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Lab 1: Introduction to Scientific Inquiry

Purpose

To show how the processes of scientific inquiry can help you learn about the natural world

Background

Scientific inquiry is a way of learning about the natural world by gathering information and then trying to make sense of it. Scientific inquiry does not always occur in the same way, but certain steps are often involved. Some steps that scientists often use in their investigations are posing questions, developing hypotheses, designing experiments, collecting and interpreting data, drawing conclusions, and communicating ideas and results.

Skills Focus

Posing questions, developing hypotheses, designing an experiment, collecting and interpreting data, interpreting a graph, predicting, drawing conclusions, communicating

Introduction

1. **Posing Questions** Have you ever observed how a gas in a balloon acts when heated? What did you see? What questions could you ask about how changing temperature affects the gas in a balloon? (Remember, the questions you ask should be questions that can be answered by making observations.)

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2. **Developing Hypotheses** Scientific inquiry moves forward when ideas can be tested. Your first step is to develop a hypothesis. A hypothesis is a possible answer to a scientific question or an explanation for a set of observations. Your hypothesis is not a fact. It must be tested. Your observations may support your hypothesis or they may not. If they do not support your hypothesis, you have not wasted your time. You have learned that your hypothesis is not correct and that you must explore further. Write a hypothesis about the volume of a balloon when the temperature of the gas in a balloon is changed.

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Circuit diagram

Describing What happens in your circuit?

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Analyze and Conclude

6. Some people think it is easier to build circuits just by moving around the components on the breadboard. However, as you have probably seen, that can get really messy with wires connecting all over the place. What is the advantage to planning circuits with a diagram?

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7. Describe how you can tell where the current is flowing in a circuit diagram.

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8. When would it be important to have a circuit diagram?

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9. In your life, where have you used something similar to a circuit diagram?

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f. Increase the voltage from the battery by clicking on the arrow next to the power button on the battery controller at the top.

g. You should see the light bulb assembled on the breadboard. If you connected your wires correctly, then the light bulb should be lit.

4. You will now build a circuit with a light bulb and an oscillating power source.

a. On the pad of paper, grab and drag the function generator symbol and place it on the right hand side of the paper. The function generator symbol is a circle with a sine wave symbol inside and has two lines representing wires coming out from the sides.

b. Now place a light bulb symbol on the pad to the right of the function generator.

c. Connect one end of the light bulb to the positive terminal of the function generator as you did in Step 3c above.

d. Attach the other end of the light bulb to the negative end of the function generator.

e. You should see the light bulb assembled on the breadboard. If you connected your wires correctly, then the light bulb should be lit. You will probably need to adjust the frequency on the function generator until you see the light bulb fade on and off as the voltage gradually increases and decreases. At what frequency do you see the light bulb blinking?

5. Now play around with building a circuit with the different batteries, light bulbs, capacitors, and inductors available. You will want to make sure your light bulb will light, but you can wire it however you want to. You must have 4 elements in your circuit.
Draw your circuit diagram in the box below and describe what happens when you connect the circuit. For example, does your bulb flash, does it blow out, does it start out lit, then turn off? You might need to change the amount of resistance, capacitance, and inductance from the default values. You do this by clicking on the label for each component and entering the amount. Here are some sample values if you need suggestions on component values: R1 = 100 Ω, C1 = 0.1F, L1 = .001H.

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Lab 49: Circuit Diagrams

Problem

Understand the meanings of the different symbols in circuit diagrams and learn how to create and use them

Background

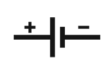
An electric circuit diagram is a symbolic drawing showing the elements of an electric circuit. The diagrams are drawn to make it easy to see the whole path through which a current is flowing, through all of the different parts of a circuit. Circuit diagrams can look like very complex mazes of wires and symbols. However, if you learn to break them down piece by piece, they will make sense. Knowing how to interpret circuit diagrams will help you understand how your house is wired and how simple electrical devices like flashlights and blow dryers work.

