Goal 2 Chemistry Released Questions Name _____

1. Which best describes the current atomic theory?
   a. atoms consist of electrons circling in a definite orbits around a positive nucleus.
   b. atoms are composed of electrons in a cloud aound a positive nucleus.
   c. Atoms can easily be split, at which time they become radioactive.
   d. an atom's mass is determined by the mass of its neutrons.
2. What is the nuclear composition of uranium-235?
   a. 92 electrons + 143 protons c. 143 protons + 92 neutrons
   b. 92 protons + 143 electrons d. 92 protons + 143 neutrons
3. Which best describes the relationship between subatomic particles in any neutral atom?
   a. the number of protons equals the number of electrons
   b. the number of protons equals the number of neutrons
   c. the number of neutrons equals the numbers of electrons
   d. the number of neutrons is greater than the number of protons
4. What is the name of the compound PbO_2?
   a. lead oxide b. lead(II) oxide c. lead oxide (I) d. lead (IV) oxide
5. What is the name of $HCl(aq)$?
   a. chloric acid b. hydrochloric acid c. hydrogen chloride d. perchloric acid
6. What is the formula for calcium nitrate?
   a. $CaNO_3$ b. $Ca(NO_2)_2$ c. $Ca(NO_3)_2$ d. Ca_3N_2
7. What is the correct formula for dinitrogen pentoxide?
   a. N_4O b. NO_2 c. N_2O_5 d. NO_4
8. If the volume of 18.5 gram piece of metal is 2.35 cm^3, what is the identity of the metal?
   a. iron b. lead c. nickel d. zinc

$D = \frac{m}{V}$ $7.87\ g/cm^3 = \frac{18.5\ g}{2.35\ cm^3}$

9. Which substance listed in the table is a liquid at 27°C?
   a. I b. II c. III d. IV

	Melting Point	Boiling Point
I	28°C	140°C
II	−10°C	25°C
III	20°C	140°C
IV	−90°C	14°C

10. Which will increase the solubility of MOST solid solutes?
    a. decreasing the temperature
    b. decreasing the amount of solvent at constant temperature
    c. increasing the amount of solute at constant temperature
    d. increasing the temperature

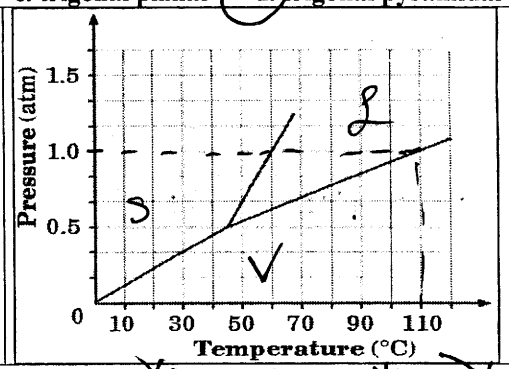
indirect ∝ $PV = PV$

11. What happens to the pressure of a gas at constant temperature when the volume is doubled? The pressure is .....
    a. doubled c. reduced by 1/2
    b. going to remain the same d. reduced by 1/4
12. The total pressure in an enclosed container containing N_2, O_2, and CO_2 is 30 atm. If the partial pressure of N_2 is 4 atm and the partial pressure of O_2 is 6 atm, what is the partial pressure of CO_2?
    a. 20 atm b. 30 atm c. 40 atm d. 50 atm

30 atm = 4 atm + 6 atm + P_{CO_2}

13. What is the pressure (in atmospheres) exerted by a 0.100 sample of oxygen in a 2.00 L container at 272°C?
    a. 0.448 atm b. 2.24 atm c. 1120 atm d. 2240 atm
14. What type of bonding is associated with compounds that have the following characteristics:
    - High melting points
    - Conduct electricity in the molten state
    - Solutions conduct electricity
    - Normally found as crystalline solids at room temperature

    a. covalent b. ionic c. hydrogen d. metallic
15. What is a unique characteristic of the bonding between metal atoms?
    a. atoms require additional electrons to reach a stable octet
    b. atoms must give away electrons to reach a stable octet
    c. atoms share valence electrons only with neighboring atoms to reach a stable octet.
    d. delocalized electrons move among may atoms creating a sea of electrons
16. Which pair of elements would MOST likely bond to form a covalently bonded molecule?
    a. sodium and fluorine c. phosphorus and oxygen
    b. barium and chlorine d. magnesium and sulfur
17. Based on VESPR theory, what is the molecular geometry of a molecule of PI_3?
    a. linear b. tetrahedral c. trigonal planar d. trigonal pyramidal
18. Consider the phase diagram shown on the right. At what temperature does the normal boiling point occur?
    a. 45°C b. 60°C
    c. 100°C d. 110°C



