

*Important Things to Know - Do Not Skip Over these 2 Sections  
READ and REMEMBER*

**Kinetic Theory of Matter:**

- Molecules are always *moving*. This is known as the *kinetic* theory of matter.
- We measure this kinetic energy with a thermometer as *temperature*.
- The greater the material's internal energy, the higher the temperature of that material.
- *Heat* is the energy flow between objects of different temperature.
- Heat and temperature are NOT the same.
- *Brownian motion* describes how visible particles are seen moving due to invisible molecules bumping into them.

**Phases of Matter:**

**Solid**

- matter that has definite volume and shape.
- The molecules are packed together tightly and move slowly.

**Liquid**

- matter that has definite volume but not shape.
- Since the molecules of a liquid are loosely packed and move with greater speed,
- a liquid can flow and spread.

**Gas**

- matter that has indefinite volume or shape.
- Molecules of a gas are so loosely arranged and move so rapidly that they will fill their container.

**Phase Change Descriptions:**

**Melting**

the change from \_\_\_\_\_ to \_\_\_\_\_.

**Freezing**

the change from \_\_\_\_\_ to \_\_\_\_\_.

**Evaporation**

the change from \_\_\_\_\_ to \_\_\_\_\_.

**Condensation**

the change from \_\_\_\_\_ to \_\_\_\_\_.

