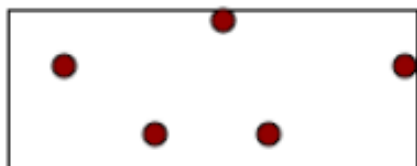


Target Inquiry – Particulate Level Questions

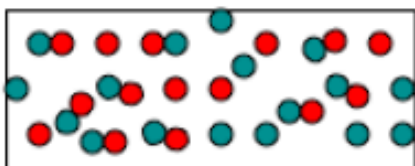
**GOING FURTHER**

1. Label each of the following pictures as Solid, Liquid, or Gas. Explain your choice.
2. Label each of the following pictures as Element, Compound, or Mixture of Elements, Mixture of Compounds, or Mixture of Elements & Compounds. Explain your choice.

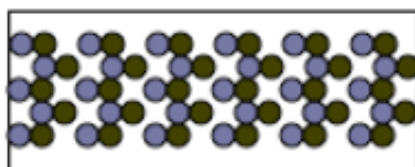
A



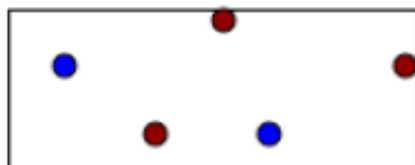
B



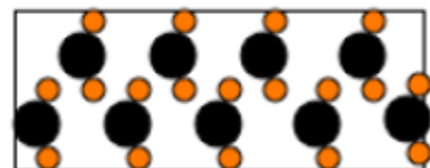
C



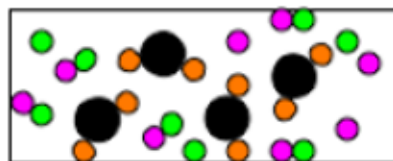
D



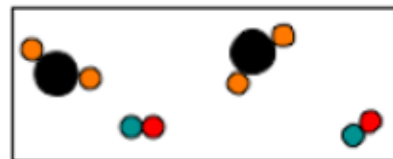
E



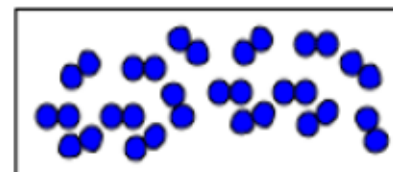
F



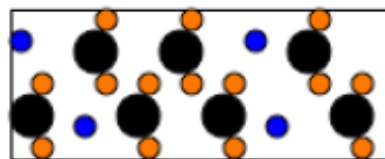
G



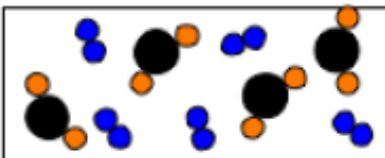
H



I



J



A. _____

B. _____

C. _____

D. _____

E. _____

F. _____

G. _____

H. _____

I. _____

J. _____

3. Choose 4 substances from the list below.

- Classify each as “Solid, Liquid, or Gas” at room temperature (22⁰C)
- Classify each as “Element, Compound, or Mixture.”
- Draw a particle picture of each. Explain your drawing.

You should be prepared to do some research, if needed.

Copper pipe

Air

Methane

Water

Aluminum foil

Bronze medallion

Carbon dioxide

Helium (like what is sometimes in a balloon)

Table salt





PROCEDURE

You have been provided nine *Changes in Chemistry* cards by your instructor. Each card represents a change that a substance or substances undergo.

The circle(s) on the left represent the atoms and molecules before they undergo the change and the circle(s) on the right represent the atoms and molecules after they undergo the change. Each circle is a snapshot of a situation, so the number of particles between “before” and “after” may not be the same. Particles that have a + or – are called ions. Something about that particle has changed and the “charged” particle has different properties from the “neutral” particle.

Your group’s task is to categorize each of these changes as “physical” or “chemical.” This means you must decide, based on your observations of the changes, what indicates a physical change has occurred and what indicates a chemical change has occurred.

As your group works through categorizing the changes, record your ideas in the *Data and Observations* section. First, describe what seems to be occurring during the change. Once you’ve decided whether a change is physical or chemical, record your decision. Then, in the space provided, describe why your group decided a change was physical or chemical.



DATA AND OBSERVATIONS

<p>Change A Describe the Change:</p> <p>Type of Change:</p> <p>Defend your Decision:</p>	<p>Change F Describe the Change:</p> <p>Type of Change:</p> <p>Defend your Decision:</p>
<p>Change B Describe the Change:</p> <p>Type of Change:</p> <p>Defend your Decision:</p>	<p>Change G Describe the Change:</p> <p>Type of Change:</p> <p>Defend your Decision:</p>
<p>Change C Describe the Change:</p> <p>Type of Change:</p> <p>Defend your Decision:</p>	<p>Change H Describe the Change:</p> <p>Type of Change:</p> <p>Defend your Decision:</p>
<p>Change D Describe the Change:</p> <p>Type of Change:</p> <p>Defend your Decision:</p>	<p>Change I Describe the Change:</p> <p>Type of Change:</p> <p>Defend your Decision:</p>
<p>Change E Describe the Change:</p> <p>Type of Change:</p> <p>Defend your Decision:</p>	



RESULTS AND ANALYSIS

Based on your lab group's discussions and decisions write concise, one-sentence descriptions for *physical change* and *chemical change*.

