Science is Elementary

Inquiry and Engagement Using hands on Labs

Physical Science
Book 1

Simpson/Pack/Tucker
Draft

1.Water Quality Name……...

Vocabulary.
Analyze, conclusion, evidence, interpretation, procedure, describe, hypothesis, investigate, processes, classify, demonstrate, explanation, identify, observe, reasonable, inference, inquiry, predict, reliability, theories, formation, interaction, calculator, compass, equipment, hand lens, magnets, balance, beaker, hot plate, goggles thermometer, reusable resources, microscope, ruler, timing device, reuse, and collecting nets.

Choose the Problem from your **observations**…**a purpose or reason is established.**

e.g. Which sample of water would be safest to drink?

Questions and Research-Personal knowledge and experience can be used here.

What makes water safe? Make a list

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More Observations…Now Look at the water samples. Describe some of the characteristics you see (Physical)
1

2

3

Hypothesis A Statement (Educated Guess)

Experiment (Procedure) -Testing

Equipment needed/used

Testing your Hypothesis..What you did.
Each group will test one sample and share their data with the other groups.

Data Collection (You may need to redraw this table on a full page)

Sample	Temperature	pH	O2 Level	Conductivity	Microscope
1					
2					
3					
4					
5					

Analysis of data What did you discover? (similarities, differences etc)

Conclusion Did you prove your Hypothesis? Give reasons for your answer.

2. States of Matter-Density of Liquids Experiment

1. Question
What happens when we mix food coloring with samples pf water that have different temperatures.

2. Equipment and Materials

Equipment	**Materials**
Beaker (Measuring) Thermometer Temperature sensors Hand Held computer	Boiling Water Iced Water Room Temperature Water Food Coloring

3. Process

A. Record the temperature the temperature of each water sample in Degrees F and Degrees C
B. Add 2 drops of food coloring to each water sample. Watch what happens to the drops.

Record your observations below.

Sample	1.	2.	3.
Degrees F			
Degrees C			

Explain what happened to the food coloring and suggest a reason for this.

3. Hot and Cold Colors : Delving into States of Matter

Task : Observe how colored drops spread in different temperature liquids.

What is your prediction or hypothesis?
Choose One
____Colored drops will disperse at the same rate in all three liquids
____Colored drops will disperse more quickly in warm water
____Colored drops will disperse more quickly in cold water

Complete the Data Table below. *Use handhelds and the temperature sensor to measure temperature. You can then use the timer on the handhelds to measure how long it takes for the colored drops to disperse.*

	Temperature Degrees Fahrenheit	**Prediction when you add 5 drops of coloring**	**Observation : How long did it take to disperse?**
Liquid 1			
Liquid 2			
Liquid 3			

List the equipment you used.
1.
2.
3.

Conclusion

Extension

Draw diagrams to show the arrangement of particles in ice, water and water vapor.

4. Compounds and Elements

Part 1

A. Collect the two beakers with solids in each. Describe the characteristics of each substance.

B. Predict what will happen when you mix the water with each of the solids.

Water and Solid 1

Water and Solid 2

The following elements are sometimes called "building blocks" because they make up over 99% of the earth's crust, atmosphere, and oceans, by weight.

oxygen (0), silicon (Si), aluminum (Al), iron (Fe), calcium (Ca), sodium (Na), potassium (K), magnesium (Mg), hydrogen (H), phosphorus (P), chlorine (Cl), and carbon (C).

Part 2

Chlorine is an important "building block," one of a handful of single elements that combine to form most of the matter on the earth.

"Exploring chlorine compounds."

PROCEDURE

Note you will need to turn on the computer and go to the window called Graph. Once there press F1 to get your scale. To stop and start your graph you will need to press the large arrow in the centre of the control panel.

1. Collect two empty glass beakers per group.

2. Add water to each (half full only)

3. Use the hand held computer and temperature probe to measure changes in temperature. Place the probe in the water before you begin. Draw a graph to show the change in temperature.

4. Add **Substance 1** to one beaker of water and watch what happens to the temperature on the screen. Touch the side of the container. Can you feel anything? Draw a graph to show the change in temperature below.

5. Place the probe in your other beaker and add **Substance 2** Watch what happens to the temperature. Touch the side of the container. Can you feel anything? Draw a graph to show the change in temperature below.

6. Once this is done one group should test the pH with the probe and share their data with the other groups. Record your findings.

7. Test a piece of chalk in each container and record your observations.

8. Add Bromothymol Blue to each of your beakers. Observe and record what you see.

9. Add 3 drops of food coloring to each container. Record your observations and suggest why this has happened.

Note the difference between physical properties (appearance, color, odor, etc.) and chemical properties, which are determined by the interaction of the chlorine compound with other substances.

