Chemistry EOC Review 2016 Name _____ Per ___

Completing this review and showing your work will be worth up to 60 extra credit points. We will go over the review together on Wednesday, May 18th through Monday, May 23rd in class.

I, I, I, 4- Measurement

Unit Conversions- Kilo, Hecto, Deka, base unit, Deci, Centi, Milli. Move the decimal each time.

Percent Composition- Percent is 'part divided by whole'. To calculate percent composition, find the molar mass for each atom with the compound. Take each individual molar mass and divide by the total molar mass of the compound.

1. 0.25g is equivalent to
   a. 250kg.
   b. 250mg.
   c. 0.025mg.
   d. 0.025kg.

2. 0.05cm is the same as
   a. 0.000 05m.
   b. 0.005mm.
   c. 0.05m.
   d. 0.5mm.

3. 1.06L of water is equivalent to
   a. 0.001 06mL.
   b. 10.6mL.
   c. 106mL.
   d. 1060mL.

4. The number of grams equal to 0.5kg is
   a. 0.0005.
   b. 0.005.
   c. 500.
   d. 5000.

5. What is the percentage composition of CF_4?
   a. 20% C, 80% F
   b. 13.6% C, 86.4% F
   c. 16.8% C, 83.2% F
   d. 81% C, 19% F

6. What is the percentage composition of CO?
   a. 50% C, 50% O
   b. 12% C, 88% O
   c. 25% C, 75% O
   d. 43% C, 57% O

7. What is the percentage composition of $CuCl_2$?
   a. 33% Cu, 66% Cl
   b. 50% Cu, 50% Cl
   c. 65.50% Cu, 34.50% Cl
   d. 47.27% Cu, 52.73% Cl

8. The percentage composition of sulfur in SO_2 is about 50%. What is the percentage of oxygen in this compound?
   a. 25%
   b. 50%
   c. 75%
   d. 90%

I, I, III, 5- Calculations

Use mathematics to express and establish scientific relationships (e.g., scientific notation, vectors, dimensional analysis). Use of correct number of significant figures. Keep smallest number of places to the right of the decimal for addition and subtraction; keep fewest number of sig figs for multiplication and division.

Molarity- a concentration unit of a solution expressed as moles of solute dissolved per liter of solution.
Molality- the concentration of a solution expressed in moles of solute per kilogram of solvent
Dilutions **$M_1V_1 = M_2V_2$ where M is molarity and V is volume.**

1. What is the molarity of a solution that contains 0.202 mol KCl in a 7.98 L solution?
   a. 0.0132 M
   b. 0.0253 M
   c. 0.459 M
   d. 1.36 M

2. What is the molality of a solution that contains 5.10 mol KNO_3 in 4.47 kg water? (molar mass of KNO_3 = 101.11 g/mol)
   a. 0.315 *m*
   b. 0.779 *m*
   c. 1.02 *m*
   d. 1.14 *m*

3. What is the molarity of a solution that contains 125g NaCl in 4.00 L solution? (molar mass of NaCl = 58.44 g/mol)

a. 0.535 M
b. 2.14 M
c. 8.56 M
d. 31.3 M

4. How many mL of 9M HNO_3 would it take to make 200 mL of 0.2 M HNO_3?

a. 0.009 mL
b. 4.44 mL
c. 44.4 mL
d. 9000 mL

II, I, I, 2- Density, pH

Identify, measure, and use a variety of physical and chemical properties (e.g., electrical conductivity, density, viscosity, chemical reactivity, pH, melting point)

Density is the ratio of the mass of a substance to the volume of the substance. It is often expressed as grams per cubic centimeter for solids and liquids and as grams per liter for gases.

Mass is a measure of the amount of matter in an object. It does not change.

Weight is a measure of the gravitational force exerted on an object. Its value can change with the location of the object in the universe.

pH- a value that is used to express the acidity or alkalinity (basicity) of a system. Each whole number on the scale indicated a tenfold change in acidity. A pH of 7 is neutral, a pH of less than 7 is acidic, and a pH of greater than 7 is basic.

