

# Notes: Properties of Solids, Liquids, Gasses, and Kinetic Theory

Gasses, Pressure, Kinetic Theory,  
Temperature, Pressure, Heating Curve,  
Diffusion

# Textbook

- States of Matter - Chapter 2.1, p. 36-37
- Temperature - Chapter 3.2, p. 78-79
- Kinetic Energy, Kinetic Molecular Theory, Chapter 13.1, p. 420-424; p. 426
- Temperature , Pressure - Chapter 14.1, p. 451-454
- Gasses , Chapter 14.2-14.3, p. 456-461
- Diffusion, Chapter 14, p472
- Heating Curve For Water, Chapter 17.3, see graph p. 572 & explanations p. 571 – 572
- PhET Simulations:

<http://phet.colorado.edu/en/simulations/category/chemistry/general>

# The Model so Far

1. What do we know about our particles? (They have \_\_\_\_\_ & take up \_\_\_\_\_ and they can not be \_\_\_\_\_).

**They have mass & take up space (volume) and can not be divided**

2. What do we know about how our particles arrange themselves?  
What is this property called?

**These particles can "pack together" in different ways, giving different substances and different states of matter This property of packing together is called density.**

3. Whose model is this? **Democritus**

4. What do we know about COM?

**These particles are neither created or destroyed. They can rearrange themselves into different substances.**

# Solids, liquids and Gasses

## 1. Describe the solid, liquid and gas.

	<b>gas</b>	<b>liquid</b>	<b>solid</b>
<b>shape</b>	<b>Assumes the shape and volume of its container. Particles can move past one another.</b>	<b>assumes the shape of the part of the container which it occupies. Particles can move/slide past one another.</b>	<b>retains a fixed volume and shape rigid - particles locked into place.</b>
<b>compressible</b>	<b>Compressible, lots of free space between particles</b>	<b>not easily compressible, little free space between particles</b>	<b>not easily compressible, little free space between particles</b>
<b>Flows or moves</b>	<b>flows easily, particles can move past one another</b>	<b>flows easily, particles can move past one another</b>	<b>does not flow easily rigid - particles cannot move/slide past one another</b>

**What do we know about how our particles arrange themselves in solids, liquids & gasses ? What is this property called?**

- The solid particles are very close together (very dense).**
- The liquid particles are not as dense as a solid but are still close together, and the gas particles are very spread out.**

**This property is called density.**

**2. Explain why the mercury or alcohol level in a thermometer rises when it is placed in a warmer fluid. (3-step process)**

- 1. Energy from the warmer fluid (the surroundings) is transferred to the liquid in the thermometer.**
- 2. This energy causes the alcohol molecules to move faster.**
- 3. The alcohol molecules move further apart (expand).**

**Result: alcohol rises in the tube.**

**3. Explain why the mercury or alcohol level in a thermometer falls when it is placed in a warmer fluid. (3-step process).**

- 1. Energy from the warmer thermometer is transferred to the fluid (the surroundings).**
- 2. This energy loss causes the alcohol molecules to move slower.**
- 3. The alcohol molecules move closer together (contract).**

**Result: alcohol goes down in the tube.**

# Diffusion of Gasses

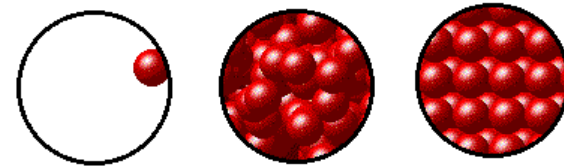
- **To see the diffusion animation click this link:** [Diffusion](#)
    - **Diffusion is a term that refers the tendency of particles in a fluid (gasses & liquids) to spread out and mix in with their surroundings.**
    - This usually happens because everything moves from high to low.
    - In this case from high concentration (as in a bottle of perfume) to low concentration (as in a room full of air with no perfume mixed in).
      - If a perfume bottle is opened into the air and mixes with the air what is the solute & what is the solvent??
    - The mixing is caused by the motion of the solvent particles.
- Solute:** thing present in the smaller quantity, being mixed or dissolved.
- Solvent:** thing in the greater quantity that is doing the mixing or dissolving.

