"Mixtures and Solutions"
Grade 5 – Summative Assessment

Assessed Understandings

Students will understand:

1. The mass of an object remains unchanged when broken into parts (Conservation of Mass).
2. Physical properties differences can be used to separate, sort, and group the materials of a mixture.
3. Mixtures can consist of different combinations of solids and/or liquids.
4. Physical properties can be used to separate mixtures through techniques such as filtration and/or evaporation.
5. When a solid is dissolved in a liquid, a solution is formed that can be separated through the process of evaporation.

Teacher Notes for "Mixtures and Solutions"

Introduction

These items are designed to provide an assessment of what students know and understand at the completion of the *FOSS* "Mixtures and Solutions" module. This document includes teacher directions, response sheets for the individual students, and analytic scoring rubrics for each question. A separate document contains the anchor papers for each question. **A close look at the rubrics prior to the administration of the assessment will be helpful to the teacher.**

Time and Preparation for the Assessment

This assessment should take about **two, 45-minute class periods** to administer. You are free to read aloud any or all portions of the assessment to your students. Without giving away a more appropriate response, please help students understand the intent of the question or task. This is not a test of reading, writing, or artistic ability. Students may be encouraged to use any and all resources available, including material from classroom charts and individual journals. Please use the **terminology** from the investigations within the kit.

Directions for Administration

After reading over the assessment, preparation is needed prior to assessing students on separating mixtures. These materials are needed for the students. The tool kits are pre-packaged and should be available in your module. The mixture recipe is as follows:

Mixture (make 1 mixture for each student)

Mix the following materials together in a 9-ounce clear cup:

- 25 ml of water with 1 drop of yellow food coloring
- 3 marbles (these must be saved)
- 3 metal washers or screws (these must be saved)
- 5 plastic pieces (cut up plastic coffee straws—pieces should fit through screen)

Prepare for each student to complete **Question 1** of the assessment.

- 1 mixture for every student
- 1 tool bag for every student
- 1 bag of 3 oz. small paper soufflé cups
- 4 balances with weights and 9-ounce cups

Note: All marbles and screws must be saved and returned

Tool Bag (prepackaged)

- 1 magnet
- 1small brown coffee filter
- 1 piece of string
- 1 taster spoon
- 1 large paperclip
- 1 screen with large holes

Additional Tools (Distributed with Tool Bag)

- 1 ruler
- 1 hand lens
- 1 9-ounce cup

Question 1: This question is to be independently completed by the student. The teacher should emphasize that a different tool is required during each of the following processes.

(Use a different tool each time.)

FIRST…
To separate out the _____from the mixture,
(Name or describe a material)

I will use _____because
(Name the tool)

_____
(Describe one physical property of the material that will allow you to separate it using this tool.)

NEXT…
To separate out the _____from the mixture,
(Name or describe a material)

I will use _____because
(Name the tool)

_____.
(Describe one physical property of the material that will allow you to separate it using this tool.)

THEN…
To separate out the _____from the mixture,
(Name or describe a material)

I will use _____because
(Name the tool)

_____.
(Describe one physical property of the material that will allow you to separate it using this tool.)

Question 2: After recording the process of separating a mixture, the student will describe how they will separate a material that is dissolved in a liquid.

2. If you want to find out if there is something dissolved in the liquid that you could not see, describe what you could do to separate it from the liquid. Explain why this would work.

Question 3: Questions 1 and 2 are focus questions to this item. The student is asked to draw a conclusion about weighing of separated materials from the mixture. Taking the evidence, the student will draw on their results to formulate an opinion.

3. If you could weigh each of the separated materials from the mixture and then add the results together, which of the following would be true? Circle your answer below.
   a. The total mass of the separated materials would weigh more than the mass of the original mixture.
   b. The total mass of the separated materials would weigh the same as the mass of the original mixture.
   c. The total mass of the separated materials would weigh less than the mass of the original mixture

   Explain your answer.

The next questions require the teacher to prep. The cups will have different sample solutions. This requires the students to be placed in groups; however, they need to understand the questions are to be completed independently. (Teachers can share these samples with each other to assist in the time for preparation.)

