Chemistry

Toole

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Kinetic Theory

- Gases are composed of _____, _____ particles called _____.
- Gas molecules are in _____ _____.
- All _____ between particles are _____ _____.
- The _____ of a gas display no _____ or _____ for one another.
- The _____ _____ _____ of the molecules is _____ _____ to the _____ temperature of the gas.

Ideal Gas

- Gas whose _____ conforms to the _____ _____—it is _____.

Gas Pressure:

Pressure = _____

Atmospheric Pressure - the _____ the earth's _____ exerts due to its _____.

Barometer:

- Instrument used to measure _____ _____.
- Invented by _____

Normal Atmospheric Pressure

- Also called _____ _____
- _____
- _____
- _____
- _____

STP:

- _____ _____ and _____
- _____
- _____

Manometer:

- _____ used to measure _____ _____
- U-shaped tube _____ filled with _____
- One end _____ to _____ _____
- One end _____ to _____

The Chemistry Quiz

CR1. _____ CR2. _____ 1. _____ 2. _____

3. _____ 4. _____ 5. _____

Gas Laws Formula Sheet Name_____

$$P_1V_1 = P_2V_2 \qquad \frac{V_1}{T_1} = \frac{V_2}{T_2} \qquad \frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$PV = nRT \qquad P_T = P_1 + P_2 + P_3 \ldots$$

$$\frac{v_1}{v_2} = \sqrt{\frac{d_2}{d_1}} \qquad \frac{v_1}{v_2} = \sqrt{\frac{m_2}{m_1}}$$

$$R = 8.314 \frac{L \cdot kPa}{mol \cdot K} \qquad R = 0.0821 \frac{L \cdot atm}{mol \cdot K}$$

Water-Vapor Pressure

Temp (°C)	Pressure (mm Hg)	Pressure (kPa)
0.0	4.6	0.61
5.0	6.2	0.87
10.0	9.2	1.23
15.0	12.8	1.71
16.0	13.6	1.82
17.0	14.5	1.94
18.0	15.5	2.06
19.0	16.5	2.19
20.0	17.5	2.34
21.0	18.5	2.49
22.0	19.8	2.64
23.0	21.1	2.81

Temp (°C)	Pressure (mm Hg)	Pressure (kPa)
24.0	22.4	2.98
25.0	23.8	3.17
26.0	25.2	3.36
27.0	26.7	3.57
28.0	28.3	3.78
29.0	30.0	4.01
30.0	31.8	4.25
35.0	42.2	5.63
40.0	55.3	7.39
50.0	92.5	12.23
60.0	149.4	19.93
70.0	233.7	31.18

Worksheet: Episode 901 Review Name_____

1. The theory that explains the behavior of gases at the molecular level is called the _____ _____ which is based on assumptions about a theoretical gas often referred to as an _____ - _____.

2. Gases deviate most from ideal gas behavior under conditions of very low _____ and very high _____.
   --The molecules of an ideal gas display no _____ or _____ for one another.
   --Under ordinary conditions, an ideal gas consists chiefly of _____ space, which explains why gases are so easily compressed.
   -- Ideal gas particles travel in _____ lines until they collide with each other or with the walls of their container.
   --The collisions between the molecules of an ideal gas are completely _____.
   --The average kinetic energy of the molecules of an ideal gas is _____ proportional to the _____ temperature of the gas.

3. A gas exerts pressure on the walls of its container because gas molecules _____ with the walls of the container. So, the pressure exerted by a gas depends on two factors:
   a)
   b)

4. To measure gas pressure an instrument called a _____ is used.

5. The earth's atmosphere has weight, which creates _____ _____.

6. The instrument used to measure atmospheric pressure is the _____.

7. Standard Temperature and Pressure (or _____) is:

_____ K	_____ kPa	_____ atm
_____ °C	_____ mm Hg	_____ torr

8. At 1 atm, the height of the _____ in a barometer is 760 mm.

9. A block of wood with a weight of 18 Newtons rests on a table top. How much pressure is the block of wood exerting on the surface of the table directly beneath it if the block is 3 cm long and 2 cm wide?