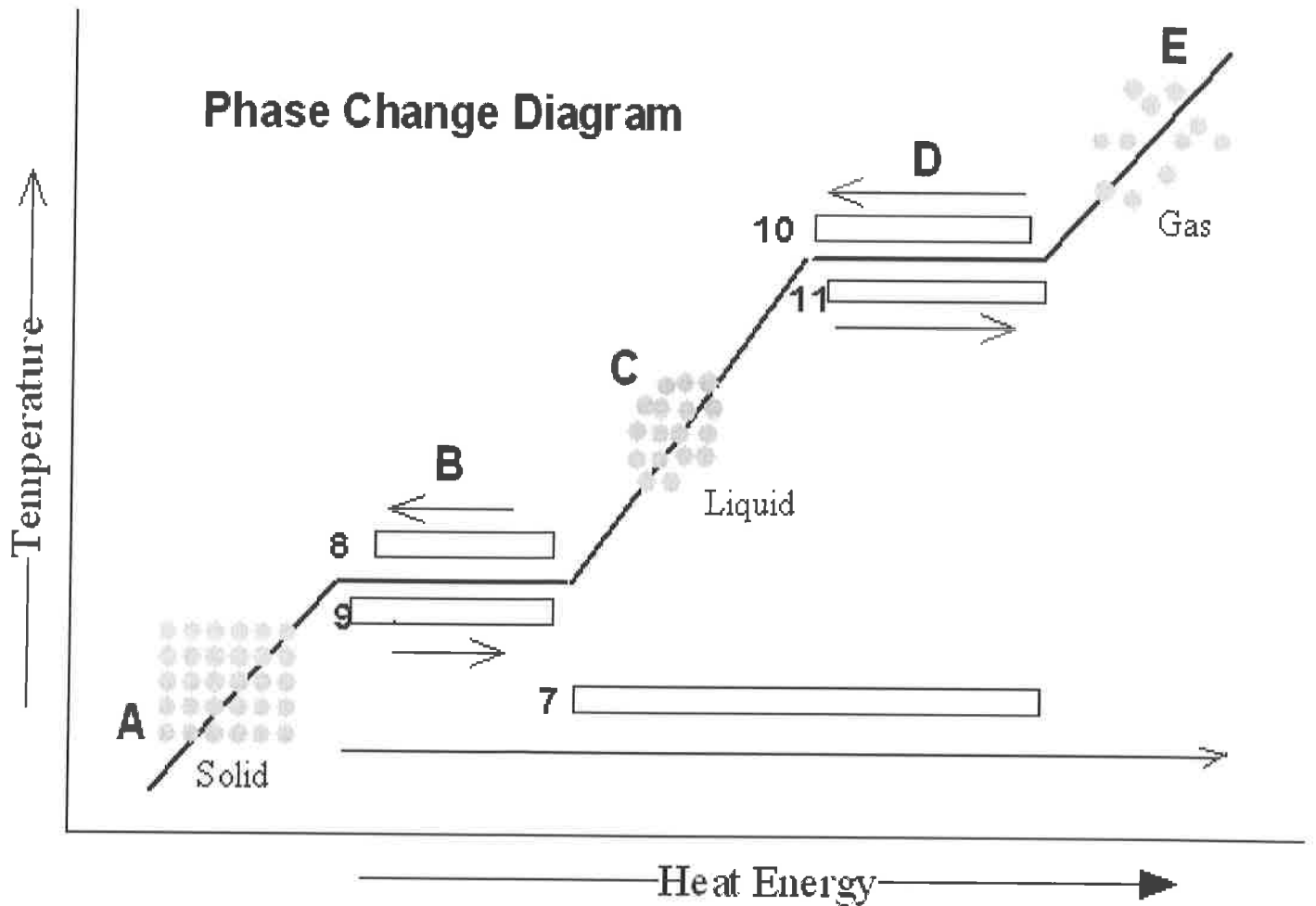
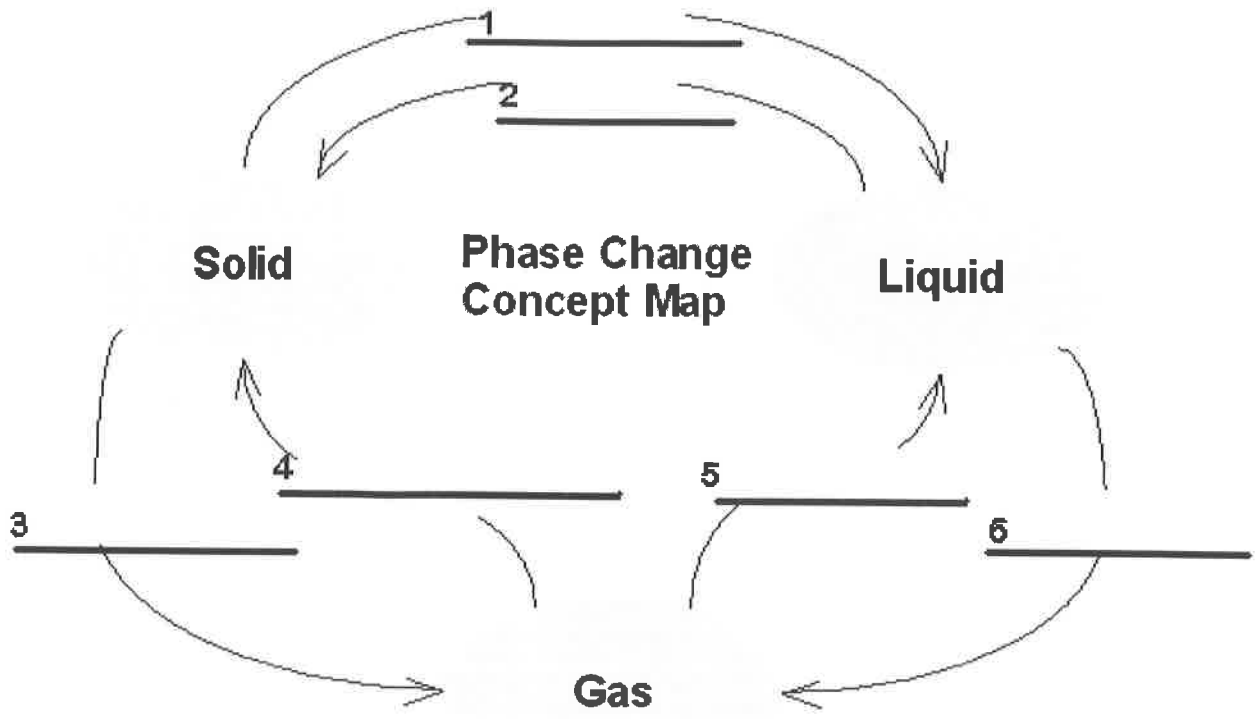
**Sublimation**

the change from \_\_\_\_\_ to \_\_\_\_\_.

