Name: ANSWER KEY Unit : Heat Review

247 Mp Mt. Palermo

1. Which statement best describes the shape and volume of an aluminum cylinder at STP? solid
A) It has a definite shape and a definite volume.
B) It has a definite shape and no definite volume.
C) It has no definite shape and a definite volume.
D) It has no definite shape and no definite volume.

2. Which grouping of the three phases of bromine is listed in order from left to right for increasing distance between bromine molecules?
A) gas, liquid, solid
B) solid, gas, liquid
C) liquid, solid, gas
D) solid, liquid, gas

3. Which 5.0-milliliter sample of NH_3 will take the shape of and completely fill a closed 100.0-milliliter container? gas
A) $NH_3(s)$ B) $NH_3(g)$ C) $NH_3(aq)$

4. Which phase change results in the release of energy? exothermic
A) $H_2O(s) \rightarrow H_2O(l)$
B) $H_2O(s) \rightarrow H_2O(g)$
C) $H_2O(s) \rightarrow H_2O(g)$
D) $H_2O(g) \rightarrow H_2O(l)$

5. As ice melts at standard pressure, its temperature remains at 0°C until it has completely melted. Its potential energy
A) Decreases
B) remains the same
C) increases

6. Which kind of energy is stored within a chemical substance?
A) free energy
B) kinetic energy
C) activation energy
D) potential energy

7. When a quantity of electricity is converted to heat, the heat energy produced is measured in
A) volts
B) joules
C) amperes
D) degrees

8. Which term is defined as a measure of the average kinetic energy of the particles in a sample?
A) Temperature
B) thermal energy
C) pressure
D) chemical energy

9. At which temperature would atoms of a He(g) sample have the greatest average kinetic energy?
A) 25°C B) 37°C C) 273 K D) 298 K
298K 310K

10. Solid A at 80ºC is immersed in liquid B at 60ºC. Which statement correctly describes the energy changes between A and B?
A) A releases heat and B absorbs heat.
B) A absorbs heat and B releases heat.
C) Both A and B absorb heat.
D) Both A and B release heat.

11. Which phase change is accompanied by the release of heat? exothermic
A) $H_2O(s) \rightarrow H_2O(g)$
B) $H_2O(l) \rightarrow H_2O(g)$
C) $H_2O(s) \rightarrow H_2O(l)$
D) $H_2O(l) \rightarrow H_2O(s)$

12. Which change of phase is exothermic?
A) solid to liquid
B) solid to gas
C) gas to liquid
D) liquid to gas

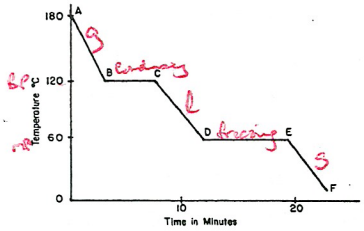
13. The table below shows the data collected by a student as heat was applied at a constant rate to a solid below its freezing point.

Time (min)	Temperature (°C)	Time (min)	Temperature (°C)
0	20	18	44
2	24	20	47
4	28	22	51
6	32	24	54
8	32	26	54
10	32	28	54
12	35	30	54
14	38	32	58
16	41	34	62

Name: Unit . Heat Review

What is the boiling point of this substance?
A) 32°C B) 54°C C) 62°C D) 100°C

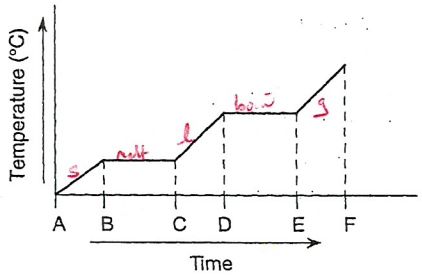
Base your answers to questions 14 and 15 on the graph below, which represents uniform cooling of a sample of a pure substance, starting as a gas.



