

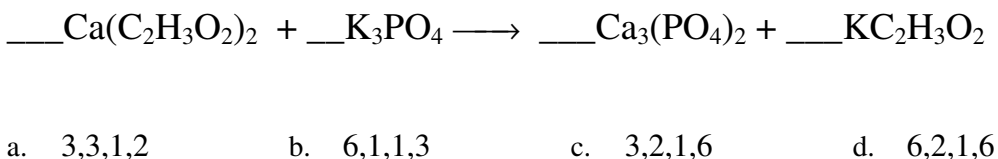
**Chemistry - Spring Semester Exam Review Ch. 8-17**

**This is your Final Exam Review.**

**It was posted electronically on Thursday, May 12, 2016. Your semester exam either 5/26-5/27 (periods 1-4) or 5/31-6/1 (Periods 5-9). You should take the time (both in class and at home) to work through these problems. Your chemistry teachers will select the questions for the final exam directly from this packet. You will be provided with a formula chart.**

**NO CHEAT SHEETS ON THE SEMESTER EXAM.**

- \_\_\_\_\_ 1. The equation  $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$  is the equation for a
- a. synthesis reaction.    c. combustion reaction.  
b. decomposition reaction.    d. single-replacement reaction.
- \_\_\_\_\_ 2. The formation of a solid product in a chemical reaction is represented by the symbol
- a. (aq).                      b. (g).                      c. (l).                      d. (s).
- \_\_\_\_\_ 3. Which equation below violates the law of conservation of mass?
- a.  $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$   
b.  $\text{KCl} + \text{Br}_2 \rightarrow \text{KBr} + \text{Cl}_2$   
c.  $2\text{Fe}_2\text{O}_3 + 3\text{C} \rightarrow 4\text{Fe} + 3\text{CO}_2$   
d.  $\text{Na}_2\text{CO}_3 + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$
- \_\_\_\_\_ 4. When the reaction below is balanced, the coefficient for oxygen ( $\text{O}_2$ ) is:
- \_\_\_\_\_  $\text{Al}_{(s)} +$  \_\_\_\_\_  $\text{O}_{2(g)} \rightarrow$  \_\_\_\_\_  $\text{Al}_2\text{O}_{3(s)}$
- a. 2                                      b. 3                                      c. 4                                      d. 6
- \_\_\_\_\_ 5. In the synthesis of hydrobromic acid, HBr, what are the two reactants?
- a. H and Br                      b.  $\text{H}_2$  and  $\text{Br}_2$                       c.  $\text{H}_2$  and  $\text{BrO}_3$                       d.  $\text{H}_2$  and Br
- \_\_\_\_\_ 6. What is the formula for aluminum sulfate?
- a.  $\text{AlSO}_4$                       b.  $\text{Al}_2\text{SO}_4$                       c.  $\text{Al}_2(\text{SO}_4)_3$                       d.  $\text{Al}(\text{SO}_4)_3$
- \_\_\_\_\_ 7. Which set of coefficients balances the equation?



\_\_\_ 8. What is the formula for the compound formed by calcium ions and fluoride ions?  
a. CaF                      b. Ca<sub>2</sub>F                      c. CaF<sub>3</sub>                      d. CaF<sub>2</sub>

\_\_\_ 9. To balance a chemical equation, it may be necessary to adjust the  
a. coefficients.    c. formulas of the products.  
b. subscripts.    d. number of products.

\_\_\_ 10. Balance the following equation with the **smallest whole number coefficients**.

The coefficients of **ZrO<sub>2</sub>** and **CCl<sub>4</sub>** are \_\_\_ and \_\_\_, respectively.



a. 1,1                      b. 2,4                      c. 1,2                      d. 2,2

\_\_\_ 11. In the expression 3CO<sub>2</sub>, the numbers 3 and 2 are, respectively,  
a. a subscript and a coefficient.                      c. two subscripts.  
b. a coefficient and a subscript.                      d. two coefficients.

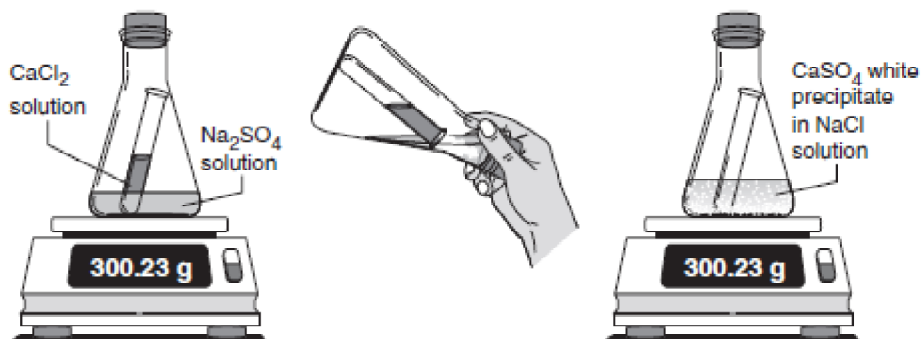
\_\_\_ 12. The activity series helps to predict  
a. the amount of product formed by a chemical reaction.  
b. whether or not a specific chemical reaction is possible.  
c. the coefficients needed to balance a chemical equation.  
d. the amount of energy needed to start a chemical reaction.

\_\_\_ 13. In a single-displacement reaction, an element in the activity series most likely can replace any element  
a. above it on the list.    c. below it on the list.  
b. in the same group.    d. in any other group.