$pH = -\log[M] = -\log[H_3O^+]$ and $pOH = -\log[OH^-]$

$pH + pOH = 14.0$ at 25 °C

$[H_3O^+]\,[OH^-] = 1.0 \times 10^{-14}$ at 25 °C

pH Measurement Scale

Neutral

increasing acidity <- -> increasing basic

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

* * * * *

Stomach Acid Tomatoes **H_2O** Soap Lye

1. Which pair of quantities determines the density of a material?

a. mass and weight
b. volume and weight
c. volume and concentration
d. volume and mass

2. The density of an object is calculated by

a. multiplying its mass times its volume.
b. dividing its mass by its volume.
c. dividing its volume by its mass.
d. adding its mass to its volume.

3. What is the pH of a neutral solution at 25˚C?

a. 0
b. 1
c. 7
d. 14

4. The pH scale in general use ranges from

a. 0 to 1.
b. -1 to 1.
c. 0 to 7
d. 0 to 14

5. If $[H_3O^+] = 8.26 \times 10^{-5}$ M, what is the pH of the solution?

a. 2.161
b. 3.912
c. 4.083
d. 8.024

6. What is the pH of a solution whose hydronium ion concentration is 5.03×10^{-1} M?

a. 0.2984
b. 0.5133
c. 1.542
d. 5.031

II, I, I, 3- Mixtures

Know how to use properties to separate mixtures into pure substances (e.g., distillation, chromatography, solubility).

A **mixture** is two or more substances together which can be separated by physical means. If the mixture has a uniform composition, it is said to be **homogeneous**- like salt water. If the composition of the mixture is not uniform, it is said to be **heterogeneous**- like Italian salad dressing.

Name six ways that mixtures might be separated.

1. 4.

2. 5.

3. 6.

II, I, I, 4- Periodic Trends

Describe trends in properties (e.g., ionization energy or reactivity as a function of location on the periodic table, boiling point of organic liquids as a function of molecular weight).

Atomic radius is one-half of the distance between the center of identical atoms that are not bonded together.
Ionization energy is the energy required to remove an electron from an atom or ion. The smaller the atom, the closer the valence electrons are to the nucleus and therefore, the tighter the electrons are being held. This gives the smallest atoms the largest ionization energy. As you go down a family/group (column), the atomic radius gets larger because you add in another energy level for the electrons for each space you go down and the ionization energy becomes less. (Think about a football player running with the ball. If he holds it in tight against his body, it is difficult to get it away from him. However, if he is running down the field with his arm outstretched holding the ball it is easy to take the ball away from him.) Now, the atomic radius actually gets smaller as you go across a period (row). You would think that if you add in electrons the radius should get bigger, but it doesn't. You are also adding in a proton, which adds mass and increases the nuclear force of the nucleus, so it can hold the electrons even tighter. Therefore the largest ionization energies are in the upper right of the periodic table and the lowest are in the bottom left.

1. Within a group of elements, as the atomic number increases, the atomic radius
   a. increases.
   b. remains approximately constant.
   c. decreases regularly.
   d. varies unpredictably.

2. For alkaline-earth metals, atoms with the smallest radii
   a. are the most reactive.
   b. have the largest volume.
   c. are all gases.
   d. have the highest ionization energies.

3. Across a period in the periodic table, atomic radii
   a. gradually decrease.
   b. gradually decrease, then sharply increase.
   c. gradually increase.
   d. gradually increase, then sharply decrease.

4. Which is the best reason that the atomic radius generally increases with atomic number in each group of elements?
   a. The nuclear charge increases.
   b. The number of neutrons increases.
   c. The number of occupied energy levels increases.
   d. A new octet forms

II, I, I, 6- Isotopes

Understand atomic structure, including isotopes of an element.

Isotopes- two atoms that have different numbers of neutrons but the same number of protons and electrons. If they have the same number of protons but different number of neutrons, they must have different masses.

1. Chlorine, atomic number 17 and mass number 35, has
   a. 17 protons, 17 electrons, and 18 neutrons.
   b. 35 protons, 35 electrons, and 17 neutrons.
   c. 17 protons, 17 electrons, and 52 neutrons.
   d. 18 protons, 18 electrons, and 17 neutrons.

2. Carbon-14 (atomic number 6), the radioactive nuclide using in dating fossils, has
   a. 6 neutrons.
   b. 8 neutrons.
   c. 10 neutrons.
   d. 14 neutrons.