Skills Focus

Understanding procedures, relating concepts

Procedure

1. Start *Virtual Physical Science* and select *Circuit Diagrams* from the list of assignments. The lab will open in the Circuits laboratory.
2. The laboratory will be set up with all of the components in the boxes at the bottom of the table. Nothing will be on the breadboard, which is the board with holes in the middle of the table that we use to build circuits on. You will need to follow the instructions below to determine how to place the components on the diagram. You will also check to see if you correctly placed the components.
3. You will first build a circuit with a light bulb and a battery in series. You will be drawing the diagram on the pad of paper, which will automatically pull those actual elements out onto the breadboard and you will see the circuit being built as you draw it.
   a. On the pad of paper, grab and drag battery symbol and place it on the right hand side of the paper. The battery symbol has two small parallel lines labeled + and - and has two lines representing wires at right angles with the parallel lines coming out from the sides.

   b. Now find a light bulb symbol and place it on the pad to the left of the battery. This looks like an x in the middle of a circle.

   c. Connect one end of the light bulb to positive terminal of the battery by clicking and dragging the blue spot on the resistor to the green spot on the positive end of the battery.
   d. Attach the other end of the light bulb to the negative end of the battery.
   e. Now click the number above the light bulb and change its value to 100w.

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6. The virtual eye does not have a lens in it, like human eyes do, which means that light isn't focused down to a point, and you will not see variations in image size due to distance. The virtual eye is just a detector screen that light rays are reflected on to. The detector screen and the mirror are both bigger than the object, like a full body sized mirror. Since there is nothing to bend the light rays, they continue to travel in straight lines, no matter how far they are from the mirror.

7. Study how the image orientation is produced in a plane mirror. Click on the candle and drag it to the tray next to the beach ball. Click on the beach ball and bring it back to the optics table to where the candle in the same row of peg holes as the eye was. Use a colored pencil to draw in the colors of the ball in the correct order. Now drag the ball back to the position that the candle was in, so the eye can see the image of the ball from the mirror. The white images lines are displayed to help you find the sight line. Sketch the image of the ball as seen in the mirror below, making sure to correctly order the colors as you see them again.

Beach ball as seen directly   Beach ball as seen in 1st mirror   Beach ball as seen in 2nd mirror

8. Pick up another mirror from the tray at the top of the table, and place it in a position so the light from the mirror can bounce on the second mirror too. You will probably need to rotate the mirror to face the direction of the bouncing light. The arrow head on the mirror indicates the reflective side. Now move the detector to be in line with the light bouncing off the second mirror. Rotate the eye as needed. You may need to adjust the orientation of your mirrors and detector so the sight line from the actual object is blocked. If you don't, you will have multiple images displayed in the detector simultaneously and it might be hard to see which is the reflected image and which is the actual object. ______________________________

9. Analyzing What observations did you make about the orientation of an image in a mirror? Where does the image appear to be?

10. Plane mirrors reflect what is called virtual images, images that seem to be inside the mirror or on the other side of the mirror, when actually no light can penetrate through the mirror. If you put a piece of paper behind the mirror, no image would show because the light isn't really making it to that point. Devise and execute an experiment you could do to test this hypothesis.

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Lab 44: Plane Mirror Images

Purpose

To study the images observed in plane mirrors and to examine what a virtual image means

Background

Mirrors are everywhere. They are used to see images of ourselves, cars behind us, even to the stars. Plane mirrors are the most common type of mirrors. They have flat surfaces, and the image you see in them is exactly the same size as the original object.

Skills Focus

Predicting, observing, designing experiments

Procedure

1. Start *Virtual Physical Science* and select *Plane Mirror Images* from the list of assignments. The lab will open in the Optics laboratory.
2. The laboratory will be set up with a candle on an optics table with a plane mirror in front of it. An eye will be set up at exactly the same distance from the mirror to be used as a detector, to look at the candle reflection in the mirror. You will observe the image of the candle from various distances and also observe the image of a beach ball to determine how images are changed in a mirror.
3. **Predicting** What do you think will happen to the image of the candle as the eyeball is pulled farther and farther back? ____________________
4. Mouse over the eye and a rotation control panel will appear. Rotate the eye to 90 degrees, so it is directly facing the candle. Sketch the candle as seen by directly looking at it on the optics table. Then rotate the eye to face towards the image from the mirror, at about 0 degrees. You can see the image of the candle in the Virtual Eye detector screen. Sketch the image of the candle that you see in the mirror.