14. Solid and liquid phases can exist in equilibrium between points
A) E and F C) B and C
B) C and D D) D and E

15. The boiling point of the substance is
A) 10°C B) 60°C C) 120°C D) 180°C

16. The diagram below represents the uniform heating of a substance that is a solid at Time A.



Between which times could the heat of fusion be determined?
A) A and B C) B and C
B) C and D D) E and F

17. A 36-gram sample of water has an initial temperature of 22°C. After the sample absorbs 1200 joules of heat energy, the final temperature of the sample is
A) 8.0°C B) 14°C C) 30.°C D) 55°C

$q = mc\Delta T$
$q = 1200\,J$
$m = 36\,g$
$c = 4.18\,J/g°C$
$\Delta T = ?$

$1200\,J = (36\,g)(4.18\,J/g°C)(\Delta T)$
$\Delta T = 8.0°C$
$T_{final} = 22°C + 8°C =$
$30°C$

18. The temperature of a sample of water changes from 10°C to 20°C when the sample absorbs 418 joules of heat. What is the mass of the sample?
A) 1 g B) 10 g C) 100 g D) 1000 g

$q = mc\Delta T$
$418 = (m)(4.18)(\quad)$
$m = 10\,g$

19. When 200 grams of water cools from 50.°C to 25°C, the total amount of heat energy released by the water is
A) 42 kJ B) 21 kJ C) 34 J D) 17 J

$q = mc\Delta T$
$q = ?$
$m = 200\,g$
$c = 4.18$
$\Delta T = 25°C$
$q = (200)(4.18)(25)$

20. When a 500. gram sample of water at 19.0ºC absorbs 8.40 kiloJoules of heat, the temperature of the water will change to
A) 23.0ºC B) 19.0ºC C) 15.0ºC D) 4.00ºC

$q = mc\Delta T$ $8400\,J = (500)(4.18)\Delta T$
$\Delta T = 40°$
$T_f = 19 + 4 = 23$

21. The number of Joules needed to raise the temperature of 10 grams of water from 20ºC to 30ºC
A) 42 B) 84 C) 420 D) 1680

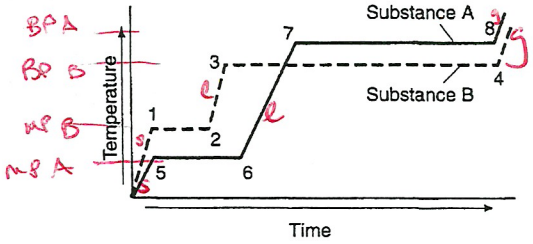
$q = mc\Delta T$
$10 \cdot 4.18 \cdot 10 =$

22. At which Celsius temperature does lead change from a solid to a liquid?
A) 874°C B) 601°C C) 328°C D) 0°C

23. What amount of heat is required to completely melt a 29.95-gram sample of H2O(s) at 0°C?
A) 334 J C) 2260 J
B) 1.00×10^3 J D) 1.00×10^4 J

$q = m\Delta H_f$
$= (29.95)(334)$
$= 10000$

Base your answers to questions 24 and 25 on the graph below. The graph shows heat being added at a constant rate to substance A and to substance B, which begin as solids below their melting point temperatures.



Name: Unit : Heat Review

247 Mp Mr. Palermo

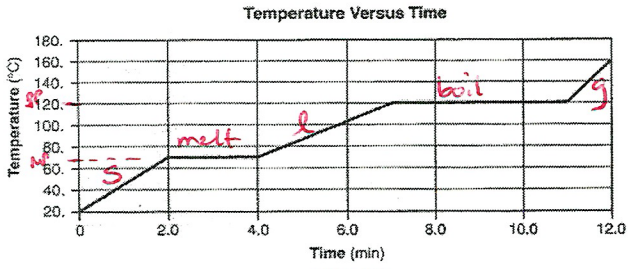
24. During which interval is the greatest amount of energy absorbed?
A) 1-2 B) 2-3 C) 3-4 D) 7-8

25. Compared to substance B, substance A has a
A) lower melting point and a lower boiling point
B) lower melting point and a higher boiling point
C) higher melting point and a lower boiling point
D) higher melting point and a higher boiling point

26. In which process does a solid change directly into a vapor?
A) condensation C) sublimation
B) deposition D) solidification

Base your answers to questions 27 through 33 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.



