Notes: Nov 4 – Nov 8, 2013

Gasses, Pressure, Kinetic Theory, Temperature, Pressure, Heating Curve, Mixtures, Pure Substances

The Model so Far

1. What do we know about our particles? (They have _____ & take up _____).

They have mass & take up space (volume).

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. What do we know about COM?

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

Objectives

- Given a heating/cooling curve for a substance, identify what phase(s) is/are present in the various portions of the curve, and what phase changes are taking place.
- Recognize the effect of:
  - Thermal energy– due to the motion of the particles. The temperature of a system is a measure of its thermal energy.
  - Phase energy – due to the arrangement of the particles in solid, liquid and gaseous phases.

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).
  - 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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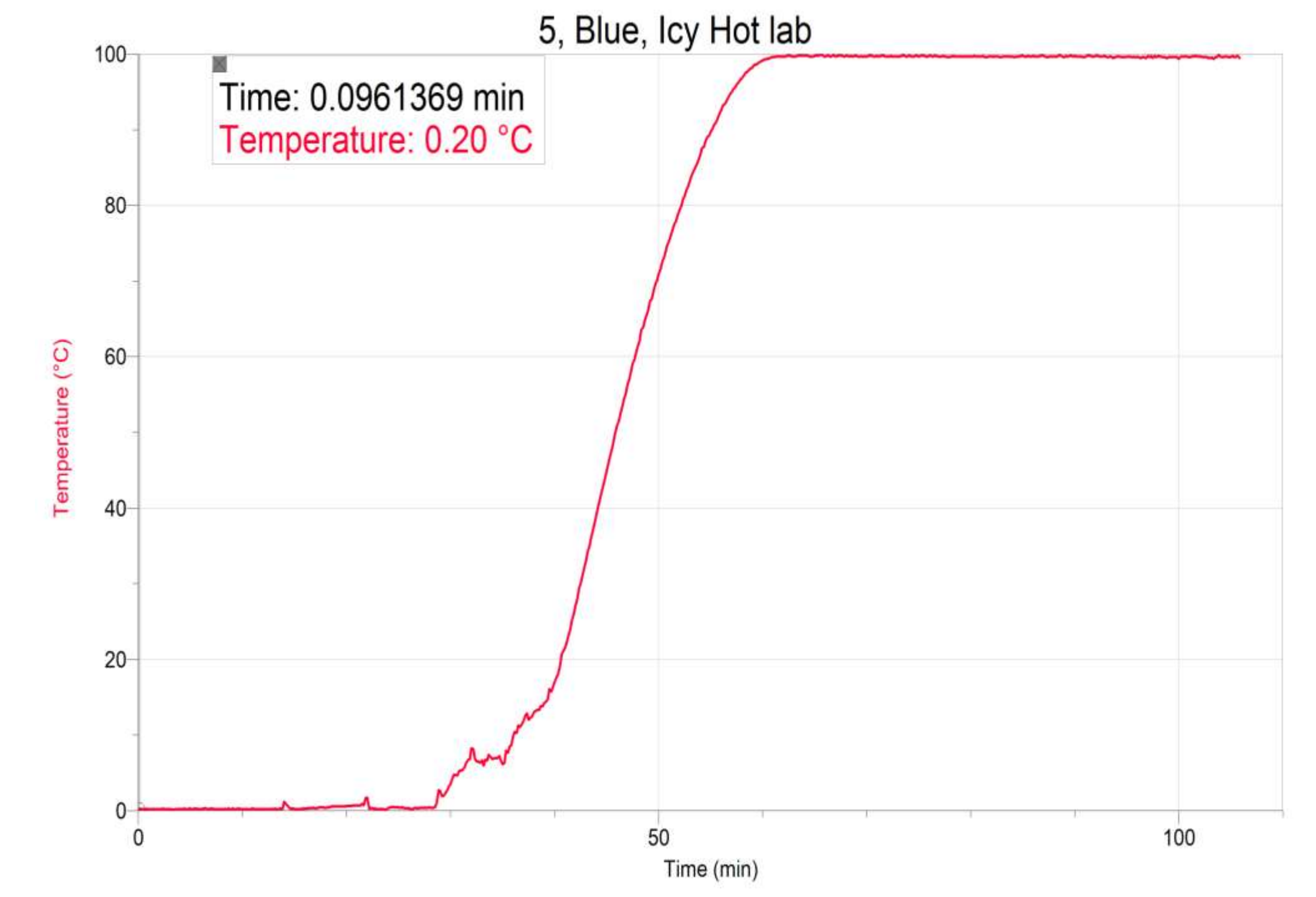
5, Blue, Icy Hot lab
Time: 0.0961369 min
Temperature: 0.20 °C
100
80
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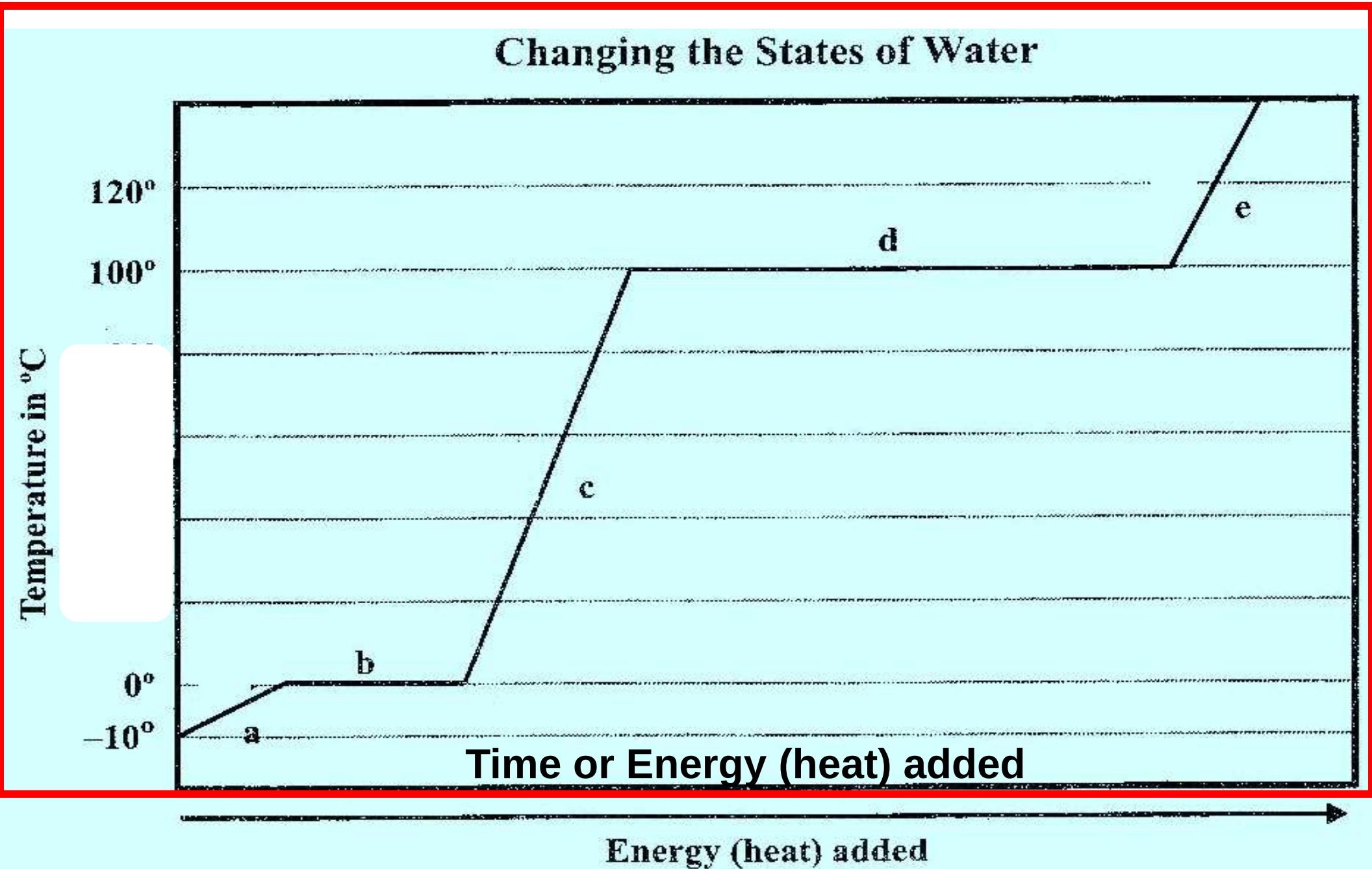
Temperature (°C)
0
50
100
Time (min)

