Mixtures and Solutions
Teacher Facilitation Notes

In General . . .

- Project the slide deck in edit mode–do not show it as a slideshow.
- Hide the speaker notes before projecting. (View/Show Speaker Notes)
- Hide the toolbar. (Click on the up arrow at the right end of the tool bar.)
- Call on students to read the various content shown on slides.
- For each investigation, assemble the needed materials for each group and place in a central location for ease of distribution.
- Duplicate copies of the data sheets for each student.

Materials Needed Per Group:

<u>Engage: Mixtures and Solutions</u>

Raisins	Chex Mix®	Honeycomb cereal®
M&Ms®	Pretzel sticks	Powdered lemonade mix
Water	Paper towels	Stirring sticks
Teaspoon	Salt	

<u>Explore: All Mixed Up!</u>

Clear, plastic glasses, 3	Water	Powdered drink mix
Snack baggie, 1	Yellow food coloring	Blue food coloring
Clear soda (i.e., Sprite™)	Craft sticks, 6-8	Plastic spoons, 2-3
Paper towels		

<u>Elaboration–Sugar and Water</u>

Clear beaker	Sugar, 10 mL	Plastic spoon
Digital or balance scale	Snack baggie	Water

<u>Elaboration–Sand and Water</u>

Clear beaker	Sand, 30 mL	Plastic spoon
Digital or balance scale	Snack baggie	Water

<u>Elaboration–Cooking Oil and Water</u>

Clear beaker	Cooking oil	Plastic spoon
Small condiment cup	Snack baggie	Water
Digital or balance scale	Paper towels	

<u>Elaboration–Dried Beans</u>

Clear beaker	Dried lima beans	Dried pinto beans
Dried kidney beans	Snack baggies, 3	Digital or balance scale

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Other Materials (Per student)

Student Recording Sheets
Student Evaluation Document
Small paper cup
Pencils
Small snack baggie

Engage: Mixtures and Solutions

- Prepare a baggie of snack mix for each student. You may purchase prepared mix or place raisins, Chex Mix®, Honeycomb cereal®, M&Ms®, and pretzel sticks in the baggies. (Do not add nuts due to possible allergies!)
- Read through the introductory slides with the students.
- Read through the steps with the students as they explore the snack mix and lemonade.
- Discuss using the following questions:
  - What are some physical properties of the ingredients in the snack mix?
  - Did the physical properties of the ingredients change when they were mixed together? How do you know?
  - Did mixing these ingredients make a mixture? How do you know?
  - What state(s) of matter are the ingredients in this mixture?
  - What are some physical properties of the ingredients in the lemonade?
  - What happened to the powdered mix when you put it in the water? (dissolved)
  - What does it mean to dissolve?
  - What physical properties of the water changed when the drink mix was mixed with the water?
  - What state(s) of matter were the ingredients used in the lemonade?
- Allow the students to eat the trail mix and drink the lemonade as you complete the discussion as desired.

Explore: All Mixed Up!

- Discuss the task, the materials used, and relevant lab rules prior to beginning the investigation.
- According to student ability levels, either let the groups work independently or read and follow each step together simultaneously.
- Ask the following questions:
  - What did you observe when you dropped the food coloring into the cup of water?

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Explore: All Mixed Up!, continued

- Ask the following questions:
  - What did you observe when you sprinkled the powdered drink mix on the water?
  - What did you observe after you stirred the contents of both glasses?
  - Did the food coloring and the water form a mixture? A solution? How do you know?
  - What states of matter are the water and the food coloring? (Point out that this is a solution of a liquid in a liquid.)Water is a liquid. The powdered drink mix is a solid. What can you not see the solid particles of the drink mix in the water? (The particles spread out so evenly in the water, they seem to disappear. The powdered drink mix DISSOLVES in the water.)
  - Clear soda is actually a solution. Carbon dioxide gas is dissolved in the flavored liquid. What evidence can you see of the gas in the liquid?
  - What happened when you sprinkled the salt on the glass of clear soda? Why do you think this happened?
  - Was there more gas dissolved in the soda? How did you prove this?
  - Which combinations that you observed were mixtures only? Which were solutions?
  - What makes a solution a special kind of mixture?
  - How can you tell if something is a solution?
- Discuss other aspects of this activity as desired.