\_\_\_ 14. In an equation, the symbol for a substance in water solution is followed by  
a. (l).                      b. (g).                      c. (aq).                      d. (s).

\_\_\_ 15. Metal X replaces the ions of metal Y from solution, but it cannot replace the ions of metal Z from solution. The order these metals should have in the activity series (from top to bottom) is  
a. x, y, z                      b. z, x, y                      c. y, x, z                      d. z, y, x

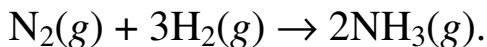
\_\_\_ 16. In writing an equation that produces nitrogen, what is the correct representation of nitrogen?  
a. N                      b. 2N                      c. N<sub>2</sub>                      d. NO<sub>3</sub>



17. In the procedure shown above, a calcium chloride solution is mixed with a sodium sulfate solution to create the products shown. Which of the following is illustrated by this activity?
- The law of conservation of mass
  - The theory of thermal equilibrium
  - the law of conservation of momentum
  - the theory of covalent bonding
18. Which of the following correctly demonstrates conservation of mass?
- $C_4H_{10} + O_2 \longrightarrow CO_2 + H_2O$
  - $C_4H_{10} + 4O_2 \longrightarrow 4CO_2 + 5H_2O$
  - $2C_4H_{10} + 13O_2 \longrightarrow 8CO_2 + 10H_2O$
  - $C_4H_{10} + 8O_2 \longrightarrow 4CO_2 + 10H_2O$
19. Which observation does NOT indicate that a chemical reaction has occurred?
- formation of a precipitate
  - production of a gas
  - evolution of heat and light
  - change in total mass of substances
20. When the equation below is correctly balanced, what is the coefficient of Fe?
- $$\underline{\hspace{1cm}} FeSO_4 + \underline{\hspace{1cm}} Al \rightarrow \underline{\hspace{1cm}} Al_2(SO_4)_3 + \underline{\hspace{1cm}} Fe$$
- 3
  - 4
  - 6
  - 9
21. The coefficients in a chemical equation represent the
- masses, in grams, of all reactants and products.
  - relative numbers of moles of reactants and products.
  - number of atoms in each compound in a reaction.
  - number of valence electrons involved in the reaction.
22. In the reaction  $N_2 + 3H_2 \rightarrow 2NH_3$ , what is the mole ratio of nitrogen to ammonia?
- 1:1
  - 1:2
  - 1:3
  - 2:3
23. In the reaction  $2Al_2O_3 \rightarrow 4Al + 3O_2$ , what is the mole ratio of aluminum to oxygen?
- 10:6
  - 3:4
  - 2:3
  - 4:3
24. In the reaction  $Ca + Cl_2 \rightarrow CaCl_2$ , what is the mole ratio of chlorine to calcium chloride?
- 2:3
  - 2:1
  - 1:2
  - 1:1

\_\_\_ 25. In the reaction  $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$ , what is the mole ratio of hydrogen to ammonia?  
a. 1:1                      b. 2:1                      c. 3:2                      d. 6:8

\_\_\_ 26. The Haber process for producing ammonia commercially is represented by the equation



To completely convert 9.0 mol hydrogen gas to ammonia gas, how many moles of nitrogen gas are required?

a. 1.0 mol                      b. 2.0 mol                      c. 3.0 mol                      d. 6.0 mol

\_\_\_ 27. In the equation  $2\text{KClO}_3 \rightarrow 2\text{KCl} + 3\text{O}_2$ , how many moles of oxygen are produced when 3.0 mol of  $\text{KClO}_3$  decompose completely?

a. 1.0 mol                      b. 2.5 mol                      c. 3.0 mol                      d. 4.5 mol

\_\_\_ 28. For the reaction  $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$ , how many moles of nitrogen are required to produce 18 mol of ammonia?

a. 9.0 mol                      b. 18 mol                      c. 27 mol                      d. 36 mol

\_\_\_ 29. For the reaction  $\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$ , how many moles of hydrochloric acid are required to produce 150. g of water?

a. 1.50 mol                      c. 8.32 mol  
b. 4.16 mol                      d. 12.2 mol

\_\_\_ 30. A chemical reaction involving reactants A and B stops when B is completely used. B is the  
a. excess reactant.    b. limiting reactant.    c. primary reactant.    d. primary product.

\_\_\_ 31. What is the ratio of the actual yield to the theoretical yield, multiplied by 100%?  
a. mole ratio                      b. percent yield                      c. Avogadro yield                      d. excess yield

\_\_\_ 32. In most chemical reactions the amount of product obtained is  
a. equal to the theoretical yield.                      c. more than the theoretical yield.  
b. less than the theoretical yield.                      d. more than the percent yield.