   Candle as seen from above Candle as seen in mirror

5. Click on the eye and drag it farther back on the table. How did the image change when you pulled back the viewing eye? ____________________

Name ____________________ Date ______________ Class __________

Analyze and Conclude

1. **Interpreting Data** Is the momentum of the system conserved in each trial? Explain.

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2. **Applying Concepts** If the balls were initially traveling along the same line and in the same direction, would they also obey the law of conservation of momentum? Try it out with Ball 1 going twice as fast as Ball 2 but both heading to the right with some positive velocity. In the *Parameters Palette,* set the angle of the velocity to be the same for both balls (Angle of 0°). Was there anything that surprised you about this collision?

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3. **Drawing Conclusions** How can a ball with a small mass have the same momentum as a ball with a large mass?

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4. Describe momentum in your own words.

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4. **Experiment 2: One ball moving** Click the *Reset* button to reset the experiment. Use the *Objects* tab under the *Parameters Palette* to change the mass of Ball 1 to 15 kg and the mass of Ball 2 to 5 kg. (First uncheck "Balls Same Mass and Diameter.") Set the velocity of Ball 1 to –10 m/s and the velocity of Ball 2 to 0 m/s. Set a negative velocity (moving to the left) by adjusting the angle of the velocity to 180 degrees. Click the *Start* button to watch the balls collide. Click the *Pause* button immediately after they bounce off each other and before ball 2 hits the wall. Record the final velocity of each ball in Table 2 using the data in the display panel in the experiment window.

Table 2

Trial 2	Mass (kg)	Velocity Before (m/s)	Velocity After (m/s)	Momentum Before (mass x $velocity_{before}$)	Momentum After (mass x $velocity_{after}$)
Ball 1	15	–10			
Ball 2	10	0			
			Total Momentum =		

5. **Experiment 3: Choose your own variables** Click the *Reset* button to reset the experiment. Choose your own masses and velocities for each ball. Then predict what you think the resulting velocities might be after the collision. Test your prediction. Record the data in Table 3.

Table 3

Trial 3	Mass (kg)	Velocity Before (m/s)	Prediction: Velocity After (m/s)	Actual: Velocity After (m/s)	Momentum Before (mass x $velocity_{before}$)	Momentum After (mass x $velocity_{after}$)
Ball 1						
Ball 2						
				Total Momentum =		

Name ____________ Date ____________ Class ____________

Lab 31: Conservation of Momentum

Purpose

To discover what happens to the total momentum when objects collide

Background

You might think of conservation as paying attention to how much water or gas you use. But conservation also means that conditions before and after an event do not change. Conservation of momentum means that the total momentum of any group of objects before an event is the same as it is afterwards. No momentum has been lost and none has been gained. In this assignment you will observe a system of two balls colliding. You will measure the momentum before and after the collision and see if the two measurements are the same.

Skills Focus

Interpreting data, drawing conclusions, applying concepts

Procedure

1. Start *Virtual Physical Science.* Select *Conservation of Momentum* from the list of assignments. The lab will open in the Mechanics laboratory.
2. The laboratory is set up with two balls of the same mass on a table. You will perform three experiments to measure the momentum of the system by measuring the momentum of each ball within the system.
3. **Experiment 1: Two balls moving** The masses of the balls are the same. The velocities of the balls are the also the same in magnitude (size) but they are not the same in direction. (The balls will be heading towards each other.) The balls start out separated by 10 meters. Click the *Start* button to watch them collide. Click the *Pause* button immediately after they bounce off each other. Record the final velocity of each ball in Table 1 using the data in the display panel in the experiment window. You will need to click the arrows under *Tracking* to change the values in the panel from Ball 1 to Ball 2.