# States of Matter

## Solid, Liquid, Gas

- Click the links below to see the States of Matter animation and simulations

**States of Mater Animation**



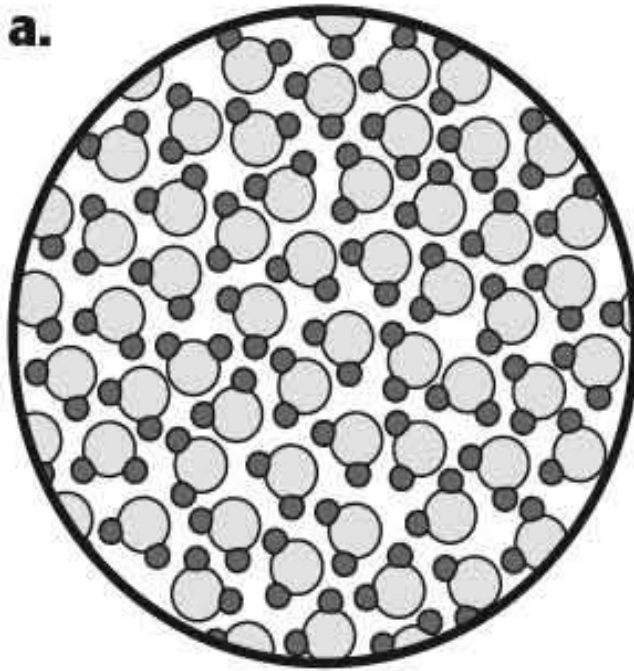
<http://www.chem.purdue.edu/gchelp/liquids/character.html>

- [States of Matter Simulation](#)
- [http://phet.colorado.edu/sims/states-of-matter/states-of-matter-basics\\_en.jnlp](http://phet.colorado.edu/sims/states-of-matter/states-of-matter-basics_en.jnlp)

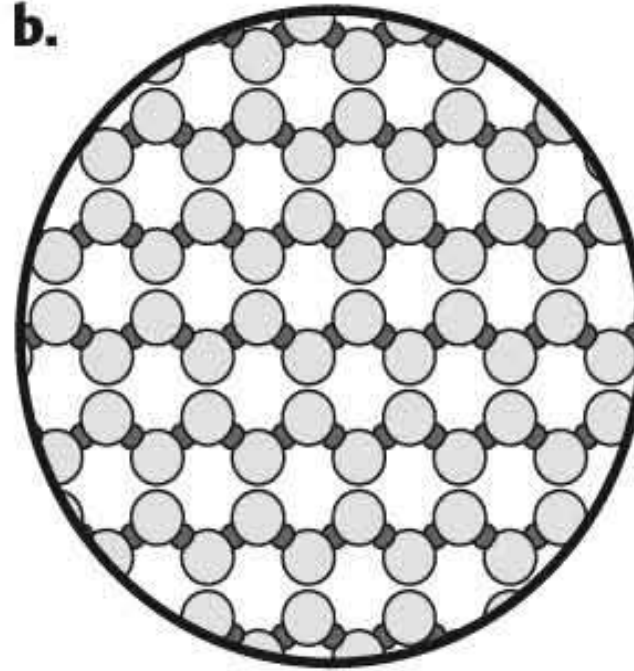




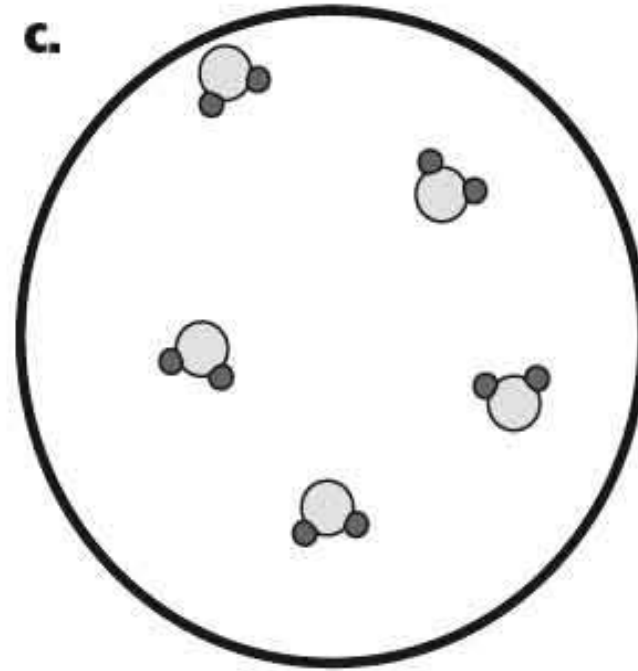
# States of Water



**liquid**



**solid**



**gas**

- Identify the solid, liquid & gas
- Remember, ice floats in water
- Remember, the less dense item floats!!

