ANSWERS August 2007

1. Given this balanced equation representing a reaction:

$$Cl_{2(G)} \longrightarrow Cl_{(G)} + Cl_{(G)}$$

What occurs during this change?

A. energy is absorbed and a bond is broken
B. energy is absorbed and a bond is formed
C. energy is released and a bond is broken
D. energy is released and a bond is formed

June 2007

3. Given the balanced equation:

$$I + I \longrightarrow I_2$$

Which statement describes the process represented by this equation?

A. A bond is formed as energy is absorbed
B. A bond is formed as energy is released
C. A bond is broken as energy is absorbed
D. A bond is broken as energy is released

The temperature of a sample is increased from 20.°C to 160.° centigrade as the sample absorbs heat at a constant rate of 15 kilojoules per minute at standard pressure.

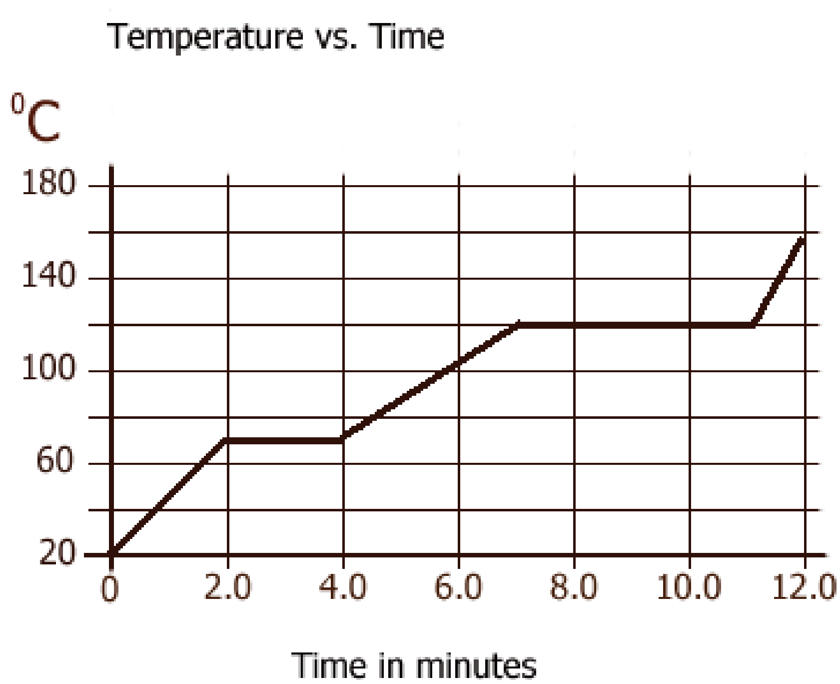
The graph at right represents the relationship between temperature and time as the sample is heated.

2. What is the boiling point of the sample? **120°C**

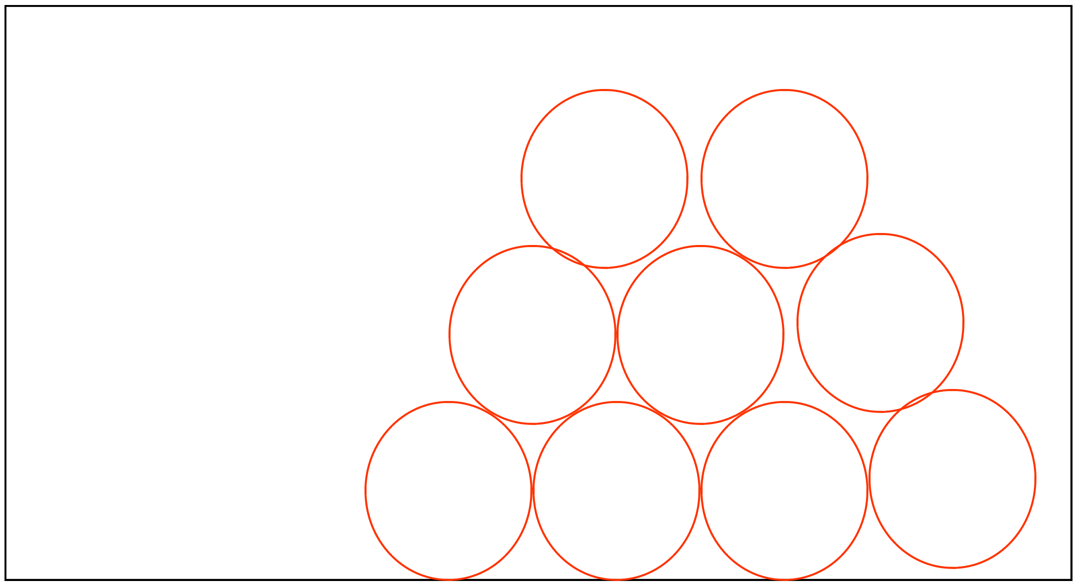
3. In your answer booklet, draw at least nine particles showing the correct particle arrangement during the first minute of heating. **See next page**

