

# Changes of State of Matter

Name: \_\_\_\_\_

Molecules of all matter are in constant motion. When temperature increases, molecular motion and therefore kinetic energy increases. Molecular motion increases when substances change from a solid to a liquid and then to a gas. Molecular motion decreases when substances change from a gas to a liquid and then to a solid. The following changes of state, or phase changes, are *physical* changes, not chemical changes.

freezing point – the temperature at which a liquid changes to a solid

melting point – the temperature at which a solid changes to a liquid

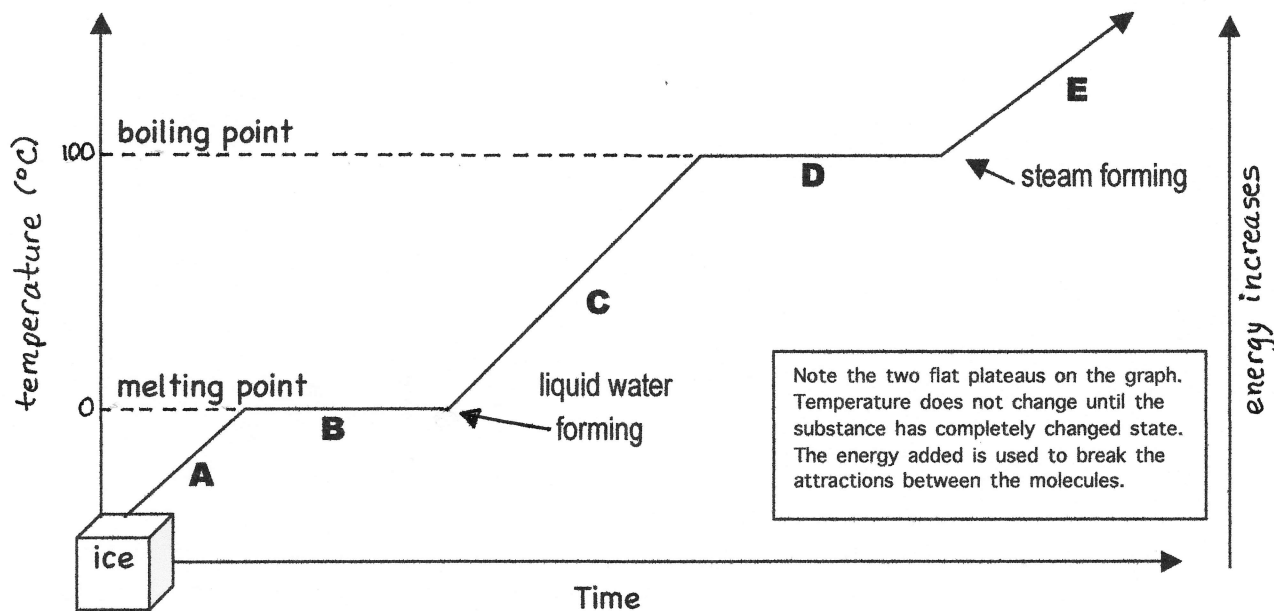
boiling point – the temperature at which a liquid becomes a gas

evaporation – occurs when molecules change from a liquid to a gas below the boiling point; occurs when high-energy particles near the surface break bonds and become a gas

condensation – occurs when molecules change from a gas to a liquid below the boiling point

sublimation – occurs when a substance changes from a solid directly to a gas

Use the graph below to answer the questions 1 - 15.



1. What is the melting point (temperature) of ice? \_\_\_\_\_
2. What is the freezing point (temperature) of ice? \_\_\_\_\_
3. What is the boiling point (temperature) of water? \_\_\_\_\_
4. What letter on the graph corresponds to only liquid water? \_\_\_\_\_
5. What letter on the graph corresponds to only steam? \_\_\_\_\_
6. What letter on the graph corresponds to only ice? \_\_\_\_\_
7. What letter on the graph corresponds to both liquid water and steam? \_\_\_\_\_
8. What letter on the graph corresponds to both ice and liquid water? \_\_\_\_\_
9. Is molecular motion greater in region A or region E? \_\_\_\_\_
10. Do the particles in region B or in region D have more kinetic energy? \_\_\_\_\_
11. Liquid water exists between \_\_\_\_\_ degrees and \_\_\_\_\_ degrees Celsius.
12. Is a hotter temperature represented by letter D or letter E? \_\_\_\_\_
13. Which two letters correspond to phase changes? \_\_\_\_\_

