Name _____

Date _____

Class Period _____

Dimensional Analysis Worksheet

Set up and solve the following using dimensional analysis.

1 mile = 5,280 ft
1 inch = 2.54 cm
3 feet = 1 yard
454 g = 1lb
946 mL = 1 qt
4 qt = 1 gal

Don't forget: $\frac{\text{What you want}}{\text{What you've got}}$

1) 5,400 inches to miles

2) 16 weeks to seconds

3) 54 yards to mm

4) 36 cm/sec to mph

5) 1.09 g/mL to lbs/gal

6) 19 inches to feet

7) 840 inches to cm

8) 4.22 g/cm to lbs./ft

9) 32 ft/sec to meters/min

10) Write, and then solve your own dimensional analysis problem. Be creative!

WRITING FORMULAS FROM NAMES

Name _____

Write the formulas of the following compounds.

1. ammonium phosphate _____
2. iron (II) oxide _____
3. iron (III) oxide _____
4. carbon monoxide _____
5. calcium chloride _____
6. potassium nitrate _____
7. magnesium hydroxide _____
8. aluminum sulfate _____
9. copper (II) sulfate _____
10. lead (IV) chromate _____
11. diphosphorus pentoxide _____
12. potassium permanganate _____
13. sodium hydrogen carbonate _____
14. zinc nitrate _____
15. aluminum sulfite _____

GRAM FORMULA MASS

Name _____

Determine the gram formula mass (the mass of one mole) of each compound below.

1. $KMnO_4$ _____
2. KCl _____
3. Na_2SO_4 _____
4. $Ca(NO_3)_2$ _____
5. $Al_2(SO_4)_3$ _____
6. $(NH_4)_3PO_4$ _____
7. $CuSO_4 \cdot 5H_2O$ _____
8. $Mg_3(PO_4)_2$ _____
9. $Zn(C_2H_3O_2)_2 \cdot 2H_2O$ _____
10. $Zn_3(PO_4)_2 \cdot 4H_2O$ _____
11. H_2CO_3 _____
12. $Hg_2Cr_2O_7$ _____
13. $Ba(ClO_3)_2$ _____
14. $Fe_2(SO_3)_3$ _____
15. $NH_4C_2H_3O_2$ _____

THE MOLE AND VOLUME

Name _____

For gases at STP (273 K and 1 atm pressure), one mole occupies a volume of 22.4 L. What volume will the following quantities of gases occupy at STP?

1. 1.00 mole of H_2
2. 3.20 moles of O_2
3. 0.750 mole of N_2
4. 1.75 moles of CO_2
5. 0.50 mole of NH_3
6. 5.0 g of H_2
7. 100. g of O_2
8. 28.0 g of N_2
9. 60. g of CO_2
10. 10. g of NH_3

THE MOLE AND AVOGADRO'S NUMBER

Name _____

One mole of a substance contains Avogadro's Number (6.02×10^{23}) of molecules.

How many molecules are in the quantities below?

1. 2.0 moles
2. 1.5 moles
3. 0.75 mole
4. 15 moles
5. 0.35 mole

How many moles are in the number of molecules below?

1. 6.02×10^{23}
2. 1.204×10^{24}
3. 1.5×10^{20}
4. 3.4×10^{26}
5. 7.5×10^{19}

MIXED MOLE PROBLEMS

Name _____

Solve the following problems.

1. How many grams are there in 1.5×10^{25} molecules of CO_2?

2. What volume would the CO_2 in Problem 1 occupy at STP?

3. A sample of NH_3 gas occupies 75.0 liters at STP. How many molecules is this?

4. What is the mass of the sample of NH_3 in Problem 3?

5. How many atoms are there in 1.3×10^{22} molecules of NO_2?

6. A 5.0 g sample of O_2 is in a container at STP. What volume is the container?

7. How many molecules of O_2 are in the container in Problem 6? How many atoms of oxygen?

MOLES AND MASS

Name _____

Determine the number of moles in each of the quantities below.

1. 25 g of NaCl

2. 125 g of H_2SO_4

3. 100. g of $KMnO_4$

4. 74 g of KCl

5. 35 g of $CuSO_4 \cdot 5H_2O$

Determine the number of grams in each of the quantities below.