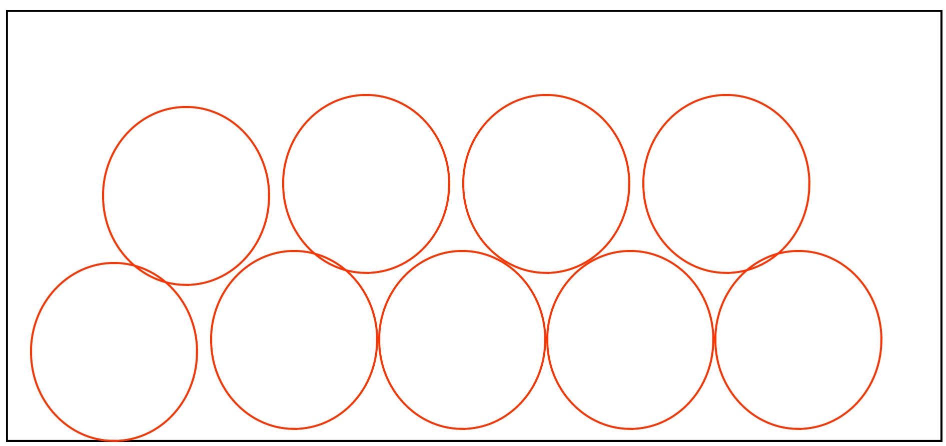
4. What is the total time the sample is in the liquid phase?
   From 4.0 to 7.0 minutes, so 3.0 minutes

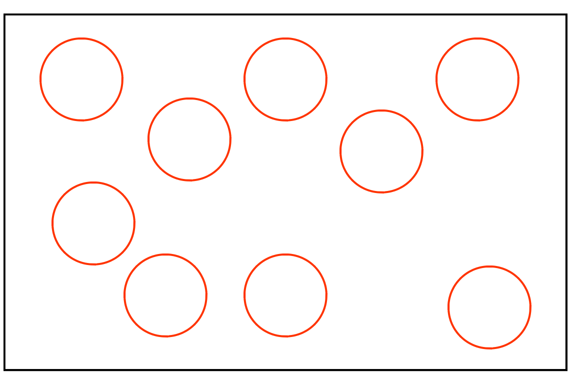
5. Determine the total amount of heat needed to melt the sample at its melting point.
   It takes 2.0 minutes at 15 kJ per minute, so that's 30 kJ total.



During the first minute of heating the sample is only in the solid phase, so your particles should be arranged touching and in order. This drawing is an example of many orderly drawings that could be correct. Loose particles, or particles that appear to be in the gas phase would be wrong. The particles must hold their own shape, not

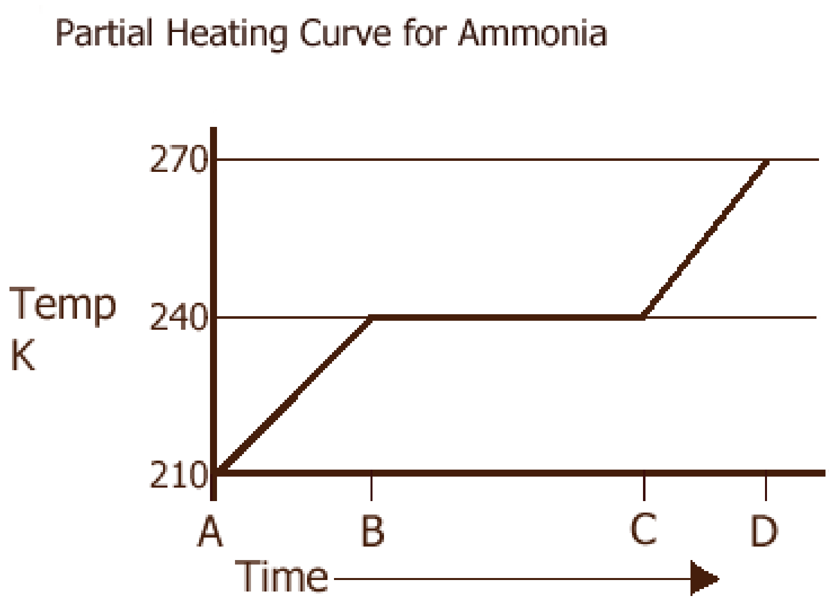






To the left represents particles that are NOT touching, and appear to be floating without touching. This is a gas, not correct for this problem.