Bell Work, Monday, Nov 4, 2013



Bell Work, Monday Nov 4

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

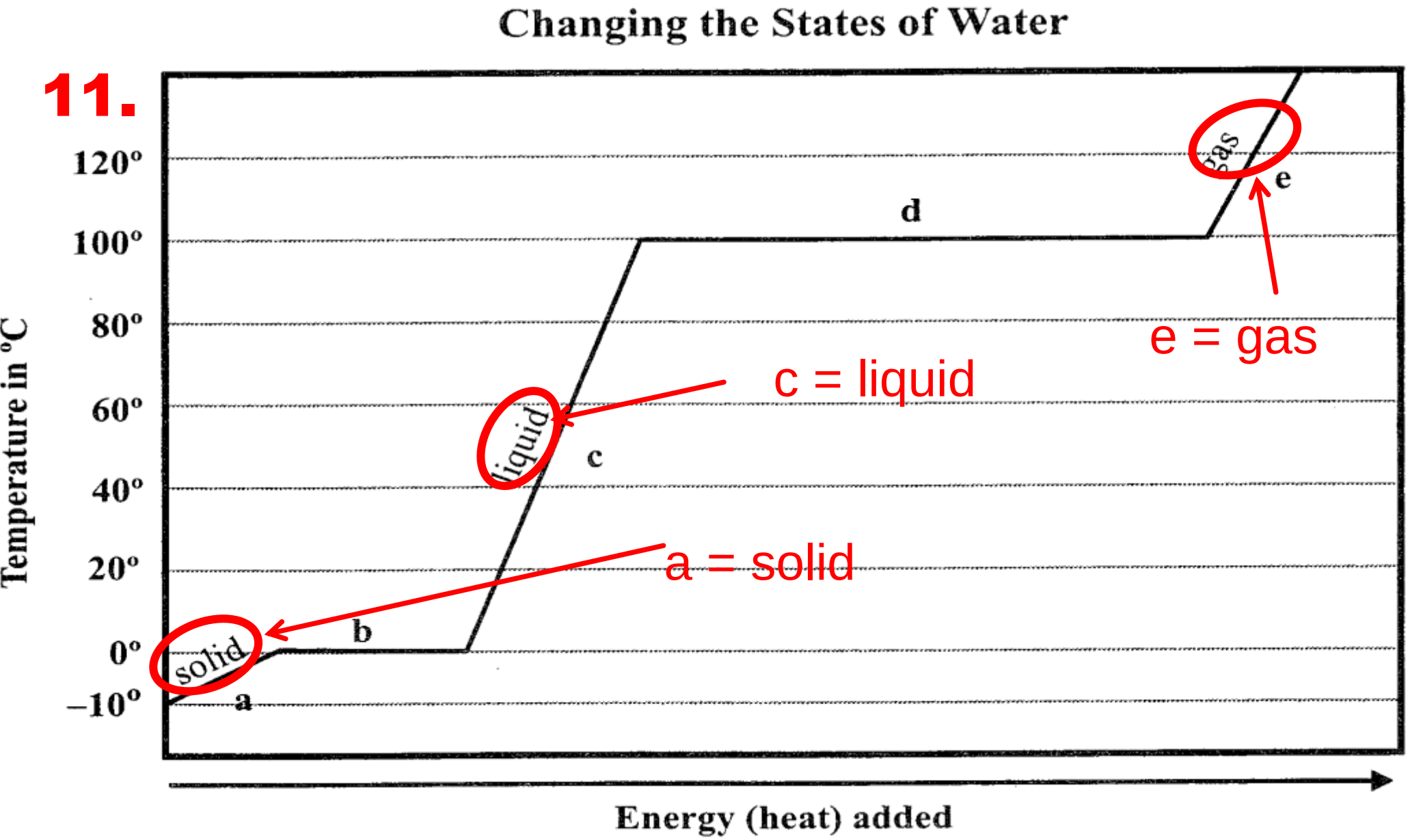
10. **What section of the graph above represents boiling?**

