

RET Lesson Plan

Title: Identifying “Mystery” Powders

Primary Subject Area: 8th Grade Physical Science

RET Teacher: Brenda Neagle

School: Nichols Middle School

District: Middleboro, MA

Overview of lesson: Students will discover that even though the physical properties of different substances are similar, i.e. color, luster, texture and transparency, there are other properties that make the substance unique including density, chemical reaction to different substances- physical and chemical changes; and “fingerprints” of the substance using a spectroscopy.

Students will travel through a series of stations to test their mystery powder and determine what it is by comparing it to known substances.

Objectives/Goals:

- Students will use inquiry to determine the “mystery” substance through a series of inquiry based lessons- including physical/chemical changes, compare/contrast of physical properties and “fingerprints” of known substances to the unknown substance.
- Students will review physical and chemical changes and will use this knowledge to determine the unknown sample
- Students will use lab equipment such as triple beam balance, graduated cylinder and metric rulers to determine the density of the mystery powder
- Students will be able to work cooperatively to arrive at an answer.

Approximate Duration: 2-3 forty-five minute classes

MASSACHUSETTS CURRICULUM FRAMEWORKS

Physical Science

Grades 6-8

PS 2 - Differentiate between mass and volume. Define Density

PS 3 – Recognize that the measurement of volume and mass requires understanding of the sensitivity of measurement tools (e.g., rulers, graduated cylinders, balances) and knowledge and appropriate use of significant digits.

PS 10 - . Differentiate between physical changes and chemical changes.

High School Chemistry

1. Properties of Matter

Central Concept: Physical and chemical properties reflect the nature of the interactions between molecules or atoms, and can be used to classify and describe matter.

- 1.1** Identify and explain physical properties (e.g., density, melting point, boiling point, conductivity, malleability) and chemical properties (e.g., the ability to form new substances). Distinguish between chemical and physical changes.

Lesson Materials and Resources

- Baking soda
- Baking powder
- Cornstarch
- Water
- Vinegar
- Iodine
- Laminated “fingerprints” from Raman Spectroscopy Microscope of baking soda, baking powder and cornstarch

Technology Tools and Materials

Triple beam balance

Graduated cylinder

Raman spectroscope

Digital Microscope with slides

Background Information:

This lesson is to help students have a deeper understanding about properties, chemical /physical changes and also understand about the growing trend of how much the science field is linked to the tech/engineering field and it is necessary to have an understanding of both for the products and research in today's changing world.

Pre-lab: All students will have completed the physical /chemical changes lab on different powders and data should be in their Science Lab Notebook. They will use the data collected previously for this lab. They will have a basic understanding of identifying physical and chemical changes as well as know how to find the density of objects. This lab will be its application.

Lesson Procedures:

Introduction:

Each student will receive a given scenario to set the stage

Background music such as the Who (for CSI) or the music for Mission Impossible.

"The crime scene investigators are inundated with work and they need your help. There was a body found 2 doors down and they need to collect and examine the evidence. There was some white powder that was found around the body and your job is to identify what it is. They were able to extract some of the powder from the crime scene so that you can test it."

After reading the scenario, there will be a discussion with the class to brainstorm ways in which we can figure out what the powder is. The discussion will start with, "Can you think of any labs that we did that could help us determine what this is?"

Have students work in pairs and brainstorm for 5 minutes – then put answers on the board. Hopefully, the majority of responses will be emulating the first two stations (below) and then this would segue into "fingerprints" on the Raman Microscope—which would be the 3rd station.

There will be three stations set up in the lab; Each station should take about 15 -20 minutes

Station 1 – *Students will be figuring out what the mystery powder is by checking the physical and chemical changes of the mystery powder and referring to previously recorded data to see which one it matches.*

Using the data from the physical/ chemical changes labs, you will test this mystery powder in the same way that you did the other known powders. After you have recorded your results, you will use the data to determine which, if any, this powder matches.

Record your findings on the data sheet.

Station 2 - Determining the density of objects – students will understand that objects have their own unique density. They will find the mass and the volume of the unknown substance. Divide mass by the volume to determine the density.

Look up densities of known objects- either google or ... check out www.powderandbulk.com then toggle down on the left to Bulk Density Tables – (** Remind students that Baking Soda is compound called Sodium Bicarbonate**)

Compare results and see if they can match it up.

*** This may be difficult because I would suspect that some students will pack in the powder while others don't ***

Station 3 - There will be 2 things set up at this station

One will be the laminated fingerprints of the cornstarch, baking soda and baking powder. The teams will get their mystery fingerprint with their mystery powder.

The other part will have the digital microscope set up with prepared slides of baking soda, cornstarch and baking powder. They will examine and record what they saw in their science notebooks and compare it with their mystery powder.

Assessment Procedures

Informal – teacher will be walking around the room and ensuring that they are on task

Formal assessment –**Paper will be made up with questions – see Appendix**

Name: _____ Date: _____ Group _____

The Case of the Mystery Powder

Please copy and record your data with answers of the following questions in your Science notebook.

Station 1

Copy chart : Explain what happened when it was mixed with the following liquids:

	Vinegar	Water	Iodine
Mystery powder			

Check out the data chart from Physical and Chemical Changes and see if these results looked similar to any of the known powders.

Record this information in chart and explain which known powder has similar physical/chemical changes.

Station 2

What was the mass of the powder? _____

What was the Volume of the powder? _____

Explain how you found each, what instrument did you use?

Calculate the Density. _____

Did it match any of the powders in the table? Which one?

Would the density change if you had a different amount of the sample? Why or why not? _____

Station 3

Which fingerprint from the Raman microscope most resembled your "fingerprint"? _____

Draw and label the 3 slides of the known substances –
Draw and label the slide of the unknown.

Did all 4 tests lead you to the same substance? _____

If yes, what do you think the mystery powder is?

If you answered no, what do you think the different powders were? How could you explain the different results with different tests? Is there any other tests that you can think of that would confirm the actual powder?

