

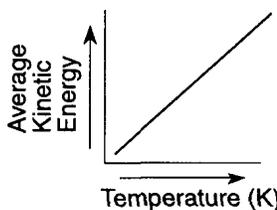
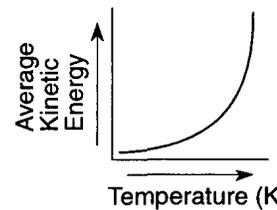
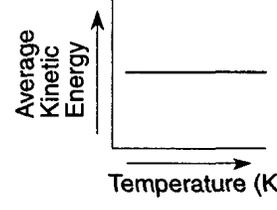
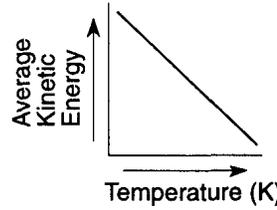
- Which statement describes a chemical property of oxygen?
  - Oxygen has a melting point of 55 K.
  - Oxygen can combine with a metal to produce a compound.
  - Oxygen gas is slightly soluble in water.
  - Oxygen gas can be compressed.
- At STP, which 2.0-gram sample of matter uniformly fills a 340-milliliter closed container?
 

A) $\text{Br}_2(\ell)$	B) $\text{Fe}(\text{NO}_3)_2(\text{s})$
C) $\text{KCl}(\text{aq})$	D) $\text{Xe}(\text{g})$
- A large sample of solid calcium sulfate is crushed into smaller pieces for testing. Which two physical properties are the same for both the large sample and one of the smaller pieces?
  - mass and density
  - mass and volume
  - solubility and density
  - solubility and volume
- Particles are arranged in a crystal structure in a sample of
 

A) $\text{H}_2(\text{g})$	B) $\text{Br}_2(\ell)$	C) $\text{Ar}(\text{g})$	D) $\text{Ag}(\text{s})$
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- Which statement best describes the molecules of  $\text{H}_2\text{O}$  in the solid phase?
  - They move slowly in straight lines.
  - They move rapidly in straight lines.
  - They are arranged in a regular geometric pattern.
  - They are arranged in a random pattern.
- When a battery is in use, stored chemical energy is first changed to
 

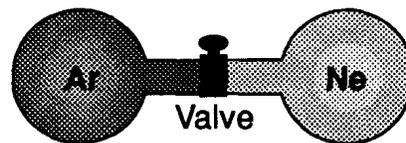
A) electrical energy	B) heat energy
C) light energy	D) mechanical energy
- Which phase change results in the release of energy?
 

A) $\text{H}_2\text{O}(\text{s}) \rightarrow \text{H}_2\text{O}(\ell)$	B) $\text{H}_2\text{O}(\text{s}) \rightarrow \text{H}_2\text{O}(\text{g})$
C) $\text{H}_2\text{O}(\ell) \rightarrow \text{H}_2\text{O}(\text{g})$	D) $\text{H}_2\text{O}(\text{g}) \rightarrow \text{H}_2\text{O}(\ell)$
- The burning of magnesium involves a conversion of
  - chemical energy to mechanical energy
  - chemical energy to heat energy
  - heat energy to chemical energy
  - heat energy to mechanical energy

- The potential energy possessed by a molecule is dependent upon
  - its composition, only
  - its structure, only
  - both its composition and its structure
  - neither its composition nor its structure
- A person with a body temperature of  $37^\circ\text{C}$  holds an ice cube with a temperature of  $0^\circ\text{C}$  in a room where the air temperature is  $20^\circ\text{C}$ . The direction of heat flow is
  - from the person to the ice, only
  - from the person to the ice and air, and from the air to the ice
  - from the ice to the person, only
  - from the ice to the person and air, and from the air to the person
- Which graph best shows the relationship between Kelvin temperature and average kinetic energy?
  - 
  - 
  - 
  - 