14. Which three letters correspond to temperature changes? \_\_\_\_\_

15. Explain what is happening in each section of the graph.

Section A \_\_\_\_\_

Section B \_\_\_\_\_

Section C \_\_\_\_\_

Section D \_\_\_\_\_

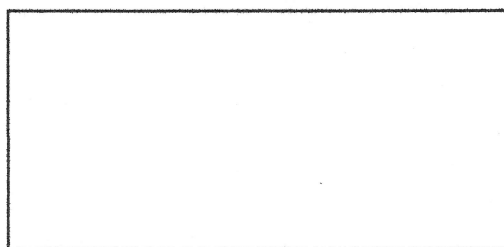
Section E \_\_\_\_\_

**Use the information on the top of page 1 to answer the following questions.**

12. Water vapor molecules with the least amount of energy form water drops on grass in the early morning.

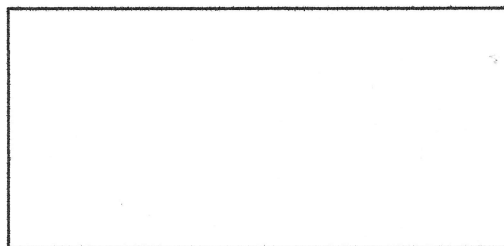
What is this process called? \_\_\_\_\_

Draw a picture of this in the box on the right.



13. A puddle of water in the grass begins to dry up. The highest energy molecules of water escape into the air as a gas. What is this process called? \_\_\_\_\_ Draw a

picture of this in the box on the right.



**Matching. Match each question to the best answer. Each answer is used once.**

- |                                                                                      |                   |
|--------------------------------------------------------------------------------------|-------------------|
| 1. _____ occurs when molecules change from a gas to a liquid below the boiling point | A. boiling point  |
| 2. _____ the temperature at which a liquid changes to a solid                        | B. sublimation    |
| 3. _____ occurs when a substance changes from a solid directly to a gas              | C. evaporation    |
| 4. _____ the temperature at which a liquid becomes a gas                             | D. freezing point |
| 5. _____ the temperature at which a solid changes to a liquid                        | E. melting point  |
| 6. _____ occurs when molecules change from a liquid to a gas below the boiling point | F. condensation   |

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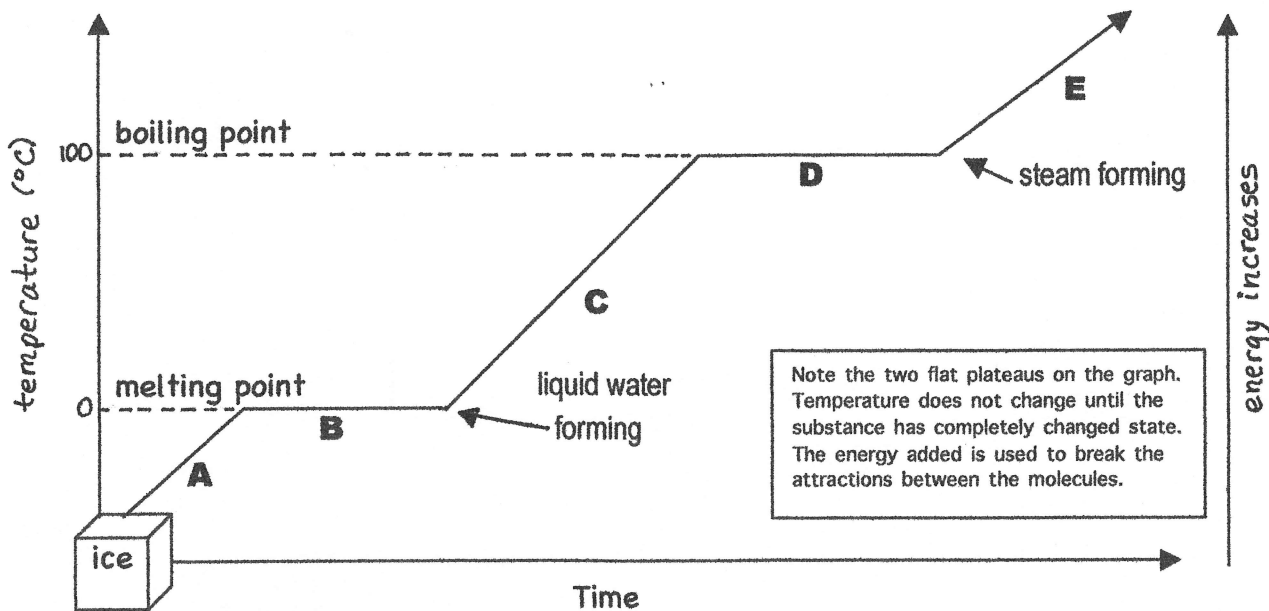
boiling point – the temperature at which a liquid becomes a gas