# Notes

- Energy is stored in an object or system in several ways; for now we restrict our discussion to:
  - **Thermal Energy** – **due to the motion of the particles.**
  - **Phase Energy** – **due to the arrangement of the particles in solid, liquid and gaseous phases.**  
*Attractions lower the energy of a system;*
    - *therefore, solids have the lowest phase energy because the particles are bound most tightly,*
    - *liquids have greater energy because they have more freedom of motion,*
    - *and gases have the greatest amount of energy because the particles have overcome the attractions that hold solids and liquids together.*

- **Energy**

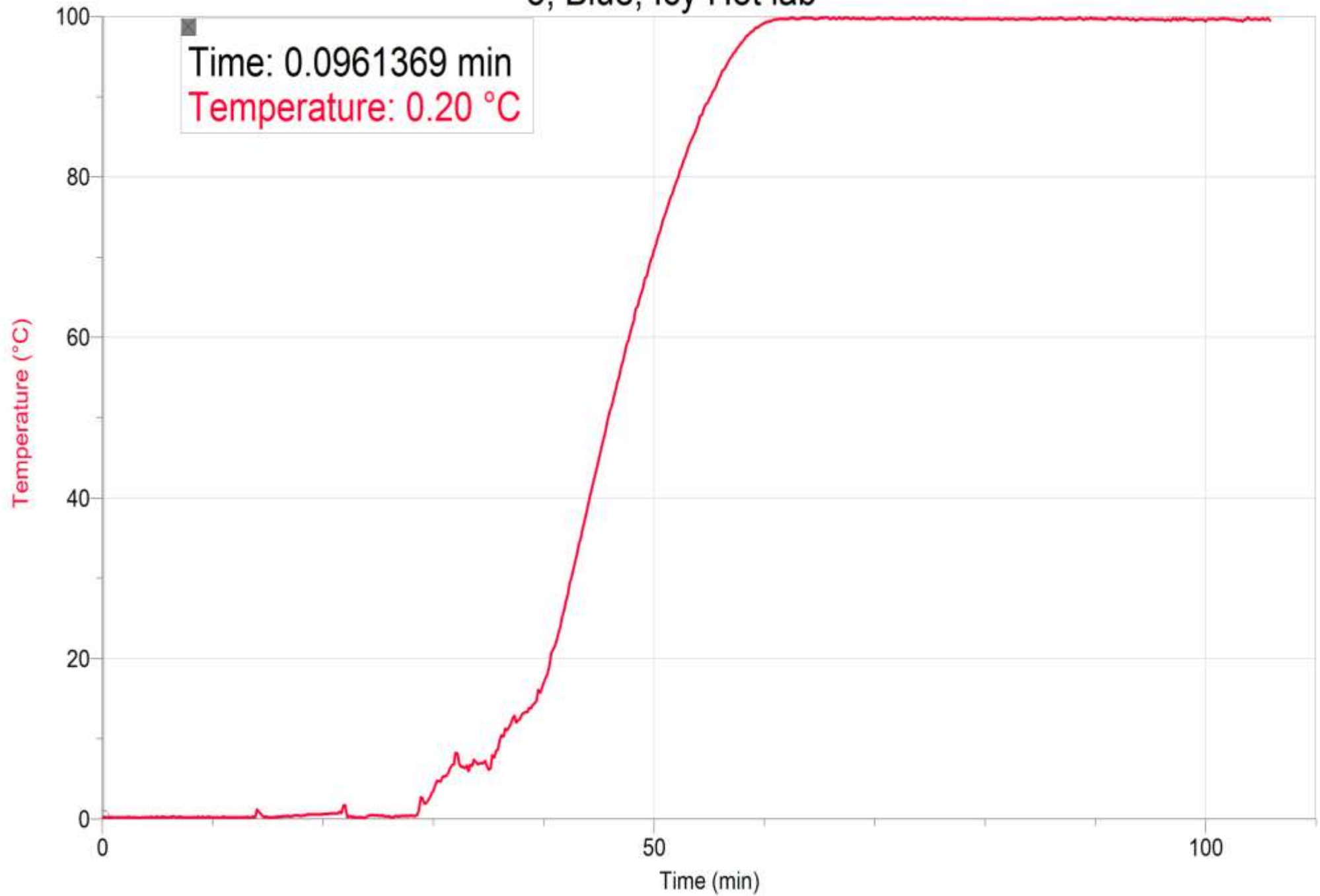
- Think of energy as a quantity that is always involved when there is a *change* in the state of matter. When a substance gets hotter or colder or changes phase, energy is either transferred into or out of the system. The two key ways energy is stored is **thermal** (due to the motion of the particles) and **phase** (due to attractions between the particles).

