Name: _____ Period: _____

Date: _____ **Hybrid Chemistry Regents Prep** Ms. Hart/Mr. Kuhnau

UNIT 6: Energy
Lesson 2: Heating and Cooling Curves
By the end of the today, we will be able to answer:
How do we represent phase changes in order to understand molecular behavior during a phase change?

Do Now:

1. Write the definition for the word entropy:

_____

_____

2. Which term is defined as a measure of the disorder of a system?
   (1) heat
   (2) entropy
   (3) kinetic energy
   (4) activation energy

3. Which list of the phases of H2O is arranged in order of increasing entropy?
   (1) ice, steam, and liquid water
   (2) ice, liquid water, and steam
   (3) steam, liquid water, and ice
   (4) steam, ice, and liquid water

4. How do we know if something is exothermic?

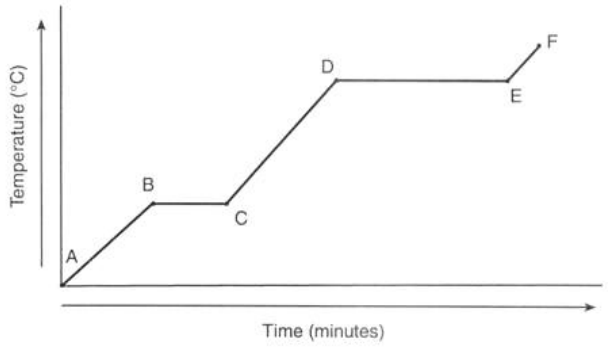
_____

_____

5. Which process is exothermic?
   (1) boiling of water
   (2) melting of copper
   (3) condensation of ethanol vapor
   (4) sublimation of iodine

6. A sample of helium gas is in a sealed, rigid container. What occurs as the temperature of the sample is increased?
   (1) The mass of the sample decreases.
   (2) The number of moles of gas increases.
   (3) The volume of each atom decreases.
   (4) The frequency of collisions between atoms increases.

7. Which property is a measure of the average kinetic energy of the particles in a sample of matter?
   (1) mass
   (2) density
   (3) pressure
   (4) temperature



Line Segment	Phase of Matter	Kinetic Energy	Potential Energy
A to B			
B to C			
C to D			
D to E			
E to F			

YOUR TURN: draw and label a cooling curve below!

Line Segment COOLING CURVE	Phase of Matter	Kinetic Energy	Potential Energy
A to B			
B to C			
C to D			
D to E			
E to F			

Drawing Comparisons

1. Why is the freezing point and melting point of a substance the same?

2. During the phase changes in a cooling curve, heat is continuously taken out of the system to cool the substance down. What is happening to the following and why:

Temperature:

Kinetic energy:

Entropy:

Heat of reaction (ΔH):

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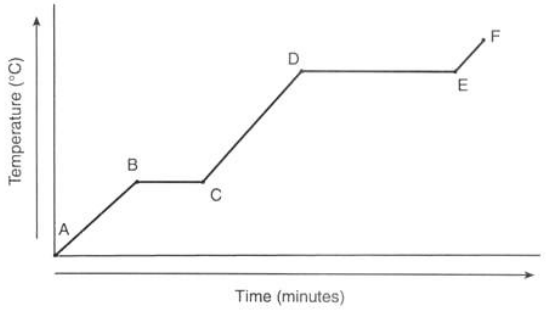
INDEPENDENT PRACTICE 6.2- Heating and Cooling Curves
Directions: Answer all questions based on your knowledge of chemistry.

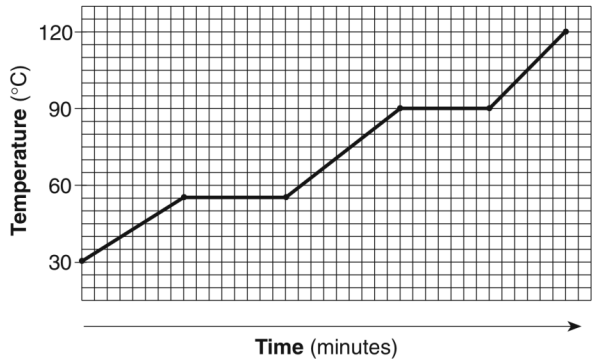
1. Base your answers to a) and b) on the heating curve below, which represents a substance starting as a solid below its melting point and being heated at a constant rate over a period of time.



a) What is happening to the average kinetic energy of the particles during segment BC?