Student Data Table

compound	appearance	*temperature change in water*	*acid, base, or neutral*	chalk reaction	Bromothymol Blue Reaction
Substance 1 CaCl					
Substance 2 NaCl					

Summary Write a paragraph describing your findings.

5. Making Crystals…..

Background Information.

Borax is an example of crystal - "a solid with flat sides and a symmetrical shape because its molecules are arranged in a unique, repeating pattern."

Every crystal has a repeating pattern based on it's unique shape. They may be big or little, but they all have the same "shape". Salt, sugar, and Epsom salts are all examples of crystals. Salt crystals are always cube-shaped while snow crystals form a six-sided structure.

How do the Borax crystals grow? Hot water holds more borax crystals than cold water. That's because heated water molecules move farther apart, making room for more of the borax crystals to dissolve. When no more of the solution can be dissolved, you have reached saturation. As this solution cools, the water molecules move closer together again. Now there's less room for the solution to hold onto as much of the dissolved borax. Crystals begin to form and build on one another as the water lets go of the excess and evaporates.

This also applies to snowflakes - As water cools the molecules move closer together. Since all water molecules are shaped the same (H_2O) they align in a six sided crystal.

Activity.

Cut a pipe cleaner into three equal sections.

Twist the sections together at their centers to form a six-sided snowflake shape. Don't worry if an end isn't even, just trim to get the desired shape. The snowflake should fit inside the jar. (See diagram above)

Tie the string to the end of one of the snowflake arms. Tie the other end of the string to a pop stick. You want the length to be such that the pencil hangs the snowflake into the jar.

Fill the jar with boiling water.

Add borax one tablespoon at a time to the boiling water, stirring to dissolve after each addition. The amount used is 3 tablespoons borax per cup of water. It is okay if some undissolved borax settles to the bottom of the jar.

If desired, you may tint the mixture with food color.

Hang the pipe cleaner snowflake into the jar so that the pencil rests on top of the jar and the snowflake is completely covered with liquid and hangs freely (not touching the bottom of the jar).

Allow the jar to sit in an undisturbed location overnight

6. Matter :Testing Substances

Part 1

Materials and Equipment
Unknown Substances
Storage containers

Demonstration
Skillet
Heat source
Substance 1 and 2

Student Activity
Each group is given 2 cups, one with and substance 1 in it, and another with substance 2 in it.

Observations
Cup 1.

1. Take the cup and draw and describe your observations.
2. Write down questions you may think of as you observe the cup with ice in it.

Share your observations with the class.

Cup 2
LOOK AT THE CUP OBJECT AND RECORD YOUR OBSERVATIONS.

Share your observations.

Remember " just knowing a name does not explain how a substance behaves or what it really is"

Complete the data table below.

Substance	Characteristic 1	Characteristic 2	Characteristic 3	Characteristic 4
Substance 1				
Substance 2				

Part 2 Heat is added…..

Prediction for Substance 1………

Observations _____

Explanations……..

Prediction for Substance 2……

Observations for _____

Explanations……

Conclusions. “Nullius in Verba”

Extension 1

Using the hand held computers and temperature probes to measure the temperature of each substance in water. Record your findings.

Extension 2

Create your own experiment using one or more of the substances used today.

7. Science : Problem Solving

Mixture or Solution?

Part A
Material:, washers, sugar, water, two beakers or glasses, paper clips, toothpicks, bits of paper.
1. Fill the two beakers about half full with water.
2. Put a spoonful of sugar in one beaker and the washers, paper clips, toothpicks, and bits of paper in the other beaker.
3. Stir both beakers. What do you observe?
4. One of these beakers is a mixture and the other beaker contains a solution. Identify them.

QUESTIONS/CONCLUSIONS

1. Which beaker contains a mixture? Why?

2. Which beaker contains a solution? Why?

3. If you mix the sand, salt, chocolate powdered milk into a beaker of water, would you have a mixture or a solution?

4. Give your best definition of a mixture and a solution.

Part B

You have a mixture of sugar, sawdust, iron filings and pebbles. Design an experiment to separate these materials.

List of equipment Needed

Step 1

Step 2

Step 3

Step 4

Conclusion.

8. Force, Energy & Motion

The following is based upon a series of stations where students work in small groups

Station 1 Energy and Waves

Sound moves in both compression and transverse waves. This is an example of energy being transferred through the spring and how once it arrives at the end it is reflected back

Compression Waves

Use a slinky spring to send waves of energy back and forth. Do not stretch the spring too far. Vary the length of the spring by holding different numbers of coils and pushing the spring with varying degrees of force. Record your observations using a diagram and labels.

