Mixtures and Solutions

Investigation 1 Notes:
Separating Mixtures
Mixtures and Solutions

<table>
<thead>
<tr>
<th>Separating Mixtures</th>
<th>Reaching Saturation</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Grit" /></td>
<td><img src="image2.png" alt="Powder" /></td>
</tr>
<tr>
<td><img src="image3.png" alt="Salt" /></td>
<td><img src="image4.png" alt="Solution" /></td>
</tr>
</tbody>
</table>

Concentration

Fizz Quiz

![Solution](image5.png)
SEPARATING MIXTURES

PART 1. Prepare three cups. Put one level spoon (5 ml spoon) of each solid material in its cup. Observe the three solid materials. Fill in the property chart below.

| Material          | Color   | Texture  | Particle shape | Particle size | Other
|-------------------|---------|----------|----------------|---------------|-------
| Gravel            | multi   | rough    | bumpy          | small (mm)    | some are very
|                   |         |          |                |               | fluffy
| Powder            | white   | smooth   | round          | miniscule     | tiny
| Ribbons           | white   | gritty   | square         | pellets       | clumpy

PART 2. Add 50 ml of water (one full syringe) to each cup. Stir and observe. Write your observations here.

| Material          | Observations
|-------------------|-------------------
| Gravel and water  | gravel sunk and became darker when wet
| Powder and water  | turned water white, eventually settled
| Salt and water    | salt "disappeared" (dissolved)

PART 3. Separate all three mixtures with filters.

   a. Place a screen over an empty labeled cup.
   b. Stir the mixture thoroughly.
   c. Pour the mixture through the screen filter.
   d. If the screen filter doesn't separate the mixture, repeat the process with a filter paper.

Were you able to separate the mixtures? Record your results.

<table>
<thead>
<tr>
<th>Material</th>
<th>Screen</th>
<th>Filter Paper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gravel</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Powder</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>Salt</td>
<td>no</td>
<td>no</td>
</tr>
</tbody>
</table>

THINKING ABOUT MIXTURES

1. What is a mixture? Give some examples.
   Two items put together that can still be separated. Cereal & milk, chalk mix
2. What is a solution? Give some examples.
   A special mixture when one item dissolves in the other: salt water, Koolaid, iced tea
   Yes, yes, yes!
3. Is salt and water a mixture? A solution? Is it both a mixture and a solution?
   when the solid dissolves and the solution is clear
4. How do you know when a solid and a liquid form a solution?
   with a filter
5. How can mixtures be separated?
   they can separate mixtures, of different sizes though
MAKING A SOLUTION

1. Weigh 50 ml of water. Record its mass on line 2 in the box below.

| 1. Mass of salt-and-water solution | 53 g |
| 2. Mass of 50 ml of water           | 50 g |
| 3. Mass of salt                     | 3 g  |

2. Make a solution with one level spoon of salt and 50 ml of water.
3. Carefully weigh the solution. Record its mass on line 1 in the box below.

4. Calculate the number of grams of salt you put in the water to make the solution, by subtracting to find the difference.

How could you separate the salt from the water in the solution?

Let the water evaporate out from the solution and the salt will be left behind.

Word Bank

- **Mixture**: A substance containing two or more materials with different properties.
- **Property**: A characteristic of an object that can be observed, such as size, color, shape, or texture.
- **Solution**: A special mixture formed when one or more materials dissolves in another.
- **Dissolving**: The process of a material becoming incorporated uniformly into another or mixing together evenly.

Content / Inquiry

- What happens if you add water to a cup containing dry materials?
  - Water and solid material make a mixture.
- How can a mixture be separated?
  - Some mixtures can be separated with filters.
Evaporation: causes liquids to dry up—the liquid turns into gas and disperses into the air, leaving any dissolved solid material behind.

Crystal: a solid form of a material that can be used to identify the material by its properties, such as shape, color, and pattern.

*How can a solution be separated?
When a solution evaporates, it leaves the dissolved solid material behind.

*How can the material left behind by evaporation be identified?
If the evaporation material forms a crystal, it can be identified by its properties, such as shape and pattern.

Salt (Sodium Chloride; NaCl) Crystals
Square shaped, clear, with an X pattern from corner to corner

Separating a Dry Mixture:
How to separate a mixture:
1. Gravel and water: use a sieve filter
2. Powder and water: use a paper filter and funnel stand
3. Salt and water: stir until it makes a solution, then let the water evaporate
SEPARATING A DRY MIXTURE

Challenge: Design a method to separate a mixture of gravel, salt, and powder.

PART 1. Prepare the solid mixture.
   a. Label a plastic cup "dry mixture."
   b. Put one 5-ml spoon of salt in the cup.
   c. Put one 5-ml spoon of gravel in the cup.
   d. Put one 5-ml spoon of powder in the cup.
   e. Stir the mixture with a stick.