15 kJ/min

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

4.0 − 2.0 min = 2.0 min × 15 kJ/ = 30. kJ

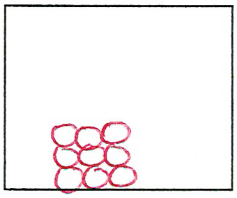
28. What is the total time this sample is in the liquid phase, only?

7.0 − 4.0 min = 3.0 min

29. 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

solid

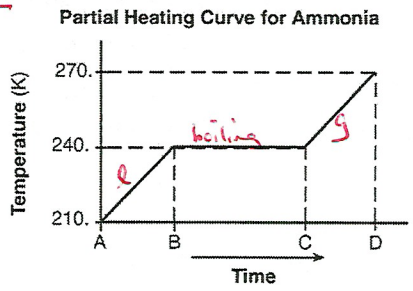


30. What is the boiling point of this sample?

120. °C

31. Base your answer to the following question 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.



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

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.

$q = mc\Delta T$

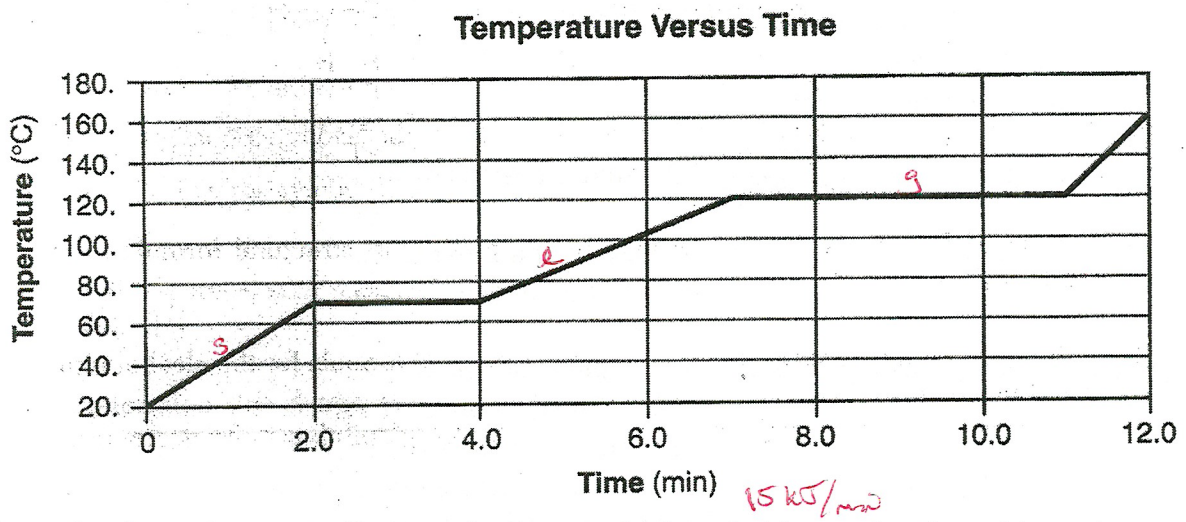
$q = (5.00\,g)(4.71\,J/g°K)\left(\frac{240. - 210.\,K}{30.\,K}\right)$

706.5 J = 710 J

Unit Heat Part 2 Review

Base your answers to questions **1** through **4** 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.



Scenes #27-30

1. Determine the total amount of heat required to completely melt this sample at its melting point.
2. What is the total time this sample is in the liquid phase, only?
3. 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.