- \_\_\_ 33. Which of these would support the idea that mass is conserved in a reaction that produces a gas as a product?
- Heating the reactants to ensure the reaction occurs in a gaseous state
  - Subtracting the mass of the gas from the mass of the solid and liquid products
  - Mixing the reactants and measuring their total mass
  - Trapping the gas and measuring its mass
- \_\_\_ 34. Actual yield must be determined by
- experiments.
  - calculations.
  - theoretical yield.
  - estimation.
- \_\_\_ 35. Which expression can be used to solve a mass-to-mole conversion for the following equation:



- $\text{mass HCl} \times \frac{1 \text{ mol HCl}}{\text{molar mass HCl}} \times \frac{1 \text{ mol Cl}_2}{2 \text{ mol HCl}}$
  - $\frac{1 \text{ mol Cl}_2}{2 \text{ mol HCl}} \times \text{mass HCl}$
  - $\frac{1 \text{ mol Cl}_2}{2 \text{ mol HCl}} \times \frac{1 \text{ mol HCl}}{\text{molar mass HCl}} \times \text{mass HCl}$
  - $\text{mass HCl} \times \text{molar mass HCl} \times \frac{1 \text{ mol Cl}_2}{2 \text{ mol HCl}}$
- \_\_\_ 36. Which of the following mathematical expressions correctly states the relationship among percentage yield, actual yield, and theoretical yield?
- $\text{actual yield} = \frac{\text{percentage yield}}{\text{theoretical yield}} \times 100$
  - $\text{percentage yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100$
  - $\text{theoretical yield} = \frac{\text{percentage yield}}{\text{actual yield}} \times 100$
  - Both (b) and (c)
- \_\_\_ 37. For the equation  $\text{P}_{4(s)} + 5\text{O}_{2(g)} \rightarrow \text{P}_4\text{O}_{10(s)}$ , if 3 mol of phosphorus react with 10 mol of oxygen, the theoretical yield of phosphorus(V) oxide will be:
- 1 mol.
  - 2 mol.
  - 3 mol.
  - 10 mol.

- \_\_\_ 38. In the reaction represented by the equation  $\text{CH}_4(g) + 2\text{O}_2(g) \rightarrow \text{CO}_2(g) + 2\text{H}_2\text{O}(g)$ , a mass of 125 g  $\text{CH}_4$  is reacted with excess oxygen. The expression

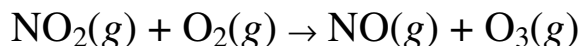
$$125 \text{ g CH}_4 \times \frac{1 \text{ mol CH}_4}{16.05 \text{ g CH}_4} \times \frac{2 \text{ mol H}_2\text{O}}{1 \text{ mol CH}_4} \times \frac{18.02 \text{ g H}_2\text{O}}{1 \text{ mol H}_2\text{O}}$$

is used to calculate the:

- mass of oxygen reacted.
  - mass of carbon dioxide produced.
  - mass of water produced.
  - None of the above
- \_\_\_ 39. What is the mole ratio of  $\text{H}_2\text{O}$  to  $\text{H}_3\text{PO}_4$  in the following chemical equation?



- 4 to 6
  - 1 to 6
  - 3 to 2
  - 2 to 3
- \_\_\_ 40. Ozone,  $\text{O}_3$ , is produced in automobile exhaust by the reaction represented by the equation



What mass of ozone is predicted to form from the reaction of 2.0 g  $\text{NO}_2$  in a car's exhaust and excess oxygen?

Element	Molar mass
Nitrogen	14.01 g/mol
Oxygen	16.00 g/mol

- 1.1 g  $\text{O}_3$
  - 1.8 g  $\text{O}_3$
  - 2.1 g  $\text{O}_3$
  - 4.2 g  $\text{O}_3$
- \_\_\_ 41. The pressure of a sample of helium is 2.0 atm in a 200-mL container. If the container is compressed to 10 mL without changing the temperature, what is the new pressure?
- 200 atm
  - 0.10 atm
  - 100 atm
  40. atm
- \_\_\_ 42. In the equation  $\text{H}_2(g) + \text{Cl}_2(g) \rightarrow 2\text{HCl}(g)$ , one liter of hydrogen yields how many liters of hydrogen chloride?
- 4
  - 3
  - 2
  - 1

- \_\_\_ 43. The equation for the complete combustion of methane is  $\text{CH}_4(g) + 2\text{O}_2(g) \rightarrow 2\text{H}_2\text{O}(g) + \text{CO}_2(g)$ . If 50 L of methane at STP are burned, what volume of carbon dioxide will be produced at STP?
- 16.6 L
  - 25 L
  - 50 L
  - 100 L
- \_\_\_ 44. A real gas
- does not obey all the assumptions of the kinetic-molecular theory.
  - consists of particles that do not occupy space.
  - cannot be condensed.
  - cannot be produced in scientific laboratories.
- \_\_\_ 45. Convert the pressure 0.840 atm to mm Hg.
- 365 mm Hg
  - 437 mm Hg
  - 638 mm Hg
  - 780 mm Hg
- \_\_\_ 46. What is the approximate volume of gas in a 1.50 mol sample that exerts a pressure of 0.922 atm and has a temperature of  $10.0^\circ\text{C}$ ?
- 13 L
  - 14.2 L
  - 37.8 L
  - 378 L
- \_\_\_ 47. An ideal gas is an imaginary gas
- not made of particles.
  - that conforms to all of the assumptions of the kinetic theory.
  - whose particles have zero mass.
  - made of motionless particles.
- \_\_\_ 48. When hydrogen burns, water vapor is produced.

The equation is  $2\text{H}_{2(g)} + \text{O}_{2(g)} \rightarrow 2\text{H}_2\text{O}_{(g)}$ .

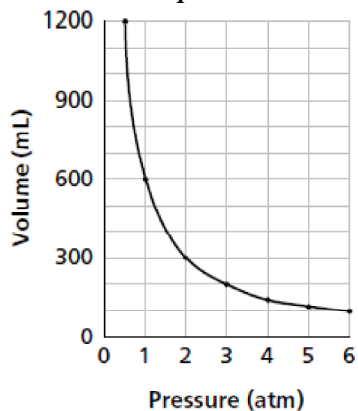
If 12 L of oxygen are consumed, what volume of water vapor is produced?