    D

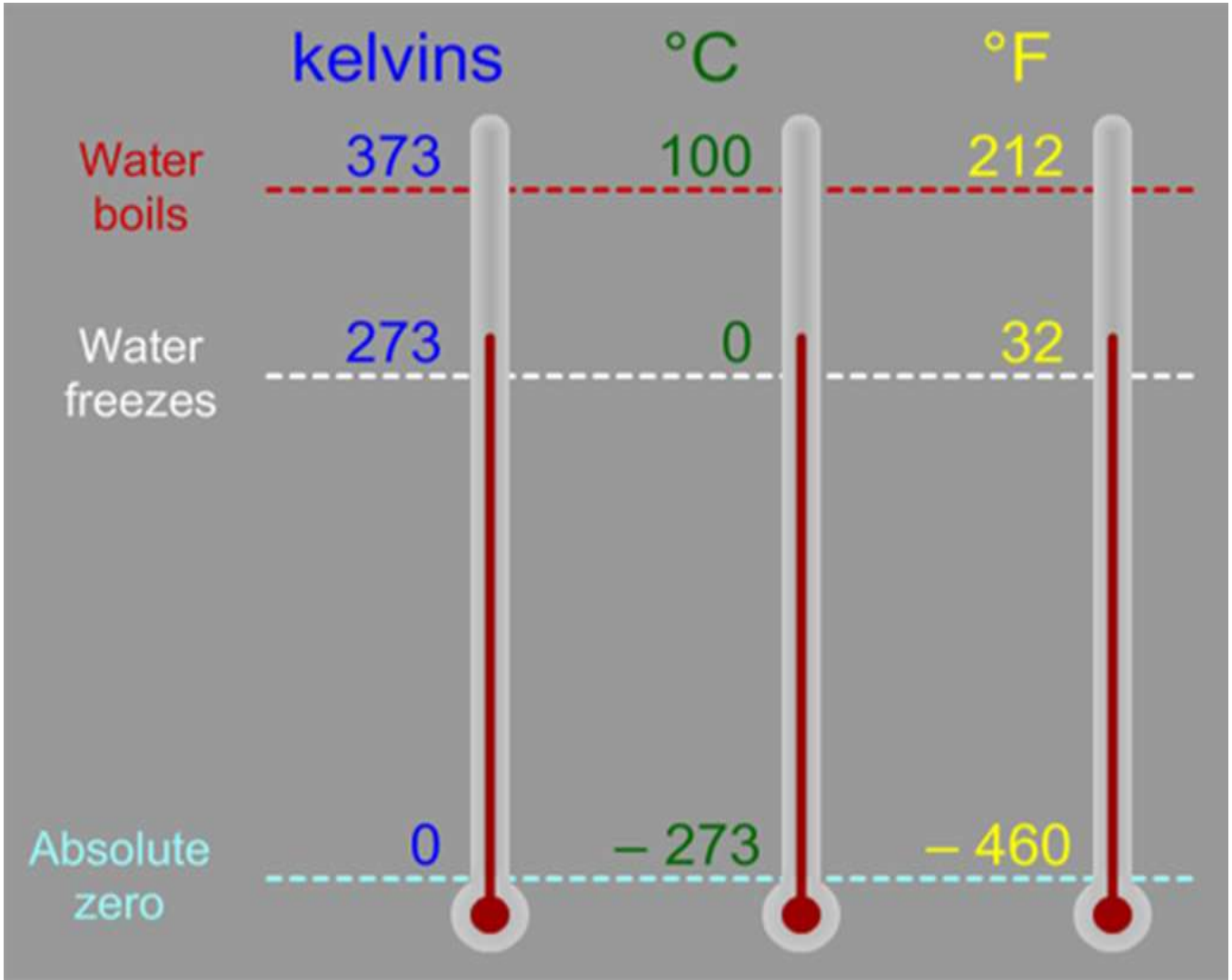
11. **Label the sections of the graph: solid, liquid, gas.**

Bell Work Answers, Mon, Nov, 4

11.

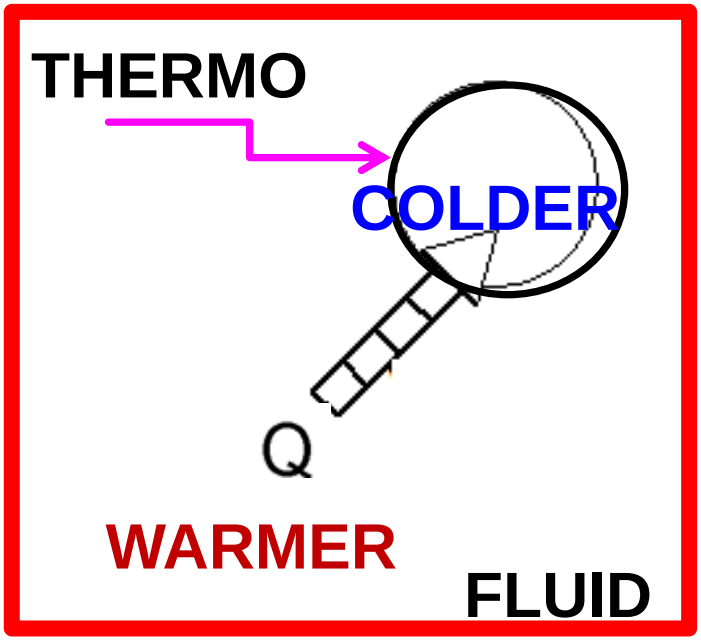


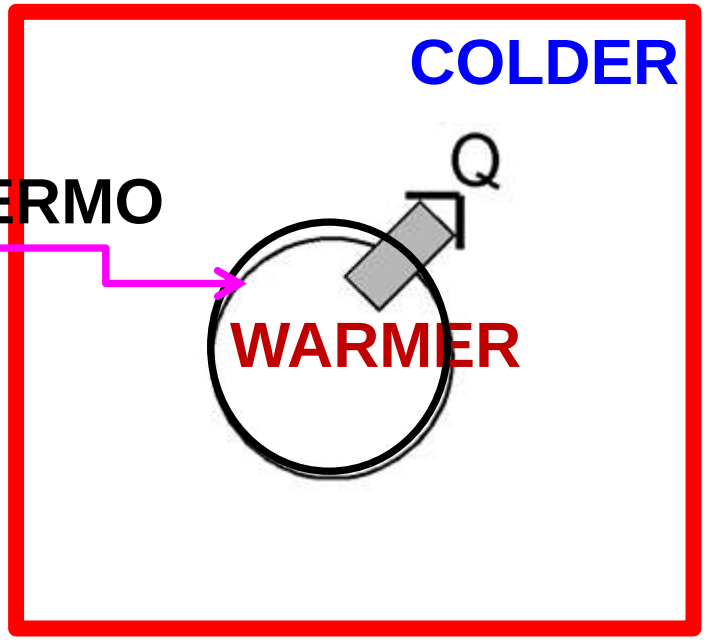
- Energy spontaneously flows from high to low
- Spontaneous – happens without stimulus.
- For heat that means it flows from hot to cold.