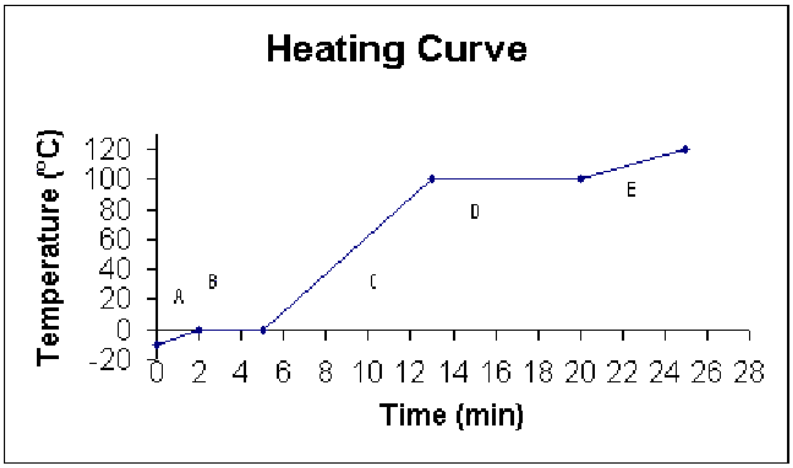
b) Which line segments represent an increase in average kinetic energy?
(1) AB and BC
(2) AB and CD
(3) BC and DE
(4) DE and EF

2. The graph below represents the heating curve of a substance that starts as a solid below its freezing point.



What is the melting point of this substance?
(1) 30°C (3) 90°C
(2) 55°C (4) 120°C

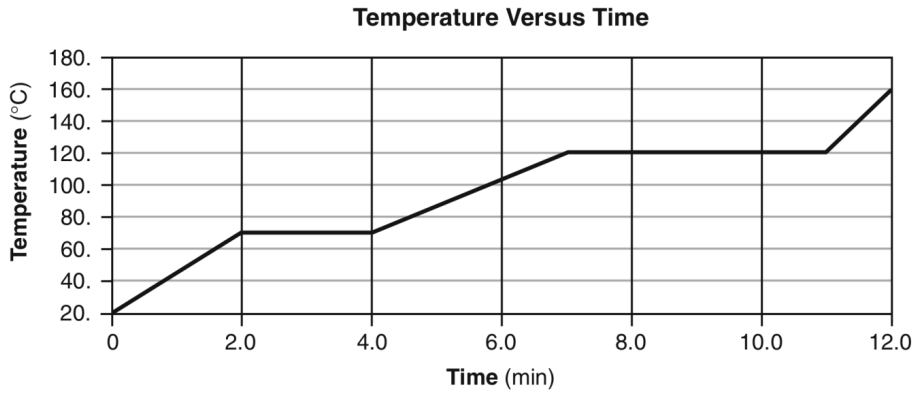
3. A sample of water is heated from a solid at -10°C to a gas at 110°C. The graph of the heating curve is shown below.



a) State what is happening to the kinetic energy in section C.

b) Identify a section where the kinetic energy is constant.

4. The temperature of a sample of a substance is increased from 20°C to 160°C as the sample absorbs heat at a constant rate of 15 kilojoules per minute at standard pressure. The graph below represents the relationship between temperature and time as the sample is heated

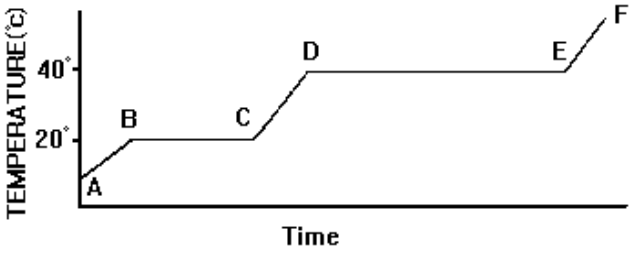


a) What is the boiling point of this sample?

b) Draw at least nine particles in the box, showing the correct particle arrangement of this sample during the first minute of heating.