1. 2.5 moles of NaCl

2. 0.50 moles of H_2SO_4

3. 1.70 moles of $KMnO_4$

4. 0.25 moles of KCl

5. 3.2 moles of $CuSO_4 \cdot 5H_2O$

WORD EQUATIONS

Name _____

Write the word equations below as chemical equations and balance.

1. zinc + lead (II) nitrate yield zinc nitrate + lead

2. aluminum bromide + chlorine yield aluminum chloride + bromine

3. sodium phosphate + calcium chloride yield calcium phosphate + sodium chloride

4. potassium chlorate when heated yields potassium chloride + oxygen gas

5. aluminum + hydrochloric acid yield aluminum chloride + hydrogen gas

6. calcium hydroxide + phosphoric acid yield calcium phosphate + water
   H_3PO_4

7. copper + sulfuric acid yield copper (II) sulfate + water + sulfur dioxide

8. hydrogen + nitrogen monoxide yield water + nitrogen

GRAM FORMULA MASS

Name _____

Determine the gram formula mass (the mass of one mole) of each compound below.

1. $KMnO_4$ _____
2. KCl _____
3. Na_2SO_4 _____
4. $Ca(NO_3)_2$ _____
5. $Al_2(SO_4)_3$ _____
6. $(NH_4)_3PO_4$ _____
7. $CuSO_4 \cdot 5H_2O$ _____
8. $Mg_3(PO_4)_2$ _____
9. $Zn(C_2H_3O_2)_2 \cdot 2H_2O$ _____
10. $Zn_3(PO_4)_2 \cdot 4H_2O$ _____
11. H_2CO_3 _____
12. $Hg_2Cr_2O_7$ _____
13. $Ba(ClO_3)_2$ _____
14. $Fe_2(SO_3)_3$ _____
15. $NH_4C_2H_3O_2$ _____

BALANCING CHEMICAL EQUATIONS

Name _____

~~Rewrite and balance the equations below.~~ Write the Reaction Type for each.

1. $N_2 + H_2 \rightarrow NH_3$ _____
2. $KClO_3 \rightarrow KCl + O_2$ _____
3. $NaCl + F_2 \rightarrow NaF + Cl_2$ _____
4. $H_2 + O_2 \rightarrow H_2O$ _____
5. $AgNO_3 + MgCl_2 \rightarrow AgCl + Mg(NO_3)_2$ _____
6. $AlBr_3 + K_2SO_4 \rightarrow KBr + Al_2(SO_4)_3$ _____
7. $CH_4 + O_2 \rightarrow CO_2 + H_2O$ _____
8. $C_3H_8 + O_2 \rightarrow CO_2 + H_2O$ _____
9. $C_8H_{18} + O_2 \rightarrow CO_2 + H_2O$ _____
10. $FeCl_3 + NaOH \rightarrow Fe(OH)_3 + NaCl$ _____
11. $P + O_2 \rightarrow P_2O_5$ _____
12. $Na + H_2O \rightarrow NaOH + H_2$ _____
13. $Ag_2O \rightarrow Ag + O_2$ _____
14. $S_8 + O_2 \rightarrow SO_3$ _____
15. ~~$CO_2 + H_2O \rightarrow C_6H_{12}O_6 + O_2$~~ _____
16. $K + MgBr_2 \rightarrow KBr + Mg$ _____
17. $HCl + CaCO_3 \rightarrow CaCl_2 + H_2O + CO_2$ _____

Warmup

Write the Chemical Formula for each:

1. Silicon Tetrachloride
2. Aluminum Hydroxide
3. Magnesium Iodide
4. Dinitrogen Trioxide
5. Ammonium Phosphate
6. Barium Sulfide
7. Dioxide Difluoride
8. Aluminum Acetate
9. Iron (III) Oxide

Name the following Compounds:

1. $MgCl_2$
2. BF_3
3. N_2O_5
4. $CaCO_3$
5. Al_2S_3
6. $Mg_3(PO_4)_2$
7. P_4S_6
8. N_2O
9. SnO_2

Warmup: Classify by Type:

$2HgO \rightarrow 2Hg + O_2$

$2KBr + Cl_2 \rightarrow 2KCl + Br_2$

$CaO + H_2O \rightarrow Ca(OH)_2$

$AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$

$C_3H_8 + O_2 \rightarrow CO_2 + H_2O$

Law of Conservation of Mass: Mass can be neither created nor destroyed. It is always conserved.

