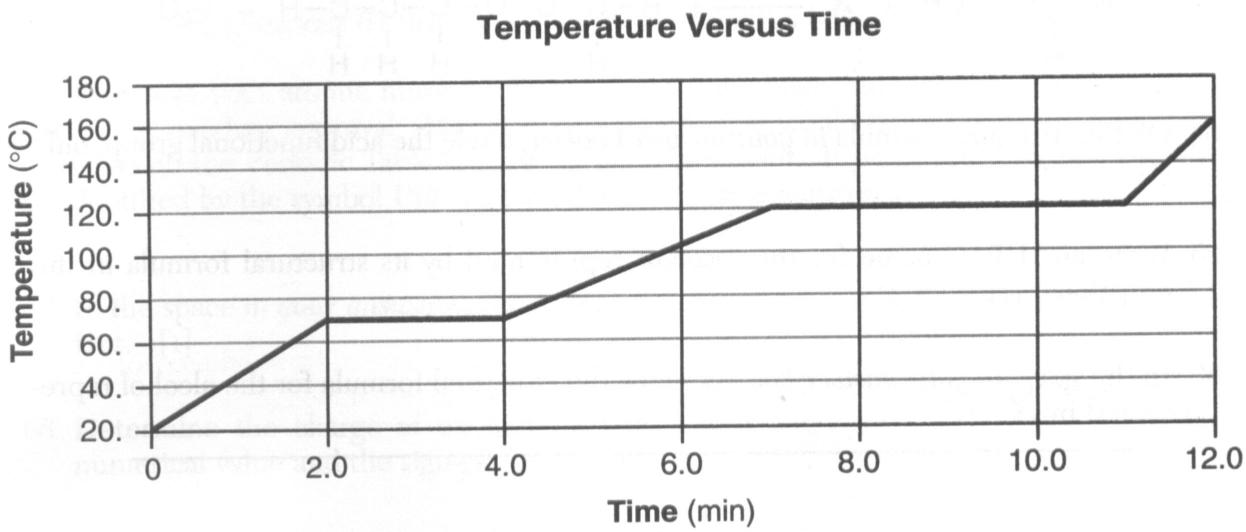
Name:______________________ **Period:**___ **Date:**_____

Ms. Randall **Constructed repsonse practice** **2014-2015**

Base your answers to questions **1** through **3** on the information below.

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.



1. Determine the total amount of heat required to completely melt this sample at its melting point.

2. Use the key below to draw at least nine particles in the box, showing the correct particle arrangement of this sample during the first minute of heating.

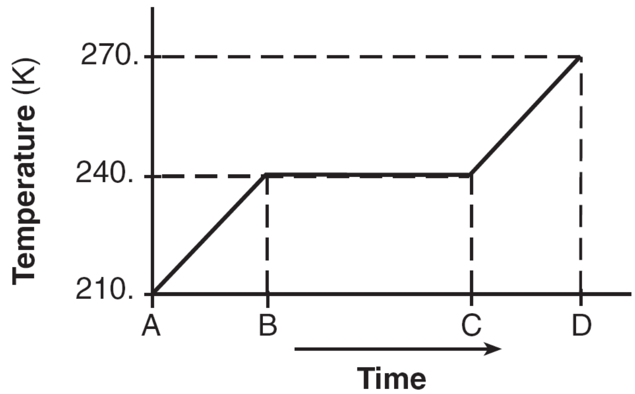
Key
○ = particle of the substance

3. What is the boiling point of this sample?

Base your answers to questions **4** and **5** on the information below

A 5.00-gram sample of liquid ammonia is originally at 210. K. The diagram of the partial heating curve below represents the vaporization of the sample of ammonia at standard pressure due to the addition of heat. The heat is *not* added at a constant rate.

Partial Heating Curve for Ammonia



Some physical constants for ammonia are shown in the data table below.

Some Physical Constants for Ammonia

specific heat capacity of $NH_3(\ell)$	4.71 J/g•K
heat of fusion	332 J/g
heat of vaporization	1370 J/g

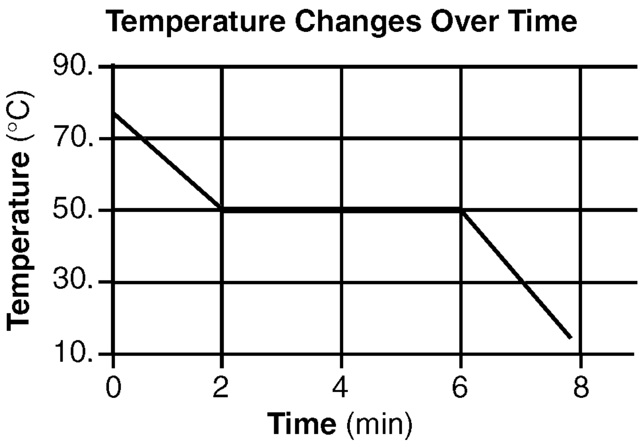
4. Determine the total amount of heat required to vaporize this 5.00-gram sample of ammonia at its boiling point.