10. Use the kinetic theory to explain why a helium filled balloon "shrinks" when it is taken from a warm room to the outside on a cold day.

11. Use the kinetic theory to explain why bubble wrap pops when it is squeezed.

12. Use the kinetic theory to explain why tire pressure increases when more air is added to a tire.

Boyle's Law

- The _____ of a fixed _____ of gas varies _____ with the _____ at constant _____.
- _____
- _____

Kinetic Theory and Boyle's Law

- _____ of a gas is caused by the _____ of the gas _____ the walls of the _____.
- If the gas is _____ to _____ the volume it had, _____ as many _____ are present in any _____ _____.
  * _____ as many _____ per _____ on the walls of the _____
  * _____ of the gas will _____

Ex 1: A balloon filled with Helium has a volume of 457 mL at standard atmospheric pressure. After the balloon is released, it reaches an altitude of 6.3 km where the pressure is only 65.5 kPa. What is the volume of the balloon at this altitude?

Ex 2: Under a pressure of _____ mm Hg, a confined gas has a volume of _____mL. If the pressure is increased until the volume is _____ mL, what is the new pressure, assuming the temperature remains constant?

Charles's Law

- For a _____ _____ of gas, as long as the _____ is held _____, the _____ varies _____ with the _____ _____.
- _____
- _____

The Kelvin Temperature Scale

- _____ zero
  * _____ possible _____
  * _____ been reached
- _____ = absolute zero
- _____ = _____
- K = _____

Ex 1: A quantity of gas occupies a volume of 506 cm^3 at a temperature of 147°C. Assuming the pressure stays constant, at what temperature will the volume of the gas be 604 cm^3?

Kinetic Molecular Theory and Charles's Law

- _____ the _____ _____ of a gas _____ the average _____ _____ of its _____.
- _____ moving molecules
  * strike the walls of the _____ _____ _____
  * strike the walls of the _____ with _____ _____
- From _____ law we derive that the _____ would have to _____ if the _____ _____ is _____ so that _____ would remain _____.

The Chemistry Quiz

CR1. _____ CR2. _____ 1. _____ 2. _____ 3. _____ 4. _____ 5. _____

Worksheet: Boyle's Law and Charles's Law Name_____

1. Boyle's Law: When _____ is held constant, the pressure and volume of a gas are _____ proportional.

2. Mathematically, Boyle's law is stated PV = _____ or P_1V_1 = _____.

3. At a pressure of 405 kPa, the volume of a gas is 6.00 cm^3. Assuming the temperature remains constant, at what pressure will the new volume be 4.00 cm^3?

4. A volume of gas at 1.10 atm was measured at 326 cm^3. What will be the volume if the pressure is adjusted to 1.90 atm?

5. If 36.5 m^3 of a gas are collected at a pressure of 755 mm Hg, what volume will the gas occupy if the pressure is changed to 632 mm Hg?

6. Charles's Law: When _____ is held constant, the volume and temperature of a gas are _____ proportional.

7. Mathematically, Charles's Law is stated: $\frac{V}{T}$ = _____ or $\frac{V_1}{T_1}$ =_____.

8. The _____ temperature scale must be used in all gas law problems.

9. At 189 K, a sample of gas has a volume of 32.0 cm^3. What volume does the gas occupy at 242 K?

10. The gas in a balloon occupies 2.25 L at 298 K. At what temperature will the balloon expand to 3.50 L?

11. A sample of gas has a volume of 852 mL at 25°C. What Celsius temperature is necessary for the gas to have a volume of 945 mL?

Worksheet: More Boyle's Law and Charles's Law Name_____

Complete each of the following showing all work and circling your final answer on all problems.

1. To change a temperature expressed in degrees Celsius to a temperature on the Kelvin scale, what must be done to the Celsius temperature?

   Why must we use the Kelvin scale in gas law problems?

2. The volume of a sample of gas is 2.00 L when the temperature is 11.0 °C. While the pressure remains constant, the temperature is changed to a new value, which causes the volume to become 3.00 L. What was the temperature changed to?

   This is an example of _____'s Law.