3. Phosphorus-33 (atomic number 15) contains
   a. 33 protons.
   b. 18 neutrons.
   c. 33 neutrons.
   d. 18 protons.

4. Neon-2 contains 12 neutrons. It also contains
   a. 12 protons.
   b. 22 protons.
   c. 22 electrons.
   d. 10 protons.

II, I, I, 7- Bonding

Explain how electrons determine the properties of substances by:

- Interactions between atoms through transferring or sharing valence electrons
- Ionic and covalent bonds

Ionic bonds happen between metals and non-metals. Ionic bonding requires a transfer of electrons. Use the criss-cross method to determine chemical compounds. **Transition elements** require the use of Roman Numerals in naming compounds. **Polyatomic ions** are compounds that contain two or more elements combined that act as one.

Covalent bonds happen between non-metals and non-metals. Covalent bonds share electrons. When naming covalent bonds, prefixes must be used.

1. What are shared in a covalent bond?
   a. ions
   b. Lewis structures
   c. electrons
   d. dipoles

2. Most chemical bonds are
   a. purely ionic.
   b. purely covalent.
   c. partly ionic and partly covalent.
   d. metallic.

3. What is the formula for zinc (II) fluoride?
   a. ZnF
   b. ZnF_2
   c. Zn_2F
   d. Zn_2F_3

4. What is the formula for the compound formed by calcium ions and chloride ions?
   a. CaCl
   b. Ca_2Cl
   c. $CaCl_3$
   d. $CaCl_2$

5. What is the formula for the compound formed by lead (II) ions and chromate ions?
   a. $PbCrO_4$
   b. Pb_2CrO_4
   c. $Pb_2(CrO_4)_3$
   d. $Pb(CrO_4)_2$

6. What is the formula for aluminum sulfate?
   a. $AlSO_4$
   b. Al_2SO_4
   c. $Al_2(SO_4)_3$
   d. $Al(SO_4)_3$

7. What is the formula for barium hydroxide?
   a. BaOH
   b. $BaOH_2$
   c. $Ba(OH)_2$
   d. Ba(OH)

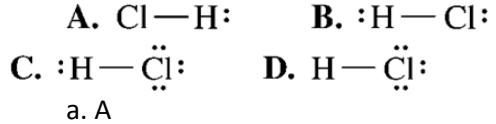
8. Name the compound $Ni(ClO_3)_2$.
   a. Nickel (II) chlorate
   b. Nickel (II) chloride
   c. Nickel (II) chlorite
   d. Nickel (II) peroxide

9. Name the compound $Zn_3(PO_4)_2$.
   a. Zinc potassium oxide
   b. Trizinc polyoxide
   c. Zinc (II) phosphate
   d. Zinc phosphite

10. Draw a Lewis structure for the oxalate ion, $C_2O_4^{2-}$.

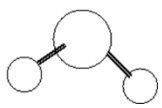
11. Draw a Lewis structure for carbon disulfide, CS_2.

12. What is the correct Lewis structure for hydrogen chloride, HCl?



   a. A
   b. B
   c. C
   d. D

13. Describe one way in which this model is like a water molecule and one way it is different than a water molecule.



I, I, I, 8 - Electron configuration

Make predictions about elements using the periodic table (e.g., number of valence electrons, metallic character, reactivity, conductivity, type of bond between elements).

Valence electrons are the electrons on the outermost electron shell of each atom. The number of valence electrons can never exceed 8 (octet rule).

1. In the electron configuration for scandium (Z= 21), what is the notation for the three highest-energy electrons?
   a. $4s^2\ 3d^1$
   b. $4s^3$
   c. $3d^3$
   d. $4s^2\ 4p^1$

2. The element with electron configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2$ is
   a. Mg (Z= 12).
   b. C (Z= 6).
   c. S (Z= 16).
   d. Si (Z= 14).

3. The electron configuration for the carbon atom is $1s^2\ 2s^2\ 2p^2$. The atomic number of carbon is
   a. 3.
   b. 6.
   c. 11.
   d. 12.