* Chemical Equations must be balanced.

Balancing Equations

Coefficients are written before each reactant and product to ensure that the amount of each element is conserved.

- Coefficients represent the mole ratios of each substance.
- Must be LOWEST whole number ratio

$Fe + Cl \rightarrow FeCl_3$ Skeleton Equation

* Balance more complex compounds First.

$H_2(g) + O_2(g) \rightarrow H_2O(l)$

$Cu + O_2 \dashrightarrow Cu_2O$

$Mg + P_4 \text{ ---> } Mg_3P_2$

Page 6

$Al + O_2 \rightarrow Al_2O_3$

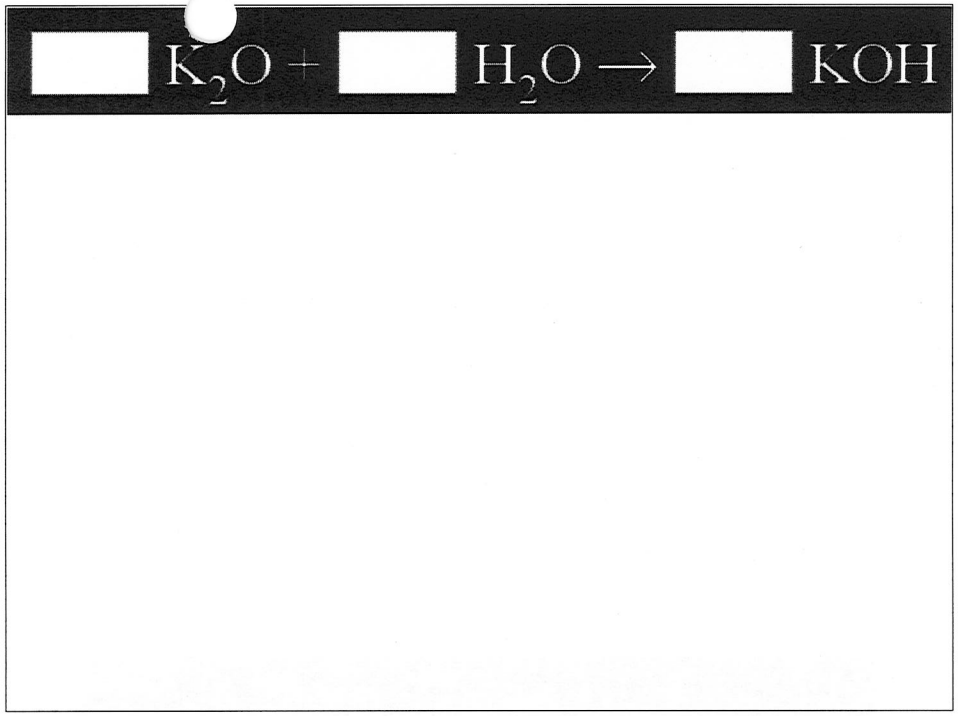
Page 7

$\square\ Fe + \square\ Cl_2 \text{ <==> } \square\ FeCl_3$

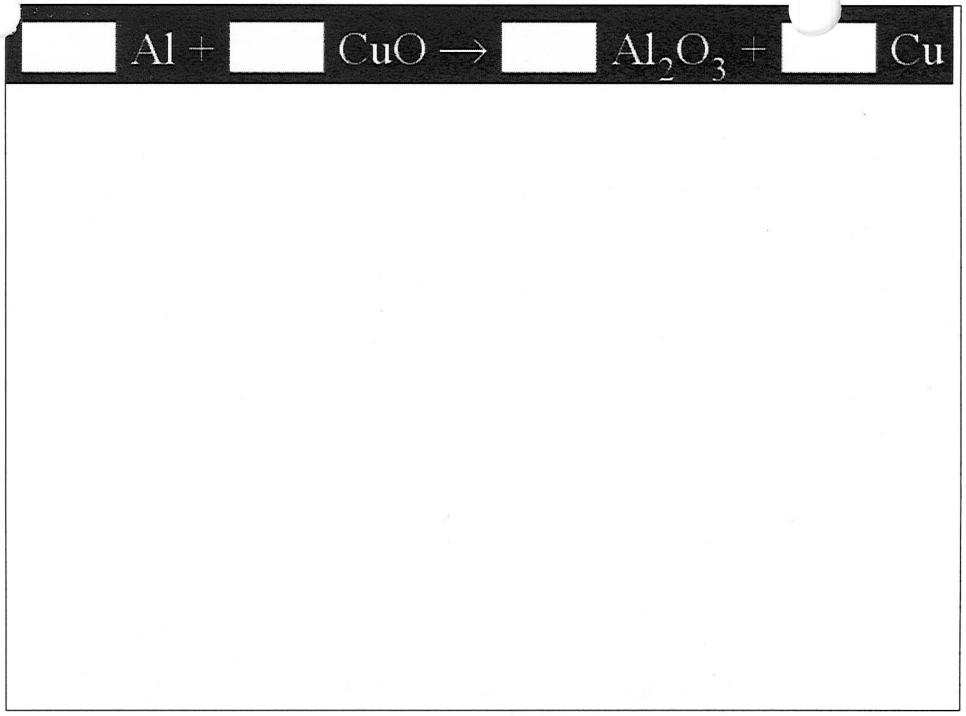
Page 8

$\square\ H_2 + \square\ N_2 \rightleftarrows \square\ NH_3$

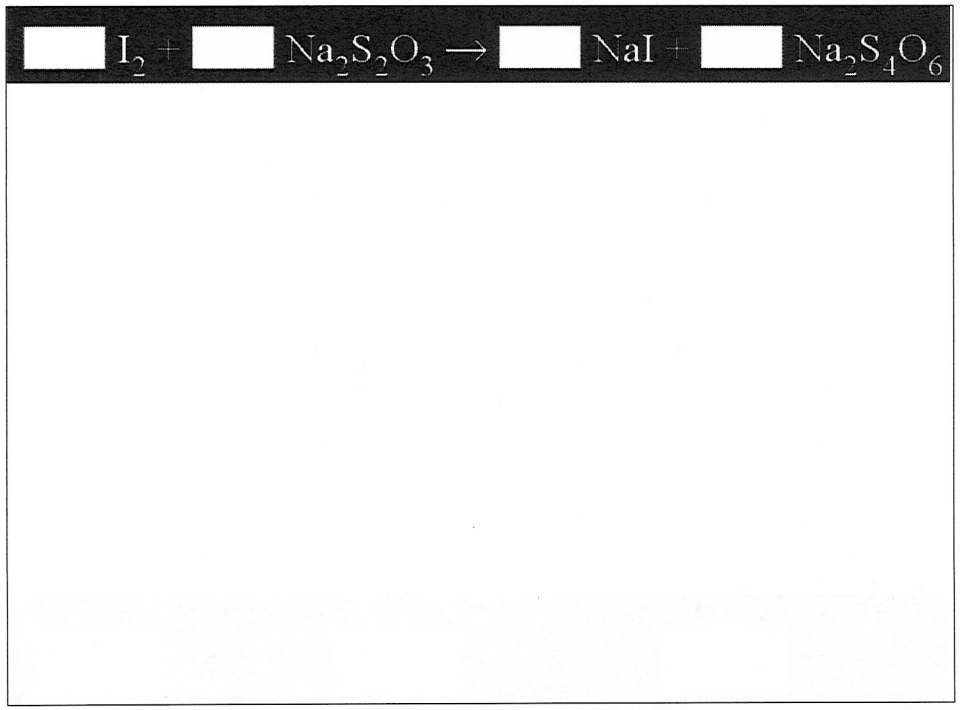
Page 9



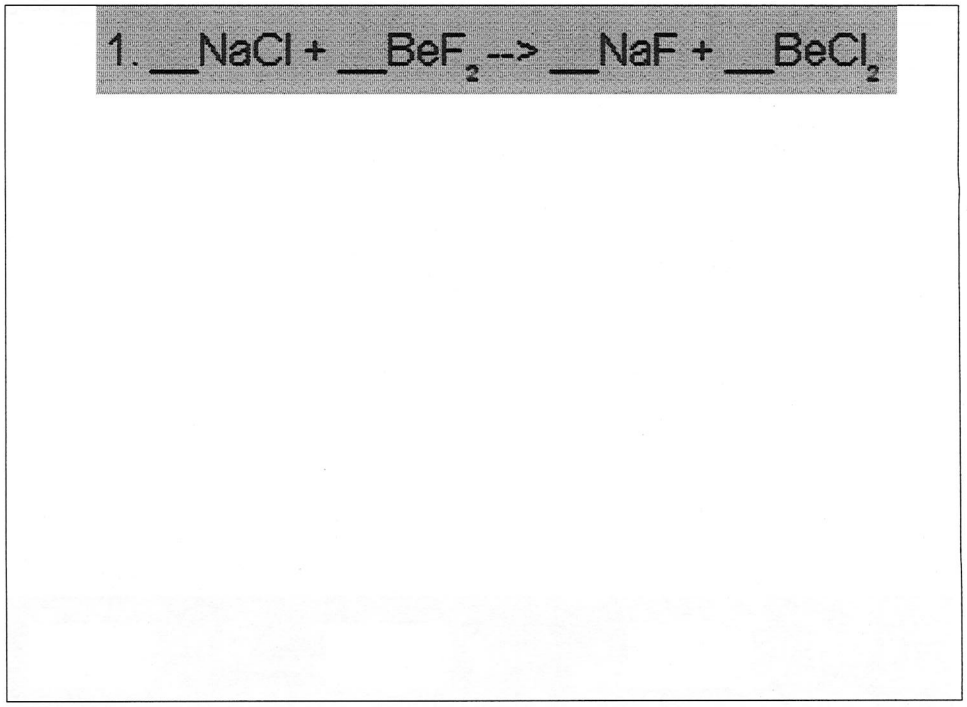
Page 10



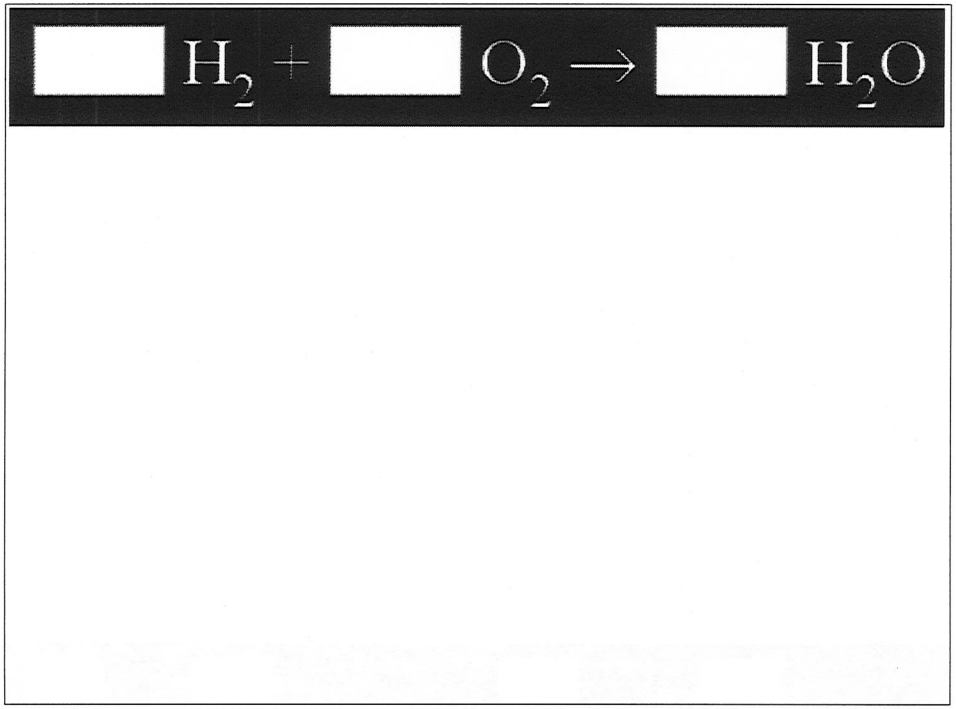
Page 11



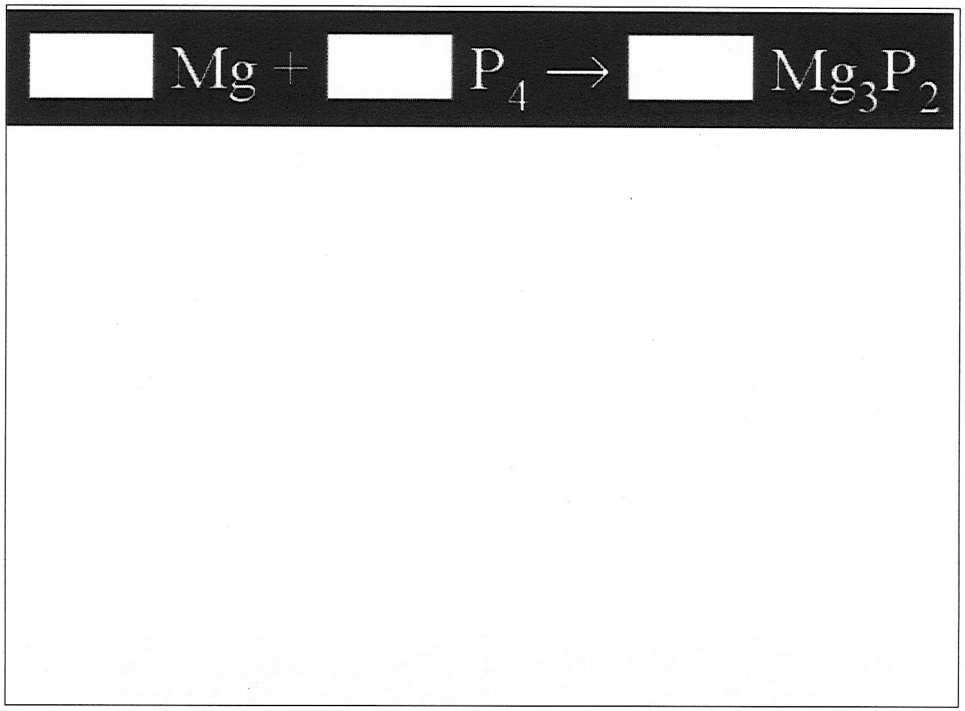
Page 12



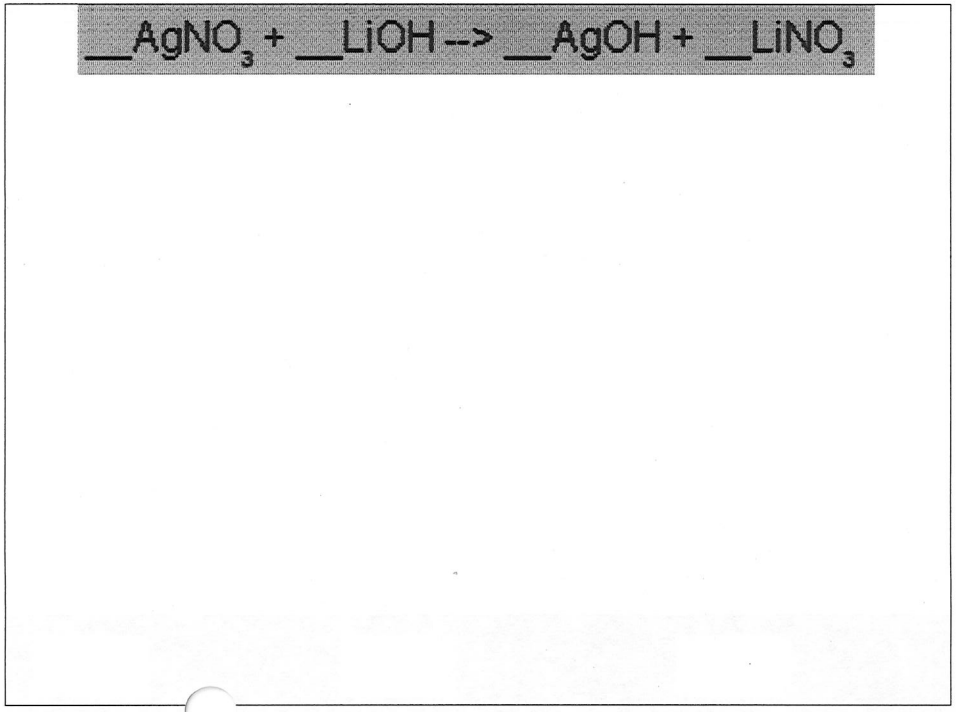