Energy (heat) Flow

- Q = heat,
- the circle is the thermometer (the system), the square is the fluid (the surroundings).
- Heat always flows from hot to cold (high to low)





Bell Work, Wednesday Oct 22, 2013

1. **Matching: contracts, expands**

When a liquid or gas is heated it expands

When a liquid or gas is cooled it contracts

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

Step 1: energy transfer (hot to cold or cold to hot?)

Step 2: speed

Step 3: hint: see #1

Resulting in:

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

Step 1: energy transfer (hot to cold or cold to hot?)

Step 2: speed

Step 3: hint: see #1

Resulting in:

Bell Work, Wednesday Oct 22, 2013

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

Step 1:

Step 2:

Step 3:

Resulting in:

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

Step 1:

Step 2:

Step 3:

Resulting in:

Objectives

1. Predict the effect of changing P, V, n or T on any of the other variables.

$$\mathbf{P \propto n,\ P \propto \frac{1}{V}, P \propto T, V \propto T}$$

2. Explain (in terms of the collisions of particles) *why* the change has the effect you predicted.

P, V, n, T

Explain the following: $P \propto n$, $P \propto \frac{1}{V}$, $P \propto T$, $V \propto T$

$\propto$ means "proportional",

P= pressure, T = Temperature. V= volume, n = amount of particles

$P \propto n$ = pressure is proportional to number of particles: if P increases, n increases. If P decreases, n decreases.

$P \propto T$ = pressure is proportional to temperature: if P increases, T increases. If P decreases, T decreases.

$V \propto T$ = volume is proportional to temperature: if V increases, T increases. If V decreases, T decreases.

$P \propto \frac{1}{V}$ = pressure is inversely proportional to volume: if P increases, V decreases. If P decreases, V increases.

Predict the effect of changing P, V or T on any of the other variables.

$$P \propto \frac{1}{V} \qquad P \propto T \qquad V \propto T$$

P ∝ n

If P ↑, then V↓ or if P doubles then V decreases ½, or visa versa, etc.

If T ↑ then P also ↑, or if T triples, P triples or visa versa.

If T ↑ then V also ↑ or if T doubles, V doubles or visa versa.

If P ↑ then n also ↑, or if P *quadruples* then n will *quadruple*.

White Boards

9. Predict the effect of changing P, V or T on any of the other variables.

n = number of particles

if T triples, P will **(~~increase~~/ decreases) by 1/3**

if T is halved, V will **(increase / ~~decreases~~) by 2**

if P triples then V (~~increase?/~~ decreases) by 1/3

$P \propto \frac{1}{V}$ $3 \propto \frac{1}{3}$

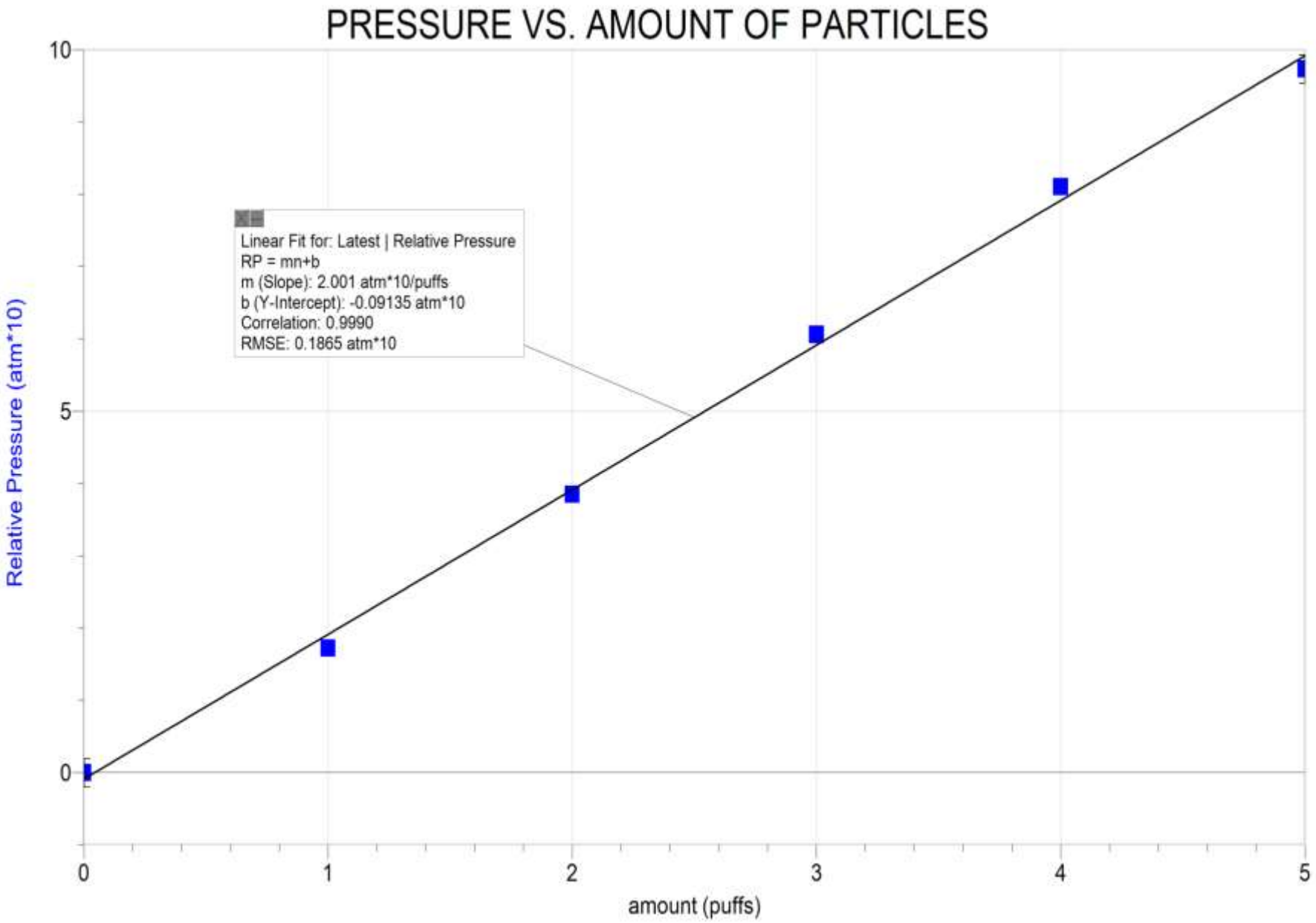
if V doubles then P (~~increase?/~~ decreases) by 1/2