13. $P = \frac{nRT}{V} = \frac{(0.100\ mol)(0.0821\ \frac{L\ atm}{mol\ K})(272 + 273\ K)}{2.00\ L}$

$P = 2.2372\ atm$

$P = 2.24\ atm$

Chemistry Released Questions Name ____________

1. The compound formed between element X and oxygen had the chemical formula X2O. Which element would X most likely represent?
   a. Fe b. Zn c. Ag d. Sn
2. Which electron configuration represents a transition element?
   a. $1s^22s^22p^3$ c. $1s^22s^22p^63s^23p^64s^23d^7$
   b. $1s^22s^22p^63s^3$ d. $1s^22s^22p^63s^23p^64s^23d^{10}4p^4$
3. Given the electronic configuration of $1s^22s^22p^4$ how many electrons does this element have in its outer level?
   a. 2 b. 4 c. 6 d. 8
4. Which correctly lists four atoms from smallest to largest radii?
   a. I<Br<Cl<F c. Si<P<S<Cl
   b. F<I<Br<Cl d. Cl<S<P<Si
5. Which BEST explains why cations are smaller than the atoms from which they are formed?
   a. The metallic atom gains electrons, causing a larger effective nuclear pull
   b. The metallic atom loses electrons, resulting in loss of an entire energy level.
   c. The nonmetallic atom gains electrons, causing a larger effective nuclear pull.
   d. The nonmetallic atom loses electrons, resulting in loss of an entire energy level.
6. Which have the lowest electronegativities?
   a. alkali metals b. halogens c. rare earth metals d. transition metals
7. How many moles are in 59.6g of $BaSO_4$?
   a. 0.256 moles b. 3.91 moles c. 13.9 moles d. 59.6 moles
8. What is the volume of two moles of hydrogen gas at STP?
   a. 44.8 L b. 22.4 L c. 11.2 L d. 2.00 L
9. How many molecules are contained in 55.0 g of H_2SO_4?
   a. 0.561 molecules c. 3.38×10^{23} molecules
   b. 3.93 molecules d. 2.37×10^{24} molecules
10. If a sample of magnesium has a mass of 60.0 g, how many moles of magnesium does the sample contain?
    a. 1.1 moles b. 1.2 moles c. 2.0 moles d. 2.5 moles
11. How many grams of KCl are necessary to prepare 1.50 Liters of a 0.500 *M* solution of KCl? A. 224 g b. 74.6 g c. 56.0 g d. 24.9 g
12. What is the molarity of a solution containing 20.0 g of sodium hydroxide dissolved in 1.0 L of solution?
    a. 0.50 M b. 0.40 M c. 0.30 M d. 0.20 M
13. What is a possible molecular formula for a substance if ... sis shows a compound to be, by mass, 43.8% N, 6.2% H, and 50.0% O?
    a. NH_4NO_2 b. NH_4NO_3 c. NH_3OH d. N_2OH
14. A compound has an empirical formula of CH_2O and a molecular mass of 180g. What is the compound's molecular formula?
    a. $C_3H_6O_3$ b. $C_6H_{12}O_6$ c. $C_6H_{11}O_7$ d. $C_{12}H_{22}O_{11}$
15. What is the percent by mass of iron in the compound Fe_2O_3?
    a. 70% b. 56% c. 48% d. 30%
16. Metallic sodium reacts violently with water to hydrogen and sodium hydroxide according to the balanced equation:
    $2Na + 2H_2O \rightarrow 2NaOH + H_2$
    How many moles of hydrogen gas are generated when 4.0 moles of sodium react with excess water?
    a. 1 mole b. 2 mole c. 3 mole d. 4 mole
17. Consider this reaction:
    $3Ca(s) + 2H_3PO4\ (aq) \rightarrow Ca_3(PO_4)_2\ (s) + 3\ H_2\ (g)$
    How many moles of calcium are required to produce 60.0 g of calcium phosphate?
    a. 0.145 mol b. 0.194 mol c. 0.387 mol d. 0.581 mol
18. According to the equation $2\ H_2O\ (l) \rightarrow 2\ H_2\ (g) + O_2\ (g)$, what mass of H_2O is required to yield 22.4 L of O_2 at STP?
    a. 12 g b. 18 g c. 24 g d. 36 g
19. Consider the reaction $3Mg\ (s) + 2H_3PO_4\ (aq) \rightarrow Mg_3(PO_4)_2\ (s) + 3\ H_2(g)$. How many grams of magnesium phosphate should be produced if 5.40 grams of magnesium react with excess phosphoric acid?
    a. 1.80 g b. 19.5 g c. 58.4 g d. 175 g
20. Methane (CH_4) is burned in oxygen according to this balanced equation: $CH_4\ (g) + 2O_2(g) \rightarrow CO_2\ (g) + 2H_2O(g)$. What volume of carbon dioxide is formed when 9.36 L of methane are burned in excess oxygen at STP?
    a. 9.36 L b. 15.0 L c. 18.7 L d. 22.4 L