evaporation – occurs when molecules change from a liquid to a gas below the boiling point; occurs when high-energy particles near the surface break bonds and become a gas

condensation – occurs when molecules change from a gas to a liquid below the boiling point

sublimation – occurs when a substance changes from a solid directly to a gas

Use the graph below to answer the questions 1 - 15.



1. What is the melting point (temperature) of ice? 0°C
2. What is the freezing point (temperature) of ice? 0°C
3. What is the boiling point (temperature) of water? 100°C
4. What letter on the graph corresponds to only liquid water? C
5. What letter on the graph corresponds to only steam? E
6. What letter on the graph corresponds to only ice? A
7. What letter on the graph corresponds to both liquid water and steam? D
8. What letter on the graph corresponds to both ice and liquid water? B
9. Is molecular motion greater in region A or region E? E
10. Do the particles in region B or in region D have more kinetic energy? D
11. Liquid water exists between 0 degrees and 100 degrees Celsius.
12. Is a hotter temperature represented by letter D or letter E? E
13. Which two letters correspond to phase changes? B D

14. Which three letters correspond to temperature changes? A C E <sup>key</sup>

15. Explain what is happening in each section of the graph.

Section A As ice is heated, the temperature increases until 0°C.

Section B The temperature stays the same until all the ice melts.

Section C As the water is heated, the temperature increases until 100°C.

Section D The temperature stays the same until all the water

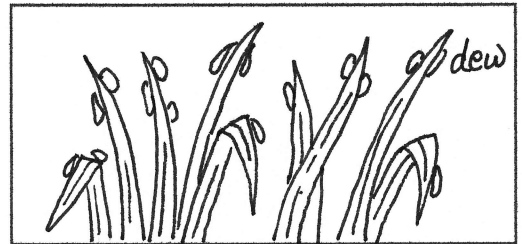
Section E As the steam is heated, the temperature rises. <sup>turns to steam.</sup>

Use the information on the top of page 1 to answer the following questions.

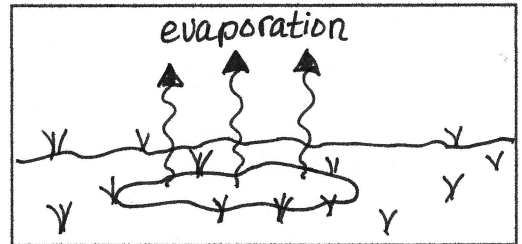
12. Water vapor molecules with the least amount of energy form water drops on grass in the early morning.

What is this process called? condensation

Draw a picture of this in the box on the right.



13. A puddle of water in the grass begins to dry up. The highest energy molecules of water escape into the air as a gas. What is this process called? evaporation Draw a picture of this in the box on the right.



**Matching.** Match each question to the best answer. Each answer is used once.

- |                                                                                         |                   |
|-----------------------------------------------------------------------------------------|-------------------|
| 1. <u>F</u> occurs when molecules change from a gas to a liquid below the boiling point | A. boiling point  |
| 2. <u>D</u> the temperature at which a liquid changes to a solid                        | B. sublimation    |
| 3. <u>B</u> occurs when a substance changes from a solid directly to a gas              | C. evaporation    |
| 4. <u>A</u> the temperature at which a liquid becomes a gas                             | D. freezing point |
| 5. <u>E</u> the temperature at which a solid changes to a liquid                        | E. melting point  |
| 6. <u>C</u> occurs when molecules change from a liquid to a gas below the boiling point | F. condensation   |