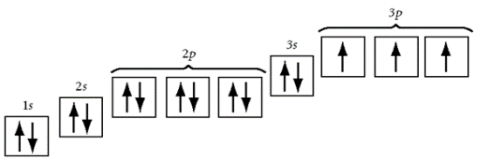
4. What is the electron configuration for nitrogen (Z=7)?
   a. $1s^2\ 2s^2\ 2p^3$
   b. $1s^2\ 2s^3\ 2p^2$
   c. $1s^2\ 2s^3\ 2p^1$
   d. $1s^2\ 2s^2\ 2p^2\ 3s^1$

5. Which element has the following electron configuration: [Ar] $4s^2\ 3d^{10}\ 4p^5$?

6. Write the noble-gas electron configuration for silicon.

7. Draw the orbital diagram for phosphorus.

8. Draw the orbital diagram for argon.

9. 

Write the noble-gas electron configuration represented in this orbital diagram.

II, I, I, 10- Gases

Know that states of matter (i.e., solid, liquid, gas) depend on the arrangement of atoms and molecules and on their freedom of motion.

At STP, T = 0 °C = 273 K, P = 1 atm = 760 mm Hg = 101.325 kPa

Boyle's Law $P_1V_1=P_2V_2$; Charles' Law $\frac{V_1}{T_1}=\frac{V_2}{T_2}$; Gay-Lussac's Law $\frac{P_1}{T_1}=\frac{P_2}{T_2}$; Ideal Gas Law PV = nRT

1. The volume of a gas is 400.0 mL when the pressure is 1.00 atm. At the same temperature, what is the pressure at which the volume of the gas is 2.0L?
   a. 0.5 atm
   b. 5.0 atm
   c. 0.20 atm
   d. 800 atm

2. A sample of oxygen occupies 560. mL when the pressure is 800.00 mmHg. At constant temperature, what volume does the gas occupy when the pressure decreases to 700.0 mmHg?
   a. 80.0 mL
   b. 490. mL
   c. 600. mL
   d. 640. mL

3. The volume of a sample of oxygen is 300.0 mL when the pressure is 1.00 atm and the temperature is 27.0°C. At what temperature is the volume 1.00 L and the pressure 0.500 atm?

a. 22.0°C
b. 45.0°C
c. 0.50 K
d. 227°C

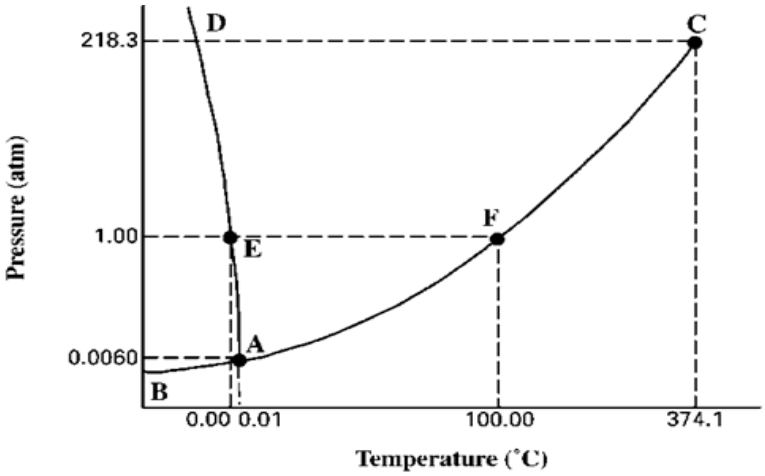
4. The volume of a gas collected when the temperature is 11.0°C and the pressure is 710 mmHg measures 14.8mL. What is the calculated volume of the gas at 20.0°C and 740 mmHg?

a. 7.8 mL
b. 13.7 mL
c. 14.6 mL
d. 15 mL

5. What do points E and F represent in the figure to the right?

6. What does point A represent in the figure to the right?

7. Explain what the curves AB, AC, and AD represent in the figure to the right.



II, I, I, 11- Nuclear chemistry

Know that some atomic nuclei can change, including:

- Spontaneous decay
- Half-life isotopes
- Fission
- Fusion
- Alpha, beta, and gamma radiation

Radiation comes from atoms with unstable nuclei- which usually mean too many neutrons-that decay.

Fusion is **nuclear** change where the nuclei of two lighter elements "fuse" together to make the nucleus of a heavier element. This is what happens in our Sun and other stars when two hydrogen atoms fuse together to make a helium atom. Energy is always released.