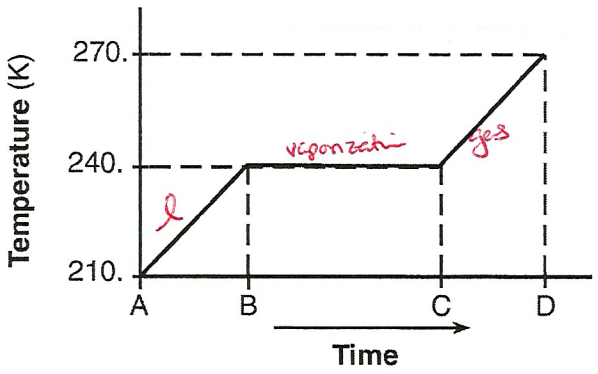
Key
◯ = particle of the substance

4. What is the boiling point of this sample?

Base your answers to questions **5** through **7** 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

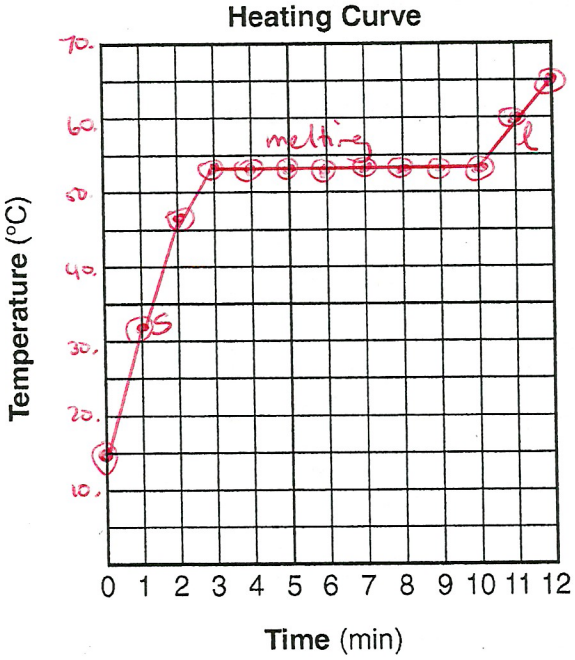
5. Determine the total amount of heat required to vaporize this 5.00-gram sample of ammonia at its boiling point. $q = m H_v = (5.00\,g)(1370\,J/g) = 6850\,J$
6. Describe what is happening to *both* the potential energy and the average kinetic energy of the molecules in the ammonia sample during time interval BC. Your response must include both potential energy and average kinetic energy. BC - kinetic energy is constant, potential energy is increasing
7. 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.

Same as #31

Base your answers to questions 8 through 11 on the information below.

A substance is a solid at 15°C. A student heated a sample of the solid substance and recorded the temperature at one-minute intervals in the data table below.

Time (min)	0	1	2	3	4	5	6	7	8	9	10	11	12
Temperature (°C)	15	32	46	53	53	53	53	53	53	53	53	60	65



8. Plot the data from the data table. Circle and connect the points.

9. Based on the data table, what is the melting point of this substance? 53°C

10. The heat of fusion for this substance is 122 joules per gram. How many joules of heat are needed to melt 7.50 grams of this substance at its melting point? $q = mH_f$ $q = (7.50\text{g})(122\text{J/g}) = 915\text{ J}$

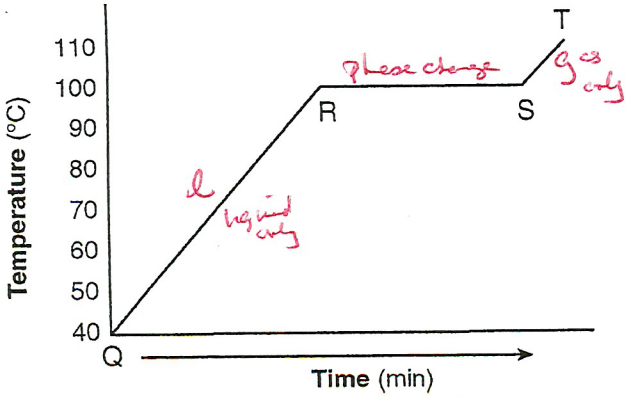
11. What is the evidence that the average kinetic energy of the particles of this substance is increasing during the first three minutes? the temperature is increasing from 15°C to 53°C.

---

12. 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.