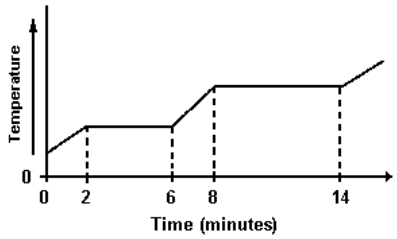
c) What is the total time this sample is the liquid phase, only?

5. The graph below represents the uniform heating of a solid, starting below its melting point. Which portion of the graph shows the solid and liquid phase existing in equilibrium?



Answer: _____

6. The graph below represents a solid heated at a uniform rate, starting at a temperature below its melting point. Once the solid has reached its melting point, how many minutes are required to completely melt the solid?



Answer: _____

7. The melting of sodium is accompanied by the
   (1) destruction of energy
   (2) creation of energy
   (3) absorption of energy
   (4) release of energy

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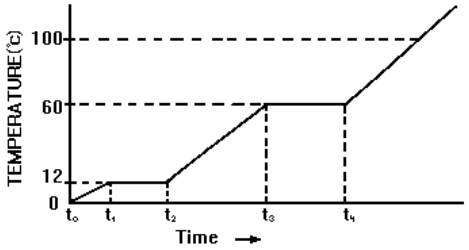
HW 6.2- Heating and Cooling Curves 10 points

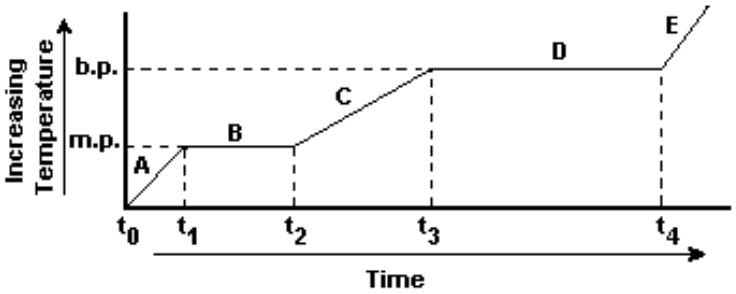
1. Energy is being added to a given sample. Compared to the Celsius temperature of the sample, the Kelvin temperature will
   (1) always be 273 greater
   (2) always be 273 lower
   (3) have the same reading at 0°
   (4) have the same reading at 273°

2. The diagram represents the uniform heating of a substance that is a solid at time t_0. What is the freezing point of the substance?



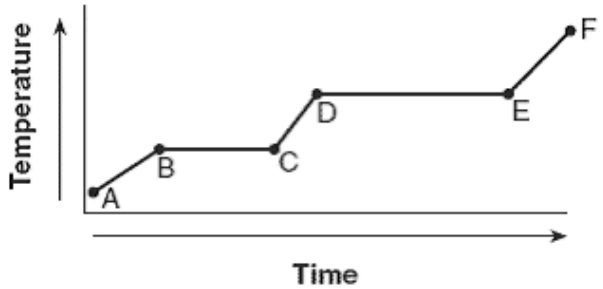
(1) 1°C
(2) 12°C
(3) 60°C
(4) 100°C

3. The graph represents a relationship between temperature and time as heat is added uniformly to a substance, starting when the substance is a solid below its melting point. Which portions of the graph represents times when heat is absorbed and potential energy increases while kinetic energy remains constant?



(1) *A* and *B*
(2) *B* and *D*
(3) *A* and *C*
(4) *C* and *D*

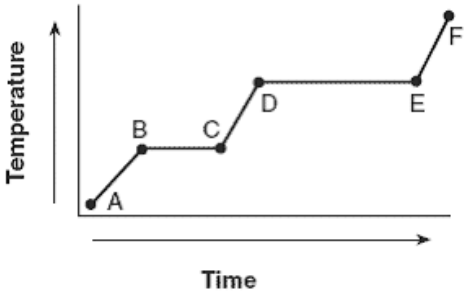
4. The graph below represents the uniform heating of a substance, starting with the substance as a solid below its melting point.