## Regents review Physical properties of matter

12. 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  $60^{\circ}\text{C}$  to a sample of gold that has a temperature of  
 A)  $50^{\circ}\text{C}$  B)  $60^{\circ}\text{C}$  C)  $70^{\circ}\text{C}$  D)  $80^{\circ}\text{C}$
13. At which temperature does an aqueous solution of LiCl have the highest average kinetic energy?  
 A)  $100^{\circ}\text{C}$  B)  $200^{\circ}\text{C}$  C) 273 K D) 373 K
14. Which term is defined as a measure of the average kinetic energy of the particles in a sample of matter?  
 A) activation energy B) potential energy  
 C) temperature D) entropy
15. Solid *A* at  $80^{\circ}\text{C}$  is immersed in liquid *B* at  $60^{\circ}\text{C}$ . 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.
16. A liquid's freezing point is  $-38^{\circ}\text{C}$  and its boiling point is  $357^{\circ}\text{C}$ . What is the number of Kelvin between the boiling point and the freezing point of the liquid?  
 A) 319 B) 395 C) 592 D) 668
17. The temperature of a sample of a substance changes from  $10.^{\circ}\text{C}$  to  $20.^{\circ}\text{C}$ . How many Kelvin does the temperature change?  
 A) 10. B) 20. C) 283 D) 293
18. Which Kelvin temperature is equal to  $-73^{\circ}\text{C}$ ?  
 A) 100 K B) 173 K C) 200 K D) 346 K
19. Which process is exothermic?  
 A) boiling of water  
 B) melting of copper  
 C) condensation of ethanol vapor  
 D) sublimation of iodine
20. Which phase change is exothermic?  
 A)  $\text{H}_2\text{O}(\text{s}) \rightarrow \text{H}_2\text{O}(\ell)$  B)  $\text{H}_2\text{O}(\ell) \rightarrow \text{H}_2\text{O}(\text{s})$   
 C)  $\text{H}_2\text{O}(\text{s}) \rightarrow \text{H}_2\text{O}(\text{g})$  D)  $\text{H}_2\text{O}(\ell) \rightarrow \text{H}_2\text{O}(\text{g})$
21. Which phase change is exothermic?  
 A) solid to liquid B) solid to gas  
 C) liquid to solid D) liquid to gas
22. Which process is accompanied by a *decrease* in entropy?  
 A) boiling of water  
 B) condensing of water vapor  
 C) subliming of iodine  
 D) melting of ice
23. Which 10-milliliter sample of water has the greatest degree of disorder?  
 A)  $\text{H}_2\text{O}(\text{g})$  at  $120^{\circ}\text{C}$  B)  $\text{H}_2\text{O}(\ell)$  at  $80^{\circ}\text{C}$   
 C)  $\text{H}_2\text{O}(\ell)$  at  $20^{\circ}\text{C}$  D)  $\text{H}_2\text{O}(\text{s})$  at  $0^{\circ}\text{C}$
24. The diagram below shows a system of gases with the valve closed.



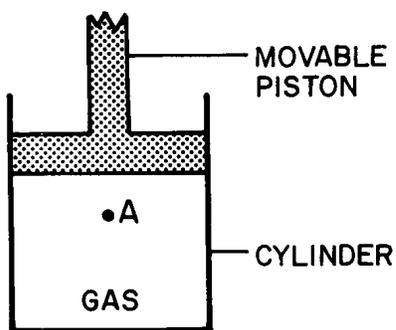
As the valve is opened, the entropy of the gaseous system

- A) decreases B) increases  
 C) remains the same
25. Under which conditions of temperature and pressure would helium behave most like an ideal gas?  
 A) 50 K and 20 kPa B) 50 K and 600 kPa  
 C) 750 K and 20 kPa D) 750 K and 600 kPa
26. The kinetic molecular theory assumes that the particles of an ideal gas  
 A) are in random, constant, straight-line motion  
 B) are arranged in a regular geometric pattern  
 C) have strong attractive forces between them  
 D) have collisions that result in the system losing energy
27. Which statement describes the particles of an ideal gas?  
 A) The particles move in well-defined, circular paths.  
 B) When the particles collide, energy is lost.  
 C) There are forces of attraction between the particles.  
 D) The volume of the particles is negligible.
28. The concept of an ideal gas is used to explain  
 A) the mass of a gas sample  
 B) the behavior of a gas sample  
 C) why some gases are monatomic  
 D) why some gases are diatomic