How to Prepare Sample Solution A:

- Label six, 9-ounce cups as Sample A
- Pour 30 ml of molasses into each 9-ounce cup

How to Prepare Sample Solution B:

- Label six, 9-ounce cups as Sample B
- Mix 90 ml of molasses and 90 ml of water into a large container and mix well
- Use a syringe and extract 30 ml of solution B and squirt into each 9-ounce cup

How to Prepare Sample Solution C:

- Label six, 9-ounce cups as Sample C
- Mix 45 ml of molasses with 225 ml of water into a large container and mix well
- Use a syringe and extract 30 ml of solution C and squirt into each 9-ounce cup

Set-Up

- Set up enough balance scales for each of the groups. Each group will have one cup of each solution. (These samples will be the ones that the teacher prepared.)
- **Reminder to Teachers:** Weigh each sample and record the mass on the Teacher Response Sheet. Be sure Sample A is the heaviest, and Sample C is the lightest.

Question 4: The students will have access to balance scales in order to determine the mass of each solution.

4. Measure the mass of each 30 ml sample. Record your results on the chart below.

Mass of Solution A (Pure)	**Mass of Solution B (Pure + 30ml water)**	**Mass of Solution C (Pure + 150 ml water)**

Question 5: As in the scientific method, the students are to draw on their investigation to analyze a logical conclusion. This question simply asks the student why mass is more or less in samples.

5. Why is the mass of Sample C less than Sample A?

Question 6: The basis of the module "Mixtures and Solutions" is for students to understand that solutions have similarities and differences. In this question, the students are asked to predict the mass of a new sample.

6. A new Solution D (Pure + 180 ml of water) was made. Using the data on the bar graph, predict the mass of Solution D.

Question 7: This question is the culmination of students' understanding of liquids and solutions. They are asked to draw conclusions about substances to see if they will dissolve in different liquids. The chart information is given and the students are asked to explain.

7. Using the data on the chart above, which liquid (vegetable oil, water, or rubbing alcohol) would be most useful in making solutions with the substances tested? Explain your answer.

Teacher Response Sheet

Question 7 – Mass of the Solutions

Solution A _____g to _____g

Solution B _____g to _____g

Solution C _____g to _____g

Scoring Rubric
"Mixtures and Solutions"
Summative Assessment

1. Think about the physical properties of the materials in the mixture and how to use the tools in the bag. On the next page, record the process of separating a mixture.

This item measures the student's ability to choose the appropriate tools to separate the mixture based on the properties of the materials.

Criteria for a complete response:

1. Appropriate tools (3 different) used to separate the materials.
2. Explanation based on a property of the material separated.

Possible explanations:

- Marbles – too big to go through the holes in the screen
- Plastic pieces – too large to go through the filter or the plastic pieces do not dissolve and are caught in the filter
- Metal washers/screws – metal is attracted to magnets

Code	Response
	Complete Response
30	Response meets the above criteria.
39	Any other completely correct response.
	Partially Correct Response
20	Response meets criterion 1 and includes at least two complete explanations for use of tools.
21	Response meets criterion 2 but uses the same tool twice.
29	Any other partially correct response.
	Minimally Correct Response
10	Response meets criterion 1 only.
11	Response matches two materials with the appropriate tools and one complete explanation.
19	Any other minimally correct response.
	Incorrect Response
70	Response matches at least one material with the appropriate tool and may include an explanation.
76	Response repeats the substance or stem of the question.
79	Any other incorrect response.
	Non-Response
90	Crossed out, erased, illegible, or impossible to interpret.
99	Blank.

2. If you want to find out if there is something dissolved in the liquid that you could not see, describe what you could do to separate it from the liquid. Explain why this would work.

This item measures a student's understanding of how evaporation can be used to separate a dissolved solid material from water.

Criteria for a complete response:

1. Identifies evaporation as a method to separate the solution.
2. Explanation states that a solid material is left behind after water evaporates.

Code	Response
	Complete Response
20	Response meets the above criteria.
29	Any other completely correct response.
	Partially Correct Response
10	Response meets criterion 1 only.
19	Any other partially correct response.
	Incorrect Response
70	Response uses a tool from the tool bag, such as a filter or screen.
76	Response repeats the substance or stem of the question.
79	Any other incorrect response.
	Non-Response
90	Crossed out, erased, illegible, or impossible to interpret.
99	Blank.