PART 2. Describe your plan for separating the mixture so that the salt is in one cup, the gravel is in a second cup, and the powder is in a third cup.
   Take the dry mixture, and using the screen filter separate the gravel from the salt and powder. Put the gravel in the "g" cup and the salt and powder into the "p" cup when filtering.
   Add 50 mL water to the salt and powder in the "p" cup, and stir until salt dissolves.
   Put the paper filter into the funnel stand, and put the "s" cup below the funnel.
   Pour the new water mixture into the filter. The powder will remain in the filter, which you can put into the "p" cup. The salt solution will drain into the "s" cup below the funnel.

PART 3. Summarize the results of your plan. Describe how you might improve your separation.

I was able to successfully separate all three materials into separately labeled cups.
Mixtures and Solutions

Investigation 2 Notes:
Saturating Solutions
SATURATING A SOLUTION

Steps for determining the amount of solid material required to saturate 50 ml of water.

1. Put a filter paper in the funnel.
   Sprinkle it with water.

2. Place the labeled cup under the funnel.

3. Pour the saturated solution from the bottle into the wet filter.

4. Place the saturated solution on one side of the balance and 50 ml of water on the other side.

5. Add gram masses to the water until it balances.
   The amount of mass added to the water is equal to the mass of the solid material dissolved in the saturated solution.

6. Record the results in your science notebook.

15 g of salt
A Solution is made of two parts, the solvent and solute.

Solvent: is the liquid that does the dissolving (Universal Solvent is water)

Solute: is the solid that dissolves in the solvent.

Saturated Solution: when a solute dissolves in a solvent until no more will dissolve.

• Salt will dissolve in water until it reaches saturation. No more salt will dissolve once saturation is reached.

• The amount of salt in a saturated solution can be determined by weighing the saturated solution and subtracting the mass of the solvent (water).

• An important property of a material is how it dissolves in a liquid, such as water. That is the property of solubility.

• It took 69.5 grams of Citric Acid to saturate 50 mL of water.

• It took 48 grams of Epsom Salt to saturate 50 mL of water.

• It took 15 grams of Kosher Salt (sodium chloride) to saturate 50 mL of water.
**Chemical Data Sheet**

Challenge: Can you identify the mystery chemical?

Here is a table of properties for five chemicals.

<table>
<thead>
<tr>
<th>Chemical name</th>
<th>Appearance</th>
<th>Amount needed to saturate 50 mL of water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium Chloride</td>
<td>Small white grains</td>
<td>14 grams</td>
</tr>
<tr>
<td>Baking soda</td>
<td>Small white grains</td>
<td>3 grams</td>
</tr>
<tr>
<td>Epsom salts</td>
<td>Small white grains</td>
<td>48 grams</td>
</tr>
<tr>
<td>Citric acid</td>
<td>Small white grains</td>
<td>60 grams</td>
</tr>
<tr>
<td>Alum</td>
<td>Small white grains</td>
<td>6 grams</td>
</tr>
</tbody>
</table>

Record your observations about the mystery chemical. White grains, bigger than salt.

The mystery chemical is **Epsom Salt**

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**Steps to Saturating a Solution (pg. 79)**

1. Use a syringe to get 50 mL of solvent.
2. Take cap off bottle and put the 50 mL of solvent into the bottle.
3. Place a sticky note on the bottle to mark the level of the solvent to track volume changes.
4. Put the bottle under the funnel stand.
5. Scoop up 5 mL of solute with the blue spoon.
6. Pour the 5 mL of solute into the funnel, which directs the solute into the bottle.
7. Take the bottle out from under the funnel.
8. Put the lid on the bottle and shake it until all solute is dissolved.
9. Repeat steps 4-8 until no more solute will dissolve in the solvent, which means you have a saturated solution.
To dissolve more solute once the solution is saturated, heat up the solvent.

The mass of a saturated solution is equal to the mass of the solvent (water) plus the mass of the solute (salt, sugar, etc.)

To tell if a clear liquid is a solution, let it evaporate. If it is a solution, the solute will be left behind in crystal form.

Draw a picture of a saturated solution in a bottle.

<table>
<thead>
<tr>
<th>Sodium Chloride</th>
<th>Citric Acid</th>
<th>Epsom Salt</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Sodium Chloride crystals" /></td>
<td><img src="image" alt="Citric Acid crystals" /></td>
<td><img src="image" alt="Epsom Salt crystals" /></td>
</tr>
</tbody>
</table>
Mixtures and Solutions