3. The volume occupied by a sample of gas is 480 mL when the pressure is 115 kPa. What pressure must be applied to the gas to make its volume become 650 mL?

   This is an example of _____'s Law.

4. The volume occupied by a sample of gas is 240.0 mL when the pressure is 1.20 atm. What volume, at constant temperature, will the gas occupy when the pressure is decreased to 0.860 atm?

5. The volume of a sample of gas is 25.0 mL when the temperature is 270 K. If the temperature is changed to 30.0 °C, what will be the new volume occupied by the gas assuming that the pressure remains constant?

6. When the volume of a sample of gas is divided by the temperature of the gas, the result is 1.33 mL/K. The temperature of the gas is changed to a new value, which happens to be 411 K while the pressure is kept constant. What volume does the sample of gas occupy at 411 K?

7. When the pressure exerted by a sample of gas is multiplied by the volume occupied by the sample, the result of this multiplication is 1.60×10^5 mm Hg·mL. The pressure exerted by the sample changes to a new value, which happens to be 750 mm Hg. What volume will the sample occupy at this pressure, assuming that temperature remains constant?

The Combined Gas Law

- Expresses the relationship between the _____, _____ and _____ of a _____ amount of _____.
- _____ or _____

Ex: A sample of gas has a volume of _____ L when its temperature is _____ K and its pressure is _____ mm Hg. What volume will the gas occupy at STP?

V_1 = _____ V_2 = _____

T_1 = _____ T_2 = _____

P_1 = _____ P_2 = _____

Diffusion

- The _____ spreading of a _____

Graham's Law of Diffusion

- Under the same conditions of _____ and _____, gases _____ at a rate __ _____ proportional to the _____ _____ of their _____ (or _____ _____)
- _____ or _____

Ideal Gas Equation

- _____
- New variables:
  n = _____ of gas in _____
  R = _____ _____ _____
  * _____ constant
  * value depends on _____ used for _____ and _____
  * value of R when using _____ and _____,
    R = _____

Ex: The average lung capacity for a female student is 3.9 L. At normal body temperature, 37°C, and 110 kPa, how many moles of air could her lungs hold?

P = _____ V = _____ T = _____

n = _____ R = _____

Avogadro's Law

- Equal _____ of different _____ under the _____ conditions have the _____ number of _____.
- Conversely, if samples of _____ _____ at the same _____ and _____ contain the _____ number of _____, then the _____ of all the _____ must be _____.
- At _____, one _____ of any gas occupies a _____ of _____.
- _____ is the _____ _____ of a gas.

Ex. 3.2 moles of KNO_3 are heated, producing O_2 and KNO_2. Calculate the volume of O_2 in liters, that could be obtained at STP.

Dalton's Law of Partial Pressures

- The _____ of a gas _____ is the _____ of the _____ _____ of each gas _____.
- _____

Ex: Oxygen gas has been collected over water at a total pressure of 95.0 kPa and a temperature of 25°C. What is the pressure of the dry oxygen gas?

The Chemistry Quiz

CR1. _____ CR2. _____ 1. _____ 2. _____

3. _____ 4. _____ 5. _____

Worksheet: Combined Gas Law and Ideal Gas Law **Name**_____

1. A 952 cm^3 container of gas is exerting a pressure of 108 kPa while at a temperature of 48 °C. Calculate the pressure of this same amount of gas in a 1236 cm^3 container at a temperature of 64 °C.

2. At STP, a sample of gas occupies 24.5 mL. Calculate the volume of this gas at a pressure of 2.3 atm and a temperature of 301 K.

3. A 3.25 L container of ammonia gas exerts a pressure of 652 mm Hg at a temperature of 243 K. Calculate the pressure of this same amount of gas in a 2.50 L container at a temperature of 221 K.

4. A sample of gas has a volume of 5.23 cm^3 at a pressure of 72.6 kPa and a temperature of 25 °C. What will be the volume of the gas if the pressure is changed to 124 kPa and the temperature is changed to 0 °C?