## Regents review Physical properties of matter

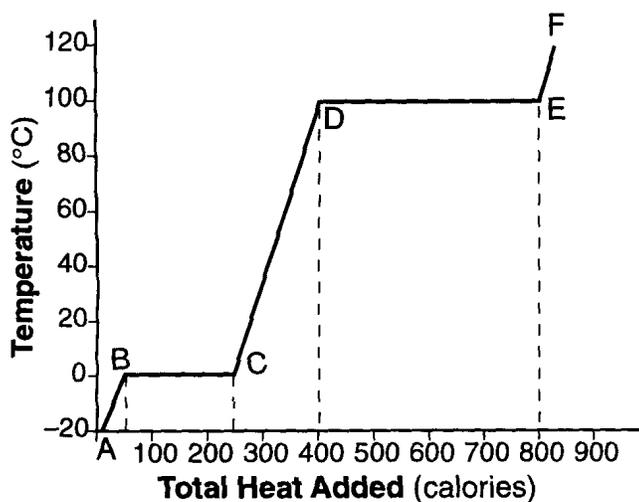
29. An assumption of the kinetic theory of gases is that the particles of a gas have
- little attraction for each other and a significant volume
  - little attraction for each other and an insignificant volume
  - strong attraction for each other and a significant volume
  - strong attraction for each other and an insignificant volume
30. Which gas is *least* likely to obey the ideal gas laws at very high pressures and very low temperatures?
- He
  - Ne
  - Kr
  - Xe
31. Under which conditions of temperature and pressure would a sample of  $\text{H}_2(\text{g})$  behave most like an ideal gas?
- $0^\circ\text{C}$  and 100 kPa
  - $0^\circ\text{C}$  and 300 kPa
  - $150^\circ\text{C}$  and 100 kPa
  - $150^\circ\text{C}$  and 300 kPa
32. Which is the first phase change that is most likely to occur as the pressure on nitrogen gas is increased and its temperature is decreased?
- evaporation
  - condensation
  - crystallization
  - solidification
33. A real gas behaves more like an ideal gas when the gas molecules are
- close and have strong attractive forces between them
  - close and have weak attractive forces between them
  - far apart and have strong attractive forces between them
  - far apart and have weak attractive forces between them
34. Under the same conditions of temperature and pressure, which of the following gases would behave most like an ideal gas?
- $\text{He}(\text{g})$
  - $\text{NH}_3(\text{g})$
  - $\text{Cl}_2(\text{g})$
  - $\text{CO}_2(\text{g})$
35. The data table below gives the temperature and pressure of four different gas samples, each in a 2-liter container.
- Temperature and Pressure of Gas Samples**
- | Gas Sample    | Temperature (K) | Pressure (atm) |
|---------------|-----------------|----------------|
| He            | 300.            | 1.20           |
| Ne            | 300.            | 1.00           |
| $\text{CO}_2$ | 200.            | 1.20           |
| $\text{CH}_4$ | 300.            | 1.00           |
- Which two gas samples contain the same total number of particles?
- $\text{CH}_4$  and  $\text{CO}_2$
  - $\text{CH}_4$  and Ne
  - He and  $\text{CO}_2$
  - He and Ne
36. A sample of oxygen gas is sealed in container X. A sample of hydrogen gas is sealed in container Z. Both samples have the same volume, temperature, and pressure. Which statement is true?
- Container X contains more gas molecules than container Z.
  - Container X contains fewer gas molecules than container Z.
  - Containers X and Z both contain the same number of gas molecules.
  - Containers X and Z both contain the same mass of gas.
37. Equal volumes of all gases at the same temperature and pressure contain an equal number of
- molecules
  - atoms
  - electrons
  - protons
38. A rigid cylinder with a movable piston contains a 2.0-liter sample of neon gas at STP. What is the volume of this sample when its temperature is increased to  $30.^\circ\text{C}$  while its pressure is decreased to 90. kilopascals?
- 2.5 L
  - 2.0 L
  - 1.6 L
  - 0.22 L
39. Which temperature change would cause a sample of an ideal gas to double in volume while the pressure is held constant?
- from 400. K to 200. K
  - from 200. K to 400. K
  - from  $400.^\circ\text{C}$  to  $200.^\circ\text{C}$
  - from  $200.^\circ\text{C}$  to  $400.^\circ\text{C}$

40. The diagram below represents a gas confined in a cylinder fitted with a movable piston.



As the piston moves toward point *A* at constant temperature, which relationship involving pressure (*P*) and volume (*V*) is correct?

- A)  $P + V = k$                       B)  $P - V = k$   
 C)  $P \div V = k$                       D)  $P \times V = k$
41. If 60. liters of hydrogen gas at 546 K is cooled to 273 K at constant pressure, the new volume of the gas will be  
 A) 120 L   B) 20. L   C) 30. L   D) 40. L
42. A sample of helium gas has a volume of 900. milliliters and a pressure of 2.50 atm at 298 K. What is the new pressure when the temperature is changed to 336 K and the volume is decreased to 450. milliliters?  
 A) 0.177 atm                      B) 4.43 atm  
 C) 5.64 atm                        D) 14.1 atm
43. The graph below shows the heating curve of 1.0 gram of a solid as it is heated at a constant rate, starting at a temperature below its melting point.



