MATTER, MATTER, EVERYWHERE!
(A Study of Matter and its Physical Properties)
Ideas for a Mini-Unit: A Work in Progress

Core Content: Properties and Changes in Properties in Matter

SCM1.1.1 A substance has characteristic physical properties (e.g., density, boiling point, solubility) that are independent of the amount of the sample. A mixture of substances often can be separated into the original substances by using one or more of these characteristic physical properties.

Academic Expectation: 2.1 Scientific Ways of Thinking and Working

Skills: measuring, collecting data, using/constructing tables and graphs, inferring and predicting, communicating results

The Challenge: Matter, matter, everywhere! Everywhere you look, everywhere you go, you are surrounded by matter. In fact, you are matter!

Matter can be defined as anything that has mass and takes up space. But, we don't want to stop with only a definition! Not only can matter be defined; it can also be described. Scientists use the physical properties of matter to describe it.

During this unit, you and your partners will work together to investigate and describe matter using several different physical properties. At the completion of this unit, you will use these same physical properties to determine how to separate a mixture into its original components. So come on and let's start investigating!

Pre-Assessment:

1. Matter is _____.

2. Name the three states of matter and give an example of matter in each of these states.

3. Define physical property:

4. Give an example of a physical property that can be used to describe matter.

5. Choose an object (matter) in the classroom and describe it as fully as possible.

The pre-assessment portion of the unit is definitely a work in progress. This part of the unit can be used to introduce the key vocabulary that students may or may not be familiar with before beginning the tasks.

Performance Tasks:

Task 1: Practical Measurement Lab

Students will use appropriate tools to measure such physical properties as mass, temperature, volume, length, and width.

An example lab sheet is included showing the different types of stations students might be expected to visit and complete measurements.

Supplies needed: triple beam balances, thermometers, graduated cylinders, metric rulers, miscellaneous objects

Task 2: Boiling Point

Students will complete a lab activity comparing the boiling points of water and salt water. This can be done as cooperative groups, or it also works well as a demonstration. Students chart the temperature of the two samples over a Bunsen burner every 30 seconds for 8 minutes and 30 seconds. After all temperatures have been recorded, students graph the data in a double line graph to make a visual comparison.

An example lab sheet is included.

Supplies needed: large test tubes, water, salt water, two hole stoppers with thermometers inserted in one hole, test tube clamps, and Bunsen burners

Task 3: Factors Affecting Solubility

Students will complete a lab activity to determine how the solubility rate of sugar is affected by crushing, heating, and stirring.

An example lab sheet is included.

Supplies needed: sugar cubes, beakers, graduated cylinders, Bunsen burner or hot plate, stirring rod or spoon

Task 4: Liquid Layer Cake

Students will complete a lab activity to investigate what can be learned about density by studying a liquid system. This works well as a demonstration using a large beaker or graduated cylinder. It can also be completed in cooperative groups using clear plastic cups. Students can make predictions about the density of certain substances based on their prior knowledge of those substances. Students can diagram their predictions as well as the actual results for comparison.

An example lab sheet is included.

Supplies needed: salt water, vegetable oil, alcohol, food coloring, rubber band, bean seed, popcorn kernel, styrofoam piece, penny, aluminum foil ball, other items you would like to test, large beaker or graduated cylinder or clear plastic cups

Task 5: Separating Mixtures

Students will complete a lab activity to determine what physical properties can be used to separate a mixture of earth materials. Students will predict how to separate a variety of mixtures, and then will use their hypotheses to actually separate the mixtures. (Note: I did this with my classes as a demonstration. At the end of the day, we had a large bowl of salt water that we placed in our classroom window. Students continued to observe this over several days as the water evaporated and dry salt was left behind.)

An example lab sheet is included.