- 1 L
  - 2 L
  - 12 L
  - 24 L
- \_\_\_ 49. The volume of a gas is 93 mL when the temperature is  $91^\circ\text{C}$ . If the temperature is reduced to  $0^\circ\text{C}$  without changing the pressure, what is the new volume of the gas?
- 100 mL
  - 70 mL
  - 120 mL
  - 273 mL

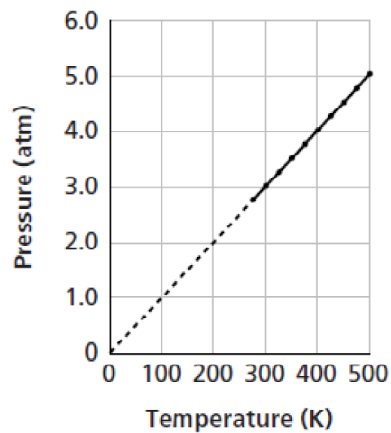
- \_\_\_ 50. Calculate the approximate volume of a 0.600 mol sample of gas at 15.0°C and a pressure of 1.10 atm.
- 129 L
  - 22.4 L
  - 24.6 L
  - 12.9 L
- \_\_\_ 51. On a cold winter morning when the temperature is  $-13^{\circ}\text{C}$ , the air pressure in an automobile tire is 1.5 atm. If the volume does not change, what is the pressure after the tire has warmed to  $15^{\circ}\text{C}$ ?
- $-1.5$  atm
  - 1.7 atm
  - 3.0 atm
  - 19.5 atm
- \_\_\_ 52. If a gas with an odor is released in a room, it quickly can be detected across the room because it
- diffuses.
  - is dense.
  - is compressed.
  - condenses.
- \_\_\_ 53. The volume of a gas collected when the temperature is  $11.0^{\circ}\text{C}$  and the pressure is 710 mm Hg measures 14.8 mL. What is the calculated volume of the gas at  $20.0^{\circ}\text{C}$  and 740 mm Hg?
- 7.8 mL
  - 13.7 mL
  - 146 mL
  - 15 mL
- \_\_\_ 54. What pressure is exerted by 0.750 mol of a gas at a temperature of  $0.00^{\circ}\text{C}$  and a volume of 5.00 L?
- 3.4 atm
  - 2.1 atm
  - 4.98 atm
  760. atm
- \_\_\_ 55. A mixture of four gases exerts a total pressure of 860 mm Hg. Gases A and B each exert 220 mm Hg. Gas C exerts 110 mm Hg. What pressure is exerted by gas D?
- 165 mm Hg
  - 310 mm Hg
  - 860 mm Hg
  - cannot be determined
- \_\_\_ 56. Sublimation involves changing from a
- solid to a gas.
  - liquid to a gas.
  - gas to a liquid.
  - gas to a solid.
- \_\_\_ 57. On a phase diagram, the point at which all equilibrium lines join is the
- melting point.
  - boiling point.
  - critical point.
  - triple point.



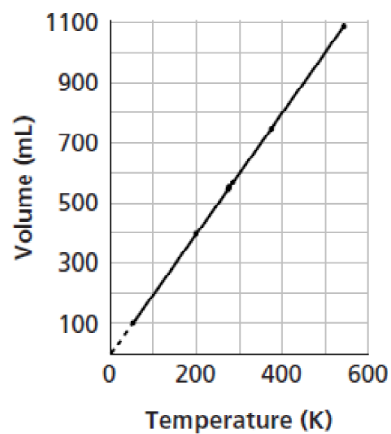
58. Which graph illustrates Boyle's law?  
 a. *Volume vs. Pressure for a Gas at Constant Temperature*



- c. *Pressure Vs. Temperature for a Gas at Constant Volume*



- b. *Volume Vs. Temperature for a Gas at Constant Pressure*

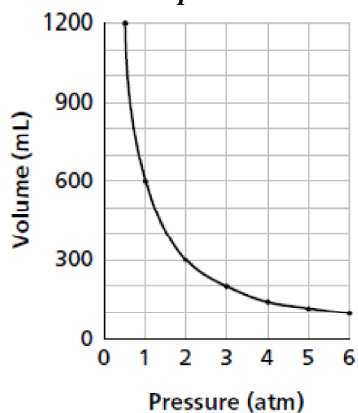


- d. None of the graphs

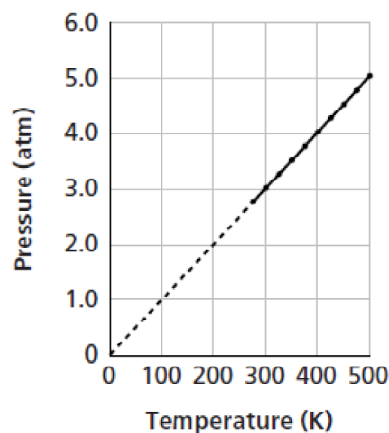
59. The law that relates the temperature and volume of a gas to each other is known as  
 a. Charles's law.  
 b. Boyle's law.  
 c. Gay-Lussac's law.  
 d. Graham's law.