If P is reduced by 1/4, volume will quadruple

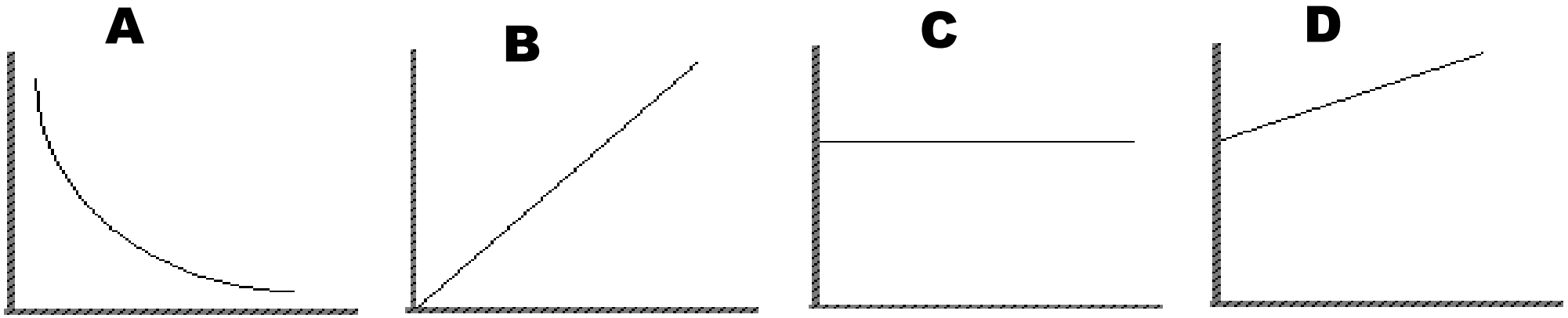
If volume is reduced in half, P will double

If P doubles, the number of particles will double

If the number of particles is reduced by 1/3 the pressure will reduce by 1/3.


PRESSURE VS. AMOUNT OF PARTICLES
Linear Fit for: Latest | Relative Pressure
RP = mn+b
m (Slope): 2.001 atm*10/puffs
b (Y-Intercept): -0.09135 atm*10
Correlation: 0.9990
RMSE: 0.1865 atm*10
Relative Pressure (atm*10)
amount (puffs)
10
5
0
0
1
2
3
4
5