**Deposition**

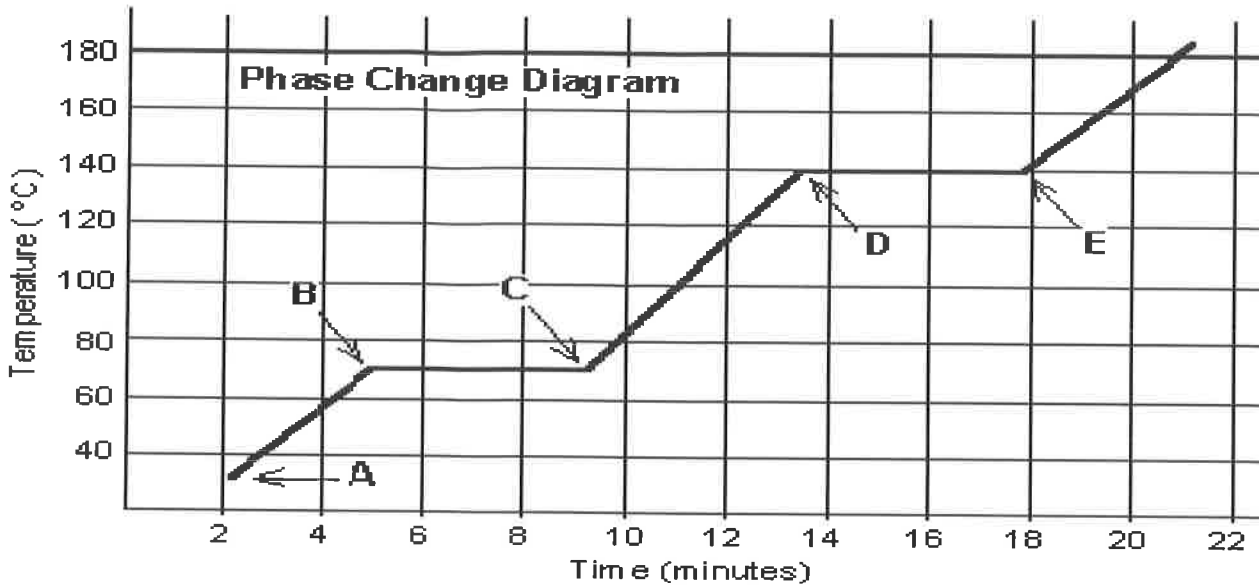
the change from \_\_\_\_\_ to \_\_\_\_\_.

Fill in the phase changes in the blank provided.



### Phase Change Worksheet

The graph was drawn from data collected as a substance was heated at a constant rate. Use the graph to answer the following questions.



At **point A**, the beginning of observations, the substance exists in a solid state. Material in this phase has \_\_\_\_\_ volume and \_\_\_\_\_ shape. With each passing minute, \_\_\_\_\_ is added to the substance. This causes the molecules of the substance to \_\_\_\_\_ more rapidly which we detect by a \_\_\_\_\_ rise in the substance. At **point B**, the temperature of the substance is \_\_\_\_\_ °C. The solid begins to \_\_\_\_\_. At point C, the substance is completely \_\_\_\_\_ or in a \_\_\_\_\_ state. Material in this phase has \_\_\_\_\_ volume and \_\_\_\_\_ shape. The energy put to the substance between minutes 5 and 9 was used to convert the substance from a \_\_\_\_\_ to a \_\_\_\_\_. This heat energy is called the **latent heat of fusion**. (An interesting fact.)

Between 9 and 13 minutes, the added energy increases the \_\_\_\_\_ of the substance. During the time from **point D to point E**, the liquid is \_\_\_\_\_. By **point E**, the substance is completely in the \_\_\_\_\_ phase. Material in this phase has \_\_\_\_\_ volume and \_\_\_\_\_ shape. The energy put to the substance between minutes 13 and 18 converted the substance from a \_\_\_\_\_ to a \_\_\_\_\_ state. This heat energy is called the **latent heat of vaporization**. (An interesting fact.) Beyond **point E**, the substance is still in the \_\_\_\_\_ phase, but the molecules are moving \_\_\_\_\_ as indicated by the increasing temperature.