Table 1

Trial 1	Mass (kg)	Velocity Before (m/s)	Velocity After (m/s)	Momentum Before (mass x $velocity_{before}$)	Momentum After (mass x $velocity_{after}$)
Ball 1	10	–10			
Ball 2	10	10			
			Total Momentum =		

Conservation of Momentum

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3. **Interpreting Data** Why do two of the graphs look exactly the same?

4. **Interpreting Data** Do the graphs of experiments with air resistance have any regions that show constant acceleration? Do they have any regions with constant velocity, or no acceleration? Why wouldn't the balls accelerate even with gravity still pulling them down? What is stopping them?

5. **Drawing Conclusions** The point at which a falling object stops accelerating is called the terminal velocity. Why is terminal velocity an appropriate name?

Going Further

6. How would the motion of the balls change if you increased the force of gravity with air resistance on?

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6. Click the *Reset* button again. Use the *Parameters Palette* to adjust the radius to 4 m again, but this time, place the air resistance graphic back on the table from the tray. Repeat Step 3 to record the velocity of the ball as it falls.

Mass of Ball (kg)	Diameter (m)	Air Resistance (on or off?)	Time to Reach $y = 0$ (s)	Velocity at $y = 0$ (m/s)
2	1	off		
2	1	on		
2	4	off		
2	4	on		

Analyze and Conclude

1. **Graphing** Using the data in each of the data links in the *Lab Book*, draw the velocity versus time graphs for each experiment on the grid below. Label the horizontal axis Time (s) and the vertical axis Velocity (m/s). Scale your graph to fit your data. The first data point is (0 s, 0 m/s) for each experiment. Connect the data points using a different colored pencil for each graph. Label each line with the radius of the ball and indicate if there was air resistance.

2. **Interpreting Data** Describe any differences you see in the graphs. Explain why the graphs are different. Is there a difference in the motion of the objects with or without air resistance?

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Lab 27: Gravity and Free Fall Motion

Purpose

To find out what effect air resistance has on a falling object

Background

When an object falls through the air, two forces act on it. The force of gravity pulls the object down and the force of air resistance slows the object's fall by opposing the motion. Air resistance is an example of fluid friction, which applies an opposing force through a gas or liquid. When you stick your hand out the window of a moving car, you can feel the air resistance against your hand. As the car goes faster, the air resistance increases. If you have jumped into a pool, you have felt the resistance of water, which slows you down much faster than air does. In this assignment, you will observe the effects of air resistance on the acceleration of falling objects.

Skills Focus

Graphing, intepreting data, drawing conclusions

Procedure

1. Start *Virtual Physical Science*. Select *Gravity and Free Fall Motion* from the list of assignments. The lab will open in the Mechanics laboratory.
2. The laboratory is set up with a ball at the top of the experiment window, 20 m above the surface. Gravity is set at the same value as on Earth. Gravity will pull the ball down. You will observe how long it takes the ball to reach $y = 0$. The mass of the ball is 2 kg. The diameter of the ball is 1 m.
3. Click on the *Lab Book* to open it. Click on the red *Recording* button to start recording data. Start the experiment by clicking on the *Start* button and observe what happens. When the ball reaches $y = 0$, the experiment will stop. You should see a link appear in the *Lab Book*. This contains the velocity versus time data for the ball falling. In the table on the next page, write the amount of time it took the ball to fall and its velocity at the nearest data point to when the ball crosses $y = 0$.
4. Click the *Reset* button to reset the experiment. Place the air resistance graphic from the tray onto the work area. Repeat Step 3 to record the velocity of the ball as it falls.
5. Drop another ball with the same mass as before but a much larger diameter (for example, a large hollow ball). Click the *Reset* button to reset the experiment. Use the *Objects* tab in the *Parameters Palette* to adjust the radius to 4 m. Repeat Step 3.