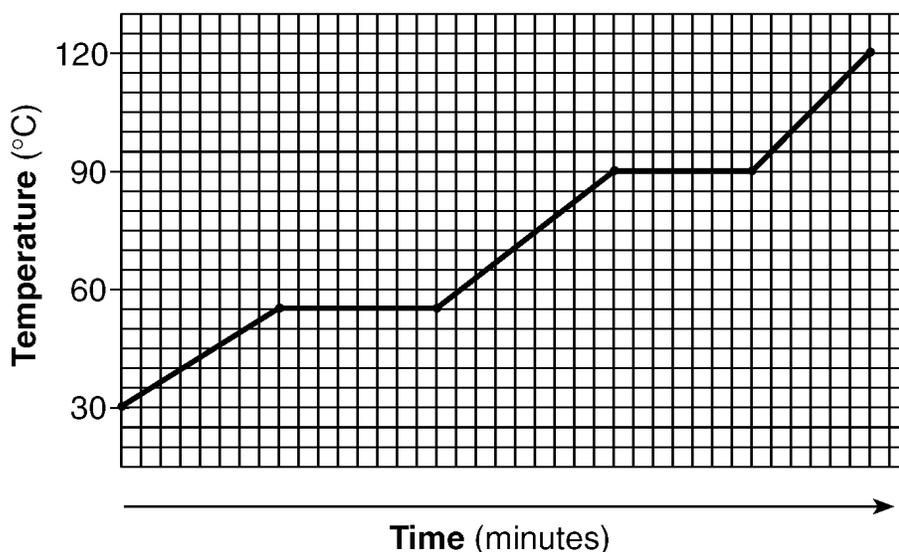
Based on this graph, what is the heat of vaporization?

- A) 200 calories, as measured along line *BC*  
 B) 250 calories, as measured along line *BC*  
 C) 400 calories, as measured along line *DE*  
 D) 800 calories, as measured along line *DE*

44. As a solid is heated, its temperature increases from 10°C to 25°C, remains at 25°C for 5 minutes, and then increases to beyond 45°C. Based on this information, what conclusion can be drawn about the substance?

- A) Its melting point is 45°C.  
 B) Its boiling point is 45°C.  
 C) Its melting point is 25°C.  
 D) Its boiling point is 25°C.

45. 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?

- A) 30°C      B) 55°C      C) 90°C      D) 120°C

46. When 420 Joules of heat energy is added to 10. grams of water at 20.°C, the final temperature of the water will be

- A) 10.°C    B) 30.°C    C) 40.°C    D) 100°C

47. What is the total number of Joules of heat energy absorbed by 15 grams of water when it is heated from 30.°C to 40.°C?

- A) 42 J    B) 63 J    C) 130 J    D) 630 J

48. How many grams of water will absorb a total of 2520 Joules of energy when the temperature of the water changes from 10.0°C to 30.0°C?

- A) 10.0 g      B) 20.0 g  
C) 30.0 g      D) 60.0 g

49. The number of Joules needed to raise the temperature of 10 grams of water from 20°C to 30°C is

- A) 42    B) 84    C) 420    D) 1680

50. What is the total number of kiloJoules of heat energy absorbed when the temperature of 200 grams of water is raised from 10°C to 40°C?

- A) 0.126 kJ      B) 0.840 kJ  
C) 25.2 kJ      D) 33.6 kJ

51. As a solid substance absorbs heat at its melting point, the melting point will

- A) decrease      B) increase  
C) remain the same

52. Given the equilibrium



at a pressure of 1 atmosphere. The temperature of the ice-water mixture must be

- A) 0°C    B) 32°C    C) 100°C    D) 212°C

53. The heat of fusion of a compound is 126 Joules per gram. What is the total number of Joules of heat that must be absorbed by a 15.0-gram sample to change the compound from solid to liquid at its melting point?

- A) 111 J      B) 141 J  
C) 1,110 J    D) 1,890 J

54. What amount of heat is required to completely melt a 29.95-gram sample of H<sub>2</sub>O(s) at 0°C?

- A) 334 J      B) 2260 J  
C)  $1.00 \times 10^3$  J    D)  $1.00 \times 10^4$  J

55. How many Joules of heat would be required to completely melt 5.00 grams of H<sub>2</sub>O(s) at 0°C to H<sub>2</sub>O(ℓ) at 0°C?

- A) 5.00    B) 167    C) 334    D) 1,670

56. How much energy is required to vaporize 10.00 grams of water at its boiling point?

- A) 2.26 kJ      B) 3.34 kJ  
C) 4.2 kJ      D) 22.6 kJ

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57. According to Reference Table *H*, what is the boiling point of ethanoic acid at 80 kPa?