Which of these three substances was likely used in this phase change experiment?

Substance	Melting point	Boiling point
Bolognium	20 °C	100 °C
Unobtainium	40 °C	140 °C
Foosium	70 °C	140 °C

\_\_\_\_\_

**BONUS:** For water, the value for the latent heat of vaporization is 6.8 times greater than the latent heat of fusion. Imagine we were adding heat at a constant rate to a block of ice in a beaker on a hot plate, and it took 4 minutes for the ice to melt completely. How long would it take, after the water started boiling, for the beaker to be completely empty (the liquid water totally converted to water vapor)?

## Phase Changes Worksheet

Name Key

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### **Kinetic Theory of Matter:**

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### **Phases of Matter:**

#### Solid

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#### Liquid

- matter that has definite volume but not shape.
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- a liquid can flow and spread.

#### Gas

- matter that has indefinite volume or shape.
- Molecules of a gas are so loosely arranged and move so rapidly that they will fill their container.

### **Phase Change Descriptions:**

#### Melting

the change from SOLID to LIQUID.

#### Freezing

the change from LIQUID to SOLID.

#### Evaporation

the change from LIQUID to Gas.

#### Condensation

the change from Gas to LIQUID.

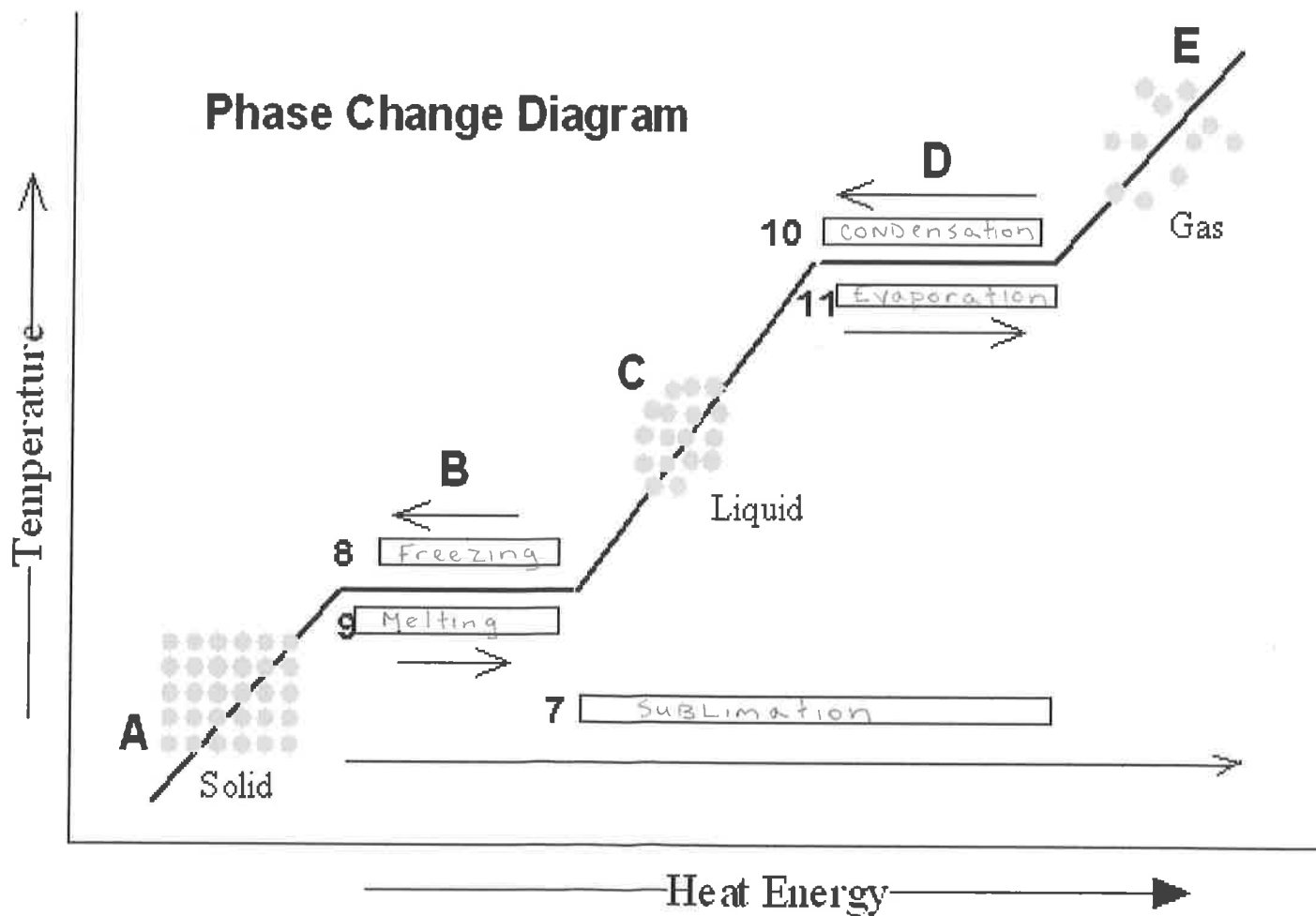
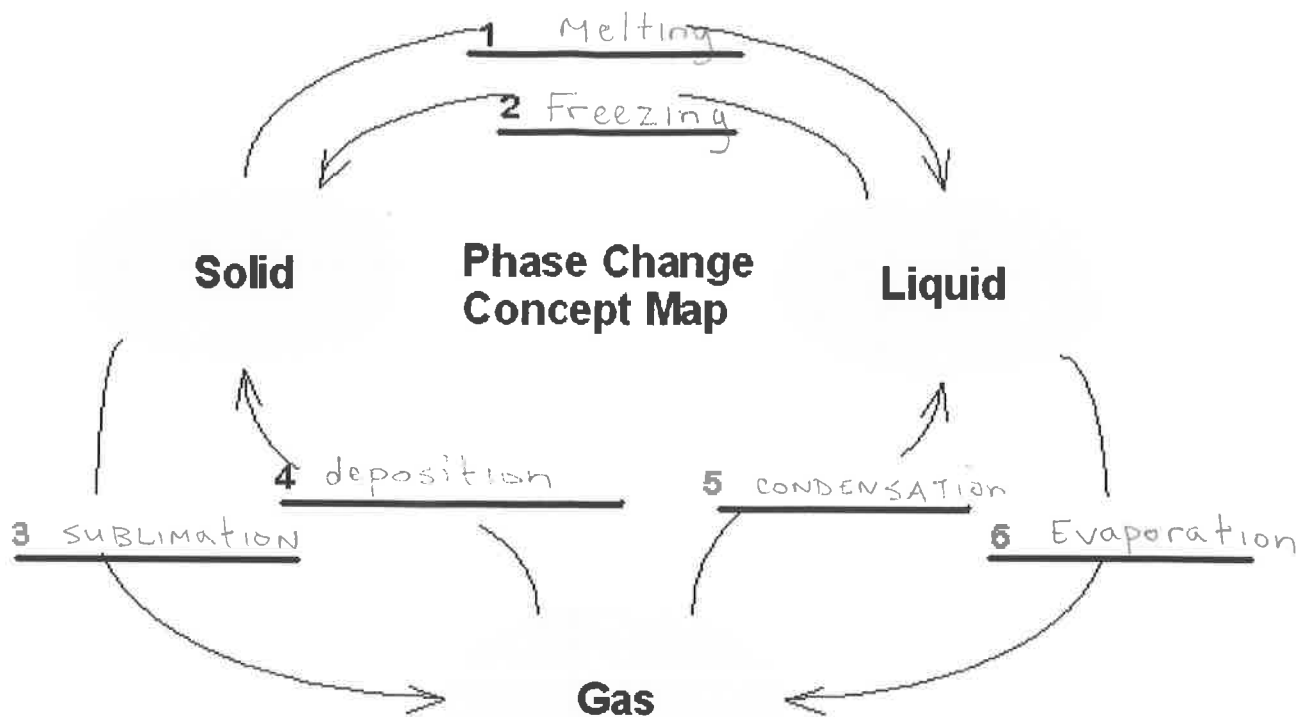
#### Sublimation

the change from SOLID to Gas.