5. Calculate the pressure (in kPa) of 0.421 mole of helium gas at 254 K when it occupies a volume of 3.32 L.

6. How many moles of argon are there in a 22.4 L sample of gas at 101.3 kPa and 0 °C?

7. What is the volume of 2.56 moles of gas at 0.634 atm and 65 °C?

8. A 500.0 g block of dry ice (solid CO_2, molar mass = 44.0 g) vaporizes to a gas at room temperature. Calculate the volume of gas produced at 25.0 °C and 1.50 atm.

Worksheet: Dalton's Law, Avogadro's Hypothesis, Molar Volume Name_____

1. A) John _____ was the first to form a hypothesis about partial _____ of combined gases. After experimenting with gases, he concluded that each gas exerts the same pressure it would if it _____ were present at the same temperature. If a gas is collected over water, the pressure in the container actually includes the sum of the vapor _____ of the gas and the _____ vapor pressure. Consequently, we must _____ the water vapor pressure from the total pressure to obtain the pressure of the _____ alone.

   B) A quantity of gas is collected over water at 20.°C. The manometer indicated a pressure of 34.6 kPa. What would be the pressure of the dry gas?

   C) Determine the total pressure of a gas mixture that contains oxygen, nitrogen and helium if the partial pressures of the gases are: oxygen = 150 mm Hg, nitrogen = 350 mm Hg, and helium = 210 mm Hg.

2. A) Avogadro's law states that equal volumes of different gases, at the same _____ and _____, contain the same _____ of _____.

   B) According to Avogadro's law, how will the number of molecules in 2 liters of hydrogen gas compare with the number of molecules in 2 liters of oxygen gas at the same temperature and pressure? _____

C) Why is 22.4 liters called the molar volume of a gas?

D) In the following equation, what volume of hydrogen will produce 0.25 mole of NH_3 at standard conditions of temperature and pressure?

$$N_2(g) + 3\ H_2(g) \rightarrow 2\ NH_3(g)$$

E) When magnesium burns in the presence of oxygen, magnesium oxide is formed. How many moles of magnesium were burned if at STP, the magnesium was ignited in a 0.50 L container of oxygen gas?

Review Sheet: Unit 9 **Name**_____

FILL IN THE BLANKS and SHORT ANSWER:

1. The theory that explains the behavior of gases at the molecular level is called the _____ _____ which is based on assumptions about a theoretical gas often referred to as an _____ _____.

2. Use the kinetic theory to explain why a helium filled balloon expands when it is brought inside to a warm room from the cold outdoors.

3. Define "IDEAL GAS"

4. Gases deviate most from ideal behavior under conditions of very _____temperature and very _____ pressure.

5. Pressure is defined as _____ per unit _____. The earth's atmosphere has weight, which creates _____ _____ _____.

6. Standard temperature has been established as _____°C or_____ K. Standard pressure has been established as _____ atm, _____ torr, _____ mm Hg, or _____ kPa. The abbreviation for standard temperature and pressure is _____.

7. A _____ is used to measure atmospheric pressure, while a _____ is used to measure gas pressure.

8. When atmospheric pressure increases, how does the height of the column of mercury change?

9. If pressure is constant, the volume of a sample of gas (increases, decreases) as temperature increases.

10. At constant pressure, the volume of a sample of gas is _____ proportional to temperature as measured on the_____ temperature scale.

11. According to _____ law, pressure and volume are _____ proportional provided all other factors remain constant. Mathematically, this means that their _____ is a constant.

12. The _____ Gas Law permits calculation of any one term when temperature, pressure, and volume change for a gas.

13. If A and B are directly proportional and the value of A becomes 1/3 as much, what happens to the value of B?

14. State Avogadro's law:

15. At STP, 22.4 L of N_2 contain how many molecules?

16. Tire manufacturers recommend checking air pressure when tires are cold, before driving. WHY?

17. Ammonia (NH_3) and sulfur dioxide (SO_2) are both gases with readily distinguishable odors. If a cylinder of each were opened at the same time in a draftless room, which odor would you expect to smell first? EXPLAIN.

18. _____Law of Partial _____ states that in a mixture of gases the total pressure of the mixture is equal to the _____ of the pressures that each gas would exert by itself in the same volume.