Name ______________________ Date ________________ Class __________

Test Tube	Formula From Screen	Color Before	Color After	Ratio

Analyze and Conclude

1. Infer from your data what must be the charge of the oxygen ion, if lead forms the compound PbO?

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2. Could the compound CuFe form? Explain your answer.

____

3. Tin (Sn) forms the ion Sn^{4+}. What must be the formula for tin chloride?

____

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4. Click on the handle just above the periodic table to pull down the TV screen. The screen will display the chemical formula of the compound in the test tube as you move the cursor over a test tube. Observe the changes that occur in the test tube in the display in the lower left corner. Notice the changes in chemical formulas on the TV screen above. Move the hand over the first test tube on the left. Observe that the solution is clear and colorless in the lower left window and that the screen shows Ag^{+}.

5. Drag the first test tube (*Ag^{+}*) from the blue test tube rack to the metal test tube stand on the lab bench. Click the bottle labeled *NaCl* on the top shelf. Notice the changes in the test tube and in the screen. The solution changes from colorless to white and the screen shows AgCl. In this compound the ratio of Ag to Cl is 1:1. Record the formula, the color before reaction, the color after reaction, and the ratio in the table on the next page. Drag the test tube to the red disposal bucket on the lower right. Do **NOT** click on *Clear All*.

6. Drag the second test tube (*Pb^{2+}*) from the blue rack to the metal stand and click the bottle labeled *NaCl* on the top shelf. What changes do you observe in the test tube and in the screen? Record the color before, the color after, and the ratio in the table. Drag the test tube to the red disposal bucket.

7. Drag the third test tube (*Fe^{3+}*) from the blue rack to the metal stand but this time click the bottle labeled *Na_2S* on the top shelf. Record the color before, the color after, and the ratio in the table. Drag the test tube to the red disposal bucket. Repeat for the fourth (*Cu^{2+}*) and fifth (*Pb^{2+}*) test tubes adding *Na_2S* in each case. Record the color before, the color after, and the ratio in the table. Drag the test tubes to the red disposal bucket.

8. **Predicting** Drag the last test tube (*Ag^{+}*) to the rack. From your observations of the last three solutions, what color do you predict when *Na_2S* is added to the *Ag^{+}* solution?

   ____

   Click the bottle labeled *Na_2S*. Record the color before, the color after, and the ratio in the table. Drag the test tube to the red disposal bucket.

   If you leave the spoon made of silver in mayonnaise, the silver metal turns dark. This is because mayonnaise is made from eggs which contain sulfur. The silver of the spoon and the sulfur from the eggs in the mayonnaise form the same compound you just created. The compound is called silver sulfide (Ag_2S). The silver sulfide that forms on silver spoons and other silver objects is called tarnish. To remove tarnish, you must use a special cleaner and polish the object with a soft cloth.

Name ____________________ Date ______________ Class __________

Lab 12: Creating Chemical Compounds

Purpose

To determine the ratio of elements in a chemical compound

Background

Matter can consist of a single element, but more often matter is made up of chemical compounds. A chemical compound consists of two or more elements combined in a set ratio. A ratio compares two numbers. It tells you the amount of one item compared to the amount of another item. The formula for a chemical compound shows the ratio of the elements in the compound. For example, you are familiar with table salt, a chemical compound made from sodium (Na) and chlorine (Cl). The chemical formula for table salt is NaCl. The formula shows that the ratio of sodium atoms to chlorine atoms is 1:1.

You are also familiar with a compound called rust, which is made from iron (Fe) and oxygen (O). The chemical formula for rust is Fe_2O_3. The small number to the right of each symbol is a subscript. The subscripts tell you that a molecule of rust contains two iron atoms (Fe) combined with three oxygen atoms (O). The ratio of iron atoms to oxygen atoms in rust is 2:3.

When elements combine to form compounds, the compounds have different properties from those of the combining elements. Color is a property that can change in a chemical reaction, so a color change is evidence that a chemical reaction may have occurred.