60. Which graph illustrates Charles's law?

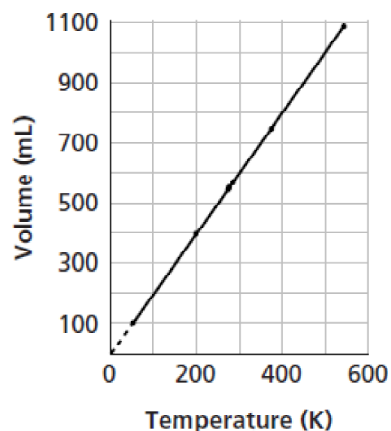
a. *Volume vs. Pressure for a Gas at Constant Temperature*



c. *Pressure Vs. Temperature for a Gas at Constant Volume*



b. *Volume Vs. Temperature for a Gas at Constant Pressure*



d. None of the graphs

61. Which of the following will dissolve most rapidly?

- |                                |                                 |
|--------------------------------|---------------------------------|
| a. powdered sugar in hot water | c. sugar cubes in hot water     |
| b. sugar cubes in cold water   | d. powdered sugar in cold water |

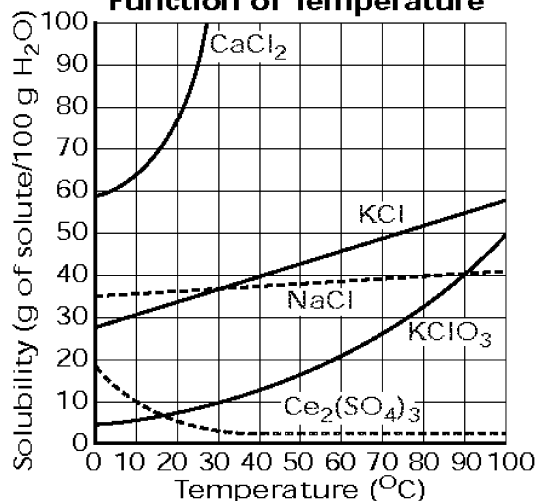
62. What volume of 1.75 M hydrochloric acid must be diluted with water to prepare 500 mL of 0.250 M hydrochloric acid?

- $8.50 \times 10^{-4}$  mL
- 71.4 mL
- 128 mL
- 429 mL

63. Making sweet tea requires tea leaves, sugar, and optional lemon mixed together in water. Which is the solvent?

- |               |          |
|---------------|----------|
| a. sugar      | c. lemon |
| b. tea leaves | d. water |

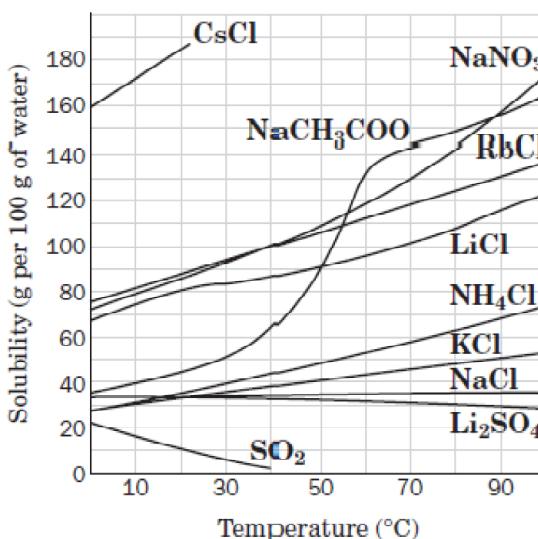
**FIGURE 1**  
**Solubilities as a**  
**Function of Temperature**



- \_\_\_ 64. How much KCl can you dissolve in 200 g of 40 °C water according to figure 1?  
 a. 40 g                      b. 80 g                      c. 120 g                      d. 160 g
- \_\_\_ 65. Which amount of KClO<sub>3</sub> dissolves in 100 g of 30°C water makes a saturated solution?  
 a. 5 g                      b. 7.5 g                      c. 10 g                      d. 12.5 g
- \_\_\_ 66. A scientist makes a solution by dissolving 50 grams of potassium chloride in 100 g of water that is heated to 90°C. What kind of solution did the scientist make? (Use Figure 1)  
 a. Supersaturated                      c. Ionic  
 b. Saturated                      d. Unsaturated
- \_\_\_ 67. As shown in Figure 1, what solute decreases in solubility as temperature increases?  
 a. CaCl<sub>2</sub>                      c. Ce<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>  
 b. NaCl                      d. KClO<sub>3</sub>
- \_\_\_ 68. Use Figure 1 Above: An unsaturated solution containing 20 grams of KClO<sub>3</sub> is dissolved in 100 g of water at a temperature of 70°C. If the temperature is cooled to 30°C, how much KClO<sub>3</sub> would fall out of solution and solidify if the solution was disturbed.  
 a. 5 g                      c. 20 g  
 b. 10 g                      d. none, it would still be unsaturated
- \_\_\_ 69. If the amount of solute present in a solution at a given temperature is less than the maximum amount that can dissolve at that temperature, the solution is said to be  
 a. unsaturated.                      b. concentrated.                      c. supersaturated.                      d. saturated.
- \_\_\_ 70. An NaOH solution contains 1.90 mol of NaOH, and its concentration is 0.555 M. What is its volume?  
 a. 0.623 L                      b. 0.911 L                      c. 1.05 L                      d. 3.42 L
- \_\_\_ 71. How many moles of HCl are present in 0.70 L of a 0.33 M HCl solution?  
 a. 0.47 mol                      c. 0.23 mol  
 b. 0.38 mol                      d. 0.28 mol

