IN THE MIX!

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Annotation

In this inquiry exercise, students will devise a procedure to separate and quantify the components of a mixture containing sand, salt, and iron filings.

Primary Learning Outcomes:

Students will be able to design and follow a laboratory procedure.

Students will be able to identify matter as an element, compound, or mixture.

Students will be able to classify a mixture as homogeneous, heterogeneous, or a solution.

Students will be able to recognize physical properties of mixture components that allow for the separation of the components from the mixture.

Students will be able to separate and quantify the mass off the components of an unknown mixture.

Students will be able to communicate scientifically the procedures and results of the exercise.

Georgia Performance Standards:

Characteristics of Science

SCSh2. Students will use standard safety practices for all classroom laboratory and field investigations.

SCSh3. Students will identify and investigate problems scientifically.

SCSh4. Students use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.

SCSh5. Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.

SCSh6. Students will communicate scientific investigations and information clearly.

SCSh8. Students will understand important features of the process of scientific inquiry.

Physical Science Content

SPS2. Students will explore the nature of matter, its classifications, and its system for naming types of matter.

Chemistry Content
SC1 Students will analyze the nature of matter and its classifications.

Duration:
Preparation: 30 minutes
Introduction: 5 minutes
Lab Exercise: 70 minutes
Discussion: 15 minutes
Total Class Time: 90 minutes

Materials and Equipment:
For Teacher Preparation:

1. Sand
2. Salt
3. Iron filings
4. Large mixing bowl
5. 1 L Beaker

Suggested Materials To Have Available for Students:

1. Electronic balance(s)
2. Hotplates or Bunsen burners
3. Ring stands
4. Clamps
5. Funnels
6. Filter paper
7. Beakers
8. Tongs
9. Magnets
10. Sieves
11. Graduated cylinders
12. Heat-resistant gloves

Safety:
The primary safety concern in this laboratory exercise is the heat produced when using hotplates or Bunsen burners. Ensure students use caution when handling hot objects.

Technology Connection:
Not applicable.

Procedures:
Teacher Preparation:
Prepare a mixture with known mass ratios of sand, salt, and iron filings.
Place the mixture in a 1 L beaker to be used by students.

Estimated Time:
30 minutes

Introduction:
Show students the 1 L beaker containing the sand, salt, and iron filings. Explain to students that their assignment will be to determine the mass of each of the mixture components contained in the 1 L beaker. Tell them that they will obtain a 100 mL sample of the mixture, as well as 50 mL samples of each of the components, and will be allowed to use any of the available laboratory equipment to complete the assignment. Explain to the students that each group will independently develop and carry out a procedure that allows them to separate the mixture components and quantify the mass of each component. Lastly, explain to students the grading procedures found below.

Estimated Time:
5 minutes

Lab Exercise:
Students should obtain a 100 mL sample of the mixture contained in the 1 L beaker, as well as 50 mL samples of each of the three components. Students should use any available equipment to develop and perform a procedure to separate the mixture into its components. **ALL** procedures, including failed attempts, should be documented. Once the mixture has been separated into its components, students should quantify the mass of each component. This data should then be used to calculate the mass of each component of the mixture contained within the 1 L beaker.

Estimated Time:
70 minutes.

Discussion:
Have each group present to the class, in two minutes or less, their separation procedure. Following the presentations, as a class, discuss the methods chosen, the reasoning each was selected, and the physical characteristics that made the separation possible.

Post-lab Questions:
Students should answer the following questions based on the data they collect during the exercise:

1. Classify the mixture used in this exercise as homogeneous or heterogeneous and each of its components as a compound or element.
2. If a solution was formed during the procedure, identify the solute and solvent. Briefly describe the properties of each that are important in the formation of a solution.
3. What mass of each of the components was added to the 1 L beaker to form the mixture used in this exercise?
4. Suppose a fourth component, poppy seeds, was added to the mixture. How might you go about separating the poppy seeds from the mixture?
5. Identify sources of error in your procedure and quantification of the components. What might you do differently if you were to perform this activity again?

Estimated Time:
15 minutes

Assessment:
Assessment should be based on process skills demonstrated during the laboratory exercise, reproducibility of procedures (i.e. could you recreate their procedures based only on their lab notes), accuracy of their results, and quality of post-lab write-up and interpretations. The following rubric may be used as a guideline.
Total Points = 100

1. Accuracy of Results and Calculations (30 points)
    - Relative Percent Difference ≤10% - 30 pts
    - 10-20% - 25 pts
    - 20-30% - 20 pts
    - 30-40% - 15 pts
    - 40-50% - 10 pts
    - >50% - 5 pts
2. Procedure (20 points)
3. Laboratory Write-Up (20 points)
4. Post-Lab Questions (30 points)