Name: Date: Class:

Types of Separations Worksheet Answer Key

Distillation

Materials needed	
1 500 mL beaker 1 graduated cylinder 250 mL water 15 g salt 1 glass stirring rod 4 pH strips	sheet of foil that fits atop beaker hot plate 1 Styrofoam cup 1 digital scale 1 weigh boat 1 spatula

Instructions:

a. Pour 250 mL of water into a 500 mL beaker using a graduated cylinder.
b. Dip a pH strip into the water and record the pH value below.
c. Measure out 15 g of table salt and add it to the beaker.
d. Use a glass stirring rod to stir the mixture until the salt completely dissolves.
e. Dip another pH strip into the saltwater solution and record the pH value below.
f. Shape a sheet of foil into a lid that fits securely on top of the beaker.
g. Place the beaker on a hot plate set to high and heat until boiling.
h. Allow the solution to boil for two minutes.
i. Carefully lift the foil lid horizontally to capture any condensation, then turn it over to collect droplets.
j. Wipe the water droplets from the foil with the spatula into a Styrofoam cup.
k. Put the foil lid back on the beaker and continue boiling and collecting distilled water.
l. Once you have enough distilled water, use a pH strip to measure its pH and record this value below.

pH measurements:

pH of water __________7.0____

pH of saltwater mixture ______ 7.5 to 8.5__________________________________

pH of collected water droplets _______7.0____________________________

Answer the following:

Compare the pH values recorded for the initial water, the saltwater solution, and the collected distilled water. Does the distilled water have a different pH from the saltwater? Why?

The distilled water will have a different pH than the saltwater mixture. The saltwater is typically slightly basic due to the presence of dissolved sodium ions and chloride ions, while distilled water is neutral (pH 7) because it contains no dissolved salts or impurities. Thus, the pH of the distilled water will be lower than that of the saltwater solution.

Name: **Date:** **Class:**

Crystallization

Materials needed	
2 clear plastic cups 50 mL water 10 g Epsom salt 10 g sodium carbonate	1 graduated cylinder 2 glass stirring rods 1 digital scale 2 weigh boats

Instructions:

1. Measure out 50 mL of water using a graduated cylinder or measuring cup and pour it into the first plastic cup.
2. Use a digital scale to measure out 10 g of Epsom salt.
3. Add the 10 g of Epsom salt to the 50 mL of water in the first plastic cup.
4. Stir the mixture with a stirring stick or spoon until the Epsom salt is completely dissolved.
5. Pour another 50 mL of water into the second plastic cup.
6. Use the digital scale to measure out 10 g of sodium carbonate.
7. Add the 10 g of sodium carbonate to the 50 mL of water in the second plastic cup.
8. Stir the mixture until the sodium carbonate is fully dissolved.
9. Slowly pour the sodium carbonate solution from the second cup into the Epsom salt solution in the first cup.
10. Stir gently while mixing to ensure the two solutions combine evenly.

Observations:

A white, cloudy precipitate will form when the two solutions (Epsom salt and sodium carbonate) are mixed. This precipitate is magnesium carbonate, which appears as a solid suspended in the liquid.

What do you think is occurring?

When Epsom salt (magnesium sulfate) and sodium carbonate are combined in water, a **double displacement reaction** occurs, resulting in the formation of magnesium carbonate (the white precipitate) and sodium sulfate, which remains dissolved in the solution. This reaction demonstrates the principles of solubility and chemical reactions between salts.

Name: **Date:** **Class:**

Adsorption

Materials needed	
1 250 mL beaker 100 mL water 100 mL vegetable oil	1 graduated cylinder 1 clean, absorbent sponge

Instructions:

1. Pour 100 mL of water into a 250 mL beaker.
2. Pour 100 mL of vegetable oil into the same beaker.
3. Take the clean sponge and gently place it on top of the oil layer.
4. Let the sponge sit for a minute or two in the mixture.
5. Carefully remove the sponge from the mixture.

Observations:

The sponge soaked up a significant amount of oil but not water.

What happened to the oil/water mixture after the sponge was added?

After the sponge was added to the oil/water mixture, it soaked up a significant amount of oil, causing the oil layer to diminish and the water layer to remain relatively unchanged.

Why do you think this happened?

This happened because the sponge is porous and hydrophobic, which means it has a strong affinity for the oil and can absorb it. Because oil is less dense than water, it floats on top, and the sponge effectively captures the oil without affecting the water layer beneath.

Name: **Date:** **Class:**

Membrane

Materials needed	
1 plastic cup 50 mL water strip of filter paper	1 graduated cylinder red food coloring blue food coloring

Challenge: I made a mystery mixture, but I cannot remember how many drops of food coloring I put into the cup. I need your help in figuring out what the combination of red and blue drops was that I put into my cup. Your group is challenged to decide on a combination of four drops using red and blue. Each group should try a different combination, giving the class more options to compare the mystery mixture.

Instructions:

1. Measure out 50 mL of water using the graduated cylinder and pour it into the plastic cup.
2. Drop your food coloring combination into the cup.
3. Place the strip of filter paper into the cup, bending the top over the edge so the paper stays in the cup and does not touch the edge.
4. Wait 5 minutes before removing the filter paper from the cup.
5. Display your filter paper on the board along with your combination of food coloring that was tested.

Observations:

Answers will vary.

What combination of food coloring drops created the mystery mixture?

1 red drop and 2 blue drops

What evidence supports your claim?

The resulting color pattern on the filter paper indicates how the different colors separated and diffused, showing the proportion of each food coloring used.

Reasoning: how does the evidence support the claim?

The evidence from the filter paper shows how each food coloring traveled up the paper, providing a visual representation of the mixture. The intensity and spread of each color confirm the specific combination used, as varying ratios will result in different diffusion patterns.

Name: **Date:** **Class:**

Absorption and Stripping

Materials needed	
1 laptop or tablet 1 empty cup 1 cup of water	1 clean, absorbent sponge hands for squeezing

Instructions:

1. Watch this video (4:26 minutes): https://www.youtube.com/watch?v=s3LIYpgMilE
2. Fill one cup with water.
3. Submerge the sponge in the water.
4. Let the sponge absorb the water.
5. Take the sponge out of the water and squeeze it over an empty cup.

How does this activity demonstrate the process of absorption?

The activity demonstrates absorption, as the sponge soaks up water when submerged, showing its ability to take in liquid. This process highlights how materials can absorb substances, indicating the sponge's porous structure that allows water to fill its spaces.

How does this activity demonstrate the process of stripping?

The activity illustrates stripping when the sponge is squeezed over the empty cup, releasing the absorbed water. This process shows how the sponge can remove or "strip" the liquid it previously absorbed, effectively demonstrating the separation of liquid from the absorbent material.

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Extraction
Instructions: Watch this video (10:08 minutes): https://www.youtube.com/watch?v=N96JaRnE7n0 **Describe how this method works:** Generally, extraction techniques separate mixture components by utilizing their different solubilities in two immiscible liquids, often water and an organic solvent. By adding the solvent, the desired compound dissolves preferentially, creating two distinct layers. This method is common in chemistry labs for purifying compounds, often followed by techniques such as evaporation to isolate the target substance. Extraction using a separatory funnel involves mixing a compound with two immiscible solvents, typically an organic solvent and water, which separate based on their densities. When the mixture is shaken in the funnel, the compound distributes between the two layers based on its solubility in each solvent. By opening the stopcock, the denser liquid drains out, allowing separation. This process can be repeated to improve purity and is useful in isolating compounds in organic chemistry.