Page 13



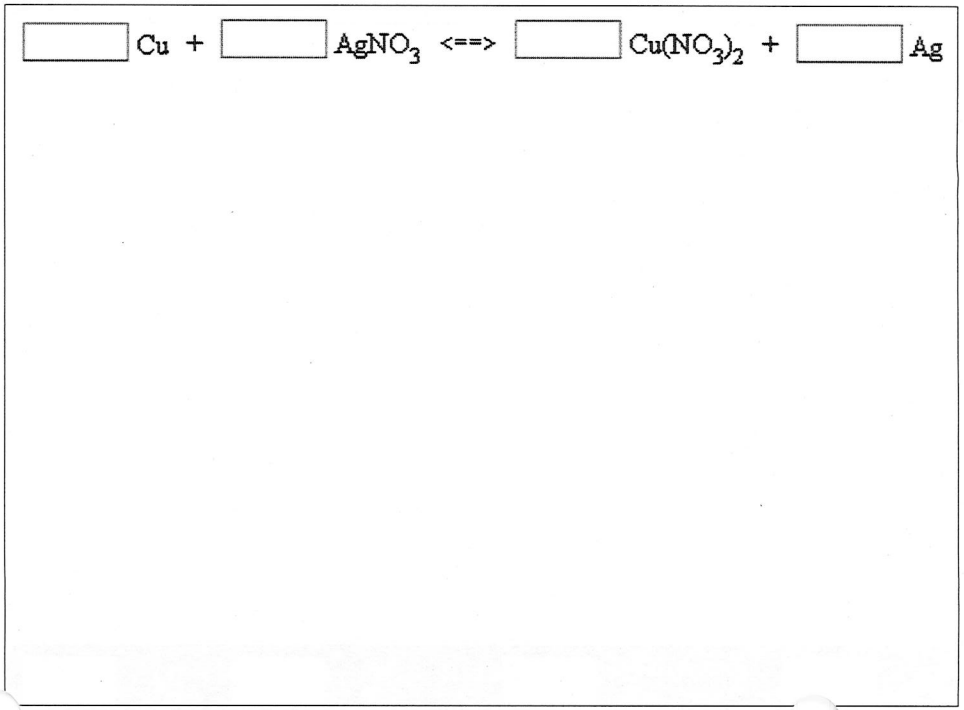
Page 14



Page 15



Page 16



age 17

$\square\ Zn + \square\ HCl \iff \square\ ZnCl_2 + \square\ H_2$

Page 18

$\square\ Pb(NO_3)_2 + \square\ AlCl_3 \iff \square\ PbCl_2 + \square\ Al(NO_3)_3$

Page 19

$$Fe_2O_3 + H_2SO_4 \longrightarrow Fe_2(SO_4)_3 + H_2O$$

Page 20

$\square\ CaCl_2 + \square\ AgNO_3 \rightarrow \square\ AgCl + \square\ Ca(NO_3)_2$

Page 21

$\square\ Fe_2(SO_4)_3 + \square\ KSCN \rightarrow \square\ K_3Fe(SCN)_6 + \square\ K_2SO_4$