Explain: Summing It All Up!

- Call on volunteers to read each paragraph of the explanation slides. Discuss as desired.
- Have students make the t-chart and classify the pictured combinations as mixtures or solutions in their science journals.
- If desired, have the students write the answer to the final questions in their science notebooks. Discuss their answers as desired.

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Elaborate: Sugar and Water

- Place some sugar in a baggie for each group prior to beginning this activity. A plastic spoon holds about 5 mL of sugar, so the groups will need at least two teaspoons of sugar in the baggies.
- Have groups follow the steps to investigate the conservation of matter when the water and sugar are mixed. If necessary, help them compute the masses of the ingredients separate from the masses of the containers. Ask why we need to do this.
- After the groups are finished, ask questions such as these:
  - What state of matter was each ingredient in this mixture? (Point out that this is a solid in a liquid mixture.)
  - Is this just a mixture or is it also a solution? How do you know?
  - Was the matter conserved when the sugar and the water mixed together? In other words, did the sum of the masses of the sugar and water equal the mass of the sugar water? (They will need to subtract the mass of the beaker from the total mass to ascertain the answer to this question.)

Elaborate: Sand and Water

- Place some sand in a baggie for each group prior to beginning this activity. A plastic spoon holds about 5 mL of sand, so the groups will need at least six teaspoons of sand in the baggies.
- Have groups follow the steps to investigate the conservation of matter when the water and the sand are mixed. If necessary, help them compute the masses of the ingredients separate from the masses of the containers. Ask why we need to do this.
- After the groups are finished, ask questions such as these:
  - What state of matter was each ingredient in this mixture? (Point out that this is a solid in a liquid mixture.)
  - Is this just a mixture or is it also a solution? How do you know?
  - Was the matter conserved when the sand and the water mixed together? In other words, did the sum of the masses of the sand and water equal the mass of the sandy water? (They will need to subtract the mass of the beaker from the total mass to ascertain the answer to this question.)

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Elaborate: Cooking Oil and Water

- Place some cooking oil in a cup or beaker for each group prior to beginning this activity. They will need enough oil to half fill the condiment cup.
- Have groups follow the steps to investigate the conservation of matter when the cooking oil and water are mixed. If necessary, help them compute the masses of the ingredients separate from the masses of the containers. Ask why we need to do this.
- After the groups are finished, ask questions such as these:
  - What state of matter was each ingredient in this mixture? (Point out that this is a liquid in a liquid mixture.)
  - Is this just a mixture or is it also a solution? How do you know?
  - Was the matter conserved when the cooking oil and the water mixed together? In other words, did the sum of the masses of the cooking and water equal the mass of the oily water? (They will need to subtract the mass of the beaker from the total mass to ascertain the answer to this question.)

Elaborate: Dried Beans

- Place 3 different kind of dried beans in snack baggies for each group prior to beginning this activity. Put about 30 mL of each kind of bean in the baggies.
- Have groups follow the steps to investigate the conservation of matter when the dried beans are mixed. If necessary, help them compute the masses of the ingredients separate from the masses of the containers. Ask why we need to do this.
- After the groups are finished, ask questions such as these:
  - What state of matter was each ingredient in this mixture? (Point out that this is a solid in a solid mixture.)
  - Is this just a mixture or is it also a solution? How do you know?
  - Was the matter conserved when the beans mixed together? In other words, did the sum of the masses of each type of dried bean equal the mass of the bean mixture? (They will need to subtract the mass of the beaker from the total mass to ascertain the answer to this question.)

Evaluate

- Go
- Let students complete the quiz independently.
- Discuss evaluation activities as desired.

Mixtures and Solutions

Name: KEY

Evaluation

Write an "M" in the blank if the phrase describes a mixture only. Write an "S" in the blank if the phrase describes a mixture that is also a solution.

1. S Orange juice and lemon juice
2. M Dirt and water
3. S Salt and water
4. M Cereal and milk
5. S Water vapor in the air
6. S Hot chocolate mix in water
7. M Oil and water

Use your knowledge of science and mixtures/solutions to answer the questions below.