19. Suppose you have 1 L of oxygen gas at a pressure of 1 atm, 1 L of nitrogen gas at a pressure of 2 atm, and 1 L of hydrogen gas at a pressure of 3 atm. All 3 samples are at room temperature. If you transfer the oxygen and nitrogen to the container occupied by the hydrogen, the pressure exerted by the oxygen in the final mixture will be _____. The pressure exerted by the mixture will be _____.

20. At STP, _____ liters is the volume one mole of a gas occupies; this quantity is consequently called the _____ volume of a gas.

PROBLEMS: SHOW SET-UP AND CIRCLE FINAL ANSWER.

1. What volume does 2.50 moles of carbon monoxide occupy at 50.5 kPa pressure and 20.0 °C?

2. At 800 mm Hg, a gas has a volume of 380 L. What is its volume at standard pressure?

3. A quantity of gas has a volume of 121 L when confined under a pressure of 2.50 atm at a temperature of 20.0 °C. At what pressure will its volume be 30.0 L at 25.0 °C?

4. At constant pressure, the volume of a gas is increased from 150.0 L to 300.0 L by heating it. If the original temperature of the gas was 20.0 °C, what will its final temperature (in Kelvins) be?

5. A quantity of gas is collected over water at 15 °C. The manometer indicated a pressure of 24.0 kPa. What would be the pressure of the dry gas?

6. How many liters of pure oxygen at STP is consumed by a human being in 24 hours if the human body requires daily energy that comes from metabolizing 816 grams of sucrose ($C_{12}H_{22}O_{11}$)?

$$C_{12}H_{22}O_{11}\ (s) + 12\ O_2\ (g) \longrightarrow 12\ CO_2\ (g) + 11\ H_2O\ (l)$$

Note Taking Guide: Episode 1001 Name_____

Solutions

- formed when substances _____ in other _____
- _____ mixtures
- _____ phase
- remain _____; particles do not _____ out
- cannot be separated by _____

  - solvent:
    - present in _____ amount
    - _____ the _____ to make the solution

  - solute:
    - present in _____ amount
    - _____ in the _____

Examples of Types of Solutions

LIQUID SOLUTIONS: _____ solvent in which a _____, _____, or _____ is _____

- _____ dissolved in _____:
  ex. _____
- _____ in _____
  ex. _____ in water
  _____: the two liquids mix
  _____: the two liquids _____ mix
- _____ dissolved in a _____:
  ex. _____ water

SOLID SOLUTIONS:

- _____: solid mixtures of _____
  (_____ is a mixture of _____ and _____)

GAS SOLUTIONS:

- gases dissolved in _____ other (_____ is most common example)

Aqueous: _____ is the _____
Tincture: _____ is the _____

Suspension

- a _____ mixture
- Particles in the _____ are thousands of times _____ than _____ and _____
- Particles will _____ out upon _____
- can be separated by _____
- exhibit the _____ _____ --the _____ of _____ in all directions

Colloid

- particles are _____ in size between those of _____ and true _____
- particles do not _____ out upon _____
- can not be separated by _____
- exhibit the _____ _____

Emulsion

- _____ dispersion of _____ in _____
- _____ agent is necessary for maintaining _____ (_____ is an example.)

Electrolyte: dissolves in water to form a _____ that _____ _____

Nonelectrolyte: dissolves in water to form a _____ that does _____ conduct _____

Factors Affecting the Rate of Solution

1) _____ _____ :
increasing the surface area of the _____ by _____
speeds up _____ by increasing the number of _____ between the _____ and the _____ surface.

2) _____:
_____ or _____ helps to disperse solute particles, _____ the number of _____ between the _____ and the _____ surface.

3) _____:
increases the average __ _____ _____ of the solvent molecules so that _____ between the solvent molecules and the _____ are more _____

The Chemistry Quiz

CR1. _____ CR2. _____

1. _____ 2. _____ 3. _____ 4. _____ 5. _____

Worksheet: Solutions Introduction Name_____

1. Explain why solutions are classified as mixtures instead of compounds.

2. Solutions are _____ mixtures made up of very small particles that are actually molecules, _____, or _____.

3. Solutions are said to be in a _____ phase even though the components may have been in different phases before the solution was formed.