Whiteboards Write this on your study guide



2. Which graph (see Wed. Bell Work) represents the relationship between the volume of a gas and the Celsius temperature?

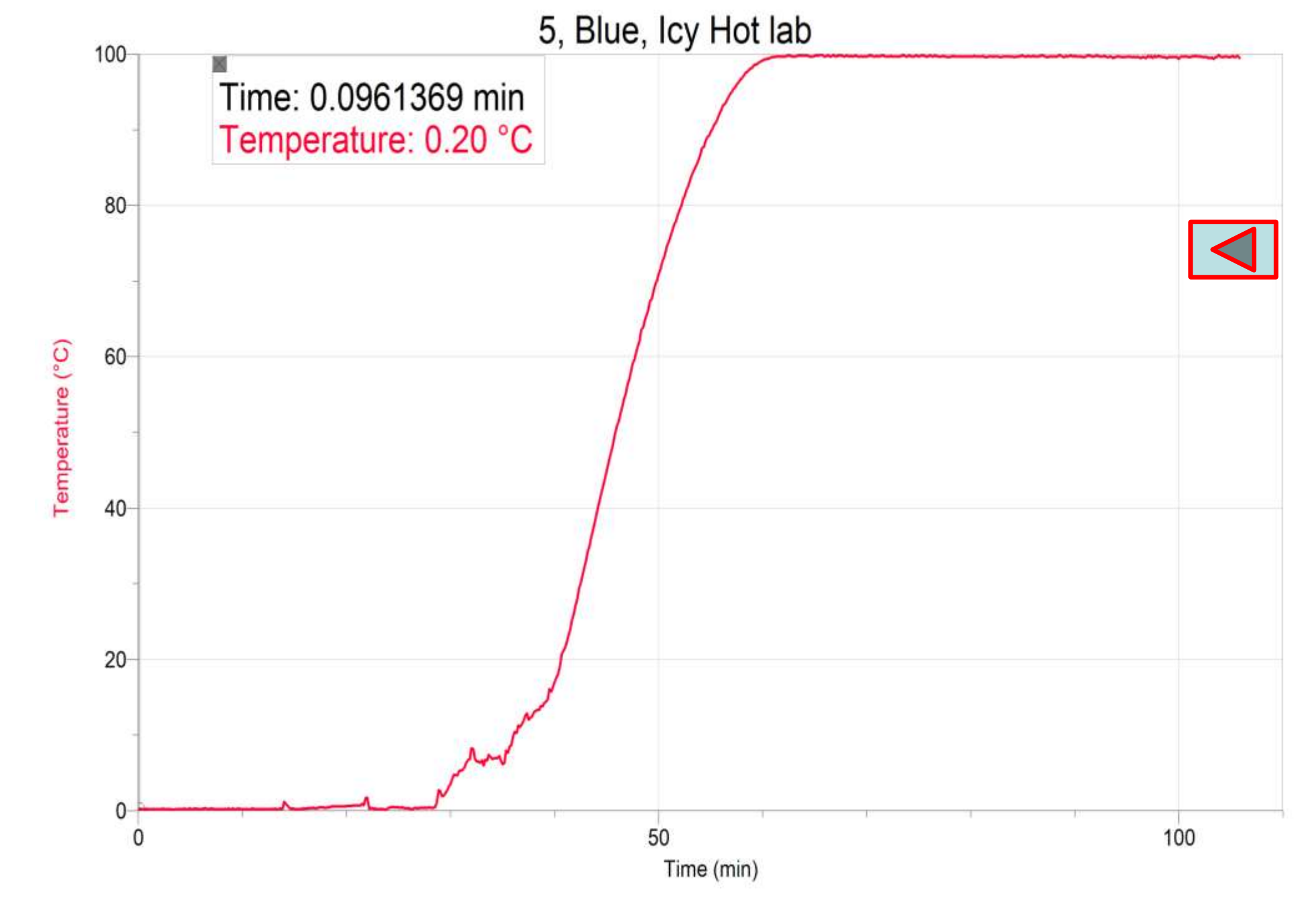
a. A b. B c. C **d. D**

3. Which graph represents the relationship between the volume of a gas and the Kelvin (absolute) temperature?

a. A **b. B** c. C d. D

***. Which graph (see Wed. Bell Work) represents Celsius temperature not changing?**

a. A b. B **c. C** d. D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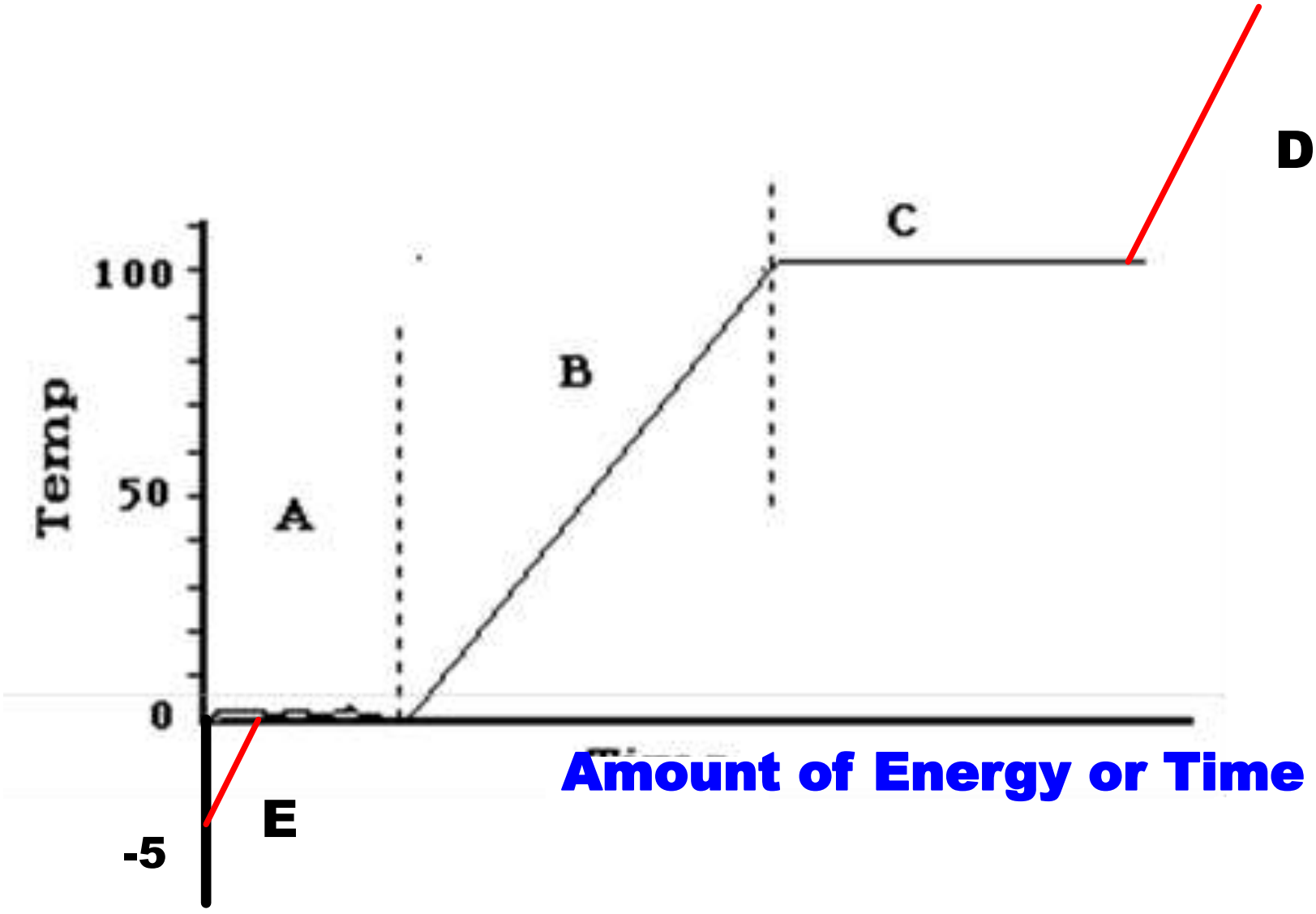
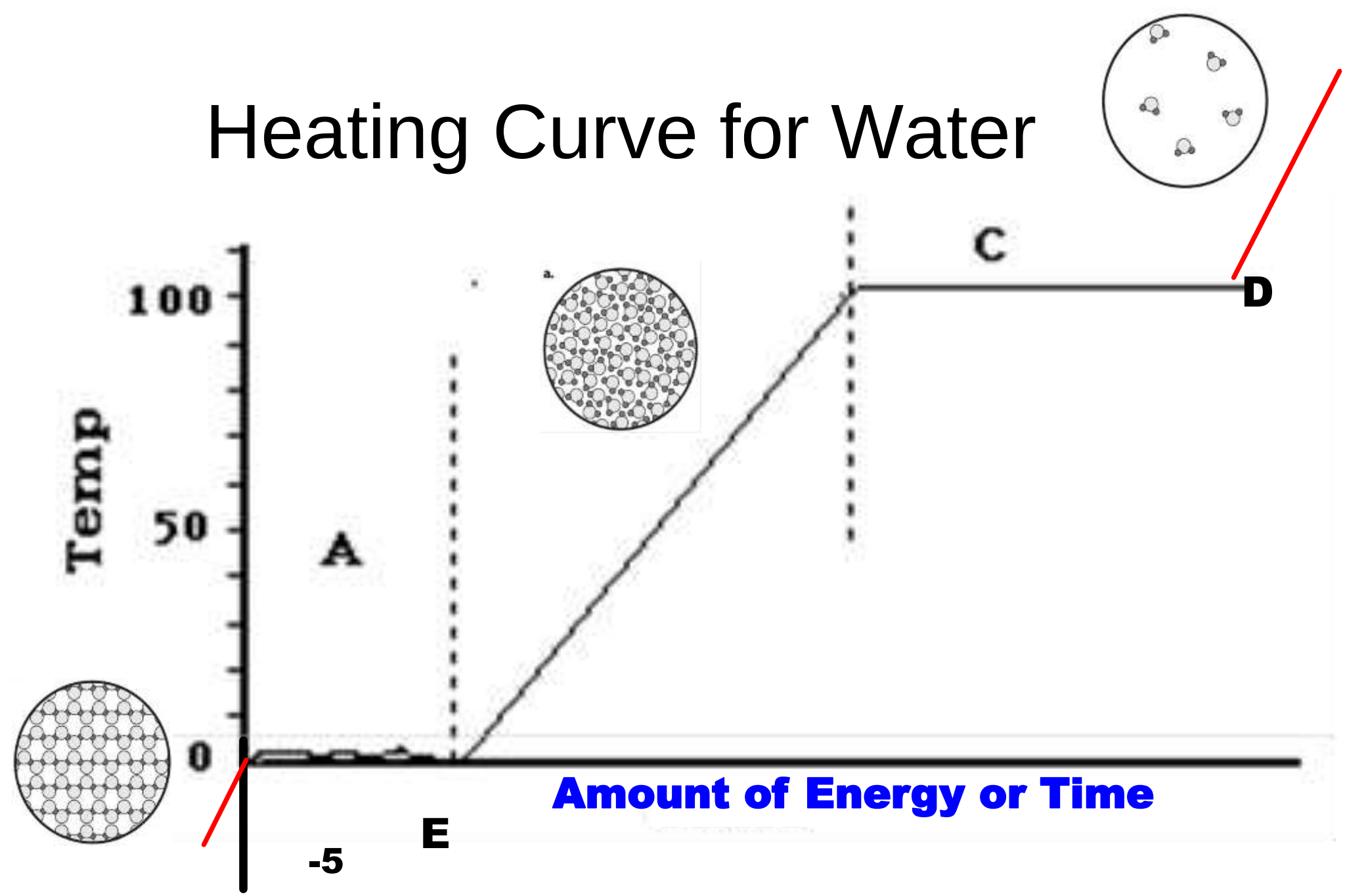
Heating Curve for Water