8. Is the following statement true or false? Explain your answer.
Sand and water both maintain their physical properties when mixed together.

The statement is true. Student explanations will vary. Accept all reasonable answers students can justify.

9. What term is used to describe a special type of mixture in which one ingredient dissolves in another?

Solution

Mixtures and Solutions

Name: KEY

Evaluation

10. A student makes a mixture by combining 15 g of powdered drink mix and 75 g of cold water. What will the combined mass of the mixture be?

F 15 g
G 90 g
H 100 g
J 1575 g

11. Which of the following substances will dissolve in water to form a solution?

A Plastic beads
B Corn oil
C Pepper
D Salt

12. Some students dissolved green-colored sugar in very hot water and let the mixture sit on a table for one hour. Which of the following changes probably did **not** occur?

F The water changed from a solid to a gas.
G The sugar crystals dissolved in the water.
H The water changed to a light green color.
J The water got cooler as it sat on the table.

13. Which of the following are examples of mixtures that are also solutions? Mark all the answers that apply.

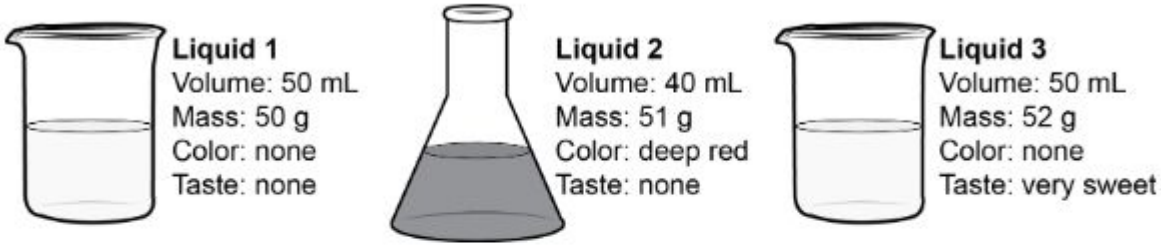
A Salt and pepper
B Hot coffee
C Air
D Popcorn kernels
E Soda (Dr. Pepper™, Coca-Cola™, etc.)
F Soil
G Chocolate milk

Mixtures and Solutions

Name: KEY

Evaluation

14. The illustration shows the properties of three different liquids.



Students mix the liquids together to form a solution. Which of the following will most likely be properties of the solution? (Mark two answers.)

F A volume of 150 mL
G A mass of 153 grams
H A sweet taste
J A deep blue color

15. Which of the mixtures below are examples of solids mixed with liquids? Mark all the answers that apply.

A Salt and water
B Chocolate syrup and milk
C Raisins and nuts
D Ice and water
E Cereal and milk
F Sand and rocks

Mixtures and Solutions

Name: _____

Engage: Mixed Up Snacks

Question

Are trail mix and lemonade mixtures?

1. What are two physical properties of each of these ingredients?

   Raisins _____

   Pretzel sticks _____

   M&Ms® _____

2. Do the physical properties of the snack mix ingredients change when they are mixed together? Explain.

3. What are two physical properties of each of these ingredients?

   Water _____

   Powdered drink mix _____

4. Which physical properties of the water change when the drink mix is added?

My Conclusions:

Are trail mix and lemonade mixtures? Use evidence from what you did to explain your answer to this question.

Mixtures and Solutions

Name: _____

Explore: All Mixed Up!

Task

Investigate and compare a variety of mixtures and solutions.

1. What did you observe as you watched the ingredients in the cups?

2. Do these ingredients form a mixture? Do they form a solution? What is your evidence for your answers?

3. What happened when you sprinkled the salt on the clear soda?

4. What happened when you put the M&Ms™ in the soda? Was there more carbon dioxide gas in the soda? Explain.

Which mixtures that you observed are . . .

5. A liquid mixed with a liquid

6. A liquid mixed with a solid

7. A solid mixed with a solid

Mixtures and Solutions

Name: _____

Elaboration: Conserving Matter–Sugar and Water

Question

How does the mass of the ingredients compare to the total mass of a mixture of sugar and water?