- A) 28°C                      B) 100°C  
C) 111°C                     D) 125°C

58. Water boils at 90°C when the pressure exerted on the liquid is equal to

- A) 25 kPa                     B) 50 kPa  
C) 81 kPa                     D) 101.3 kPa

59. What is the normal boiling point of ethanoic acid?

- A) 52°C                        B) 55°C  
C) 101.3°C                   D) 117.9°C

60. What is the boiling point of water when the atmospheric pressure exerted on the water is 81 kPa?

- A) 50°C    B) 90°C    C) 100°C    D) 110°C

61. Which sample of iodine will sublime?

- A) I<sub>2</sub>(g)    B) I<sub>2</sub>(ℓ)    C) I<sub>2</sub>(aq)    D) I<sub>2</sub>(s)

62. Hydrogen bonding is a type of

- A) strong covalent bond  
B) weak ionic bond  
C) strong intermolecular force  
D) weak intermolecular force

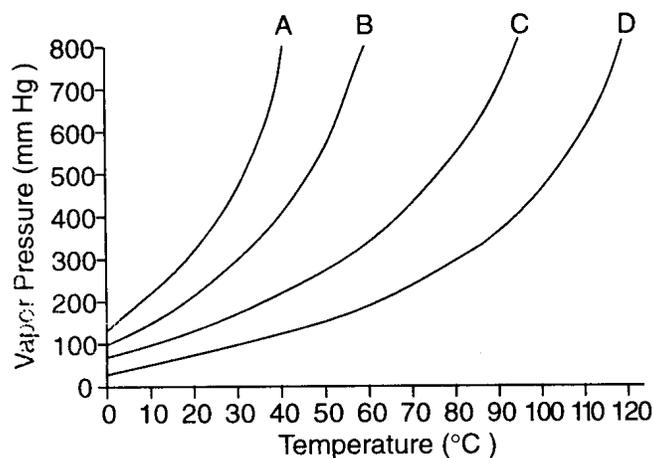
63. Hydrogen bonds would be strongest between the molecules of a compound of hydrogen and

- A) I            B) Br            C) Cl            D) F

64. As the atmospheric pressure decreases, the temperature at which water will boil in an open container

- A) decreases                      B) increases  
C) remains the same

65. Base your answer to the following question on The graph below represents the vapor curves of four liquids.



Which liquid has the highest normal boiling point?

- A) *A*            B) *B*            C) *C*            D) *D*

66. Based on Reference Table *H*, which sample has the highest vapor pressure?

- A) water at 20°C                      B) water at 80°C  
C) ethanol at 50°C                    D) ethanol at 65°C

67. According to Reference Table *H*, what is the vapor pressure of propanone at 45°C?

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

68. As the temperature of a liquid increases, its vapor pressure

- A) decreases                              B) increases  
C) remains the same

69. Which compound has the *lowest* melting point?

- A) HCl    B) KCl    C) NaCl    D) LiCl

70. Which statement explains why Br<sub>2</sub> is a liquid at STP and I<sub>2</sub> is a solid at STP?

- A) Molecules of Br<sub>2</sub> are polar, and molecules of I<sub>2</sub> are nonpolar.  
B) Molecules of I<sub>2</sub> are polar, and molecules of Br<sub>2</sub> are nonpolar.  
C) Molecules of Br<sub>2</sub> have stronger intermolecular forces than molecules of I<sub>2</sub> .  
D) Molecules of I<sub>2</sub> have stronger intermolecular forces than molecules of Br<sub>2</sub> .

71. Molecule-ion attractions are present in

- A) NaCl(aq)                                B) HCl(g)  
C) CCl<sub>4</sub>(ℓ)                                 D) KClO<sub>3</sub>(s)

## Regents review Physical properties of matter

72. In which system do molecule-ion attractions exist?

- A) NaCl(aq)                      B) NaCl(s)  
C) C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>(aq)                D) C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>(s)

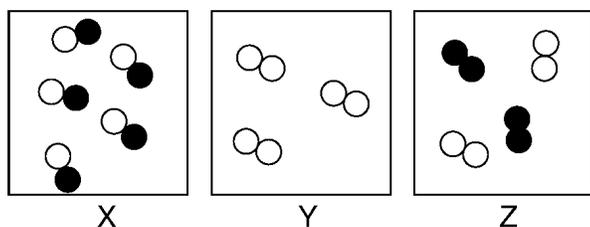
73. Which compound has the *lowest* normal boiling point?

- A) HCl    B) H<sub>2</sub>S    C) NH<sub>3</sub>    D) CH<sub>4</sub>

74. Which sequence of Group 18 elements demonstrates a gradual *decrease* in the strength of the van der Waals forces?

- A) Ar(*ℓ*), Kr(*ℓ*), Ne(*ℓ*), Xe(*ℓ*)  
B) Kr(*ℓ*), Xe(*ℓ*), Ar(*ℓ*), Ne(*ℓ*)  
C) Ne(*ℓ*), Ar(*ℓ*), Kr(*ℓ*), Xe(*ℓ*)  
D) Xe(*ℓ*), Kr(*ℓ*), Ar(*ℓ*), Ne(*ℓ*)

75. Given the diagrams X, Y, and Z below:



Key
Atom of element A = ○
Atom of element B = ●

Which diagram or diagrams represent a mixture of elements A and B?