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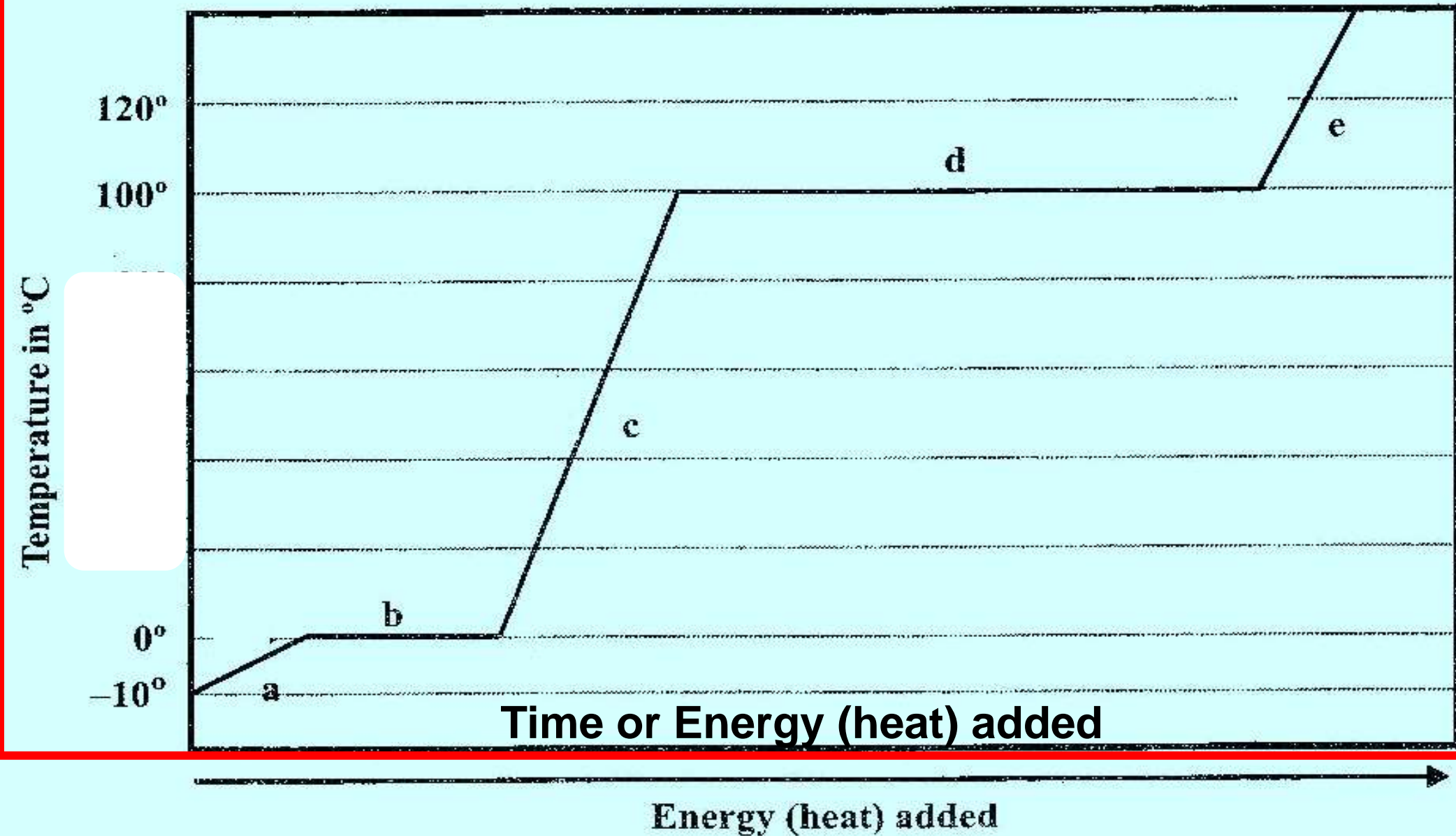
- Remember that attractions *lower* the energy state, so one must *add* energy to a system to pull particles apart. The three ways that energy is transferred is by heating (Q), working (W) and radiating (R); this course focuses on Q.