4. Pure gold is 24 carat. 14-carat gold contains 14 parts gold and 10 parts other metals. 14-carat gold is said to be a(n) _____, which is a type of _____ solution. An example of a gaseous solution is _____, which is made up mostly of _____ and nitrogen when dry. The most common solutions are _____ solutions.

5. Define miscible:

6. Define immiscible:

7. Because of the _____ _____, you can see the light beams from car headlights in a fog.

8. Multiple choice: To increase the rate of solution of a solid in water,
   a. increase the pressure over the water.
   b. decrease the pressure over the water.
   c. crush the particles of the solid.
   d. chill the water.

9. If 15 grams of iodine are dissolved in 1000 mL of alcohol, the alcohol is the (solute, solvent) and the solution is said to be a(n) _____.

10. A substance that dissolves other materials is a (solute, solvent). The substance being dissolved is a (solute, solvent).

11. In (solutions, suspensions) the substances separate after standing a while. The substances (can also, can not) be separated by filtration.

12. Smoke is an example of a _____ of solid dirt and dust particles in air. After a while, the solid particles will fall to the ground.

13. A(n) _____'s particles are between those of a solution and a suspension.

14. _____ are actually colloids comprised of one liquid in another liquid. A(n) _____ agent keeps the particles mixed.

15. What is an aqueous solution?

16. What is the solute in a brass alloy containing 75% copper and 25% zinc?

17. How does a solution behave differently from a suspension when a beam of light is shined through it?

18. Substances that conduct electricity when dissolved are said to be _____, while substances that do NOT conduct electricity when dissolved are said to be ____ _____.

Saturated: solution containing all the _____ _____ possible at given conditions of _____ and _____.

Unsaturated: solution containing _____ dissolved _____ than the _____ amount that can be _____ at given conditions of _____ and _____.

Supersaturated: unusual solution containing _____ dissolved _____ than is normally _____ at given conditions of _____ and _____.

Solubility

A _____ of how much _____ can _____ in a given amount of _____ at a specific _____.

Dilute Solution: The amount of _____ dissolved is _____ in relation to the amount of _____ present.

Concentrated Solution: The amount of _____ dissolved is _____ in relation to the amount of _____ present.

Factors Affecting Solubility

1) _____ of _____ and _____:
"_____ dissolves _____".

2) _____
- generally, increasing the _____ of the solution _____ the solubility of a _____ solute
- increasing the _____ of the solution _____ the solubility of a _____ solute

3) _____
- only affects the _____ of a _____ _____
- _____ pressure _____ solubility
- _____ pressure _____ solubility
- Henry's Law: The _____ of a _____ dissolved in a given _____ of _____ is _____ proportional to the _____ of the _____.

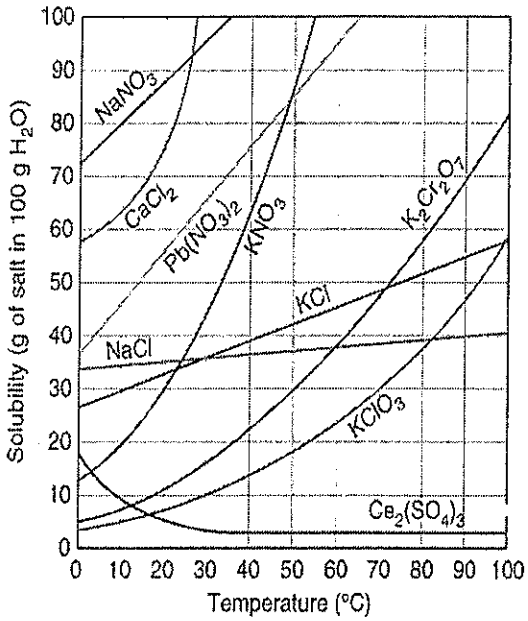
The Chemistry Quiz

CR1. _____ CR2. _____

1. _____ 2. _____ 3. _____ 4. _____ 5. _____

Worksheet: Solubility Graphs Name_____

Use the provided solubility graph to answer the following questions:



For questions 1 - 4 an amount of solute is given, and a temperature is stated. *If all of the solute could be dissolved* in 100 g of water at the given temperature, would the resulting solution be *unsaturated, saturated,* or *supersaturated?*

1. 60 g KCl at 70 °C _____
2. 10 g $KClO_3$ at 60 °C _____
3. 80 g $NaNO_3$ at 10 °C _____
4. 70 g $CaCl_2$ at 20 °C _____

For questions 5 - 8 a solute and temperature are given. Tell how many grams of each solute must be added to 100 g of water to form a saturated solution at the given temperature.

5. $Pb(NO_3)_2$ at 10 °C _____
6. $Ce_2(SO_4)_3$ at 50 °C _____
7. NaCl at 20 °C _____
8. $K_2Cr_2O_7$ at 50 °C _____

For questions 9 and 10 underline the solution that is more concentrated.

9. At 10 °C: a saturated solution of KNO_3 or a saturated solution of $CaCl_2$.
10. At 50 °C: a saturated solution of KNO_3 or an unsaturated solution of $NaNO_3$ consisting of 90 g of the solute dissolved in 100 g of water.

For questions 11 - 12, show your work and circle your final answer.

11. If 115 g KNO_3 are added to 100 g of water at 35 °C, how many grams do not dissolve?

12. What mass of KCl would be needed to form a saturated solution if the KCl was dissolved in 200 g of water at 80 °C?

Worksheet: More on Solubility Name_____

1. Explain what is meant by the expression "like dissolves like".

2. An unknown compound is observed to mix with benzene (a nonpolar solvent) but not with water. Is the unknown compound ionic or covalent?

   If the unknown compound is a liquid, will it be able to dissolve table salt?_____ Explain:

3. What are the chemical characteristics of a good dry-cleaning solvent?

4. Explain why you are more likely to overdose on vitamin A than on vitamin C.

5. Some industrial plants use water from nearby rivers and streams as a coolant. When the water is returned to the river or stream, the water is warmer than it was originally. This is referred to as "thermal pollution". Using your knowledge of solubility, why might this thermal pollution be harmful to fish?

6. After a bottle of carbonated drink has been open for a while, it tastes "flat". Explain why.

7. For most solid solutes, the degree of solubility in a liquid solvent (increases, decreases) with an increase in the temperature of the solvent.

8. Describe what happens to the degree of solubility of a gaseous solute in a liquid:
   a) with a decrease in the temperature of the solvent.

   b) with an increase in pressure (_____ Law).

9. The following statement is false: It is not possible to make a saturated solution from a substance that is described as only slightly soluble. Explain why this statement is false.

Molarity (M)

- expresses _____ _____.
- M = _____
- _____, _____, _____, and _____ all represent the same ratio.

Ex #1. A saline solution contains _____ g of NaCl per _____ mL of solution. What is its molarity?

M = _____

Ex. #2 How many moles of solute are contained in _____ L of _____ M $CaCl_2$?

Colligative Properties

- Any of the _____ of a _____ that change when the _____ of the _____ changes.

- Depend on the _____ of _____ dissolved in a given _____ of _____

- Examples of Colligative Properties:

  a. Vapor _____ Depression
  -- the _____ of the _____ _____ of a liquid that occurs when substances are _____ in the _____.
  -- Vapor Pressure: the _____ of a _____ in _____ with its _____

  b. Freezing _____ Depression
  -- the _____ of the _____ _____ of a liquid that occurs when substances are _____ in the _____.
  (ex. using _____ in car radiators and _____ on icy roads)

  c. Boiling _____ Elevation
  -- the _____ of the _____ _____ of a liquid that occurs when substances are _____ in the _____.
  -- boiling occurs when _____ _____ equals _____ _____.
  (ex. _____ in a car acts as a coolant in the summer.)