3. If you could weigh each of the separated materials from the mixture and then add the results together, which of the following would be true? Circle your answer below.
   a. The total mass of the separated materials would weigh more than the mass of the original mixture.
   b. The total mass of the separated materials would weigh the same as the mass of the original mixture.
   c. The total mass of the separated materials would weigh less than the mass of the original mixture.

Explain your answer.

This item measures the student's ability to explain conservation of matter.

Criteria for a complete response:

1. B is circled as the correct response.
2. Explanation demonstrates an understanding of conservation of matter.

Possible explanations: The student includes the reasoning that nothing has been added and nothing has been taken away or that there is reversibility (the mixture can be taken apart and put back together).

Code	Response
	Complete Response
10	Response meets the criteria above.
11	C is circled with a reasonable explanation that accounts for the parts of the mixture weighing less, e.g., spillage or absorption by the filter.
19	Any other completely correct response.
	Incorrect Response
70	Chooses B with an incorrect explanation or no explanation.
76	Response repeats the substance or stem of the question.
79	Any other incorrect response.
	Non-Response
90	Crossed out, erased, illegible, or impossible to interpret.
99	Blank.

4. Measure the mass of each 30 ml sample. Record your results on the chart below.

This item measures the student's ability to accurately weigh and record the mass of three sample solutions.

Criteria for a complete response:

1. Recorded mass of the solutions indicates that Solution A is the heaviest, Solution B is in the middle, and Solution C is the lightest.
2. Recorded mass includes grams.

Code	Response
	Complete Response
10	Response meets the criteria above.
	Incorrect Response
70	Response does not include a unit of measurement.
71	Response includes an incorrect unit of measurement.
72	Recorded mass of the solutions is out of sequence.
79	Any other incorrect response.
	Non-Response
90	Crossed out, erased, illegible, or impossible to interpret.
99	Blank.

5. Why is the mass of Sample C less than Sample A?

This item measures the student's ability to recognize that when a pure substance is diluted with water, an equal volume of the diluted solution will have less mass than the pure substance.

Criterion for a complete response:

1. States that Sample C is less than Sample A because Sample C is diluted (or mixed) with water.

Code	Response
	Complete Response
10	Meets the criterion above.
19	Any other partially correct response.
	Incorrect Response
70	Describes changes in the physical properties of Solution C other than mass.
76	Repeats the substance or stem of the question.
79	Any other incorrect response.
	Non-Response
90	Crossed out, erased, illegible, or impossible to interpret.
99	Blank.

6. A new Solution D (Pure + 180 ml of water) was made. Using the data, predict the mass of Solution D.

This item measures the student's ability to analyze data for a trend and make a prediction supported by the data.

Criteria for a complete response:

1. Logical prediction for mass of Solution D.
2. B is circled as the correct response.
3. Explanation shows an understanding of the effect that diluting the solution has on its mass.

Code	Response
	Complete Response
20	Meets the criteria above.
29	Any other completely correct response.
	Partially Correct Response
10	Logical prediction for mass of Solution D. Circles B but explanation is flawed.
11	Circles B with correct explanation but fails to make a logical prediction for mass of Solution D.
19	Any other partially correct response.
	Incorrect Response
70	Circles B with an illogical prediction of mass for Solution D and flawed explanation.
76	Repeats the substance or stem of the question.
79	Any other incorrect response.
	Non-Response
90	Crossed out, erased, illegible, or impossible to interpret.
99	Blank.

7. Using the data on the chart above, which liquid (vegetable oil, water, or rubbing alcohol) would be most useful in making solutions with the substances tested? Explain your answer.

This item measures the student's ability to interpret solubility data from a chart in order to identify the solvent that dissolves the most substances.

Criteria for a complete response:

1. Identifies water as the most useful liquid in making solutions with the substances tested.
2. Explains that water would be the most useful in making solutions because more substances dissolve in water than in vegetable oil or alcohol.

Code	Response
	Complete Response
10	Meets the criteria above.
11	States there were more "yes" responses on the data chart for water.
19	Any other correct response.
	Incorrect Response
70	Identifies vegetable oil or rubbing alcohol as being the most useful substance.
71	The response explanation does not relate to data on the chart, e.g., is pure.
72	States a substance tested instead of a solvent.
76	Repeats the substance or stem of the question.
79	Any other incorrect response.
	Non-Response
90	Crossed out, erased, illegible, or impossible to interpret.
99	Blank.

