Name: _____

_ 1) Which of the following changes is exothermic?

A) sublimation of iodine
B) vaporization of ethanol
C) freezing of water
D) melting of iron

___ 2) Which physical changes are endothermic?

A) condensation and deposition
B) melting and evaporating
C) condensation and sublimation
D) melting and freezing

___ 3) Two samples of gold that have different temperatures are placed in contact with one another. Heat will flow spontaneously from a sample of gold at 60[illegible] to a sample of gold that has a temperature of [illegible]

A) 60[illegible] °C
B) 80[illegible] °C
C) 50[illegible] °C
D) 70[illegible] °C

___ 4) As the temperature of a substance decreases, the average kinetic energy of its particles

A) decreases
B) remains the same
C) increases

___ 5) At 1 atmosphere and 298 K, 1 mole of $H_2O(l)$ molecules and 1 mole of $C_2H_5OH(l)$ molecules *both* have the same

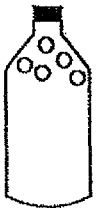
A) vapor pressure
B) average kinetic energy
C) density
D) mass

___ 6) Which kelvin temperature is equivalent to -24[illegible] °C

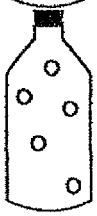
A) 297 K
B) 249 K
C) 273 K
D) 226 K

___ 7) Which diagram *best* represents a gas in a closed container?

A)



B)



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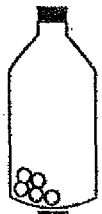
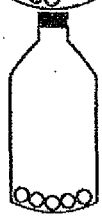


D)



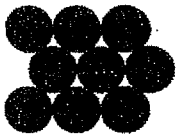
___ 8) Which grouping of the three phases of bromine is listed in order from left to right for increasing distance between bromine molecules?

A) solid, liquid, gas
B) solid, gas, liquid
C) gas, liquid, solid
D) liquid, solid, gas

___ 9) Which 5.0-milliliter sample of NH_3 will take the shape of and completely fill a closed 100.0-milliliter container?

A) $NH_3(aq)$
B) $NH_3(l)$
C) $NH_3(g)$
D) $NH_3(s)$

___ 10) Given the particle diagram:



At 101.3 kPa and 298 K, which element could this diagram represent?

A) Ag
B) Kr
C) Rn
D) Xe

___ 11) In which material are the particles arranged in a regular geometric pattern?

A) $CO_2(g)$
B) NaCl(aq)
C) $C_{12}H_{22}O_{11}(s)$
D) $H_2O(l)$

___ 12) In which equation does the term "heat" represent heat of fusion?

A) $H_2O(l) + HCl(g) \rightarrow H_3O^+(aq) + Cl^-(aq) + heat$
B) $H_2O(l) + heat \rightarrow H_2O(g)$
C) $NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l) + heat$
D) $NaCl(s) + heat \rightarrow NaCl(l)$

___ 13) As ice melts at standard pressure, its temperature remains at 0 °C until it has completely melted. Its potential energy

A) remains the same
B) decreases
C) increases

___ 14) How much heat energy must be absorbed to completely melt 35.0 grams of $H_2O(s)$ at 0°C?

A) 79,100 J
B) 11,700 J
C) 146 J
D) 9.54 J

___ 15) What is the total number of joules released when a 5.00-gram sample of water changes from liquid to solid at 0°C?

A) 11,300 J
B) 2,260 J
C) 334 J
D) 1,670 J

___ 16) What is the freezing point of bromine?

A) 539°C
B) -7.2°C
C) -539°C
D) 7°C

___ 17) In which process does a solid change directly into a vapor?

A) solidification
B) deposition
C) sublimation
D) condensation

___ 18) As the pressure on the surface of a liquid decreases, the temperature at which the liquid will boil

A) remains the same
B) increases
C) decreases

___ 19) The vapor pressure of a liquid is 0.92 atm at 60.°C. The normal boiling point of the liquid could be

A) 45 °C
B) 55 °C
C) 65 °C
D) 35 °C

___ 20) As the temperature of a liquid increases, its vapor pressure

A) increases
B) remains the same
C) decreases

___ 21) Based on the *Vapor Pressure of Four Liquids* chemistry reference table, which substance has the *weakest* intermolecular forces?

A) ethanoic acid
B) propanone
C) water
D) ethanol

___ 22) According to *Vapor Pressure of Four Liquids* chemistry reference table, what is the vapor pressure of propanone at 45°C?

A) 98 kPa
B) 70. kPa
C) 33 kPa
D) 22 kPa

___ 23) Using your knowledge of chemistry and the information in the *Vapor Pressure of Four Liquids* chemistry reference table, which statement concerning propanone and water at 50.°C is true?

A) Propanone has a lower vapor pressure and weaker intermolecular forces than water.
B) Propanone has a higher vapor pressure and weaker intermolecular forces than water.
C) Propanone has a lower vapor pressure and stronger intermolecular forces than water.
D) Propanone has a higher vapor pressure and stronger intermolecular forces than water.

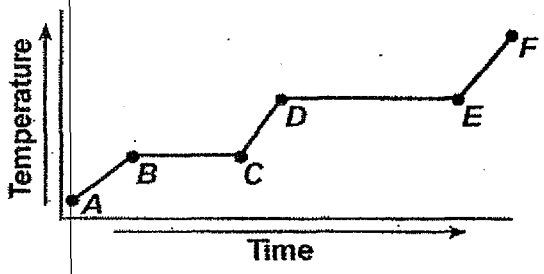
___ 24) Which phase change results in the release of energy?