Physical Change:

Chemical Change:

Don't continue to the next section until instructed to do so.



CONNECTIONS TO THE REAL WORLD

Each of the changes you observed represents a real process that you probably have seen or heard about.

Your instructor will provide you with an *Atom Key* to help you identify what processes are occurring in each of the *Changes in Chemistry* cards.

Below are descriptions of each of these processes in some real-world situation. Match each *Changes in Chemistry* card with the appropriate description.

- _____ Road salt, sodium chloride, is commonly used to de-ice roads during the winter. When road salt dissolves in the water on the road, it reduces the temperature at which the water would freeze. This helps prevent ice from forming on the roads.
- _____ Cars have been made from steel, which is mostly iron, since their introduction into society in the early 20th century. When the iron interacts with oxygen, it forms rust. This problem is accelerated by the wet, salty roads in many cold, winter climates.
- _____ Copper has been used by humans for about 10,000 years. Due to its excellent flexibility and great ability to conduct electricity, copper is used for electrical wires as well as in pipes for plumbing.
- _____ Original camera "flash bulbs" consisted of very fine magnesium filaments. An electrical current, triggered by the camera shutter, heats the filament until it ignites and burns, very quickly and brightly, with the oxygen in the air.
- _____ Before the invention of the refrigerator, perishable food was often kept in ice boxes, which were cooled using blocks of ice. People relied on ice boxes even during the summer months. Ice was often stockpiled in large "ice houses" during the winter and could often be kept from melting until the following winter.

- _____ Henry Cavendish is credited with identifying hydrogen gas as a unique element in 1766. Cavendish produced hydrogen gas by combining a metal, such as magnesium, with a strong acid, such as hydrochloric acid. Hydrogen production soon became useful as balloonists found this “lighter than air” gas quite useful.
- _____ Sodium bicarbonate, commonly known as baking soda, is used to make baked goods light and fluffy. It does so by decomposing to produce water vapor and carbon dioxide gas. This decomposition process is initiated by the presence of an acid, which donates hydrogen ions.
- _____ The first train locomotives were powered by steam. A very hot fire, usually coal powered, heats a large tank of water called a boiler. When the water evaporates and turns to steam, the boiler becomes highly pressurized by the steam. The high pressure steam is then used to push large pistons, which turns the wheels.
- _____ Rubbing alcohol has many uses, most commonly as an antiseptic for cleaning minor cuts or contaminated surfaces. Household rubbing alcohol is a mixture of isopropanol and water.



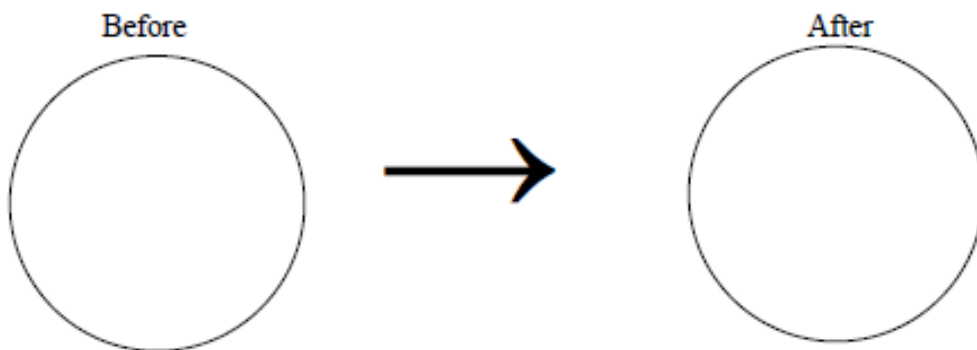
REFLECTING ON LEARNING

Consider the following two situations. After reading the description, decide whether the change described is physical or chemical, according to the definitions you created. Then, in the space provided, illustrate the change at the particulate level. Use your *Atom Key* in order to consistently represent the particles.

If available, use colored pencils and your *Atom Key* to correctly represent each particle.

1. Pure copper can be heated until it melts just below 2000°F. The liquid copper can be poured into molds.

Physical or Chemical:



2. Natural gas consists mostly of methane, CH_4 . Natural gas is used to heat homes and cook food. The methane is "burned" by reacting with oxygen, O_2 . The products of this reaction are carbon dioxide, CO_2 , and water, H_2O .

Physical or Chemical:

