test tube again and shake the contents.

   Describe what happens: _____

   _____

5. The iodine dissolves better in the paint thinner than in the water. The paint thinner acts as a solvent which *extracts* the iodine from the water. Therefore, this process is called _____ _____.

6. Make sure the ***separatory funnel*** is empty and the stopcock is closed. Remove the stopper at the top and pour the contents of your test tube into the separatory funnel. Replace the stopper on the separatory funnel., shake gently then place the funnel into a ring and let the contents settle so that there are two separate layers.

   Which solvent (water or paint thinner) is on top? _____

   Put the "waste beaker" under the separatory funnel, remove the stopper at the top and slowly let the bottom (water) layer out. Close the stopcock just as the last of the bottom layer goes through. You should now have only the top layer (pink) in the funnel.

   This top layer contains _____ _____ which has

   _____ dissolved in it.

7. You have now used the paint thinner to extract the iodine from the water and you have got rid of the water. Let the paint thinner/iodine mixture out into the bottle labeled "Paint Thinner/Iodine Mixture" Replace the stopper on the separatory funnel.

8. Wash out your test tube with a test tube brush and soapy water and replace it in the rack.

Questions for Station 4

1. Which is a better solvent for iodine, water or paint thinner? _____

2. Look up the word "miscible" and define it here. _____

   _____ .

3. Are water and paint thinner miscible or immiscible? _____

4. Will solvent extraction work if the two solvents are miscible? _____.

5. Do you think solvent extraction could effectively remove salt from salt water? ____

   Give a reason for your answer.

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Station 5 - Gravity Separation

Procedure for Station 5

1. Obtain two small test tubes labeled “A” and “B”

2. To test tube “A”, fill it to the mark with salt water solution. Place it in the centrifuge.

3. Shake the bottle of “Starch Suspension”, then add the suspension to test tube “B” up to the mark. Place test tube “B” in the centrifuge DIRECTLY ACROSS FROM test tube “A”.

4. Switch on the centrifuge (make sure you keep hands, clothes etc. away from the top of the machine!) Let it come up to speed and spin for about 30 seconds.

5. Switch off the centrifuge and let it slow down. When it is going quite slowly, stop it and remove the test tubes. Observe them and note the results.

6. Use a brush to clean out test tube “B”, rinse both test tubes and put them back in the rack.

Questions for Station 5

1. Is gravity separation able to separate the components of a solution? _____

2. Is gravity separation able to separate the components of a suspension? _____

3. Suggest a common suspension (other than starch in water) which this method could be used to separate._____

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