1. Mass of the beaker by itself _____

   Mass of the beaker with 50 mL water _____

   Mass of the water by itself _____

2. Mass of the snack baggie by itself _____

   Mass of the snack baggie with 10 mL sugar _____

   Mass of the sugar by itself _____

3. Do the sugar and water form a mixture only or do they form a solution, too? How do you know?

4. How does the mass of the sugar water in the beaker compare to the combined masses of the water and the sugar that was added to it?

My Conclusions: Was the matter conserved in this solution? Explain.

Mixtures and Solutions

Name: _____

Elaboration: Conserving Matter–Sand and Water

Question

How does the mass of the ingredients compare to the total mass of a mixture of sand and water?

1. Mass of the beaker by itself _____

   Mass of the beaker with 50 mL water _____

   Mass of the water by itself _____

2. Mass of the snack baggie by itself _____

   Mass of the snack baggie with 30 mL sand _____

   Mass of the sand by itself _____

3. Do the sand and water form a mixture only or do they form a solution, too? How do you know?

4. How does the mass of the sandy water in the beaker compare to the combined masses of the water and the sand that was added to it?

My Conclusions: Was matter conserved in this solution? Explain.

Mixtures and Solutions

Name: _____

Elaboration: Conserving Matter–Cooking Oil and Water

Question

How does the mass of the ingredients compare to the total mass of a mixture of cooking oil and water?

1. Mass of the beaker by itself _____

   Mass of the beaker with 50 mL water _____

   Mass of the water by itself _____

2. Mass of the condiment cup by itself _____

   Mass of the cup with cooking oil _____

   Mass of the cooking oil by itself _____

3. Do the cooking oil and water form a mixture only or do they form a solution, too? How do you know?

4. How does the mass of the oil and water mixture in the beaker compare to the combined masses of the water and the cooking oil that was added to it?

My Conclusions: Was matter conserved in this solution? Explain.

Mixtures and Solutions

Name: _____

Elaboration: Conserving Matter–Dried

Question

How does the mass of the ingredients compare to the total mass of a mixture of dried beans?

1. Mass of the beaker by itself _____
2. Mass of a snack baggie by itself _____

   Mass of Dried Beans #1 _____

   Mass of Dried Beans #2 _____

   Mass of Dried Beans #3 _____
3. Do the dried beans form a mixture only or do they form a solution, too? How do you know?

4. How does the mass of the bean mixture in the beaker compare to the combined masses of the beans by themselves?

My Conclusions: Was matter conserved in this solution? Explain.

Mixtures and Solutions

Name: _____

Evaluation

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3. _____Salt and water
4. _____Cereal and milk
5. _____Water vapor in the air
6. _____Hot chocolate mix in water
7. _____Oil and water

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Mixtures and Solutions

Name: _____

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H The water changed to a light green color.

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B Hot coffee

C Air

D Popcorn

E Soda (Dr. Pepper™, Coca-Cola™, etc.)

F Soil

G Chocolate milk

Mixtures and Solutions

Name: _____

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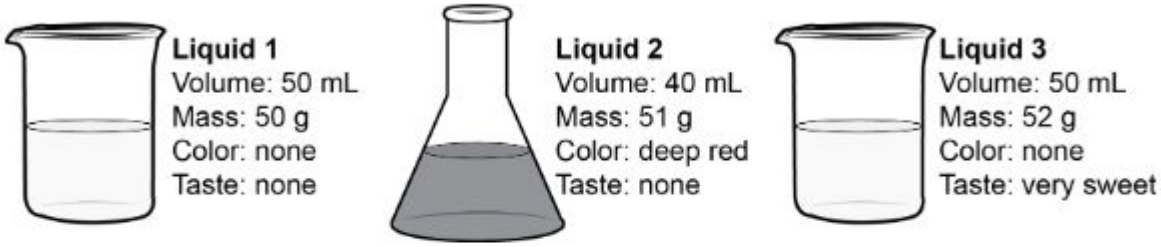

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C Raisins and nuts

D Ice and water

E Cereal and milk

F Sand and rocks