5. Calculate the total heat absorbed by the 5.00-gram sample of ammonia during time interval AB. Your response must include *both* a correct numerical setup and the calculated result.

6. A liquid boils when the vapor pressure of the liquid equals the atmospheric pressure on the surface of the liquid. Using Reference Table *H*, determine the boiling point of water when the atmospheric pressure is 90. kPa.

7. Base your answer to the following question on the information below.

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.



What kelvin temperature is equal to 15°C?

8. Base your answer to the following question on the information below.

Air bags are an important safety feature in modern automobiles. An air bag is inflated in milliseconds by the explosive decomposition of $NaN_3(s)$. The decomposition reaction produces $N_2(g)$, as well as Na(s), according to the unbalanced equation below.

$NaN_3(s) \rightarrow Na(s) + N_2(g)$

When the air bag inflates, the nitrogen gas is at a pressure of 1.30 atmospheres, a temperature of 301 K, and has a volume of 40.0 liters. Calculate the volume of the nitrogen gas at STP. Your response must include *both* a correct numerical setup and the calculated volume

9. Base your answer to the following question on the information below.

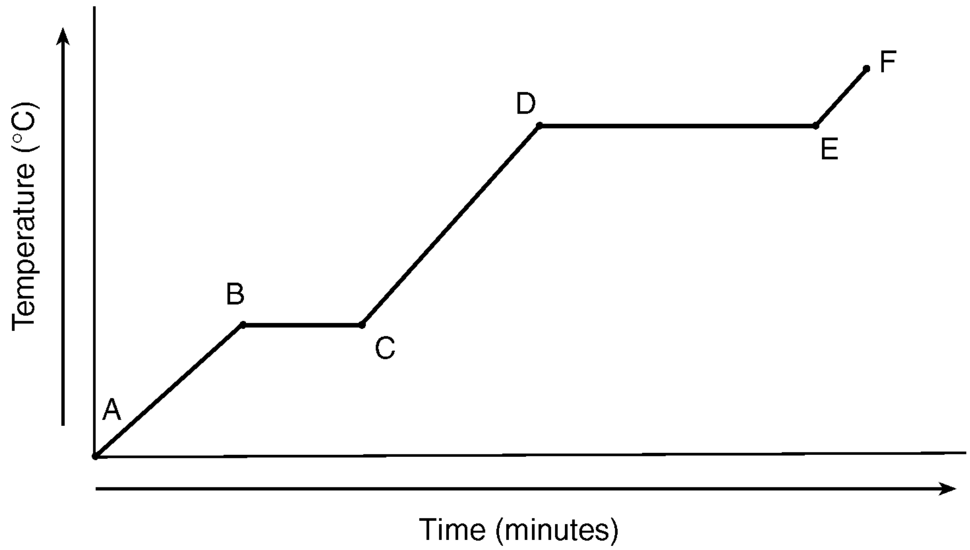
A weather balloon has a volume of 52.5 liters at a temperature of 295 K. The balloon is released and rises to an altitude where the temperature is 252 K.

The original pressure at 295 K was 100.8 kPa and the pressure at the higher altitude at 252 K is 45.6 kPa. Assume the balloon does not burst. Show a correct numerical setup for calculating the volume of the balloon at the higher altitude.

Period:___

Base your answers to questions **10** through **12** on the information below.

Given the heating curve where substance *X* starts as a solid below its melting point and is heated uniformly:



10. Describe, in terms of *particle behavior* or *energy,* what is happening to substance *X* during line segment $\overline{BC}$.