- \_\_\_ 72. What is the volume of a 1.5 M solution if it was diluted from 250 mL of 6.0 M solution?  
 a. 500 mL  
 b. 62.5 mL  
 c. 1,000 mL  
 d. 1,500 mL
- \_\_\_ 73. What is the molarity of a solution that contains 0.202 mol KCl in 7.98 L solution?  
 a. 0.459 M  
 b. 0.0132 M  
 c. 0.0253 M  
 d. 1.363 M
- \_\_\_ 74. What is the term for a substance whose water solution conducts electric current?  
 a. miscible  
 b. immiscible  
 c. electrolyte  
 d. nonelectrolyte
- \_\_\_ 75. What is the concentration of a 750 mL solution containing 1.5 mols of solute?  
 a. 0.002 M  
 b. 2.0 M  
 c. 500 M  
 d. 0.5 M

Use this figure to answer the following two questions.



- \_\_\_ 76. According to solubility curves shown in the figure, which of the following solutions is supersaturated?  
 a. 40 g of NaCH<sub>3</sub>COO in 100 g of water at 40°C  
 b. 140 g of NaCH<sub>3</sub>COO in 100 g of water at 80°C  
 c. 80 g of NaCH<sub>3</sub>COO in 100 g of water at 40°C  
 d. 80 g of NaCH<sub>3</sub>COO in 200 g of water at 40°C
- \_\_\_ 77. A solution containing 35 g of Li<sub>2</sub>SO<sub>4</sub> dissolved in 100 g of water is heated from 10°C to 90°C. According to information in the figure, this temperature change would result in  
 a. an additional 5 g of Li<sub>2</sub>SO<sub>4</sub> in solution.  
 b. an additional 30 g of Li<sub>2</sub>SO<sub>4</sub> in solution.  
 c. 5 g of Li<sub>2</sub>SO<sub>4</sub> precipitate.  
 d. no change in Li<sub>2</sub>SO<sub>4</sub> concentration.

- \_\_\_ 78. Which temperature and mass combination represents a saturated solution for lithium chloride?
- a. 100 grams at 40°C                      c. 50 grams at 70°C  
b. 70 grams at 30°C                        d. 100 grams at 70°C
- \_\_\_ 79. Water acts as a solvent of ionic compounds because \_\_\_.
- a. water molecules are polar  
b. water is found in three states of matter  
c. water is liquid over a wide range of temperatures  
d. water takes the shape of its container
- \_\_\_ 80. What can you do to make a solute dissolve faster in a solvent?
- a. crush it  
b. heat it  
c. stir it  
d. all of the above
- \_\_\_ 81. Substances with pH-sensitive dyes that change to different colors for different pH are used as
- a. titrants.                                      c. indicators.  
b. primary standards.                        d. None of the above

pH	Methyl green	Methyl orange	Indigo Carmine	Phenolphthalein
1	light yellow	red	yellow	clear
2	light yellow	blue	yellow	clear
3	dark yellow	green	yellow	clear
4	orange	orange	yellow	clear
5	pink	orange	yellow	clear
6	light red	orange	yellow	clear
7	red	orange	yellow	clear
8	red	orange	light blue	clear
9	red	orange	dark blue	light purple
10	red	orange	orange	light purple
11	red	orange	red	light purple
12	red	orange	red	dark purple
13	red	orange	red	dark purple
14	red	orange	red	dark purple

- \_\_\_ 82. What is the pH of an unknown solution that is tested in the indicators as follows:
- Methyl Green: Red  
Methyl Orange: Orange  
Indigo Carmine: Dark Blue  
Phenolphthalein: Light Purple
- a. 9                                      b. 5                                      c. 7                                      d. 11
- \_\_\_ 83. If  $[H^+] = 8.26 \times 10^{-5} \text{ M}$ , calculate the pH of the solution.
- a. 2.161                                  b. 8.024                                  c. 4.083                                  d. 3.912

- \_\_\_ 84. In a Brønsted-Lowry acid-base reaction, what are transferred from one reactant to another?  
 a.  $\text{H}^+$  ions                      b.  $\text{OH}^-$  ions                      c. electrons                      d. water molecules
- \_\_\_ 85. Calculate the hydronium ion concentration of a solution whose pH is 4.12.  
 a.  $4.4 \times 10^{-8} \text{ M}$                       b.  $6.4 \times 10^{-5} \text{ M}$                       c.  $7.6 \times 10^{-5} \text{ M}$                       d.  $5.1 \times 10^{-6} \text{ M}$
- \_\_\_ 86. In a neutralization reaction, acids react with  
 a. water to produce bases and salts.                      c. bases to produce salts and water.  
 b. salts to produce bases and water.                      d. neither bases, salts, nor water.
- \_\_\_ 87. If  $[\text{H}_3\text{O}^+]$  of a solution is less than  $[\text{OH}^-]$ , the solution  
 a. is always acidic.                      c. is always neutral.  
 b. is always basic.                      d. might be acidic, basic, or neutral.
- \_\_\_ 88. A substance that increases the concentration of  $\text{OH}^-$  ions in an aqueous solution is known as a(n)  
 a. Brønsted-Lowry acid.                      c. Arrhenius acid.  
 b. Brønsted-Lowry base.                      d. Arrhenius base.
- \_\_\_ 89. What is the pH of a neutral solution  $[\text{H}^+] = [\text{OH}^-]$ ?  
 a. 1                      b. 0                      c. 7                      d. 14
- \_\_\_ 90. A substance whose water solution conducts a current is a(n)  
 a. electrolyte.                      c. nonelectrolyte.  
 b. solute.                      d. nonpolar substance.
- \_\_\_ 91. Calculate the hydronium ion  $[\text{H}_3\text{O}^+]$  concentration of a solution whose pH is 7.30.  
 a.  $1.4 \times 10^{-11} \text{ M}$                       b.  $5.0 \times 10^{-8} \text{ M}$                       c.  $3.8 \times 10^{-8} \text{ M}$                       d.  $7.1 \times 10^{-6} \text{ M}$
- \_\_\_ 92. Which compound can be produced by a neutralization reaction between an acid and a base?  
 a.  $\text{H}_2\text{O}_{(l)}$                       b.  $\text{HNO}_3_{(aq)}$                       c.  $\text{H}_3\text{PO}_4_{(aq)}$                       d.  $\text{Ca}(\text{OH})_{2(s)}$
- \_\_\_ 93. In the reaction that follows, what substance is the conjugate base?  

