Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Class\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**States of Matter**

1. What are three common states of matter?

a.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ b.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ c.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Is the following sentence true or false? The fact that a copper wire can be bent shows that some solids do not have a definite shape. \_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Circle the letter of each phrase that describes how particles at the atomic level are arranged within most solids.
3. Randomly arranged
4. packed close together
5. arranged in a regular pattern
6. spaced far apart
7. Is the following sentence true or false? A liquid takes the shape of its container. \_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. What is the state of matter in which a material has neither a definite shape nor a definite volume? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
9. Compare and contrast the arrangement of particles at the atomic level for a liquid and a solid. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
10. What determines the shape and volume of a gas? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
11. Complete the table about states of matter.

|  |
| --- |
| States of Matter |
| **State** | **Shape** | **Volume** |
|  | Definite |  |
| Liquid |  |  |
|  |  | Not definite |

1. Describe kinetic energy. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Circle the letter of the phrase that describes all particles of matter in the kinetic theory of matter.
3. Randomly arranged
4. Constant temperature
5. In constant motion
6. Orderly arrangement
7. Why can scientists ignore the forces of attraction among particles in a gas under ordinary conditions?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Do forces of attraction have a stronger effect on the behavior of the particles in a gas or in a liquid? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Circle the letter of each factor that affects the behavior of liquids.
3. Fixed location of particles
4. Constant motion of particles
5. Orderly arrangement of particles
6. Forces of attraction among particles
7. What is a phase change? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Match each term with the letter of the phase-change description that best describes it.*

**Term**

1. Freezing \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Sublimation \_\_\_\_\_\_\_\_\_\_\_\_\_
3. Condensation \_\_\_\_\_\_\_\_\_\_\_\_
4. Melting \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. Deposition \_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. Vaporization \_\_\_\_\_\_\_\_\_\_\_\_\_

**Phase-Change**

1. Solid to gas
2. Liquid to gas
3. Gas to solid
4. Liquid to solid
5. Gas to liquid
6. Solid to liquid
7. What happens to the temperature of a substance during a phase change? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. Is the following sentence true or false? The temperature at which a substance freezes is lower than the temperature at which it melts. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
9. Circle the letter that describes the behavior of a substance during a phase change.
10. Neither absorbs nor releases energy
11. Always absorbs energy
12. Always releases energy
13. Either absorbs or releases energy
14. A substance absorbs energy from its surroundings during a(n) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ change.
15. The energy absorbed by one gram of ice as it melts is known as the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for water.
16. As water freezes, it releases heat to its surroundings. Freezing is an example of a (n) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ change.
17. When liquid water freezes, the average kinetic energy of its molecules \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and the arrangement of the molecules becomes more orderly.
18. Vaporization is the phase change in which a substance changes from a (n) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ into a (n) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
19. The energy absorbed by one gram of water as it changes from its liquid phase into water vapor is known as the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for water.
20. Is the following sentence true or false? When water vapor collects above the liquid in a closed container, the pressure caused by the collisions of this vapor and the walls of the container is called vapor pressure. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
21. Compare and contrast the processes of evaporation and boiling by completing the table below.

|  |
| --- |
| **Evaporation and Boiling** |
| **Process** | **Phase Change** | **Where it Occurs** | **Temperature** |
| Evaporation |  |  |  |
| Boiling |  |  |  |

1. Is the following sentence true or false? A gas absorbs energy as it changes into a liquid. \_\_\_\_\_\_\_\_\_\_\_\_
2. Dry ice can change directly from a solid to a gas without forming a liquid first. This process is an example of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
3. What is deposition? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**PHASE DIAGRAM OF COMPOUND X**



1. Label in the graph above the following: critical point, triple point, the six phase changes, critical pressure, and critical temperature.
2. If you were to have a bottle containing compound X in your closet, what phase would it most likely be in? (Hint: Assume room temperature is 22°C and pressure is 1 bar) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. At what temperature and pressure will all three phases coexist? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. If I have a bottle of compound X at a pressure of 50 bar and temperature of 200 K, what will happen if I raise the temperature to 600 K? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. If I wanted to, could I drink compound X? Why or why not? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



V

IV

III

II

I

1. In what part of the curve would substance X have a definite shape and definite volume? \_\_\_\_\_\_\_\_\_\_
2. In what part of the curve would substance X have a definite volume but no definite shape? \_\_\_\_\_\_\_\_\_
3. In what part of the curve would substance X have no definite shape or volume? \_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. What part of the curve represents a mixed solid/liquid phase of substance X? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. What part of the curve represents a mixed liquid/vapor phase of substance X? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. What is the melting temperature of substance X?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. What is the boiling temperature of substance X? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. What part of the curve would have the largest kinetic energy? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
9. What part of the curve would have the lowest kinetic energy? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
10. In what part of the curve would the molecules of the substance be the farthest apart? \_\_\_\_\_\_\_\_\_\_\_\_
11. In what part of the curve would the molecules of the substance be closest together? \_\_\_\_\_\_\_\_\_\_\_\_\_\_