Heating Curve for Water



The Model so Far

1. What do we know about our particles? **They have mass & take up space (volume).**
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. What do we know about conservation of mass?

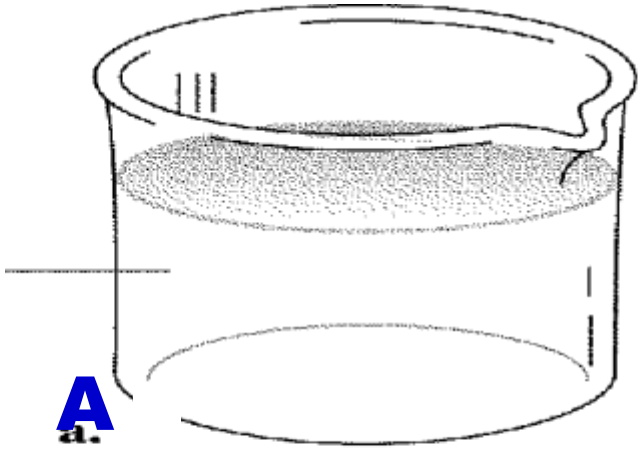
   These particles are neither created or destroyed. The can rearrange themselves into different substances.

4. What have we added to the model? **The particles are sticky. The attract each other, especially solids & liquids.**

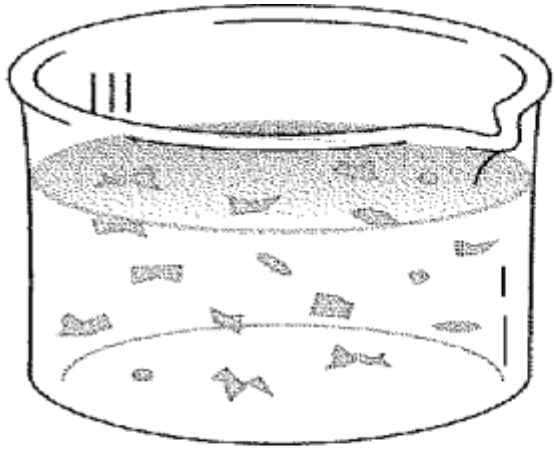
Draw the beakers.