Fission is **nuclear** change where the nucleus of a heavy element splits into nuclei of two or more lighter elements. This is used in nuclear power and bombs. Energy is always released.

Types of radiation- alpha particles, beta particles, gamma rays, neutron emission, ionizing, non-ionizing

Half-life- is the time it takes for exactly half of a sample (parent) to decay into another element (daughter)

1. The half-life of an isotope is the time required for half the nuclei in a sample to

a. undergo radioactive decay.
b. undergo nuclear fission.
c. undergo nuclear fusion.
d. react chemically.

2. How many half-lives are required for three-fourths of the nuclei of one isotope in a sample to decay?

a. 3/4
b. 3/2
c. 2
d. 3

3. Which statement is true about half-lives?

a. Different atoms of the same nuclide have different half-lives.
b. Each radioactive isotope has its own half-life.
c. All radioactive nuclides of an element have the same half-life.
d. All radioactive nuclides have the same half-life.

4. According to the table below, if a rock contains 12.5% as much uranium-235 as rocks being formed today, how old is the rock?

Nuclide	Half-Life (years)
carbon-14	5.71×10^3
potassium-40	1.26×10^9
radium-226	1.60×10^3
thorium-230	7.54×10^4
uranium-235	7.04×10^8

a. 3.52×10^8 years
b. 7.04×10^8 years
c. 1.41×10^9 years
d. 2.11×10^9 years

II, I, I, 13- Types of Chemical Reactions

Understand types of chemical reactions (e.g., synthesis, decomposition, combustion, redox, neutralization) and identify them as exothermic or endothermic.

Synthesis- a reaction in which two or more substances combine to form a new compound
Decomposition- a reaction in which a single compound breaks down to form two or more simpler substances
Double displacement- the positive ions (cation) and the negative ions (anion) of the two reactants switch places, forming two new compounds or products
Single displacement- chemical reaction where one reactant is exchanged for one ion of a second reactant (type of redox)
Combustion- the oxidation reaction of an element or compound in which energy as heat is released
Redox- any chemical change in which one species is oxidized (loses electrons) and another species is reduced (gains electrons)
Neutralization- the reaction of the ions that characterize acids (hydronium ions) and the ions that characterize bases (hydroxide ions) to form water molecules and a salt

1. In what kind of reaction do two or more substances combine to form a new compound?
   a. decomposition reaction
   b. ionic reaction
   c. double-displacement reaction
   d. synthesis reaction

2. The equation AX → A + X is the general equation for a
   a. synthesis reaction.
   b. decomposition reaction.
   c. combustion reaction.
   d. single-displacement reaction.

3. In what kind of reaction does one element replace a similar element in a compound?
   a. displacement reaction
   b. combustion
   c. decomposition reaction
   d. ionic reaction

4. The equation AX + BY → AY + BX is the general equation for a
   a. synthesis reaction
   b. decomposition reaction.
   c. single-displacement reaction.
   d. double-displacement reaction.

5. In what kind of reaction does a single compound produce two or more simpler substances?
   a. decomposition reaction
   b. synthesis reaction
   c. single-displacement reaction
   d. ionic reaction

6. The equation A + X → AX is the general equation for a(n)
   a. combustion reaction.
   b. ionic reaction.
   c. synthesis reaction.
   d. double-displacement reaction.

7. Write a balanced chemical equation for the following reaction: iron plus copper (I) nitrate yields iron (II) nitrate plus copper.

8. Write a balanced chemical equation for the synthesis of liquid phosphorus trichloride, PCl_3, from white phosphorus, P_4, and chlorine gas.

9. Tell what type of chemical equation is represented by the following formula equation. Then, balance the equation.

C_3H_8 (g) + O_2 (g) → CO_2 (g) + H_2O (l)

10. Tell what type of chemical reaction is represented by the following formula equation. Then, balance the equation.

Ga (s) + S (s) → Ga_2S_3 (s)

11. Tell what type of chemical reaction is represented by the following formula equation. Then, balance the equation.

KBr (aq) + $Mg(OH)_2$ (aq) → KOH (aq) + $MgBr_2$ (aq)

II, I, I, 14- Stoichiometry

Know how to express chemical reactions with balanced equations that show:

- Conservation of mass
- Products of common reactions

The **Law of Conservation of Mass** says that mass cannot be created or destroyed. In a chemical reaction, this means that the number of each type of atom must be the same on each side of the equation. It also means that you must have the same type of atoms on each side of the reaction. The coefficients in the reaction tell you the constant ratio of the reactants and products. Use the REP chart to help balance equations. For example, consider the reaction aX + bY → cZ. This tells us that a moles of X and b moles of Y will always react to produce c moles of Z.