Investigation 3 Notes:
Concentration
# SOFT-DRINK RECIPES

<table>
<thead>
<tr>
<th>Solution 1. 1 spoon of powder in 1000 ml of water</th>
<th>Solution 2. 3 spoons of powder in 1000 ml of water</th>
</tr>
</thead>
<tbody>
<tr>
<td>List all the ways that the solutions are the same.</td>
<td>List all the ways that the solutions are different.</td>
</tr>
<tr>
<td>Same amt. solvent</td>
<td>diff. amt. solute</td>
</tr>
<tr>
<td>both red</td>
<td>Sol. 2 is darker</td>
</tr>
<tr>
<td>both are mixtures</td>
<td>Sol. 2 smells &amp;</td>
</tr>
<tr>
<td>both are same flavor</td>
<td>tastes stronger</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Solution A. 2 spoons of powder in 1000 ml of water</th>
<th>Solution B. 2 spoons of powder in 500 ml of water</th>
</tr>
</thead>
<tbody>
<tr>
<td>List all the ways that the solutions are the same.</td>
<td>List all the ways that the solutions are different.</td>
</tr>
<tr>
<td>Same amt. solute</td>
<td>diff. amt. solvent</td>
</tr>
<tr>
<td>both red</td>
<td>Sol. B is stronger</td>
</tr>
<tr>
<td>both are same flavor</td>
<td>tasting &amp; smelling</td>
</tr>
<tr>
<td>and is darkest of all solutions</td>
<td></td>
</tr>
</tbody>
</table>

My recommended recipe for soft drink is **Solution 2**.
Investigation 3: Concentration Notes

Word Bank

- Concentration - the amount of material dissolved in a measure (volume) of liquid. The more material dissolved, the greater the concentration.

- Dilute - to make a solution less concentrated, usually by adding more liquid.

- Volume - the three-dimension space occupied by something, like the amount of liquid.

Concepts/Inquiry

* What happens to the soft-drink solution when you increase the amount of powder in a given amount of water?

* As the amount of solute in a solution is increased, the concentration goes up.

* How can you determine the relative concentrations of solutions?
Steps to Determine Concentrations of Mystery Solutions

Red, Blue, & Green:

1. Get 3 cups & label them solution 1, 2, 3

2. Using a syringe, get 50 ml of solution 1 (red) and put in cup 1.
   Repeat for solutions 2 & 3 and put them in corresponding cups.

3. Use a balance to compare them in the following order:

<table>
<thead>
<tr>
<th>Test #</th>
<th>Cups</th>
<th>Result (color)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 &amp; 2</td>
<td>2 (green)</td>
</tr>
<tr>
<td>2</td>
<td>2 &amp; 3</td>
<td>2 (green)</td>
</tr>
<tr>
<td>3</td>
<td>1 &amp; 3</td>
<td>1 (red)</td>
</tr>
</tbody>
</table>

Results: heaviest = solution 2 green
         middle = solution 1 red

Review notes for quiz:

- Solubility is the amount of solute that will dissolve in a given amount of solvent
- Concentration increases as the amount of solute dissolved in a solvent increases until it reaches the point of saturation.
- Once a solution is saturated, it has the highest concentration possible. The concentration cannot increase after saturation (unless the solvent is heated).
- Therefore, two saturated solutions made with the same materials have the same concentration.
- To determine the most concentrated solution when given different recipes, compare the amount of solute to solvent in fraction form. The bigger the fraction, the greater the concentration.
FIZZ-QUIZ OBSERVATIONS

Follow the Fizz Quiz Place Mat directions to make the mixtures. Record the results. Draw and describe what you observed.

Cup 1: 1 spoon of calcium chloride, 1 spoon of baking soda, and 50 ml of water

The mixture began to fizz and turned all white. After a bit, the bubbles subsided and the precipitate settled.

Cup 2: 1 spoon of calcium chloride, 1 spoon of citric acid, and 50 ml of water

The mixture got very warm, but there were no bubbles or precipitate.

Cup 3: 1 spoon of baking soda, 1 spoon of citric acid, and 50 ml of water

The mixture got cold and very bubbly. It looked like sprite.

Which chemicals reacted to form a gas? 1 & 3 (Calcium chloride & baking soda; citric acid & baking soda)

Which chemicals reacted to form a precipitate? 1 - calcium chloride & baking soda

FIZZ QUIZ Notes

Chemical Reaction - when 2 or more materials (chemicals) are mixed together and a change occurs.

Precipitate - a solid material that forms as a product of a reaction.

Change - the process of becoming something different.

* What happens when a solution is made with water and two different solutes?

- Sometimes when two (or more) solutes (chemicals) are mixed, changes take place and new materials form.

Changes, such as heat, gas formation, and precipitate formation, are evidence of a chemical reaction.

Which chemicals reacted to form a gas?

- Calcium chloride & baking soda; citric acid & baking soda

Which chemicals reacted to form a precipitate?

- Calcium chloride & baking soda
Calcium Chloride + baking soda + water = chalk + salt + water + fizz
(Calcium carbonate) (Calcium chloride) (Carbon dioxide)

Reactants: Calcium Chloride & baking soda
Products: Chalk, salt, water, gas bubbles (1/2 bag)

Reactants: Citric Acid & Baking Soda
Products: Lots of gas bubbles (whole bag!) and temperature change... cold!
Reactants: Calcium Chloride, baking soda, citric acid

Products: Bubbles (very full bag!)

45 minutes later...

Products: White precipitate!

I know this precipitate is not chalk because it did not foam up when mixed with vinegar like chalk should.

* The precipitate is Calcium Citrate.
  The "calcium" came from the calcium chloride.
  The "citrate" came from the citric acid.