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# 5, Blue, Icy Hot lab



## Changing the States of Water



4. What phase is a?

**solid**

5. What phases exist together at b?

**Solid & liquid**

6. What phase is c?

**liquid**

7. What phases exist together at d?

**Liquid and gas**

8. What phase is e?

**gas**

9. What section of the graph above represents melting?

**B**

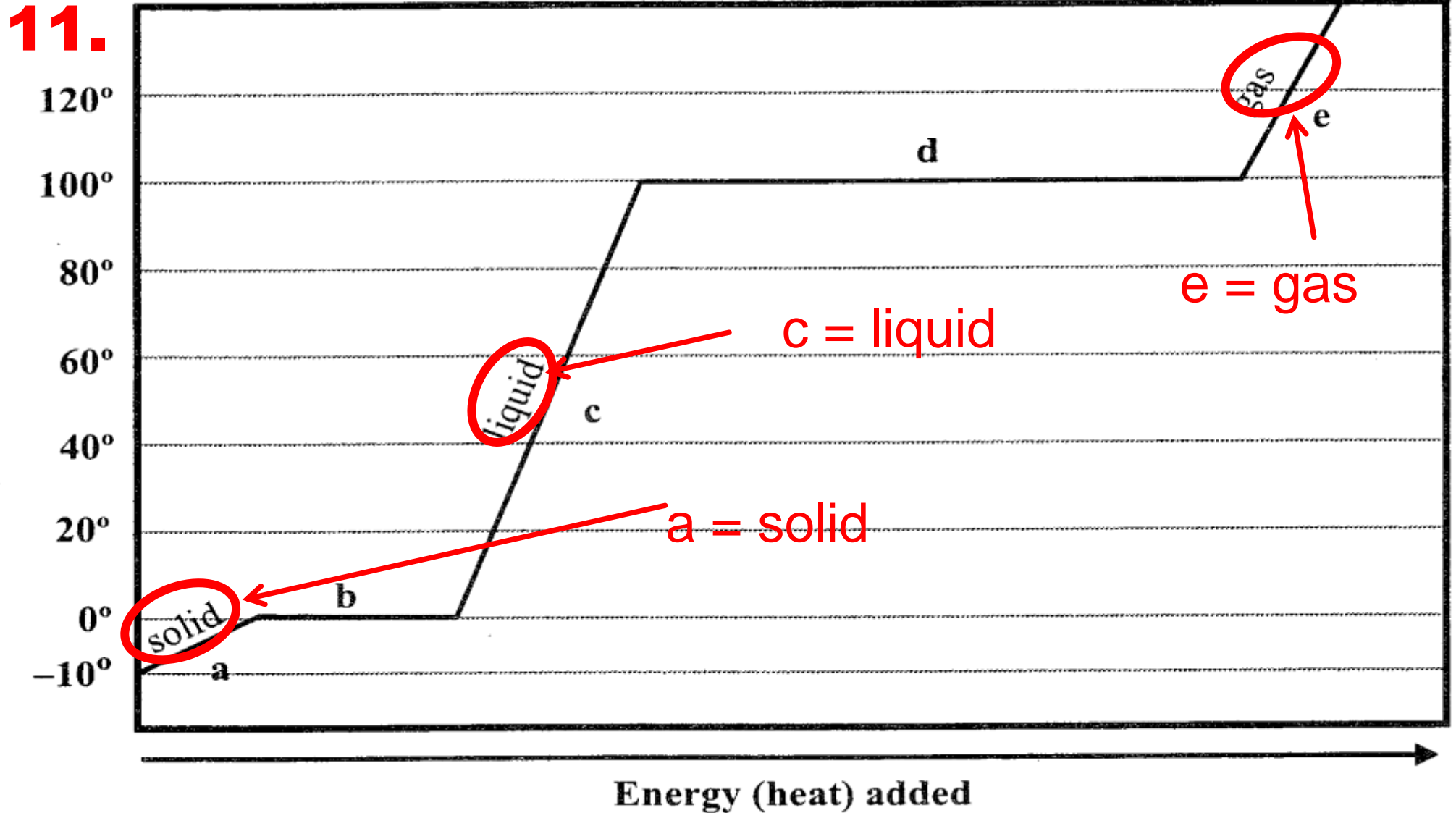
10. What section of the graph above represents boiling?

