What are chemical and physical properties? Liquid nitrogen

1. What are the states of matter?
2. What is a melting point? What is a boiling point? Here is a hint – the melting point for water is 32°F and the boiling point is 212°F.
3. Examine the melting and boiling points for nitrogen and oxygen in the following table.

Element	Melting point		Boiling point	
	°C	°F	°C	°F
N_2	-210	-346	-195	-320.42
O_2	-218.8	-361.8	-183	-297.3

(3a) Does nitrogen usually exist as a solid, liquid, or gas at Earth's surface? Here is a hint– the following table displays the composition of the air you are currently breathing.

Composition of the Atmosphere	
78%	nitrogen
21%	oxygen
1%	other gases such as carbon dioxide and water

(3b) Based upon the freezing point and boiling point temperatures, what is the warmest possible temperature that liquid nitrogen could be?

(3c) What would you need to do to make liquid nitrogen from the gaseous nitrogen in air?

4. Are the melting point and boiling point physical or chemical properties of a substance? Why?

What are chemical and physical properties? Metals

1. Recall the states of matter – solid, liquid, and gas. In which of these states do we usually find metals such as copper (Cu), iron (Fe), aluminum (Al), and zinc (Zn)? Why? Use the table of melting points and boiling points for these metals to explain.

   A melting point is the temperature at which a solid melts (turns into a liquid). A boiling point is the temperature at which a liquid boils (turns into a gas).

Element	Melting point		Boiling point	
	°C	°F	°C	°F
Al	660.32	1220.58	2519	4566
Cu	1084.6	1984.3	2562	4643
Fe	1538	2800	2861	5182
Zn	419.53	787.15	907	1665

2. Are any of these metals attracted to a magnet?

3. Examine the mineral sample also provided. Is it attracted to the magnet? Does the magnetic property of this mineral suggest that any of the metals you observed may be in it? We use the physical and chemical properties of matter to determine what is in it.

4. Are the melting point and boiling point physical or chemical properties of a substance? What about magnetism – physical or chemical? Explain why in each case.

What are chemical and physical properties? Vinegar and baking soda

1. You have before you vinegar (acetic acid - CH_3COOH) and baking soda (sodium bicarbonate - $NaHCO_3$). Does either smell? Remember to whaff and don't inhale baking soda dust!!!

2. Place 20 mL of vinegar in a beaker followed by a teaspoon of baking soda. The baking soda will react with the vinegar to produce carbon dioxide (CO_2) gas. Can you see any evidence of this? What is the evidence?

3. Is the smell of a substance a physical or chemical property? Please explain why.

4. Does the reaction of baking soda with vinegar represent a chemical or physical property of each substance? Please explain why.

What are chemical and physical properties? $BaSO_4$ precipitation

1. You are provided with some barium chloride ($BaCl_2 \cdot 2H_2O$) and copper sulfate ($CuSO_4 \cdot 5H_2O$). Do not breathe the dust from either of these compounds.
    - Add a teaspoon of barium chloride to a beaker with 50 mL of the provided water.
    - To a second beaker, add a teaspoon of copper sulfate to 50 mL of water.
    - Swirl each solution gently until the barium chloride and copper sulfate you added are dissolved.

    What color are the solutions? Did both compounds dissolve easily?

2. Now add the two solutions together. The solutions should react to form a new substance with the composition $BaSO_4$. This new substance dissolves very little in water. Can you see any evidence of its formation?

3. Are color and ability to dissolve physical or chemical properties? Please explain why.

4. Does the reaction of barium chloride with copper sulfate represent a chemical property of each substance? Please explain why.

What are chemical and physical properties? Liquid immiscibility

1. You are provided with corn oil and water. Pour 30 mL of oil into a graduated cylinder. Into a separate graduated cylinder, pour 30 mL of water. Do they appear different from each other in any way?

2. Gently pour the water into the oil. Do they mix or remain separated? If they remain separated, does one float on the other? Why would that be?

3. Is the appearance of these liquids part of their physical or chemical properties? Please explain why.

4. What about their ability to mix (or lack of) – does this represent physical or chemical properties? Please explain why.

What are chemical and physical properties? **Potato and H_2O_2**

1. You are provided with some potato and some hydrogen peroxide (H_2O_2). Put 25 mL of hydrogen peroxide in a petri plate. Does it smell? Is it colored?

2. Next, add a piece of potato to the hydrogen peroxide. An enzyme present in the potato splits two molecules of hydrogen peroxide into oxygen gas and water. Can you see any evidence that this reaction is taking place?

3. Does the smell and appearance of the hydrogen peroxide represent chemical or physical properties of hydrogen peroxide? Please explain why.

4. Does the reaction of the enzyme in the potato with the hydrogen peroxide represent a physical or chemical property of these substances? Please explain why.