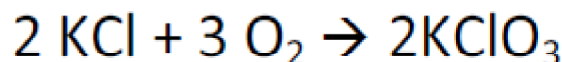
$$\text{H}_2\text{SO}_3_{(aq)} + \text{H}_2\text{O}_{(l)} \rightarrow \text{H}_3\text{O}^+_{(s)} + \text{HSO}_3^-_{(aq)}$$
 a.  $\text{H}_3\text{O}^+_{(s)}$                       b.  $\text{H}_2\text{O}_{(l)}$                       c.  $\text{H}_2\text{SO}_3_{(aq)}$                       d.  $\text{HSO}_3^-_{(aq)}$
- \_\_\_ 94. A water solution whose pH is 4  
 a. is always acidic.                      c. is always neutral.  
 b. is always basic.                      d. might be neutral, basic, or acidic.
- \_\_\_ 95. Strong acids are  
 a. weak electrolytes.                      c. nonionized.  
 b. nonelectrolytes.                      d. strong electrolytes.

- \_\_\_ 96. Which reaction below is a neutralization reaction?
- $\text{BaSO}_3(s) \rightarrow \text{BaO}(s) + \text{SO}_2(g)$
  - $2\text{K}(s) + \text{Br}_2(l) \rightarrow 2\text{KBr}(s)$
  - $\text{SnS}_2(s) + 6\text{HCl}(aq) \rightarrow \text{H}_2\text{SnCl}_6(s) + 2\text{H}_2\text{S}(aq)$
  - $\text{H}_2\text{CO}_3(aq) + \text{Ca}(\text{OH})_2(aq) \rightarrow \text{CaCO}_3(s) + 2\text{H}_2\text{O}(l)$
- \_\_\_ 97. A substance that can react as either an acid or a base is a(n)
- amphoteric substance.
  - Lewis acid.
  - oxyacid.
  - organic substance.
- \_\_\_ 98. To conduct electricity, a solution must contain
- free electrons.
  - polar molecules.
  - nonpolar molecules.
  - ions.
- \_\_\_ 99. If  $[\text{H}^+] = 1.7 \times 10^{-3} \text{ M}$ , calculate the pH of the solution.
- 2.77
  - 2.42
  - 1.81
  - 2.13
- \_\_\_ 100. Which of the following is a *diprotic* acid?
- $\text{H}_2\text{SO}_4$
  - $\text{HC}_2\text{H}_3\text{O}_2$
  - $\text{H}_3\text{PO}_4$
  - $\text{HCl}$
- \_\_\_ 101. Calculate the temperature change of a 2,000 g block of glass ( $c = 0.664 \text{ J/g}\cdot^\circ\text{C}$ ) which absorbs 13,280 J of energy from a heater.
- $100^\circ\text{C}$
  - $50^\circ\text{C}$
  - $10^\circ\text{C}$
  - $150^\circ\text{C}$

Molar Heat of Formation for Selected Chemicals and Compounds ( $\Delta H_f^\circ$ )					
Al, Fe (Elements in their natural state, do not form compounds, therefore their $\Delta H_f^\circ$ is 0)					
Cl <sub>2</sub> , H <sub>2</sub> , O <sub>2</sub> (Diatomic molecules bond to themselves in their natural state, do not form compounds, therefore their $\Delta H_f^\circ$ is 0)					
CaCO <sub>3</sub>	-1207 kJ/mol	CCl <sub>4</sub>	-135 kJ/mol	CO <sub>2</sub>	-394 kJ/mol
CO <sub>2</sub>	-394 kJ/mol	KCl	-436 kJ/mol	H <sub>2</sub> O <sub>(g)</sub>	-242 kJ/mol
CaO	-635 kJ/mol	KClO <sub>3</sub>	-391 kJ/mol	H <sub>2</sub> O <sub>(l)</sub>	-286 kJ/mol
CH <sub>4</sub>	-75 kJ/mol	C <sub>2</sub> H <sub>2</sub>	+227 kJ/mol	C <sub>2</sub> H <sub>5</sub> OH <sub>(l)</sub>	-228 kJ/mol
Fe <sub>3</sub> O <sub>4(s)</sub>	-1121 kJ/mol	Al <sub>2</sub> O <sub>3(s)</sub>	-1670 kJ/mol		

\_\_\_ 102. Use the table of molar heat of formation to answer the following question:

Potassium chloride reacts with oxygen in the balanced reaction below:

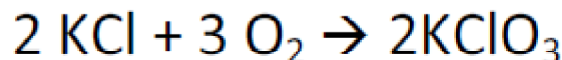


What is the change in enthalpy ( $\Delta H$ ) for the reaction.