**D**

11. Label the sections of the graph: solid, liquid, gas.

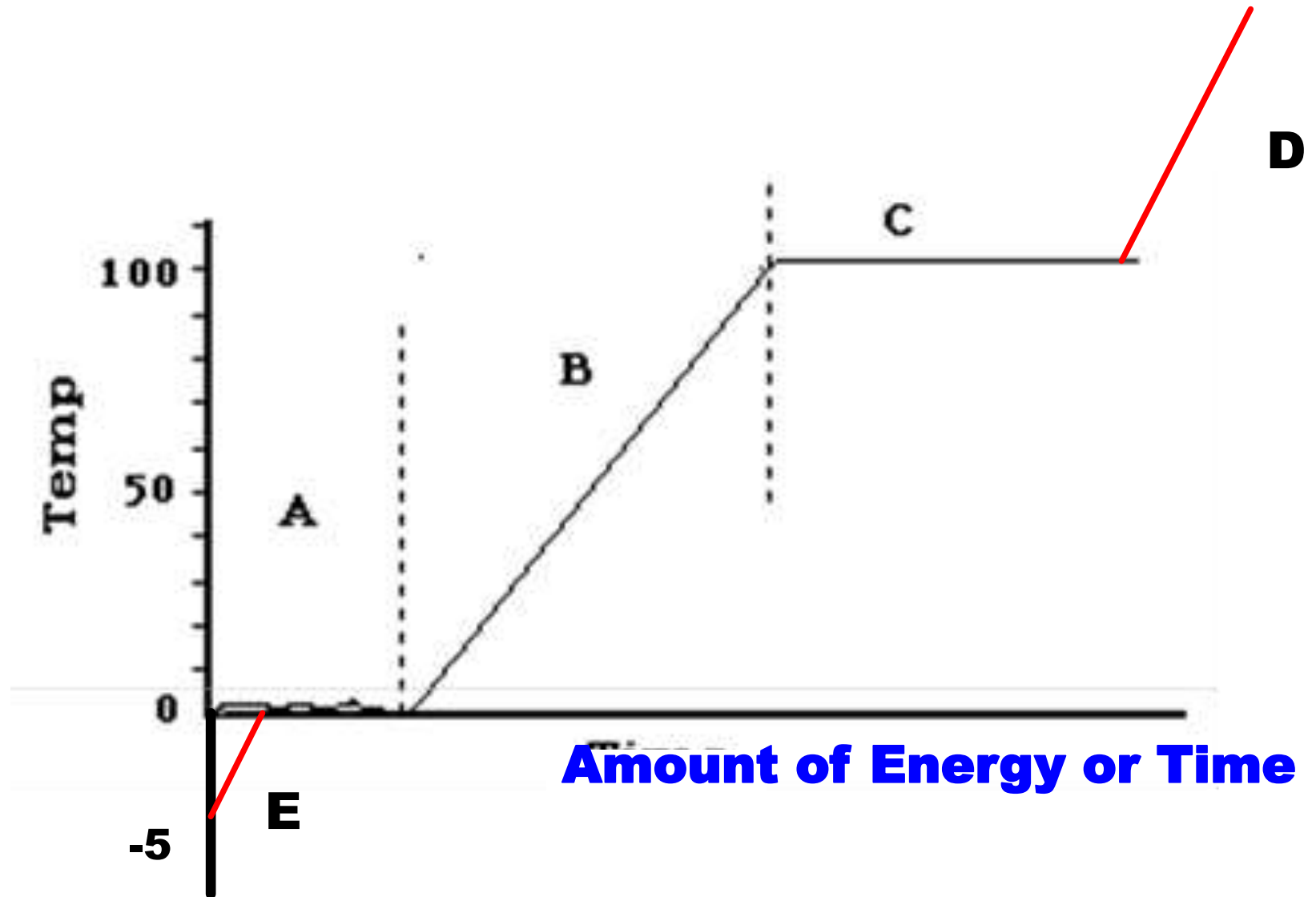
# Bell Work Answers, Mon, Nov, 4

## Changing the States of Water



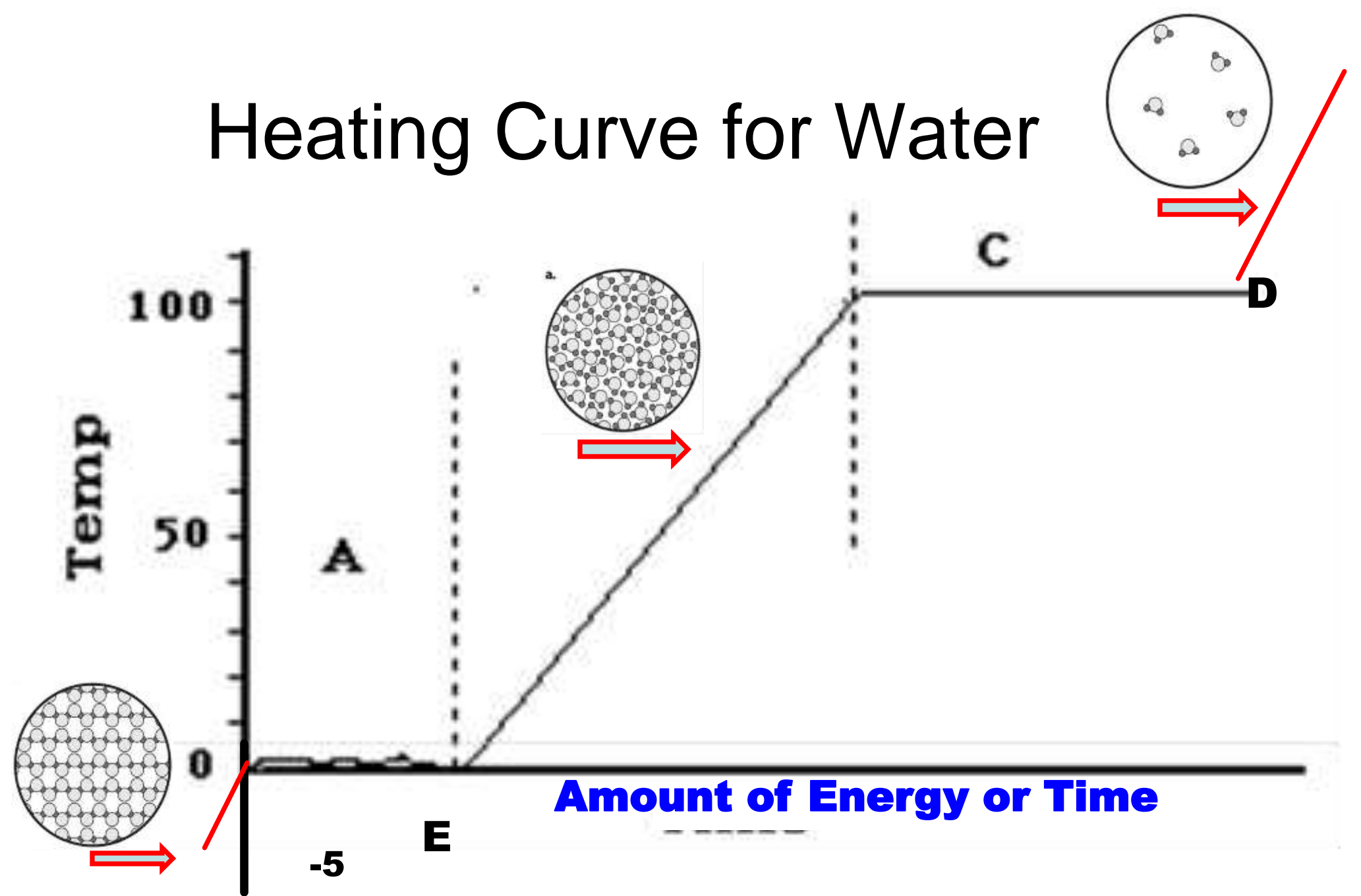


# Heating Curve for Water





# Heating Curve for Water



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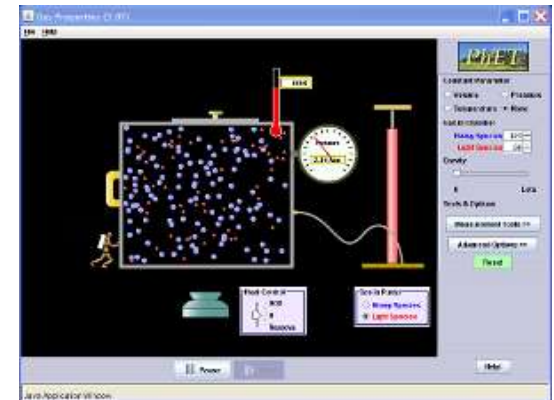
# Pressure