Chemistry Goal 4 Released Questions Name _____

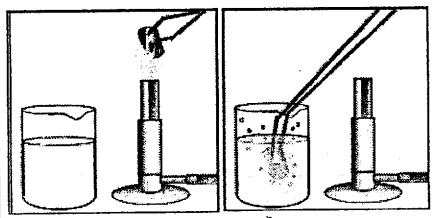
1. Consider the spectrum for the hydrogen atom. In which situation will light be produced?
   a. Electrons absorb energy as they move to an excited state.
   b. Electrons release energy as they move to an excited state.
   c. Electrons absorb energy as they return to the ground state.
   d. Electrons release energy as they return to the ground state.

2. Which statement regarding red and green light visible light is correct?
   a. The speed of green light is greater than that of red light.
   b. The wavelength of green light is longer than that of red light.
   c. The energy of the green light is lower than that of red light.
   d. The frequency of green light is higher than that of red light.

3. Which color of light would a hydrogen atom emit when an electron changes from the *n=5* level to the *n=2* level?
   a. red b. yellow c. green d. blue

4. What energy level transition is indicated when the light emitted by a hydrogen atom has a wavelength of 103 nanometers (nm)?
   a. n=2 to n=1 b. n=3 to n=1 c. n=4 to n=2 d. n=5 to n=2

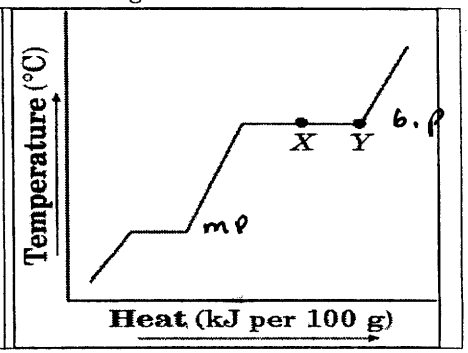
5. A piece of metal is heated in a Bunsen burner flame and then immersed in a beaker of cool water. Which statement BEST describes the effect of the temperature change on the kinetic energy of the particles?



   a. Kinetic energy of the metal atoms decreases in the flames.
   b. Kinetic energy of the water molecules increases when the heated metal is immersed.
   c. Kinetic energy of the water molecules decreases when the heated metal is immersed.
   d. Kinetic energy of the metal atoms increases when immersed in the cooler water.

6. The gases helium, neon, and argon are in separate containers at 55°C. Which is true about the kinetic energy of the gases?
   a. Helium has the lowest mass and therefore the greatest kinetic energy.
   b. The have different kinetic energies.
   c. Argon has the greatest mass and therefore the greatest kinetic energy.
   d. They all have the same average kinetic energies.

7. A particular substance has the heating curve shown on the right. Between points *X* and *Y*, which would be observed?
   a. Solid and liquid will be present.
   b. Only vapor will be present.
   c. Liquid and vapor will be present.
   d. Only liquid will be present.



8. An open container of water is brought to a boil and heated until all of the water is converted to water vapor. Which describes the changes in the water molecules?
   a. The molecules speed up and move farther apart.
   b. The molecules speed up and move closer together.
   c. The molecules slow down and move farther apart.
   d. The molecules slow down and move closer together.