#### Deposition

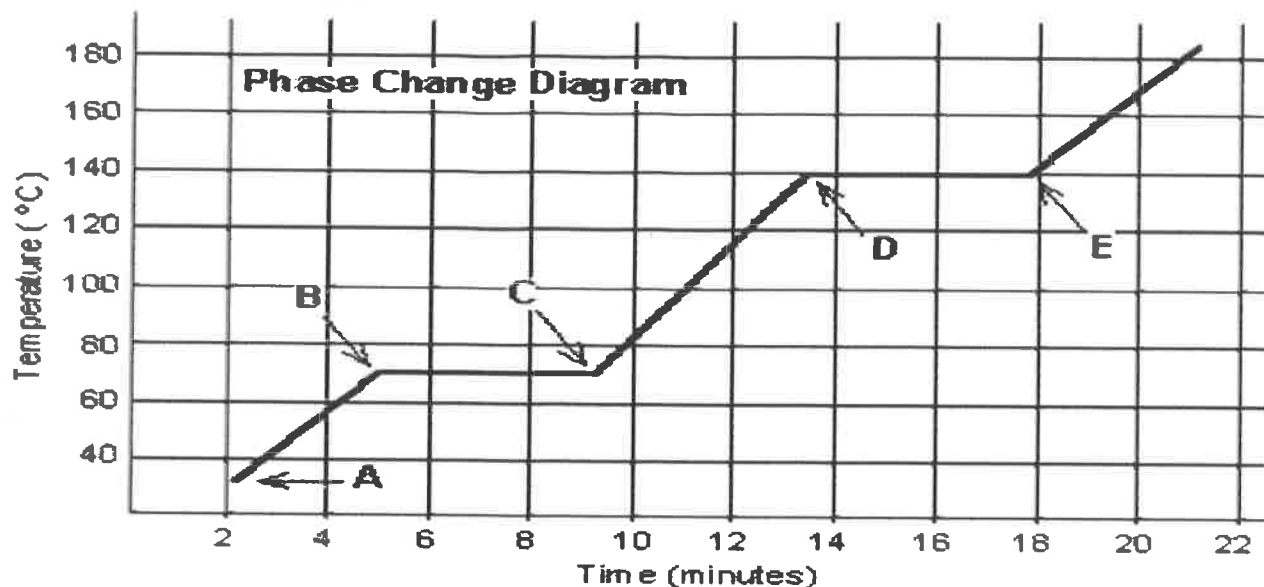
the change from Gas to SOLID.

Fill in the phase changes in the blank provided.



## Phase Change Worksheet

The graph was drawn from data collected as a substance was heated at a constant rate. Use the graph to answer the following questions.



At **point A**, the beginning of observations, the substance exists in a solid state. Material in this phase has definite volume and definite shape. With each passing minute, energy is added to the substance. This causes the molecules of the substance to vibrate more rapidly which we detect by a steady rise in the substance. At **point B**, the temperature of the substance is 70 °C. The solid begins to melt. At **point C**, the substance is completely melted or in a liquid state. Material in this phase has definite volume and indefinite shape. The energy put to the substance between minutes 5 and 9 was used to convert the substance from a solid to a liquid. This heat energy is called the **latent heat of fusion**. (An interesting fact.)

Between 9 and 13 minutes, the added energy increases the temperature of the substance. During the time from **point D to point E**, the liquid is boiling. By **point E**, the substance is completely in the gas or vapor phase. Material in this phase has indefinite volume and indefinite shape. The energy put to the substance between minutes 13 and 18 converted the substance from a liquid to a gas state. This heat energy is called the **latent heat of vaporization**. (An interesting fact.) Beyond **point E**, the substance is still in the gas phase, but the molecules are moving rapidly as indicated by the increasing temperature.

Which of these three substances was likely used in this phase change experiment?

Foosium

Substance	Melting point	Boiling point
Bolognium	20 °C	100 °C
Unobtainium	40 °C	140 °C
Foosium	70 °C	140 °C

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