Transverse Waves

Send a wave down to your partner. Note. Is on your left or right? When it is reflected back from your partner which side is it on? Record your observations.

Standing Wave

Move the spring back and forth until you have a permanent wave. Record your observations.

Station 2 Energy and Light

Part 1.
Hold up a cardboard square, a plastic container, wax paper and a clear flask. Describe how the light in the room interacts or passes through each.

Observe the symbols on the Red Card. What is the secret message? Use a mirror to help you.

How did the mirror help you? What do we call this?

Part 2.
Hold the prism up to the light coming from the window and record what you see.

What are the colors of the rainbow?

Part 3.
Shine the flashlight through each jar of water. Use the light meter and hand held computer to monitor and record the differences. What happens when you change the distance between the light and the jar? How do the directions of the light beam change?

Station 3 Energy and Light

Part 1
Place a pencil I the jar of clear water and record your observations. What is this called?

Sound and Vibration. (You will need a tuning fork, water, ping pong ball, thread, tape, ruler, rubber band and pencil.)

Do the following
1. Hold the edge of the ruler tightly on your desk. Pluck the end of the ruler and listen. Make the ruler shorter. What differences did you notice?

2. Clench a craft stick in your teeth and pluck the end of the stick. Listen to the result. Now change the length of the stick and listen when you pluck it. What do you notice?

3. Strike a tuning for on the table. Watch and listen. Put the vibrating fork in water. Watch and record your observations.

4. *Choose 3 different tuning forks and test each using a sound sensor? What do you notice? Why do you think this is the case?*

5. Put a pingpong ball on a thread and touch it with a vibrating fork. Record your observations.

6. Wrap a rubber ban around a ruler length ways. Push a pencil under the rubber band and pluck the rubber band. Watch, Listen and record your findings? You may use the sound sensor to do this.

Station 4 Force and Motion

1. You will need a drinking straw, scissors, balloon, string line, masking tape, balloon and motion sensor. Your task is to get the straw from one end of the string to the other and record its speed/acceleration.

Record your observations.
Draw a graph to show the speed of the balloon.
What did you observe?

Newtons Law : action and reaction states that when an object is pushed it pushes back. When the balloon was opened the walls of the balloon pushed air out. When the balloon pushed against the air, the air pushed back and the balloon moved forward dragging the straw with it. The string and straw keep the balloon on a straight course.

Can you find something in real life that uses Newton's Law?

Station 5 Force and Motion

Use the motion sensor and ball to record a bouncing ball. Redraw your graph and label where PE and KE can be found. How does this compare to a roller coaster.

Station 6 Energy and Magnets

1. Magnetic attraction is a force that makes some things move toward a magnet. Choose 6 things from the table to test this.

Draw a data table to record your findings.

2. What happens when you put 2 N ends of a magnet together? A N and S together?

3. Using a nail, (copper), wire and large battery construct an electro magnet. Use it to pick up paper clips. Explain what is happening.

Sation 7 Light, Energy and Motion.

1. Place the radiometer near the light source and record what happens.

Move it away at 20 cm intervals. Record the light intensity and chart your findings below.

Distance from source	20cm	40cm	60cm	80cm
Intensity Reading				
Radiometer Observation				

Summarize your findings. Explain why this happened?

9. Density of Liquids Experiment

1. Question
What happens when we mix oil, water and syrup in the same container?

2. Equipment and Materials

Equipment	Materials
Beaker (Measuring) Plastic Cup Eye Dropper Petri Dish	Oil Syrup Water Food Coloring

3. Process
A. Use the measuring beaker to collect 50ml of water from the water bottle and add this to the plastic cup. Now do the same for Oil and then Syrup. After adding each of these liquids record in writing your observations. You may draw a diagram to help you.

B. Add 10 drops of food coloring to the plastic cup. Watch what happens to the drops. Record your observations.

C. Use and Eye Dropper to remove the liquid at the bottom of the plastic cup. Place the liquid in the Petri Dish. What is this liquid?

4. Observations
Record your observations after each step is completed.

Observation 1 (After the Oil is added)

Observation 2 (After the Syrup is added)

Observation 3 (After the Food Coloring is added)

Observation 4 (After the liquid has been removed using an Eye Dropper)

10. Melting Points and Boiling Points

Part 1 Melting Points

Fill a small plastic container with water and carefully place the end of a probe in the liquid. Place the container in the freezer and leave over night.