Molar mass is the mass in grams of 1 mole of a substance. Molar mass can be calculated by adding the atomic masses of the atoms within a compound.

A **mole ratio** (a conversion factor) allows for the movement within a chemical reaction.

1. Molar mass
   a. is the mass in grams of one mole of a substance.
   b. is numerically equal to the average atomic mass of the element.
   c. both (a) and (b).
   d. neither (a) nor (b).

2. What is the molar mass of magnesium chloride, $MgCl_2$?
   a. 46 amu or g/mol
   b. 59.76 amu or g/mol
   c. 95.21 amu or g/mol
   d. 106.35 amu or g/mol

3. What is the molar mass of ethyl alcohol, C_2H_5OH?
   a. 30.00 amu or g/mol
   b. 33.27 amu or g/mol
   c. 45.06 amu or g/mol
   d. 46.08 amu or g/mol

4. What is the molar mass of $(NH_4)_2SO_4$?
   a. 114.09 amu or g/mol
   b. 118.34 amu or g/mol
   c. 128.06 amu or g/mol
   d. 132.16 amu or g/mol

5. The word equation solid carbon + oxygen gas → carbon dioxide gas + energy, represents a chemical reaction because
   a. the reaction releases energy.
   b. CO_2 has the chemical properties that differ from those of C and O.
   c. the reaction absorbs energy.
   d. CO_2 is a gas and carbon is a crystal.

6. The complete balanced equation for the reaction between zinc hydroxide and acetic acid is
   a. $ZnOH + CH_3COOH \rightarrow ZnCH_3COO + H_2O$
   b. $Zn(OH)_2 + CH_3COOH \rightarrow Zn + 2CO_2 + 3H_2O$
   c. $Zn(OH)_2 + 2CH_3COOH \rightarrow Zn(CH_3COO)_2 + 2H_2O$
   d. $Zn(OH)_2 + 2CH_3COOH \rightarrow Zn(CH_3COO)_2 + H_2 + O_2$

7. What is the balanced equation for the combustion of sulfur?
   a. $S(s) + O_2(g) \rightarrow SO(g)$
   b. $S(s) + O_2(g) \rightarrow SO_2(g)$
   c. $2S(s) + 3O_2(g) \rightarrow SO_3(s)$
   d. $S(s) + 2O_2(g) \rightarrow SO_4^{2-}(aq)$

8. Which equation is **not** balanced?
   a. $2H_2 + O_2 \rightarrow 2H_2O$
   b. $4H_2 + 2O_2 \rightarrow 4H_2O$
   c. $H_2 + H_2 + O_2 \rightarrow H_2O + H_2O$
   d. $2H_2 + O_2 \rightarrow H_2O$

9. The Haber process for producing ammonia commercially is represented by the equation $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ + energy. To completely convert 9.0 moles 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

10. In the equation $2KClO_3 \rightarrow 2KCl + 3O_2$, how many moles of oxygen are produced when 3.0 mol of $KClO_3$ decompose completely?

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

11. For the reaction represented by the equation $2H_2 + O_2 \rightarrow 2H_2O$, how many grams of water are produced from 6.00 moles of hydrogen?

a. 2.00 g
b. 6.00 g
c. 54.0 g
d. 108 g

12. For the reaction represented by the equation $2Na + 2H_2O \rightarrow 2NaOH + H_2$, how many grams of sodium hydroxide are produced from 3.0 moles of sodium with an excess of water?

a. 40. g
b. 80. g
c. 120 g
d. 240 g

II, I, II, 11- Equilibrium
Understand the concept of equilibrium (i.e., thermal, mechanical, and chemical)

Equilibrium- the state in which a chemical reaction and the reverse chemical reaction occur at the same rate such that the concentrations of reactants and products do not change.