Which line segment represents an increase in potential energy and no change in average kinetic energy?

(1) $\overline{AB}$
(2) $\overline{BC}$
(3) $\overline{CD}$
(4) $\overline{EF}$

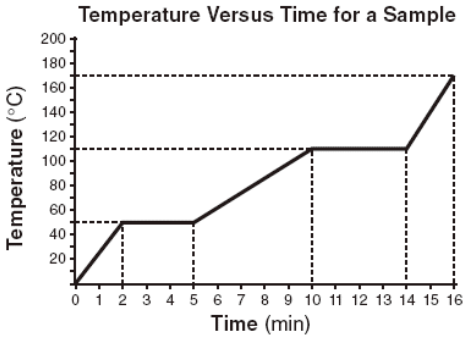
5. The graph represents the uniform heating of a substance, starting below its melting point, when the substance is solid.



Which line segments represent an increase in average kinetic energy?

(1) $\overline{AB}$ and $\overline{BC}$
(2) $\overline{AB}$ and $\overline{CD}$
(3) $\overline{BC}$ and $\overline{DE}$
(4) $\overline{DE}$ and $\overline{EF}$

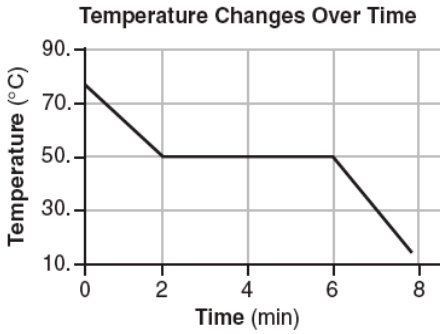
6. Starting as a solid, a sample of a substance is heated at a constant rate. The graph below shows the changes in temperature of this sample.



What is the melting point of the sample and the total time required to completely melt the sample after it has reached its melting point?

(1) 50°C and 3 min
(2) 50°C and 5 min
(3) 110°C and 4 min
(4) 110°C and 14 min

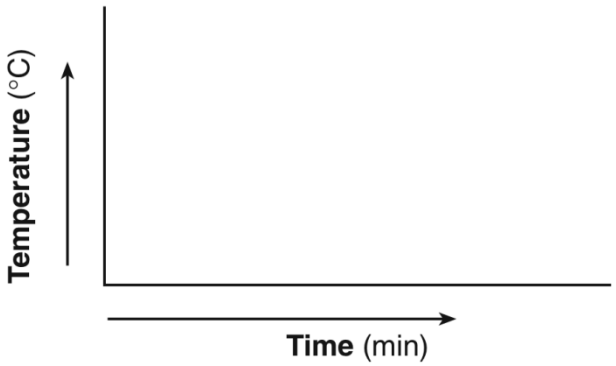
7. The graph below shows a compound being cooled at a constant rate starting in the liquid phase at 75°C and ending at 15°C.



a) What is the freezing point of the compound, in degrees Celsius?

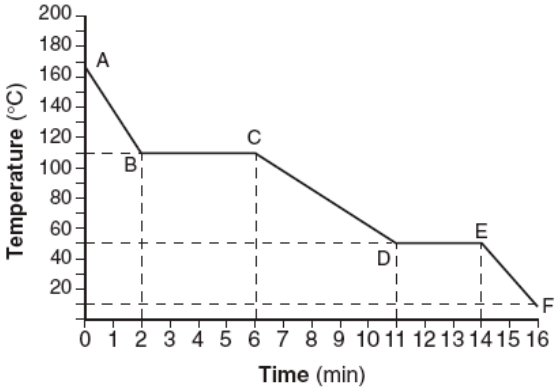
b) State what is happening to the average kinetic energy of the particles of the sample between minute 2 and minute 6.

c) A different experiment was conducted with another sample of the same compound starting in the solid phase. The sample was heated at a constant rate from 15°C to 75°C . Draw the resulting heating curve below.



d) What Kelvin temperature is equal to 15°C.

8.



a) What is the melting point of this substance?

b) Which segment of the graph represents the gas phase, only?