1. Identify the homogeneous mixture(s)
2. Identify the heterogeneous mixture(s)
3. Which is not a mixture?

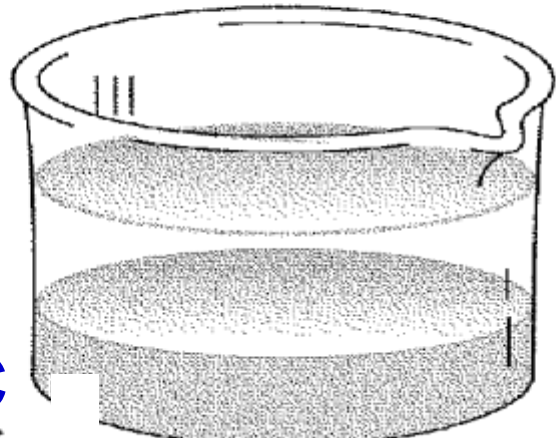
Salt water solution



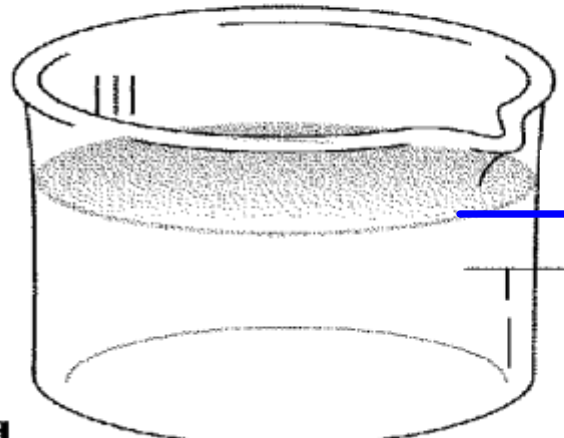
A



B



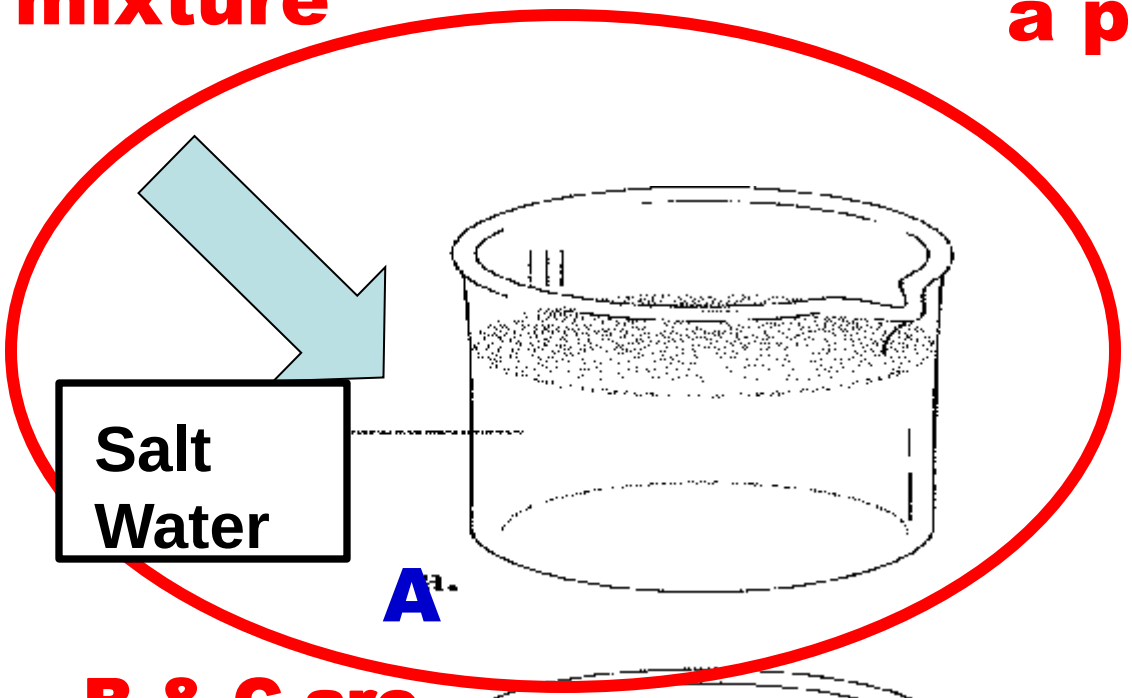
C



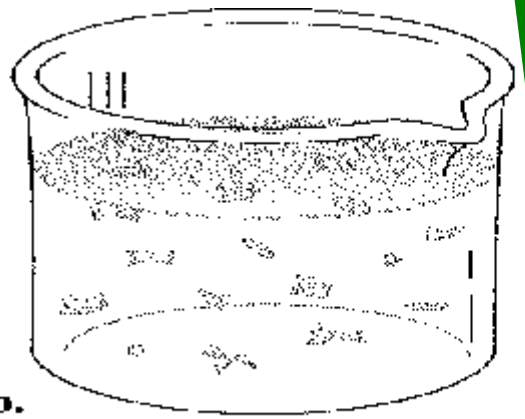
D

1. A is Homogeneous mixture

3. D: Not a mixture (it is a pure substance)

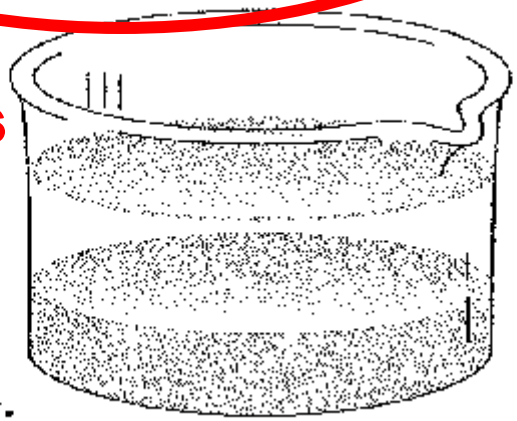


A

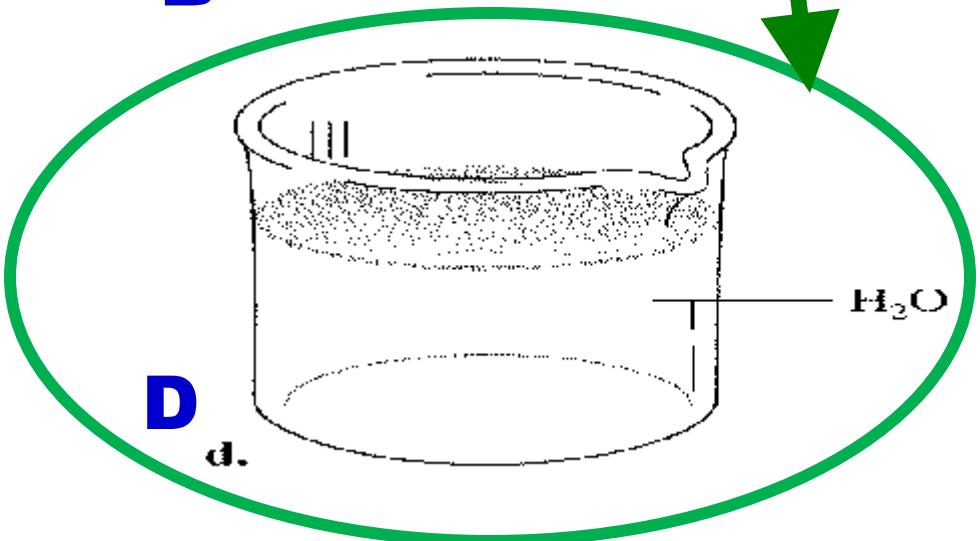


B

2. B & C are heterogeneous



C



D

Classification of Matter

1. Fill in the concept map below to show the relationship between the following: compound, element, matter, mixture, pure substance.