- A) X, only                      B) Z, only  
C) X and Y                    D) X and Z

76. Which represents a homogeneous mixture?

- A) CuSO<sub>4</sub>(s)                    B) Br<sub>2</sub>(*ℓ*)  
C) NaCl(aq)                    D) CO<sub>2</sub>(g)

77. An aqueous solution of sodium chloride is best classified as a

- A) homogeneous compound  
B) homogeneous mixture  
C) heterogeneous compound  
D) heterogeneous mixture

78. When KCl(s) is dissolved in water, the resulting solution is classified as a

- A) heterogeneous compound  
B) homogeneous compound  
C) heterogeneous mixture  
D) homogeneous mixture

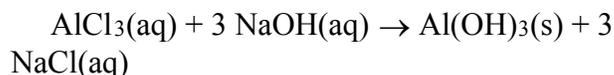
79. Which must be a mixture of substances?

- A) solid                            B) liquid  
C) gas                              D) solution

80. If a student pours a mixture of sand and salt water through a filter paper into a beaker, what will be found in the beaker after filtering?

- A) salt, only                      B) sand, only  
C) salt and water                D) salt and sand

81. A student observed the following reaction:



After the products were filtered, which substance remained on the filter paper?

- A) NaCl                            B) NaOH  
C) AlCl<sub>3</sub>                          D) Al(OH)<sub>3</sub>

82. Fractional distillation is a technique used to separate complex mixtures of hydrocarbons based on differences in their

- A) heats of fusion  
B) heats of vaporization  
C) melting points  
D) boiling points

83. Which sample of matter can be separated into different substances by physical means?

- A) LiCl(aq)                        B) LiCl(s)  
C) NH<sub>3</sub>(g)                        D) NH<sub>3</sub>(*ℓ*)

84. According to Reference Table F, which of these compounds is most soluble at 298 K and 1 atm?

- A) AgNO<sub>3</sub>                        B) AgCl  
C) PbCrO<sub>4</sub>                        D) PbCO<sub>3</sub>

85. Based on Reference Table F, which of the following compounds is *least* soluble in water?

- A) NaCl                            B) Pb<sub>2</sub>ClO<sub>3</sub>  
C) Na<sub>2</sub>CrO<sub>4</sub>                        D) PbCrO<sub>4</sub>

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86. Base your answer to the following question on A student tested the solubility of a salt at different temperatures and then used Reference Table g to identify the salt. The student's data table appears below.

Temperature (°C)	g of salt per 10 g of water
30	1.2
50	2.2
62	3.0
76	4.0

What is the identity of the salt?

- A) potassium nitrate    B) sodium chloride  
C) potassium chlorate    D) ammonium chloride
87. According to your Reference Tables, which substance forms an unsaturated solution when 80 grams of the substance is dissolved in 100 grams of H<sub>2</sub>O at 10°C?
- A) KI                                  B) KNO<sub>3</sub>  
C) NaNO<sub>3</sub>                              D) NaCl
88. According to Reference Table G, which of the following substances is *least* soluble in 100 grams of water at 50°C?
- A) NaCl                                B) KCl  
C) NH<sub>4</sub>Cl                                D) HCl
89. Based on Reference Table G, which of the following substances is most soluble at 50°C?
- A) KClO<sub>3</sub>                                B) NH<sub>3</sub>  
C) NaCl                                 D) NH<sub>4</sub>Cl
90. A student obtained the following data in a chemistry laboratory.

Trial	Temperature (°C)	Solubility (grams of KNO <sub>3</sub> /100 g of H <sub>2</sub> O)
1	25	40
2	32	50
3	43	70
4	48	60

Based on Reference Table g, which of the trials seems to be in error?