A) $H_2O(l) \rightarrow H_2O(g)$
B) $H_2O(s) \rightarrow H_2O(g)$
C) $H_2O(g) \rightarrow H_2O(l)$
D) $H_2O(s) \rightarrow H_2O(l)$

___ 25) Which phase change is an exothermic process?

A) $NH_3(g) \rightarrow NH_3(l)$
B) $Hg(l) \rightarrow Hg(g)$
C) $CO_2(s) \rightarrow CO_2(g)$
D) $Cu(s) \rightarrow Cu(l)$

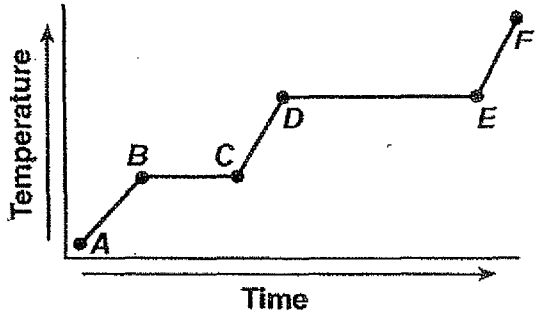
___ 26) The graph below represents the uniform heating of a substance, starting with the substance as a solid below its melting point.



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

A) *EF*
B) *CD*
C) *BC*
D) *AB*

___ 27) The graph below represents the uniform heating of a substance, starting below its melting point, when the substance is solid.



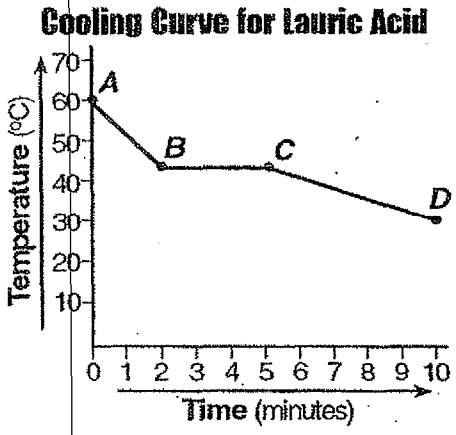
Which line segments represent an increase in average kinetic energy?

A) *DE* and *EF*
B) *BC* and *DE*
C) *AB* and *CD*
D) *AB* and *BC*

___ 28) Calculate the heat released when 25.0 grams of water freezes at 0 °C. [*Show all work. Record your answer with an appropriate unit.*]

___ 29) A liquid's boiling point is the temperature at which its vapor pressure is equal to the atmospheric pressure. Using the *Vapor Pressure of Four Liquids* chemistry reference table, what is the boiling point of propanone at an atmospheric pressure of 70 kPa?

___ 30) Given the graph below that represents the uniform cooling of a sample of lauric acid starting as a liquid above freezing point.



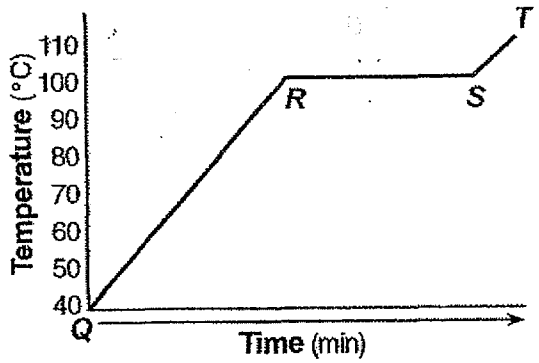
(a) Which line segment represents a phase change, only?

(b) What is the melting point of lauric acid?

(c) At which point do the particles of lauric acid have the *highest* average kinetic energy?

(d) Name the phase change that takes place during this 10-minute cooling time.

___ 31) A sample of water is heated from a liquid at 40.°C to a gas at 110DC. The graph of the heating curve is shown below.



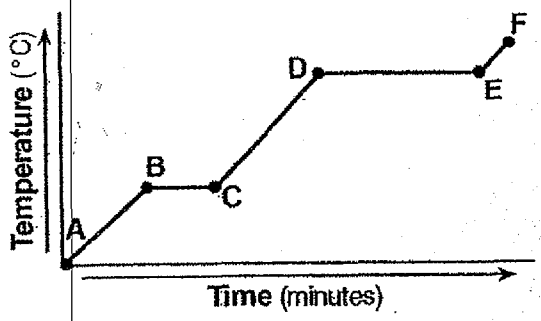
(a) On the heating curve diagram above, label each of the following regions:

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.

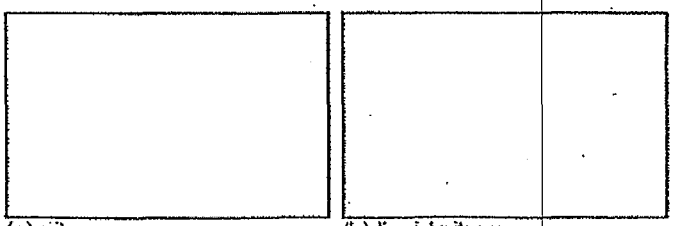
(c) For section *RS* of the graph, state what is happening to the water molecules as heat is added.

___ 32) Given the heating curve where substance *X* starts as a solid below its melting point and is heated uniformly:



Using (●) to represent particles of substance *X* in the given diagram, draw at *least* five particles as they would appear in the substance at point *F*. [*Use the box below.*]

___ 53) The diagram  represents one molecule of nitrogen.



(a) In the box labeled *(a)* above, draw a particle model that shows *at least* six molecules of nitrogen gas.

(b) In the box labeled *(b)* above, draw a particle model that shows *at least* six molecules of liquid nitrogen.

(c) Describe, in terms of particle arrangement, the difference between nitrogen gas and liquid nitrogen.

(d) Good models should reflect the true nature of the concept being represented. What is a limitation of two-dimensional models?