- |                |                 |
|----------------|-----------------|
| a. 1654 kJ/mol | c. -90 kJ/mol   |
| b. 90 kJ/mol   | d. -1654 kJ/mol |

\_\_\_ 103. Use the table of molar heat of formation to answer the following question:

Potassium chloride reacts with oxygen in the balanced reaction below:



Is this reaction exothermic or endothermic?

- |               |                |
|---------------|----------------|
| a. exothermic | b. endothermic |
|---------------|----------------|

\_\_\_ 104. Use the table of molar heat of formation to answer the following question:

Aluminum reacts with Iron (IV) Oxide in the following balanced reaction.



Calculate is the change in enthalpy ( $\Delta H$ ) for the reaction.

- |                  |                 |
|------------------|-----------------|
| a. -549 kJ/mol   | c. 3,320 kJ/mol |
| b. -3,320 kJ/mol | d. 549 kJ/mol   |



\_\_\_ 105. Use the table of molar heat of formation to answer the following question:

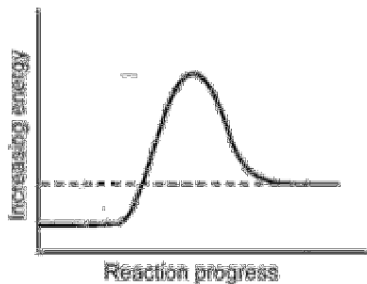
Aluminum reacts with Iron (IV) Oxide in the following balanced reaction.



Is this reaction exothermic or endothermic?

- a. Endothermic                                  b. Exothermic
- \_\_\_ 106. The transfer of energy by the movement of fluids or gases with different temperatures is called
- a. convection.                                    c. contact.  
b. conduction.                                   d. radiation.
- \_\_\_ 107. The transfer of energy that does NOT require matter is \_\_\_\_.
- a. combustion                                    c. conduction  
b. radiation                                        d. convection
- \_\_\_ 108. How much energy is absorbed as heat by 20.0 g of gold when it is heated from 25°C to 35°C? (The specific heat of gold is 0.129 J/g·°C.)
- a. 26 J    b. 26 J/g·°C                                    c. 0.0006 J                                    d. 0.0006 J/g·°C
- \_\_\_ 109. As the kinetic energy of the molecules in a substance increases, the
- a. temperature of the substance increases.  
b. temperature of the substance decreases.  
c. potential energy of the substance changes.  
d. temperature remains the same.
- \_\_\_ 110. The transfer of energy most prevalent in the warming of a black rooftop on a sunny day is \_\_\_\_.
- a. combustion                                  b. radiation                                  c. conduction                                  d. convection
- \_\_\_ 111. A chemical reaction is exothermic when  $\Delta H$  is
- a. positive.                                      b. negative.                                    c. zero.    d. constant.
- \_\_\_ 112. The transfer of energy most prevalent in the baking of a cake in a warm oven is \_\_\_\_.
- a. combustion                                    c. conduction  
b. radiation                                        d. convection
- \_\_\_ 113. Temperature is
- a. associated with the sensation of hot and cold.  
b. proportional to the average kinetic energy of molecules.  
c. measured with thermometers.  
d. all of the above
- \_\_\_ 114. A 4.0 g sample of metal was heated from 0°C to 20.°C. It absorbed 35.2 J of energy as heat. What is the specific heat of this piece of unknown metal?
- a. 2816 J/g·°C                                    c. 2.27 J/g  
b. 2.27 J/g·°C                                    d. 0.44 J/g·°C

\_\_\_ 115. Given the energy diagram below:



The reaction

- releases energy.
- absorbs energy.
- occurs without a net change in energy.
- is impossible.

\_\_\_ 116. Calculate the energy (in joules) produced by a food sample in a calorimeter containing 157 grams of water. The temperature of the water in the calorimeter increases by 11.2°C.

Assume the specific heat of the water is 4.184 J/g•°C.

- 7360 J
- 1758 J
- 7.36 J
- 58.6 J

<b>Specific Heats at 25°C</b>			
<b>Substance</b>	<b>c (J/g•°C)</b>	<b>Substance</b>	<b>c (J/g•°C)</b>
<b>Water (liquid)</b>	<b>4.186</b>	<b>Copper</b>	<b>0.385</b>
<b>Steam</b>	<b>1.870</b>	<b>Gold</b>	<b>0.129</b>
<b>Ammonia (gas)</b>	<b>2.060</b>	<b>Iron</b>	<b>0.449</b>
<b>Ethanol (liquid)</b>	<b>2.440</b>	<b>Mercury</b>	<b>0.140</b>
<b>Aluminum</b>	<b>0.902</b>	<b>Lead</b>	<b>0.129</b>
<b>Carbon (graphite)</b>	<b>0.709</b>	<b>Silver</b>	<b>0.234</b>

\_\_\_ 117. Using the table, determine which substance can absorb the most energy in a temperature increase of 1 °C.

- liquid water
- aluminum
- gold
- lead

\_\_\_ 118. Aluminum has a specific heat of 0.902 J/g•°C. How many joules of heat are required to change the temperature of 8.50 grams of aluminum from 25.0°C to 93.4°C?

- 7.67 J
- 483 J
- 192 J
- 524 J