- A) 1    B) 2    C) 3    D) 4

91. As the pressure on a gas confined above a liquid increases, the solubility of the gas in the liquid
- A) decreases                              B) increases  
C) remains the same
92. Carbon dioxide gas is most soluble in water under conditions of
- A) high pressure and low temperature  
B) high pressure and high temperature  
C) low pressure and low temperature  
D) low pressure and high temperature
93. When an equilibrium exists between the dissolved and the undissolved solute in a solution, the solution must be
- A) diluted                                  B) saturated  
C) supersaturated                        D) unsaturated
94. A solute is added to water and a portion of the solute remains undissolved. When equilibrium between the dissolved and undissolved solute is reached, the solution must be
- A) dilute                                    B) saturated  
C) unsaturated                            D) supersaturated
95. An unsaturated solution is formed when 80. grams of a salt is dissolved in 100. grams of water at 40.°C. This salt could be
- A) KCl                                        B) KNO<sub>3</sub>  
C) NaCl                                      D) NaNO<sub>3</sub>
96. One hundred grams of water is saturated with NH<sub>4</sub>Cl at 50°C. According to Table G, if the temperature is lowered to 10°C, what is the total amount of NH<sub>4</sub>Cl that will precipitate?
- A) 5.0 g    B) 17 g    C) 30. g    D) 50. g
97. A solution contains 35 grams of KNO<sub>3</sub> dissolved in 100 grams of water at 40°C. How much *more* KNO<sub>3</sub> would have to be added to make it a saturated solution?
- A) 29 g    B) 24 g    C) 12 g    D) 4g
98. What is the molarity of a solution of KNO<sub>3</sub> (molecular mass = 101) that contains 404 grams of KNO<sub>3</sub> in 2.00 liters of solution?
- A) 1.00    B) 2.00    C) 0.500    D) 4.00

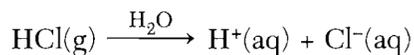
## Regents review Physical properties of matter

99. If 20. milliliters of a 1.0 M solution of HCl is exactly neutralized by 40. milliliters of NaOH, the molarity of the NaOH solution is
- A) 1.0 M                      B) 2.0 M  
C) 0.50 M                    D) 4.0 M
100. A 3.0 M HCl(aq) solution contains a total of
- A) 3.0 grams of HCl per liter of water  
B) 3.0 grams of HCl per mole of solution  
C) 3.0 moles of HCl per liter of solution  
D) 3.0 moles of HCl per mole of water
101. What is the molarity of a solution of NaOH if 2 liters of the solution contains 4 moles of NaOH?
- A) 0.5 M   B) 2 M   C) 8 M   D) 80 M
102. How many grams of KOH are needed to prepare 250. milliliters of a 2.00 M solution of KOH (formula mass = 56.0)?
- A) 1.00 g                      B) 2.00 g  
C) 28.0 g                      D) 112 g
103. Which solution is the most concentrated?
- A) 1 mole of solute dissolved in 1 liter of solution  
B) 2 moles of solute dissolved in 3 liters of solution  
C) 6 moles of solute dissolved in 4 liters of solution  
D) 4 moles of solute dissolved in 8 liters of solution
104. Based on your reference tables, which compound could form a concentrated solution?
- A) AgBr                      B) AgCl  
C) Ag<sub>2</sub>CO<sub>3</sub>                    D) AgNO<sub>3</sub>
105. A 2400.-gram sample of an aqueous solution contains 0.012 gram of NH<sub>3</sub>. What is the concentration of NH<sub>3</sub> in the solution, expressed as parts per million?
- A) 5.0 ppm                      B) 15 ppm  
C) 20. ppm                      D) 50. ppm
106. What is the concentration expressed in parts per million of a solution containing 15.0 grams of KNO<sub>3</sub> in 65.0 grams of H<sub>2</sub>O?
- A)  $1.88 \times 10^5$  ppm      B)  $2.00 \times 10^5$  ppm  
C)  $2.31 \times 10^5$  ppm      D)  $5.33 \times 10^6$  ppm
107. Which aqueous solution of KI freezes at the lowest temperature?
- A) 1 mol of KI in 500. g of water  
B) 2 mol of KI in 500. g of water  
C) 1 mol of KI in 1000. g of water  
D) 2 mol of KI in 1000. g of water
108. At standard pressure when NaCl is added to water, the solution will have a
- A) higher freezing point and a lower boiling point than water  
B) higher freezing point and a higher boiling point than water  
C) lower freezing point and a higher boiling point than water  
D) lower freezing point and a lower boiling point than water
109. Compared to pure water, an aqueous solution of calcium chloride has a
- A) higher boiling point and higher freezing point  
B) higher boiling point and lower freezing point  
C) lower boiling point and higher freezing point  
D) lower boiling point and lower freezing point

## Regents review Physical properties of matter

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

A scientist makes a solution that contains 44.0 grams of hydrogen chloride gas,  $\text{HCl}(\text{g})$ , in 200. grams of water,  $\text{H}_2\text{O}(\ell)$ , at  $20.^\circ\text{C}$ . This process is represented by the balanced equation below.



Explain, in terms of the distribution of particles, why the solution is a homogeneous mixture.