1. At equilibrium,

a. all reactions have ceased.
b. only the forward reaction continues.
c. only the reverse reaction continues.
d. both the forward and reverse reactions continue.

2. If the system $2CO\,(g) + O_2\,(g) \rightleftarrows 2CO_2\,(g)$ has come to equilibrium and then more CO (g) is added,

a. the equilibrium point shifts forward (toward the product)
b. the equilibrium point shifts reverse (toward the reactants)
c. the equilibrium point doesn't shift either direction

3. If the pressure on the equilibrium system $2CO\,(g) + O_2\,(g) \rightleftarrows 2CO_2\,(g)$ is increased,

a. the equilibrium point shifts forward (toward the product)
b. the equilibrium point shifts reverse (toward the reactants)
c. the equilibrium point doesn't shift either direction

4. If the pressure on the equilibrium system $N_2\,(g) + O_2\,(g) \rightleftarrows 2NO\,(g)$ decreases,

a. the equilibrium point shifts forward (toward the product)
b. the equilibrium point shifts reverse (toward the reactants)
c. the equilibrium point doesn't shift at all

5. If the temperature of the equilibrium system $CH_3OH\,(g) + 101\ kJ \rightleftarrows CO\,(g) + 2H_2\,(g)$ increases,

a. the equilibrium point shifts forward (toward the products)
b. the equilibrium point shifts reverse (toward the reactant)
c. the equilibrium point doesn't shift at all

II, I, I, 15-Rates of Chemical Reactions
Describe how the rate of chemical reactions depends on many factors that include temperature, concentration and the presence of catalysts.

The **rate of a reaction** is the **speed at which a chemical reaction happens**. If a reaction has a **low rate**, that means the molecules/atoms/ions combine at a **slower speed** than a reaction with a high rate.

- TEMPERATURE—raising the temperature of a system **increases the number and frequency of collisions.**
- CONCENTRATION—the more of a substance, the **greater the chance of a collision with another atom, molecule**, etc.
- PRESSURE--when you increase pressure of a gas, the greater **density** of molecules **increases the number of collisions**. When you decrease the pressure, molecules don't hit each other as often and the rate of reaction decreases.

Scientists **measure how fast a reaction is occurring and in what direction** by looking at the **concentrations of the reactants and products**. The reaction rate is the change in concentration divided by the time interval or how fast the reactants disappear or how fast products appear.

A **catalyst** lowers the amount of energy needed so that a reaction can happen more easily. It usually speeds up both the forward and reverse reaction rates and changes the equilibrium point. It can be a chemical that doesn't directly participate in the reaction, or it can be a spark or heat. However, a **catalyst doesn't affect the concentrations of either reactants or products**.

II, I, II, 1, 3-Forms of and Transfer of Energy

Understand the transformation and transmission of energy and how energy and matter interact:

- Identify different forms of energy, including kinetic, gravitational (potential), chemical, thermal, and electromagnetic.
- Understand that energy can change from one form to another and that energy is conserved in these changes.

1. What is energy? What are its units in the SI system?
2. Describe thermal energy.
3. Describe chemical energy and how it is stored.
4. Describe electromagnetic energy.
5. Describe nuclear energy.
6. Describe mechanical energy.
7. What is energy conversion?
8. Give three (3) examples of energy conversion.
9. Describe kinetic energy and give a formula for it.
10. Describe potential energy and give a formula for gravitational PE.
11. How did Einstein relate energy and matter?
12. The Law of _____ of Energy states that energy can be neither _____nor _____ by ordinary means, it can only be _____ from one form to another.

<u>Naming Acids</u>

1. Write the formulae for these acids and bases and state whether they are an binary acid, oxyacid, or base:
   a. Nitrous acid
   b. Hydrobromic acid
   c. Rubidium hydroxide
   d. Sulfurous acid
   e. Pernitric acid
   f. Hypochlorous acid
   g. Chromic acid
   h. Phosphoric acid
   i. Strontium hydroxide
2. Write the names of these acid and base formulae and state whether they are an binary acid, oxyacid, or base:
   a. HF
   b. H_2CO_3
   c. $Ca(OH)_2$
   d. HNO_3
   e. CuOH
   f. H_2S