9. How much heat was applied to gold if 6.00g of gold is heated from 20.0°C to 22.0°C? a. 1.55 J b. 15.5 J c. 17.0 J d. 32.5 J

10. A student has a beaker containing 55 g of water at 100°C. How much heat is needed to convert the water to steam?
    a. 120,000 J b. 18,000 J c. 2,200 J d. 330 J

11. How many grams of ice will melt at 0°C if the ice absorbs 420.0 J of energy?
    a. 0.186 g b. 0.795 g c. 1.26 g d. 5.38 x 10^4g

9. $Q = mC_p\Delta T$ C_p gold
$= 60.0g \times 0.13\frac{J}{g°C} 2°C = 15.6\ J$

10. $Q = \frac{55g \times 4.18J}{g°C}$ ΔH_v

10. $Q = m H_v = \frac{55g}{1g} \frac{2260}{}$
$= 124,300\ J$

11. $Q = mH_f$
$420J = m\ \frac{334\ J}{1g}$
$\frac{420}{334} = m$
$1.257 = m = 1.26$

Goal # cont

Specific Heat Table	
Substance	**Specific Heat**
Aluminum	0.90 J/g•°C
Calcium	0.65 J/g•°C
Copper	0.39 J/g•°C
Gold	0.13 J/g•°C
Iron	0.46 J/g•°C
Mercury	0.14 J/g•°C
Silver	0.24 J/g•°C

12. An 18.0 g piece of an unknown metal was heated from 21.5°C to 89.0 °C. If 292 J of heat energy was absorbed by the metal in the heating process, what was the identity of the metal? Use the Table on the left to determine the identity of the metal. $\Delta T = 67.5$

$292\,J = (18.0\,g)(C_p)(67.5)$

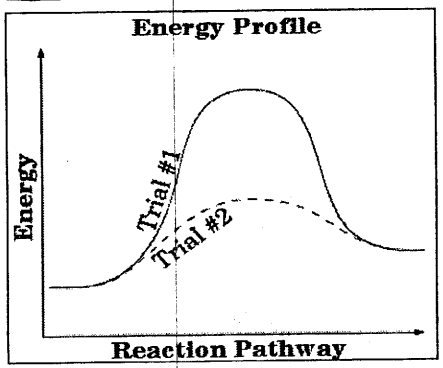
$0.240\,J = C_p$

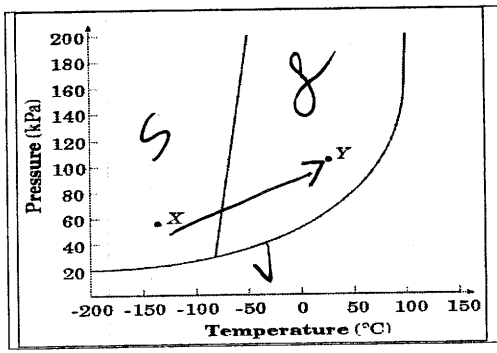
$g°C$

a. calcium
b. copper
c. iron
d. silver

13. The graph represents the change in energy for two laboratory trials of the same reaction. Which factor could explain the energy difference between the trials?

a. Heat was added to trial #2
b. A catalyst was added to trial #2
c. Trial #1 was stirred
d. Trial #1 was cooled



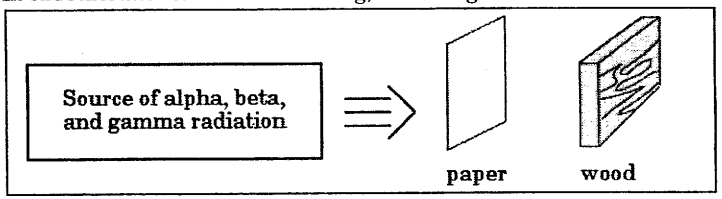


14. Refer to the phase diagram shown on the left to determine what process is occurring when a substance changes from point *X* (50 kPa and -130°C) to point *Y* (100 kPa and 30°C)?

a. boiling
c. melting
b. freezing
d. sublimation

15. When a chemical cold pack is activated, it becomes cool to the touch. What is happening in terms of energy? abs

a. An exothermic reaction is occurring, absorbing cold from its surroundings.
b. An exothermic reaction is occurring, releasing heat to its surroundings.
c. An endothermic reaction is occurring, releasing cold to its surroundings.
d. An endothermic reaction is occurring, absorbing heat from its surroundings.