1. Define pressure: **the amount of force exerted per unit area of a surface.**

**Explain why the railroad tanker car was crushed.**

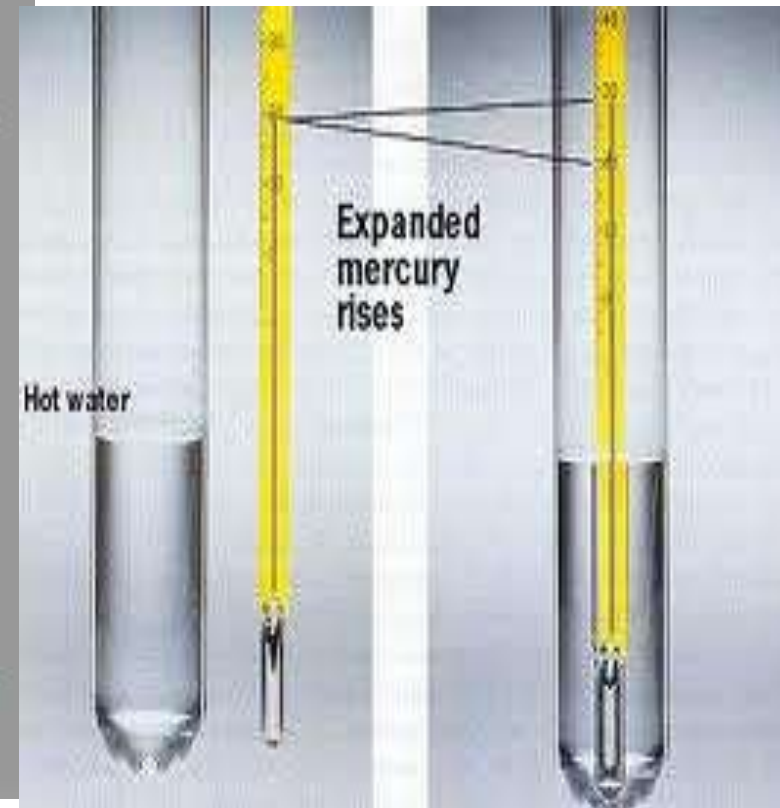
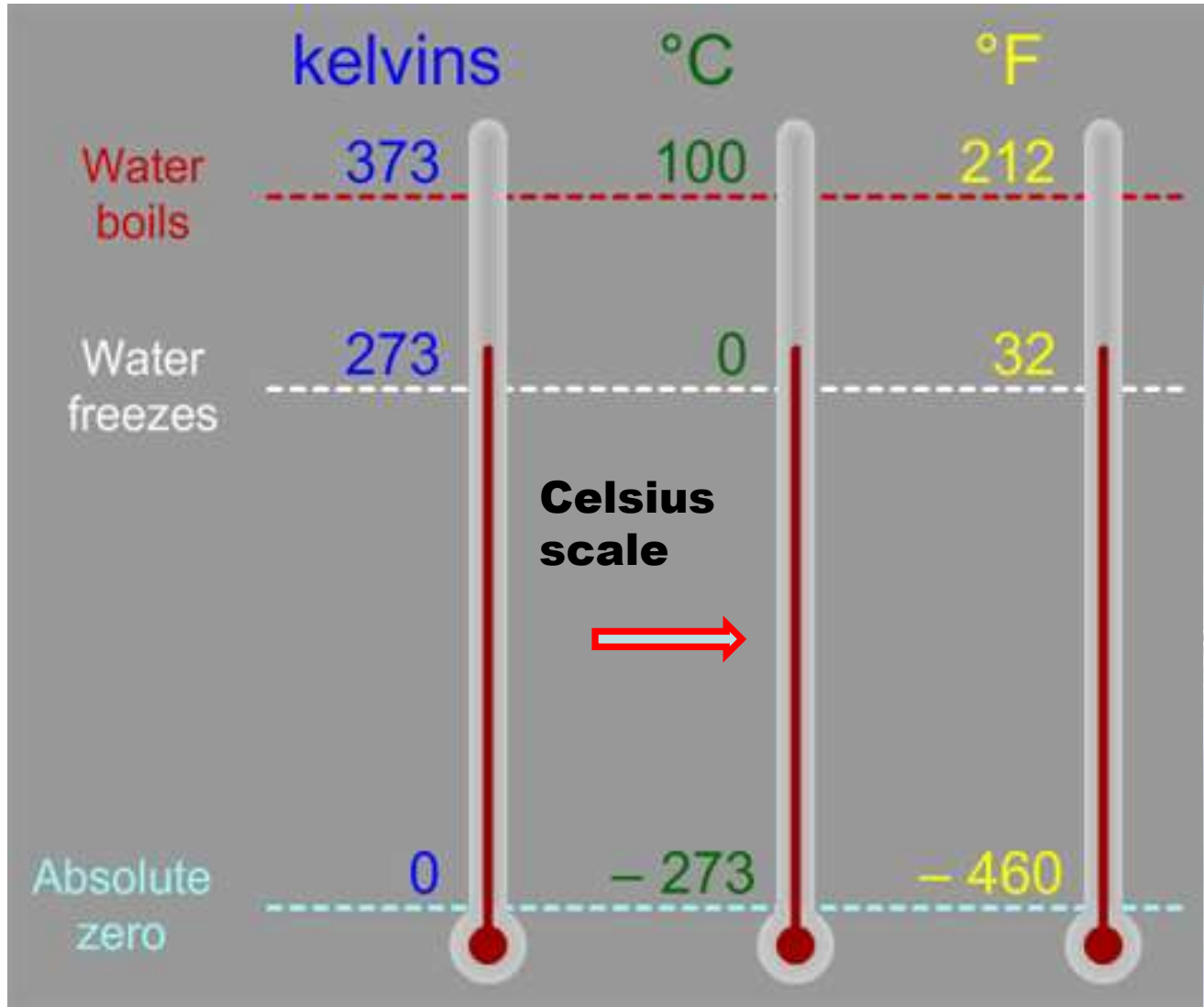


Click the link to see the simulation of pressure, volume and temperature.



[Gas Pressure, Volume, Amount of Particles, Temperature](#)

# Temperature



# Heat and Temperature.

- Temperature = speed of molecules. Faster is hotter, slower is colder.
  - Temperature does not depend on mass (how much stuff there is).
- Heat is temperature and mass. Heat depends on the degree of hotness (also called temperature) and how much stuff there is (mass).
  - A bucket of 50° water has more heat in it than a tea cup of 100° water.