Skills Focus

Observing, applying concepts, predicting

Procedure

1. Start *Virtual Physical Science* and select *Creating Chemical Compounds* from the list of assignments. The lab will open in the Inorganic laboratory.
2. Enter the stockroom by clicking inside the *Stockroom* window. Once inside the stockroom, drag a test tube from the box and place it on the metal test tube stand. Click on the bottle of Ag^+ solution on the shelf to add it to the test tube. Click *Done* to send the test tube back to the lab. If you make a mistake in selecting the correct solution, drag the test tube to the red disposal bucket and begin again.
3. Drag another test tube from the box and place it on the metal test tube stand. Click on the bottle of Pb^{2+} solution on the shelf to add it to the test tube. Click *Done* to send the test tube back to the lab. Repeat this process and create test tubes containing Fe^{3+} (not Fe^{2+}), Cu^{2+}, Pb^{2+} (again), and Ag^+ (again). Click *Done* after each test tube. Click on the *Return to Lab* arrow when finished with all test tubes. You should now be in the laboratory. Six test tubes should be in the test tube rack.

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5. Drag the aluminum ball to the top of the cylinder and drop it in the cylinder of water. Click the green *Release* button to let the ball fall into the water. Look at the close-up view window to note the new volume of the water. Record the final volume in the table. The volume of your aluminum ball will be the difference of the final volume of the water with the ball and the initial volume of just the water. Record the calculated volume of the ball in the table.

Ball	Mass of Ball (g)	Volume of Water (mL)	Volume of Water and Ball (mL)	Volume of Ball	Density (g/mL)
Au					
Al					

Analyze and Conclude

1. **Applying Concepts** If both of the objects were approximately the same size, or volume, why did they have such different masses?

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2. **Predicting** Look through all the different options of balls. Which do you think is the most dense and which would be the least dense? How could you actually determine that?

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3. **Drawing Conclusions** Aluminum and its alloys are the primary metals used in the construction of airplanes. Does this make sense given its density? Why?

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Lab 2: Making Sense of Density

Purpose

To discover whether different metals have different densities

Background

A kilogram of gold takes up much less space than a kilogram of feathers because gold has a much higher density than feathers. Density is the amount of mass of a substance in a given volume. Often, density is expressed as the number of grams in one milliliter (g/mL). In order to calculate the density of a substance, you need to know both the mass and the volume. The mathematical formula for density is shown below.

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}} \quad \text{or} \quad d = \frac{m}{V}$$

The formula shows that you find density by dividing the mass by the volume. You can calculate the volume of a spherical object (ball) using this formula:

$$\textit{Volume of a ball} = \frac{4}{3} \times \pi \times r^3 \text{, where “}r\text{” is the radius}$$

This will give you the volume of the solid balls from just knowing their radii. It is also possible to calculate the volume by measuring the amount of fluid displaced by the object in a known volume. 1 mL is equal to 1 cm^3. The unit for density in this lab will be g/mL.

Skills Focus

Calculating, relating cause and effect, drawing conclusions

Procedure

1. Start *Virtual Physical Science* and select *Making Sense of Density* from the list of assignments. The lab will open in the Density laboratory.
2. Find the gold ball on the lab wall. Pick up the ball and drag it to the spotlight on the balance. Record the mass in the table.
3. The approximate radius of the gold ball is 1.6 cm. Using this information and the formulas given earlier, calculate the volume of the ball and the density of the gold. Record your answers in the table.
4. Repeat the experiment for aluminum (Al). You can also calculate the volume of the ball by measuring the volume of water displaced by the object. On the laboratory bench, you can see a 250 mL graduated cylinder filled with water. Click on the cylinder to see a zoomed-in view of the level of the water. Record the initial volume of the water in the table.

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3. **Drawing Conclusions** After scientists interpret their data, they draw conclusions about their hypothesis. A conclusion states whether the data support the hypothesis. Review your hypothesis. Look at the information in the table and the graph. What conclusion can you make about your hypothesis?