16. Consider the diagram above. Which of the three types of radiation will penetrate the paper and wood?

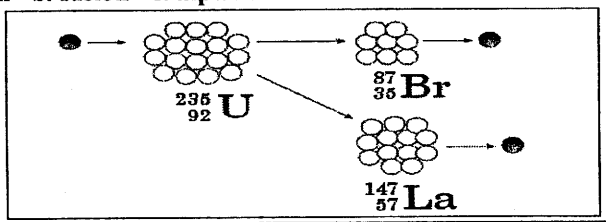
a. ~~alpha~~, beta, gamma
c. gamma only
b. ~~alpha~~ and beta only
d. beta only

17. The half-life of phosphorus-32 is 14.30 days. How many milligrams of a 20.0 mg sample will remain after 85.80 days? 6 ½ L

a. 3.333 mg b. 0.6250 mg c. 0.3125 mg d. 0.1563 mg

18. In the figure below, what type of nuclear activity is represented?

a. fission b. fusion c. alpha emission d. beta emission



19. Which particle will complete the reaction shown on the right?

$^{59}_{27}Co + {}^{1}_{0}n \rightarrow {}^{60}_{27}Co$ (neutron)

b. neutron
c. nucleus
d. proton

20. Which of these will complete this equation?

$^{238}_{92}U \rightarrow {}^{234}_{90}Th + \alpha$

A $^{0}_{-1}e$
B $^{0}_{0}\gamma$
C $^{1}_{1}H$
D $^{4}_{2}He$

17. $20 \xrightarrow{1} 10 \xrightarrow{2} 5 \xrightarrow{3} 2.5 \xrightarrow{4} 1.25 \xrightarrow{5} 0.613$

0.311

2^4

β decay $= n \rightarrow p + e^-$ particle

mass stays same
p increases

Chemistry Goal 5 Released Questions Name _____

1. Consider this reaction: $NH_3(g) + HCl(g) \rightarrow NH_4Cl(s)$
Which type of reaction does this equation represent?
a. combustion b. decomposition c. single replacement d. synthesis

2. Which equation represents a single replacement reaction that can occur?
a. $F_2 + 2NaCl \rightarrow 2NaF + Cl_2$ c. $Cu + 2NaCl \rightarrow CuCl_2 + 2Na$
b. $Cl_2 + 2NaF \rightarrow 2NaCl + F_2$ d. $Zn + 2NaF \rightarrow ZnF_2 + 2Na$

3. What products are formed when the metal potassium is added to water?
a. K and H_2O b. KOH and H_2O c. K_2O and H_2 d. KOH and H_2

4. When Na_2O reacts with H_2O, what is produced?
a. $HNaO_2$ b. $Na + H_2O$ c. $NaO + H_2$ d. NaOH

5. Which equation is correctly balanced?
a. $Cu + H_2SO_4 \rightarrow CuSO_4 + H_2O + SO_2$ c. $2Fe + 3O_2 \rightarrow Fe_2O_3$
b. $2Na + 2H_2O \rightarrow 2NaOH + H_2$ d. $4Cu + S_8 \rightarrow 8Cu_2S$

6. What coefficients are required to balance this equation?
$1\ Fe_2O_3 + 3\ CO \rightarrow 2\ Fe + 3\ CO_2$
a. 2, 6, 3, 6 b. 1, 3, 2, 3 c. 1, 1, 2, 1 d. 1, 1, 2, 1

7. An aqueous solution of silver nitrate is added to an aqueous solution of iron (II) chloride. Which is the net ionic equation for the reaction that occurs?
a. $AgNO_2(aq) + FeCl(aq) \rightarrow AgCl(s) + FeNO_2(aq)$
b. $2AgNO_3(aq) + FeCl_2(aq) \rightarrow 2AgCl(s) + Fe(NO_3)_2(aq)$
c. $2Ag^{+1}(aq) + NO_3^{-1}(aq) + Fe^{+2}(aq) + Cl_2(g) \rightarrow 2AgCl(s)$
d. $2Ag^{+1}(aq) + 2Cl^{-1}(aq) \rightarrow 2AgCl(s)$

8. Which example indicates that a chemical change has occurred?
a. When two aqueous solutions are mixed, a precipitate is formed.
b. As ammonium nitrate dissolves in water, it causes the temperature of the water to decrease.
c. Alcohol evaporates when left in an open container.
d. Water is added to blue (II) chloride solution. The resulting mixture is lighter blue in color.

