Module 2: Biochemistry

Topic 1 Application: Properties of Water Scientific Investigation

Before you begin the scientific investigation below, make sure to download the *Properties of Water Scientific Investigation Report*. As you complete this scientific investigation, fill in any needed information on the report template. If you need more information about each section of the report, please visit the Developmental Module.

Introduction

Water is a part of your daily life. Whether you use it to bathe, clean, drink, or you are running from it to shelter from the rain, you are constantly interacting with water. Maybe it is because water is usually so common, that you do not pay attention to the amazing properties of water that make life on earth possible.

Objectives

In this scientific investigation, you will:

- examine how water behaves in a variety of conditions; and
- explore the various properties of water.

CAUTION: This scientific investigation requires the use of heat source, as well as heated liquids and knives. Make sure to perform this investigation under the supervision of an adult. In addition, you should review laboratory techniques and safety suggestions prior to conducting this scientific investigation.

Hypothesis

Using the **Procedure and Data Collection** section below, read through the procedural information for each section of this scientific investigation. Based on your understanding of the procedure, develop your own hypotheses which describe your expected results. Record these hypotheses in the **Hypothesis** section of your *Properties of Water Scientific Investigation Report*.

Equipment and Materials

This list includes information about all of the equipment and materials needed for all parts of this scientific investigation. Information about the equipment and materials needed for each part is included in the **Procedure and Data Collection** section below.

- Aluminum Foil (2 Sheets)
- Blue Food Dye
- Cooking Oil
- Dishwashing Detergent
- 3 Celery Stalks
- Clear Glass Measuring Cup
- Clear Glass or Plastic Drinking Glasses
- Kitchen Tongs
- Measuring Spoon (tsp.)
- Medicine Dropper
- Medium Bowls
- Metric Ruler
- Pepper
- Plastic Knife
- 2 Pots
- Red Food Dye
- Soda Can (Empty and Cleaned)
- Spoon
- Table Salt
- Thermometer
- Toothpick
- Water

Procedure and Data Collection

The procedures and data collection for this scientific investigation is divided into five different parts. Make sure to complete each part of the investigation. In addition, make sure that you record the appropriate data in each section's data collection area on the *Properties of Water Scientific Investigation Report*.

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Part I

For this part of the scientific investigation, you will need the following equipment and materials:

- 2 Clear Glass or Plastic Drinking Cups
- Cooking Oil
- Measuring Cup
- Measuring Spoon (tsp.)
- Spoon
- Table Salt
- Water

1. Add ½ cup of water to one drinking cup.
2. Add one teaspoon of table salt to the cup with water.
3. Stir salt and water for 60 seconds. Observe the mixture afterwards.
4. Record your observations in the first row of the table in the **Data** section of the *Properties of Water Scientific Investigation Report*.
5. Add ½ cup of cooking oil to the second drinking cup.
6. Add one teaspoon of table salt to the cup with oil.
7. Stir salt and cooking oil for 60 seconds. Observe the mixture afterwards.
8. Record your observations in the second row of the table in the **Data** section of the *Properties of Water Scientific Investigation Report*.
9. Clean and dry your equipment and materials.

Part II

For this part of the scientific investigation, you will need the following equipment and materials:

- Clear Glass Measuring Cup
- Water

1. Add 1 cup of water to the clear glass measuring cup.
2. Place the measuring cup on a flat surface.
3. Lean over to get eye-level with the water line in the measuring cup.
4. Observe the shape of the water.
5. Record your observations and create a drawing of what you see in the **Data** section of the *Properties of Water Scientific Investigation Report*.
6. Clean and dry your equipment and materials.

Part III

For this part of the scientific investigation, you will need the following equipment and materials:

- Blue Food Dye
- 3 Celery Stalks
- 3 Clear Glass or Plastic Drinking Cups
- Medium Bowl
- Metric Ruler
- Plastic Knife
- Red Food Dye
- Water

1. Fill 3 glass drinking cups with 1 ½ cups of water each.
2. Label one of the cups as Cup A, one of the cups as Cup B, and one of the cups as Cup C.

3. Drop 2 drops of red food coloring into the water in Cup A.
4. Drop 2 drops of blue food coloring into the water in Cup B.
5. Do NOT add any food coloring to the water in Cup C
6. Pour additional water into a medium bowl.
7. Submerge the end of one celery stalk in the bowl of water, and cut off about two centimeters from the bottom of the celery stick.
8. Immediately place the celery stick into Cup A with the cut side facing down into the water.
9. Repeat this process with the other two sticks of celery, placing one into Cup B, and one into Cup C.
10. Immediately observe what is happening to the celery and cups. Record both quantitative and qualitative observations in the **Data** section of the *Properties of Water Scientific Investigation Report*.
11. After five hours, observe what is happening to the celery and cups. Record both quantitative and qualitative observations in the **Data** section of the *Properties of Water Scientific Investigation Report*.
12. After 24 hours, observe what is happening to the celery and cups. Record both quantitative and qualitative observations in the **Data** section of the *Properties of Water Scientific Investigation Report*.
13. After 48 hours, observe what is happening to the celery and cups. Record both quantitative and qualitative observations in the **Data** section of the *Properties of Water Scientific Investigation Report*.
14. After you have made all of your observations, clean and dry your equipment and materials.