____

4. **Communicating** An important part of scientific inquiry is communicating. Communicating is sharing ideas and conclusions with others through writing and speaking. It is also sharing the process you used in your inquiry.

Assume you are a television reporter and are assigned to do a story about the experiment you just completed. Write a short summary for your television audience describing the process of scientific inquiry. Use the procedure and results of this experiment as an example.

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Name ______________________ Date ______________ Class __________

Analyze and Conclude

1. **Communicating** The data you placed in the data table is quantitative data. Qualitative data would be your written observations about what happened in the experiment. Write a short summary of what you observed.

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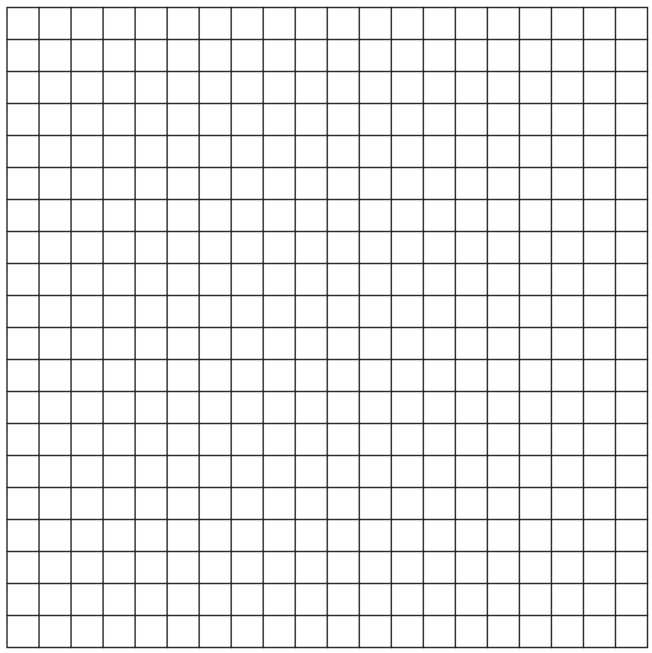
2. **Making a Graph** You can plot the information in the data table on a graph. Plot the controlled parameter on the horizontal axis and the variable parameter on the vertical axis.



a. What measurement (with its units) is plotted on the horizontal axis (x-axis)?

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b. What measurement (with its units) is plotted on the vertical axis (y-axis)?

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c. At 450°C, what is the approximate volume?

____

d. **Predicting** What will be the approximate volume when the temperature is 1000°C?

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Name ______________________ Date ________________ Class __________

3. **Designing an Experiment** Scientists test hypotheses by designing controlled experiments. A controlled experiment is one in which all but one of the variables remain the same. The variable that you change in your experiment is the controlled parameter. The variable that changes because of what you do is the variable parameter.
   a. How would you design a controlled experiment to test your hypothesis about the balloon?

   ____

   b. What is the controlled parameter in your experiment?

   ____

   c. What is the variable parameter in your experiment?

   ____

4. **Collecting and Interpreting Data** Observations can be qualitative or quantitative. Qualitative observations are descriptions, such as notes you might make in a journal or notebook. Quantitative observations are measurements that are usually recorded in tables with their units. Scientists make it easier to share data by using the same system of measurement with standard units of measure. In your experiment the unit for volume is cubic centimeters (cm^3). The unit for temperature is degrees Celsius (°C).

Procedure

1. Start *Virtual Physical Science* and select *Introduction to Scientific Inquiry* from the list of assignments. The lab will open in the Gases laboratory.
2. Note that the balloon in the chamber is filled with a gas at a temperature of 100°C and a pressure of 101.3 kPa. The volume of the gas is 1531 cm^3.
3. Observe the current volume and temperature of the gas and record them in the table. Now, click on the 1 in the temperature window. The digit should turn green. Type 2, so that the temperature is now 200°C. Record the new volume and temperature in the table. Repeat this step again but type 3 in the temperature window. Again, record your data. Continue to increase the temperature by 100°C each time and record your data until you reach 700°C.

Temperature (°C)	**Volume (cm^3)**