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

A student prepared two mixtures, each in a labeled beaker. Enough water at  $20.^\circ\text{C}$  was used to make 100 milliliters of each mixture.

**Information about Two Mixtures at  $20.^\circ\text{C}$**

	<b>Mixture 1</b>	<b>Mixture 2</b>
<b>Composition</b>	NaCl in $\text{H}_2\text{O}$	Fe filings in $\text{H}_2\text{O}$
<b>Student Observations</b>	<ul style="list-style-type: none"><li>• colorless liquid</li><li>• no visible solid on bottom of beaker</li></ul>	<ul style="list-style-type: none"><li>• colorless liquid</li><li>• black solid on bottom of beaker</li></ul>
<b>Other Data</b>	<ul style="list-style-type: none"><li>• mass of NaCl(s) dissolved = 2.9 g</li></ul>	<ul style="list-style-type: none"><li>• mass of Fe(s) = 15.9 g</li><li>• density of Fe(s) = <math>7.87 \text{ g/cm}^3</math></li></ul>

Describe a procedure to physically remove the water from mixture 1.

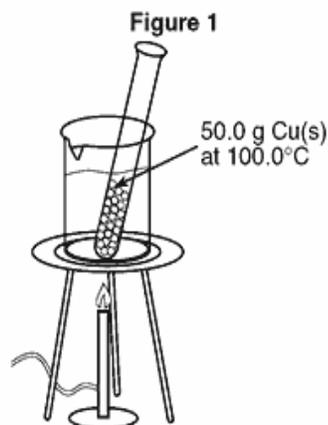
Base your answers to questions **112** and **113** on the information below.

Cold packs are used to treat minor injuries. Some cold packs contain  $\text{NH}_4\text{NO}_3(\text{s})$  and a small packet of water at room temperature before activation. To activate this type of cold pack, the small packet must be broken to mix the water and  $\text{NH}_4\text{NO}_3(\text{s})$ . The temperature of this mixture decreases to approximately  $2^\circ\text{C}$  and remains at this temperature for 10 to 15 minutes.

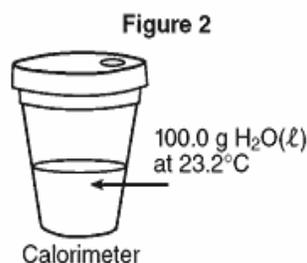
112. Identify the type of mixture formed when the  $\text{NH}_4\text{NO}_3(\text{s})$  is completely dissolved in the water.

113. State the direction of heat flow that occurs when the activated cold pack is applied to the body.

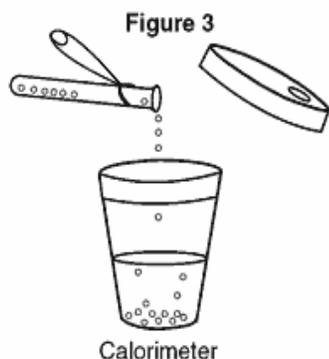
114. Base your answer to the following question on the information below.



In a laboratory investigation, a 50.0-gram sample of copper is at 100.0°C in a boiling water bath.



A Styrofoam cup with a lid is used as a calorimeter. The cup contains 100.0 grams of distilled water at 23.2°C.



The hot copper is poured into the cup of water, and the cup is quickly covered with the lid.



A thermometer is inserted through the lid. The copper and water are gently stirred in the cup. The temperature is checked periodically. The highest temperature noted is 26.3°C.

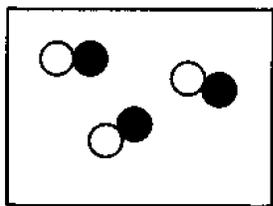
Data Table

Quantity Measured	Data (units are given)
Mass of copper	g
Temperature of hot copper	°C
Mass of H <sub>2</sub> O in calorimeter	g
Initial temperature of H <sub>2</sub> O in calorimeter	°C
Final temperature of H <sub>2</sub> O and copper	°C

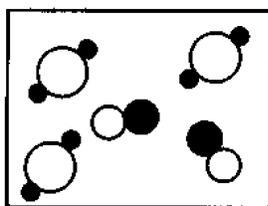
In this investigation, the change in heat of the copper is greater than the change in heat of the water. What error could account for this apparent violation of the Law of Conservation of Energy? Do not use human error as part of the answer.

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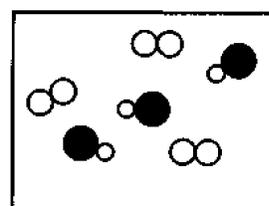
115. Base your answer to the following question on the pictures below:



A



B



C

Contrast sample *A* and sample *B*, in terms of *compounds* and *mixtures*. Include both sample *A* and sample *B* in your answer.