Supplies needed: sand, iron filings, water, salt, clear glass bowls or pie plates, spoon, magnet

MEASUREMENT LAB

alance	# 1	_____
alance	# 2	_____
alance	# 3	_____
alance	# 4	_____
alance	# 5	_____
alance	# 6	_____
mp. in shade	# 7	_____
mp. in sun	# 8	_____
p. of ice water	# 9	_____
aduated cylinder	# 11	_____
aduated cylinder	# 12	_____
aduated cylinder	# 13	_____
gth of science table	# 14	_____
gth of your shoe	# 15	_____
idth of your nkie	# 16	_____

PHYSICAL SCIENCE
PERIOD _____
LAB: BOILING POINT

I. PROBLEM:

DO ALL SUBSTANCES HAVE THE SAME BOILING POINT? WHAT IS THE BOILING POINT OF WATER? WHAT IS THE BOILING POINT OF SALT WATER?

II. PROCEDURES:

A. PREPARE TWO LARGE TEST TUBES FOR THE LAB. ONE TEST TUBE CONTAINING WATER AND THE OTHER CONTAINING SALT WATER. YOU MAY WANT TO USE BOILING CHIPS TO ENSURE EVEN HEATING.

B. EACH TEST TUBE SHOULD HAVE A TWO HOLE STOPPER WITH A THERMOMETER INSERTED IN ONE OF THE HOLES TO RECORD THE TEMPERATURE.

C. HOLD THE TEST TUBE WITH A TEST TUBE CLAMP OVER AN ALCOHOL BURNER OR A BUNSEN BURNER FOR HEATING.

D. READ THE TEMPERATURE OF THE LIQUID EVERY 30 SECONDS UNTIL THE LIQUID HAS BEEN BOILING FOR ABOUT 5 MINUTES.

E. RECORD THE TEMPERATURE IN YOUR OBSERVATIONS CHART AND GRAPH THE RESULTS AFTER YOU COMPLETE YOUR DATA.

III. OBSERVATIONS:

TIME	TEMPERATURE OF WATER	TEMPERATURE OF SALT WATER
30 SEC.		
1 MIN.		
1 MIN. 30 SEC.		

III. OBSERVATIONS:

TIME	TEMPERATURE OF WATER	TEMPERATURE OF SALT WATER
2 MIN.		
2 MIN. 30 SEC.		
3 MIN.		
3 MIN. 30 SEC.		
4 MIN.		
4 MIN. 30 SEC.		
5 MIN.		
5 MIN. 30 SEC.		
6 MIN.		
6 MIN. 30 SEC.		
7 MIN.		
7 MIN. 30 SEC.		
8 MIN.		
8 MIN. 30 SEC.		

NOW REMEMBER TO GRAPH THE TEMPERATURES OF EACH LIQUID.

IV. INTERPRETATIONS:

1. WHAT IS THE BOILING POINT OF WATER?

2. WHAT IS THE BOILING POINT OF SALT WATER?

3. WHAT DOES A DIFFERENCE IN BOILING POINT REVEAL?

4. HOW DOES THE BOILING POINT OF ANTIFREEZE COMPARE TO THE BOILING POINT OF WATER?

5. HOW DOES THE BOILING POINT OF ANTIFREEZE HELP PROTECT THE RADIATOR IN A CAR?

6. HOW CAN THE BOILING POINT OF A LIQUID HELP YOU IDENTIFY AN UNKNOWN SUBSTANCE?

V. CONCLUSION:

DO ALL SUBSTANCES HAVE THE SAME BOILING POINT? EXPLAIN.

PHYSICAL SCIENCE _____

PERIOD____ _____

LAB: FACTORS AFFECTING SOLUBILITY

I. PROBLEM:

HOW IS THE SOLUBILITY RATE OF SUGAR AFFECTED BY CRUSHING, HEATING, AND STIRRING?

II. PROCEDURES:

A. MEASURE 200 ML OF WATER IN A BEAKER. ADD TWO SUGAR CUBES. MEASURE THE AMOUNT OF TIME IT TAKES FOR THE SUGAR CUBES TO DISAPPEAR.