Part IV

For this part of the scientific investigation, you will need the following equipment and materials:

- 1 Cup Cooking Oil
- 1 Cup Water
- Kitchen Tongs
- A Pot of Boiling Water
- A Pot of Ice Water
- Soda Can (Empty and Cleaned)
- Thermometer

1. Fill the soda can with 1 cup of water.
2. Remove the pot of water from the burner, and place the soda can in the pan of hot water.
3. Insert the thermometer in the soda can. Leave the can in the water bath until the water inside the can reaches 200 °F.
4. Using kitchen tongs, remove the soda can from the hot water and place it in the ice water bath.
5. For five minutes, measure the temperature of the water every 30 seconds, recording the temperature readings in the **Data** section of the *Properties of Water Scientific Investigation Report*.
6. Repeat Steps 1-6 with the cooking oil.
7. After you have made all of your observations, clean and dry your equipment and materials.

Part V

For this part of the scientific investigation, you will need the following equipment and materials:

- Aluminum Foil (2 Sheets)
- Dishwashing Detergent
- Dropper
- Pepper
- Toothpick

1. Using the dropper, place several drops of water onto one piece of aluminum foil. Observe the water from above and at eye-level on the aluminum foil. In the **Data** section of the *Properties of Water Scientific Investigation*

Report, describe in detail the physical appearance of the water. Create a drawing of both views of the water drops.

2. Moving your finger slowly down toward the drop of water, carefully place your finger just above a drop. In the **Data** section of the *Properties of Water Scientific Investigation Report*, describe in detail what happened as you moved your finger.
3. Place several more drops of water next to the ones already on the foil. In the **Data** section of the *Properties of Water Scientific Investigation Report*, describe in detail what happened when you added the additional drops of water.
4. Place a small drop of dishwashing detergent onto one of the larger drops of water. Compare the shape of the water with the shape of another large drop of water with no detergent in it. In the **Data** section of the *Properties of Water Scientific Investigation Report*, describe in detail the differences between the two drops, as well as create a drawing of the drop with the detergent.
5. Pour a small amount of water on the second sheet of aluminum foil. Sprinkle the surface with a small amount of pepper. In the **Data** section of the *Properties of Water Scientific Investigation Report*, describe in detail what happened to the water when you added the pepper.
6. Put a small drop of detergent on the end of a toothpick, and touch the toothpick to the center of the water with the pepper. In the **Data** section of the *Properties of Water Scientific Investigation Report*, describe in detail what happened when you touched the pepper drop with detergent.
7. Clean and dry your equipment and materials.

Data

Use the tables provided in the **Data** section of your *Properties of Water Scientific Investigation Report* to record your data from this scientific investigation. The data tables are also shown below:

Part I Data Table

Solvent	Observations
Water	
Oil	

Part II Data Table

Activity	Observations and Drawing
Adding Water to a Glass Measuring Cup	

Part III Data Table

	Quantitative Observations	Qualitative Observations
Initial Observation (0 Hours)	**Cup A:** **Cup B:** **Cup C:**	**Cup A:** **Cup B:** **Cup C:**
Second Observation (5 Hours)	**Cup A:** **Cup B:** **Cup C:**	**Cup A:** **Cup B:** **Cup C:**
Third Observation (24 Hours)	**Cup A:** **Cup B:**	**Cup A:** **Cup B:**

	Cup C:	**Cup C:**
Fourth Observation (48 Hours)	**Cup A:** **Cup B:** **Cup C:**	**Cup A:** **Cup B:** **Cup C:**

Part IV Data Table

	Temperature °F									
	30 seconds	**60 seconds**	**90 seconds**	**120 seconds**	**150 seconds**	**180 seconds**	**210 seconds**	**240 seconds**	**270 seconds**	**300 seconds**
Water										
Cooking Oil										

Part V Data Table

Activity	**Observations and Drawing**
Placing Several Drops of Water on Aluminum Foil	
Moving Your Finger Slowly Down Toward the Drop of Water	
Placing More Drops of Water on Aluminum Foil	
Adding Detergent to a Drop of Water	
Adding Pepper to a Drop of Water	
Adding Detergent to a Pepper Drop of Water	

Data Analysis

In the **Data Analysis** section of the *Properties of Water Scientific Investigation Report*, provide responses to the following questions:

Part I

1. Which is a better solvent for the salt - water or oil? Why?
2. Describe what this part of the scientific investigation demonstrates about the properties of water.

Part II

1. What property of water makes the water curve up the sides?
2. What property of water creates the curve down in the center of the meniscus?
3. Describe what this part of the scientific investigation demonstrates about the properties of water.

Part III

1. Which cup is the control in Part III?

2. Why is a control necessary in Part III?
3. Describe what this part of the scientific investigation demonstrates about the properties of water.
4. How is this property beneficial for plants?

Part IV

1. Create a line graph for each material/temperature change recorded in the data table.
2. Describe what information each graph demonstrates about the properties of water.
3. Your cells are composed mostly of water. How does the property of water demonstrated in this activity help your body maintain homeostasis?

Part V

1. In three to four sentences, summarize what you observed in this part of the scientific investigation.
2. Using the terms cohesion, adhesion, and surface tension, describe what this part of the scientific investigation demonstrates about the properties of water.
3. Which property of water explains the shape of the water drops, and how the drops interact with each other?
4. Did the detergent change the shape of the water? Why did this happen?
5. What happened when the pepper was sprinkled on the water? Why did this happen?
6. What effect did the detergent have on the pepper? Why?

Conclusion

Using the **Conclusion** section of the *Properties of Water Scientific Investigation Report*, compose three to four sentences describing an overall conclusion based on your data. Were your hypotheses true or false, and how do you know? Use the data and notes that you collected from your investigation to form your conclusion. Make sure that you include information that you gained from data analysis to support your conclusion.

Experimental Sources of Error

On your *Properties of Water Scientific Investigation Report*, provide responses to the following questions: Are there any sources of error? If so, what are they, and what could be done to minimize error?

Once you have completed the *Properties of Water Scientific Investigation Report*, please submit your work to the dropbox.