9. Phenolphthalein is an indicator that turns pink when added to a basic solution. In which solution would phenolphthalein turn pink?
a. NaOH b. HCl c. H_2O d. NaCl

10. A water sample was found to have a pH of 6 at 25°C. What is the hydroxide ion concentration in the water sample?
a. 1×10^{-8} M b. 6×10^{-8} M c. 1×10^{-6} M d. 6×10^{-6} M

11. What is the pH a KOH solution with a [OH-] concentration 1×10^{-4} M?
a. -10 b. -4 c. 4 d. 10

12. In a titration experiment, if 30.0 mL of an HCl solution reacts with 24.6 mL of a 0.50 M NaOH solution, what is the concentration of the HCl solution?
a. 0.41 M b. 0.61 M c. 1.5 M d. 370 M

13. Considering this balanced chemical equation, which applied stress will increase the rate of reaction? $2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$
a. increasing the pressure on the reaction
b. decreasing concentration of the reactants
c. adding a catalyst to the reaction
d. decreasing the temperature of the reaction

14. For the reaction: A+ (aq) + B- (aq) → AB (s) increasing the temperature increases the rate of reaction. Which is the BEST explanation for this happening?
a. The pressure increases, which in turn increases the production of products.
b. The concentration of reactants increases with an increase in the temperature.
c. The average kinetic energy increases the likelihood of more effective collisions between ions.
d. Systems are more stable at high temperatures.

15. The speed of some reactions is increased when the surface area of one or all the reactants is increased because increasing surface area....
a. changes the electronegativity of the reactant particles.
b. changes the concentration of the reactant particles.
c. changes the conductivity of the reactant particles.
d. enables more reactant particles to collide.

12. $M_aV_a = M_bV_b$
$M_a(30.0\text{mL}) = (0.50\text{M NaOH})(24.6\text{mL})$
$M_{HCl} = \frac{0.50\text{M} \times 24.6}{30}$
0.41M HCl

Goal 3
Stoichiometry Acid Review

15. % Fe in Fe_2O_3

$2 \times 55.85 = 111.7$
$3 \times 16 = 48$
$159.7\ g/mol$

$$\%\,Fe = \frac{111.7}{159.7} \times 100 = \boxed{69.9\%\ Fe}$$

16. $$4.0\ mol\ Na \left| \frac{1\ mol\ H_2}{2\ mol\ Na} \right. = \boxed{2\ mol\ H_2}$$

17. $$60.0\ g\ Ca_3(PO_4)_2 \left| \frac{1.0\ mol\ Ca_3(PO_4)_2}{310\ g\ Ca_3(PO_4)_2} \right. = \boxed{0.194\ mol\ Ca_3(PO_4)_2}$$

Mass → mol problem

$3 \times 40 = 120$
$2 \times 30.97 = 61.94$
$8 \times 16 = 128$
$309.94 = 310\ g/mol$

$Ca_3(PO_4)_2$: $3 \times 40 = 120$, $2 \times 31 = 62$, $8 \times 16 = 128$, $310\ g/mol$

18. $2H_2O_{(l)} \rightarrow 2H_{2(g)} + O_{2(g)}$

$$22.4\ L\ O_2 \left| \frac{1.0\ mol\ O_2}{22.4\ L\ O_2} \right. \left| \frac{2\ mol\ H_2O}{1\ mol\ O_2} \right. \left| \frac{18.0\ g\ H_2O}{1\ mol\ H_2O} \right. = \boxed{36.0\ g\ H_2O}$$

19. $3\ Mg_{(s)} + 2H_3PO_{4(aq)} \rightarrow Mg_3(PO_4)_{2(s)} + 3H_{2(g)}$

$5.40\ g$

$$5.40\ g\ Mg \left| \frac{1\ mol\ Mg}{24.3\ g\ Mg} \right. \left| \frac{1\ mol\ Mg_3(PO_4)_2}{3\ mol\ Mg} \right. \left| \frac{262.9\ g\ Mg_3(PO_4)_2}{1\ mol\ Mg_3(PO_4)_2} \right. = \boxed{19.4\ g\ Mg_3(PO_4)_2}$$

Goal 3 Acid Review

2. $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

9.36 L 2 L

$$\frac{9.36\ \text{L}\ CH_4}{1\ \text{L}\ CH_4} \left| \frac{1\ \text{L}\ CO_2}{1\ \text{L}\ CH_4} \right. = 9.3\ \text{L}\ CO_2$$

↑ similar to Mole Ratio but simpler if all are gases coefficients can be L

$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

2 Fe		2 Fe	
~~5~~ 4 O	6	~~4~~ 2 O	6
~~2~~ 1 C	3	~~1~~ 2 C	3