- More Examples of Colligative Properties:

_____, _____, _____

The Chemistry Quiz

CR1. _____ CR2. _____

1. _____ 2. _____ 3. _____ 4. _____ 5. _____

Worksheet: Molarity Name_____

Molarity:

- a _____ description of solution concentration.
- Abbreviated _____

Molarity = _____

Problems: Show all work and circle your final answer.

1. To make a 4.00 M solution, how many moles of solute will be needed if 12.0 liters of solution are required?

2. How many moles of sucrose are dissolved in 250 mL of solution if the solution concentration is 0.150 M?

3. What is the molarity of a solution of HNO_3 that contains 12.6 grams HNO_3 in 1.0 L of solution?

4. How many grams of potassium nitrate are required to prepare 0.250 L of a 0.700 M solution?

5. 125 cm^3 of solution contains 3.5 moles of solute. What is the molarity of the solution?

6. Which solution is more concentrated? Solution "A" contains 50.0 g of $CaCO_3$ in 500.0 mL of solution. Solution "B" contains 6.0 moles of H_2SO_4 in 4.0 L of solution. *SHOW WORK!*

7. How many liters of solution can be produced from 2.5 moles of solute if a 2.0 M solution is needed?

8. What would be the concentration of a solution formed when 1.00 g of NaCl are dissolved in water to make 100.0 mL of solution?

Worksheet: Colligative Properties Name_____

1. A property that depends on the number of solute particles (concentration) is said to be a _____ property.

2. List 5 examples of colligative properties:
   a)
   b)
   c)
   d)
   e)

3. The pressure of a vapor in _____ with its liquid is referred to as vapor pressure. It is a measure of the tendency of the molecules of a liquid to escape into the _____ phase.

4. The boiling point of a liquid is the temperature at which its _____ _____ is equal to _____ _____.

5. When a solid is dissolved in a liquid, the vapor pressure of the liquid is _____ because the surface area from which molecules can evaporate is reduced.

6. What colligative property is responsible for antifreeze keeping water from freezing in a car's cooling system? _____

7. What colligative property is responsible for antifreeze keeping water from boiling over during the summer in a car's cooling system?
   _____

8. What colligative property causes ice to melt on the street after salt has been spread on it?_____

Fill in the blanks using the most appropriate word or phrase.

1. A solution is a _____ mixture of two or more substances.

2. Every solution is composed of a _____, which is normally present in the smaller amount and is the substance that is _____, and a _____, which is normally present in the greater amount and is the substance that does the dissolving.

3. A carbonated drink is an example of a _____ solute dissolved in a _____ solvent; the final phase is that of a _____. Air is an example of a _____ solution.

4. Liquids, such as antifreeze and water, which dissolve in one another are said to be _____, while liquids that do not dissolve in one another, such as salad oil and vinegar, are said to be _____.

5. Brass, a mixture of copper and zinc, is an example of a solid solution known as a(n) _____.

6. Because the particles in a solution are so small (molecules, _____, or _____), filtration cannot be used to separate the components nor do the components settle upon standing.

7. _____ contain particles too large to be true solutions, and upon standing, separate. They are actually _____ mixtures and (can, can not) be separated by filtration. They also exhibit the _____ _____ which is the scattering of a beam of light. _____ also exhibit the _____ _____, but do not separate upon standing.

8. The rate of solution expresses how _____ a solute dissolves in a solvent.

9. Henry's Law: The _____ of a gas dissolved in a given volume of liquid is _____ _____ to the pressure of the gas.

Use your graph to answer the following questions.

1. What is the solubility of ammonium chloride at 40 °C? _____

2. If 54 g of NH_4Cl are dissolved at 68 °C, the solution is _____.

3. If 54 g of NH_4Cl are dissolved at 30 °C, how many grams don't dissolve?
   _____

Answer each of the following questions about molarity. Show all work on the problems.

1. Describe, IN DETAIL, how to make one liter of a 1 M NaCl solution.

2. What is the molarity of a solution that contains 15.0 g NaCl in 1.25 L of solution?

3. A solution of HCl is 0.200M. What mass of acid is dissolved in 250 mL of solution?

4. A solution of Na_2CO_3 contains 65.0 g of solute dissolved in water to make a 3.00 M solution. What is the volume of the solution, in liters?