11. Identify the process that takes place during line segment *DE* of the heating curve.

12. Identify a line segment in which the average kinetic energy is increasing.

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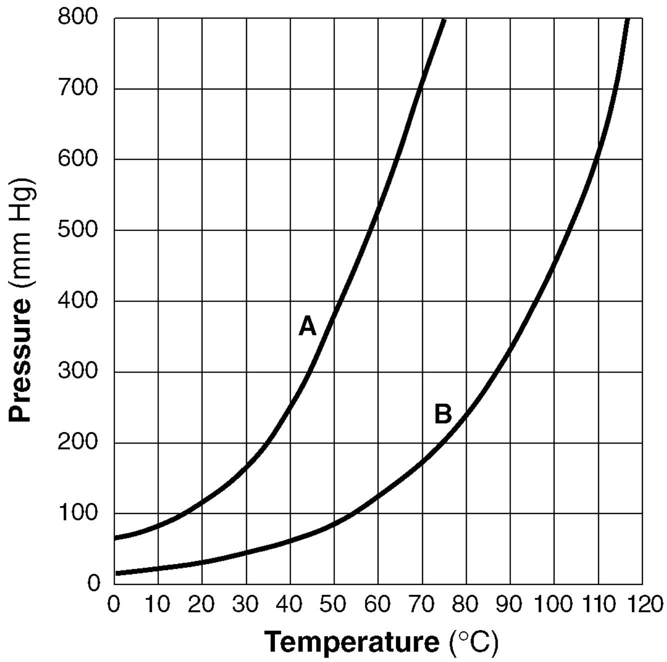
13. Base your answer to the following question on the diagram below, which shows a piston confining a gas in a cylinder.

Sketch the general relationship between the pressure and the volume of an ideal gas at constant temperature.

14. Base your answer to the following question on the graph below, which shows the vapor pressure curves for liquids *A* and *B*.

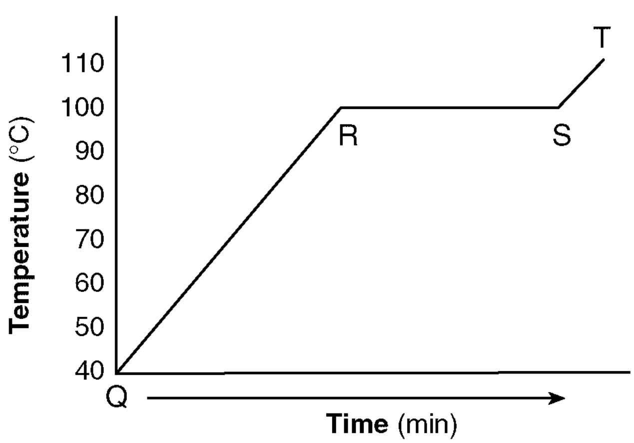


Which liquid will evaporate more rapidly? Explain your answer in terms of intermolecular forces.

15. A sample of water is heated from a liquid at 40°C to a gas at 110°C. The graph of the heating curve is shown below.

a. On the heating curve diagram provided *below*, label *each* of the following regions:

Liquid, only
Gas, only
Phase change



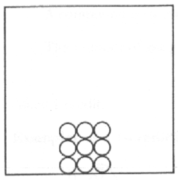
b. For section *QR* of the graph, state what is happening to the water molecules as heat is added.

c. For section *RS* of the graph, state what is happening to the water molecules as heat is added.

Answer Key

Unit 7 PPOM Constructed response practice 2013-2014 (15)

1. 30.kJ $\pm$ 3kJ

2. 

3. 120.°C $\pm$ 2°C.

4. 6850 J

5. *q = mC*Δ*T = (5.00 g)(4.71 J/g • K)(30. K)*
(5)(4.71)(30)
710 J

6. 97°C ± 1°C.

7. 288 K

8. 47.2 L
$V_2 = \dfrac{(273\text{ K})(1.30\text{ atm})(40.0\text{ L})}{(301\text{ K})(1.00\text{ atm})}$
$\dfrac{(273)(1.30)(40.0)}{(301)(1.00)}$

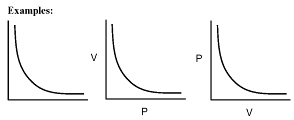
9. $\frac{(100.8\,\mathrm{kPa})(52.5\,\mathrm{L})}{295\,\mathrm{K}} = \frac{(45.6\,\mathrm{kPa})(X)}{(252\,\mathrm{K})}$

$52.5 \times \frac{252}{295} \times \frac{100.8}{45.6}$

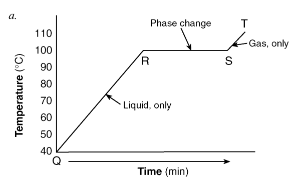
10. Examples: –The potential energy of the particles increases. –PE increases.
–KE remains the same. –particles more disordered
–Particles are spreading farther apart.
–Intermolecular forces of attraction decrease.

11. Examples: –boiling –vaporization –liquid – vapor equilibrium

12. Examples: $\overline{AB}$ or $\overline{CD}$ or $\overline{EF}$

13. 

14. liquid *A*
Example:
The higher vapor pressure of liquid *A* indicates that the intermolecular forces between its molecules are weaker, allowing the molecules to escape more readily to the vapor phase.

15. 

b. Examples: –The water molecules acquire more kinetic energy. –Heat is converted to kinetic energy of the water molecules. –The water molecules speed up or increase their relative motion.
c. Examples: –The potential energy of the water molecules increases. –The water molecules change from the liquid phase to the gas phase.
–There is less attraction between the H_2O molecules.