Remove the container from the freezer and attach the probe to the hand held computer. Turn the computer on and set to Graph Mode. Make sure you press F1 to vertically exaggerate your graph. (This will need to be explained to students i.e. what is exaggeration?)

Turn on the computer and then place the frozen ice in the pan on the heating element. Remember to remove the ice from the plastic container.

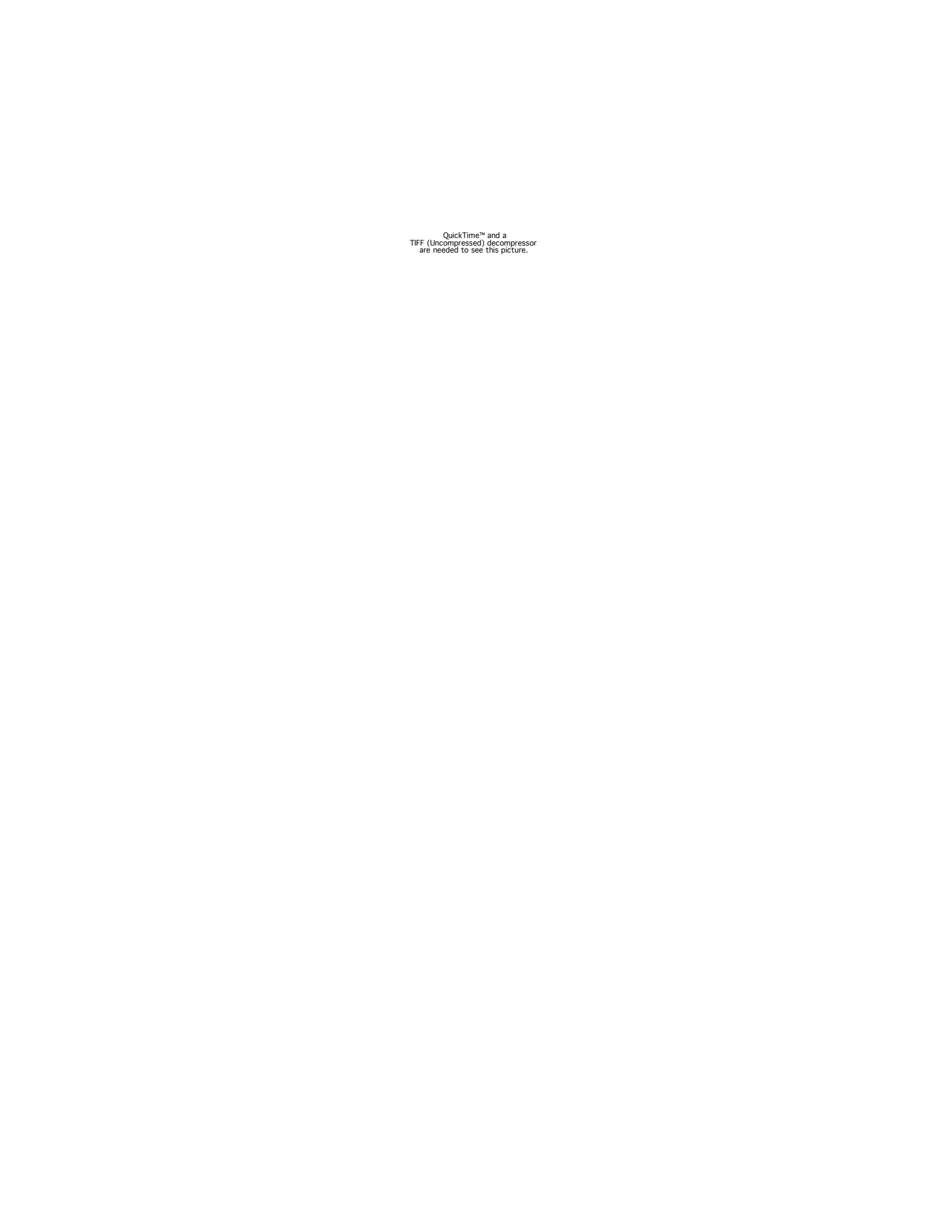
Watch the graph and identify the temperature at which the ice melts completely.

Print off the Graph and label each part.

Part 2 Boiling Points

Place a pan of water on a heating element and insert a probe that is connected to the hand held computer. Turn the computer on and start the graph. Watch to see at what temperature the water boils; r

Record this in degrees Fahrenheit and degrees Celsius. Print your graph and highlight the Minimum, Maximum and Boiling Point on your graph.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