B. BRING 200 ML OF WATER TO A BOIL IN A BEAKER. ADD TWO SUGAR CUBES. MEASURE THE AMOUNT OF TIME IT TAKES FOR THE SUGAR CUBES TO DISAPPEAR.

C. CRUSH TWO SUGAR CUBES INTO SUGAR GRANULES. ADD THE SUGAR TO 200 ML OF WATER. CAREFULLY WATCH THE SUGAR GRANULES AND MEASURE THE AMOUNT OF TIME IT TAKES FOR THE GRANULES TO DISAPPEAR.

D. PLACE TWO SUGAR CUBES IN A BEAKER WITH 200 ML OF WATER. USING A STIRRING ROD OR A SPOON, CONTINUALLY STIR THE WATER UNTIL THE SUGAR CUBES DISSOLVE. RECORD THE TIME IT TAKES FOR THE CUBES TO DISAPPEAR.

III. OBSERVATIONS:

RATES OF SOLUBILITY:

A. WATER _____ MIN. _____ SEC.

B. HEATING _____ MIN. _____ SEC.

C. CRUSHING _____ MIN. _____ SEC.

D. STIRRING _____ MIN. _____ SEC.

Assessment:

OPEN RESPONSE PHYSICAL PROPERTIS

Physical properties are characteristics that can be used to describe and identify unknown substances. They can also be used to separate mixtures into their pure components.

You have been given a mixture that contains iron filings and salt.

A. Contrast three physical properties of the two substances in the mixture.
B. Describe one process that could be used to separate the mixture.

SEPARATING MIXTURES

PURPOSE: The purpose of this demonstration is to determine what physical properties can be used to separate a mixture.

RESEARCH: In Monday's lesson we defined physical properties, mixtures, and solutions using examples of each.

HYPOTHESIS: Predict how you could separate each of these mixtures.

Mixture	Prediction
a. sand, iron filings	
b. sand, water	
c. sand, salt, water	

EXPERIMENT: Create each mixture. Separate each mixture using the hypotheses given by students.

ANALYSIS: Record your observations during the demonstration.

Mixture	Observations	Method to Separate
A.		
B.		
C.		

1. What physical property did we use to separate mixture A?

2. What if both substances in mixture A had this same property? Could you still use the same method? Explain.

3. What physical property did we use to separate mixture B?

4. What physical properties did we use to separate mixture C?

5. Describe another method you could use to separate mixtures.

CONCLUSION: How can the properties of different substances allow us to separate mixtures?

LAB ACTIVITY NAME_____
PERIOD _____ DATE_____

LIQUID LAYER CAKE

Purpose: What can you learn about density by studying a liquid system?

Research: What is density?

Hypothesis: Predict where each liquid in the system will be located when all are mixed together. Predict where each item on the materials list will end up in the liquid system.

Liquids—salt water
Vegetable oil
Alcohol

Materials—two drops of food coloring
Rubber band
Bean seed
Popcorn kernel
Styrofoam piece
Penny
Aluminum foil ball
Other items you would like to test

Experiment: Make a liquid system in a clear beaker or graduated cylinder by slowly pouring in salt water, vegetable oil, and alcohol. Make observations about this liquid system. Test your hypotheses by dropping in each item on the materials list. Make observations about where they actually end up in the liquid system.

Analysis: Record your observations during the demonstration of the liquid layer cake. Use the space given to draw the liquid system and show where each item ends up in the liquid system.

IV. INTERPRETATIONS:

1. WHAT IS A SOLVENT?

2. WHAT IS THE SOLUTE?

3. DEFINE SOLUBILITY RATE.

4. WHAT IS THE FASTEST WAY TO DISSLOVE A SUBSTANCE?

5. LIST TWO WAYS THAT SOLVENTS ARE USED IN OUR DAILY LIVES.

   A.

   B.

V. CONCLUSION:

HOW IS THE RATE OF SOLUTION AFFECTED BY CRUSHING, HEATING, AND STIRRING?