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 at standard pressure due to the addition of heat. The heat is *not* added at a constant rate.



1. Calculate the total heat absorbed by the 5.00 gram sample during time interval *AB*. Your response must show a numerical set up & a calculated result.

$q = mC\Delta T$
$q = (5.00g)(4.71 J/g \cdot K)(30K)$
$q = 706.5$ Joules
$q = 707$ joules (3SF)

note: this unit is in Kelvin, but the formula works the same.

2. Describe what is happening to both the potential energy and the average kinetic energy of the molecules during *BC*. Your response must include both potential and average kinetic energy. **During BC is the vaporization of ammonia. (Info in the paragraph above lets you know it's not melting point). During any phase changes the average kinetic energy is constant, as is the temperature. During a heating phase change the potential energy increases.**

3. Determine the total amount of heat needed to vaporize this 5.00 gram sample at its boiling point.

$q = mH_v$
$q = (5.00\ g)(1370\ J/g)$
$Q = 6850$ Joules (3 SF)

some physical constants for $NH_{3(L)}$	
heat of fusion	332 J/g
heat of vaporization	1370 J/g
specific heat capacity	4.71 J/g·K

January 2007 Regents exam

1. The balanced equation below represents a molecule of bromine separating into two bromine atoms.

$$Br_2 \longrightarrow Br + Br$$

What occurs during this change?

A. energy is absorbed and a bond is formed

B. energy is absorbed and a bond is broken

C. energy is released and a bond is formed

D. energy is released and a bond is broken

2. At STP, which list of elements contains a solid, liquid, and a gas?

A. Hf, Hg, He

B. Cr, Cl_2, C

C. Ba, Br_2, B

D. Se, Sn, Sr

3. At which temperature would atoms of $He_{(G)}$ have the highest kinetic energy?

A. 25ºC

B. 37ºC **(=310K)**

C. 273K

D. 298K

4. Given the balanced reaction as

$$N_{2(G)} + 3H_{2(G)} \longrightarrow 2NH_{3(G)} + 91.8 \text{ kJ}$$

Which statement is true about that reaction?

A. It is exothermic and the ΔH = -91.8 kJ

B. It is exothermic and the ΔH = +91.8 kJ

C. It is endothermic and the ΔH = -91.8 kJ

D. It is endothermic and the ΔH = +91.8 kJ

Do Not do the math, tell how many SF the answer should have, and/or what formulas to use.

1. If 23.45 grams of ice at exactly zero degrees is warmed and melted to water at exactly the same temperature. How many joules were used to do this?

ΔT is zero, so $q = mH_F$

2. Water at 35.6°C is vaporized to 100.0°C. How many joules did that take?

$q = mC\Delta T$ takes us to 100.0°C liquid, then the $q = mH_V$ takes us through the phase change.

3. Cold water at 5.00°C is frozen solid to exactly zero °C. How many joules of energy were required to do this? Is this an exothermic or endothermic process?

$q = mC\Delta T$ takes us to 0.0°C liquid, then the $q = mH_F$ formula takes us through the phase change to solid.

4. Steam of 100.0°C condenses to liquid water at room temperature of 22.6°C. Is energy released or absorbed by the H_2O? How many joules are exchanged in this process?

First we phase change with $q = mH_V$, then we cool through a big temperature change with $q = mC\Delta T$

5. You add exactly 12,500 joules to 25.00 grams of copper. The copper was at 20.0°C. What temperature is it now? (C of Cu = 0.39J/g·°C)

$q = mC\Delta T$ is the formula, using the C = 0.39 j/g·°C and solve for the ΔT. Do addition of 20.0°C start temperature and add the ΔT for a final answer.

6. The C of Hg is 0.14J/g·°C. If you added the same 12,500J to 25.00 grams of mercury at 20.0°C, estimate the new temperature the mercury would reach - higher or lower than the copper would reach.

q = mCΔT is the formula, using the C = 0.14 j/g·°C and solve for the ΔT. Do addition of 20.0°C start temperature and add the ΔT for a final answer. Of course since the mercury takes so much energy per gram to change the temperature per degree centigrade, the mercury is much hotter than the copper temperature.

7. To convert 123,500,000 Joules to calories, what conversion factor would you use? (write your conversion factor)

$$\frac{\textbf{1cal}}{\textbf{4.18 Joules}}$$

8. To convert 20,000 calories into Calories, what conversion factor would you use?

$$\frac{\textbf{1 Calorie}}{\textbf{1000 calories}}$$

9. To convert 56.6 kJ to joules, what is the conversion factor?

$$\frac{\textbf{1000 Joules}}{\textbf{1 kiloJoule}}$$