Page 22

__$FeCl_3$ + __$Be_3(PO_4)_2$ --> __$BeCl_2$ + __$FePO_4$

Page 23

$C_2H_4 + O_2 \longrightarrow CO_2 + H_2O$

$C_3H_8 + O_2 \rightarrow H_2O + CO_2$

Page 24

Which of the following equations is correctly balanced?

1) $CO + O_2 \rightarrow 2CO_2$
2) $2SO_2 + O_2 \rightarrow SO_3$
3) $CO + 2O_2 \rightarrow CO_2$
4) $2SO_2 + O_2 \rightarrow 2SO_3$

age 25

Reaction Types & Balancing Name _____

Balance the following equations and indicate the type of reaction taking place:

1) ____ NaBr + ____ H_3PO_4 → ____ Na_3PO_4 + ____ HBr

Type of reaction: _____

2) ____ $Ca(OH)_2$ + ____ $Al_2(SO_4)_3$ → ____ $CaSO_4$ + ____ $Al(OH)_3$

Type of reaction: _____

3) ____ Mg + ____ Fe_2O_3 → ____ Fe + ____ MgO

Type of reaction: _____

4) ____ C_2H_4 + ____ O_2 → ____ CO_2 + ____ H_2O

Type of reaction: _____

5) ____ NH_3 + ____ I_2 → ____ N_2I_6 + ____ H_2

Type of reaction: _____

6) ____ H_2SO_4 + ____ NH_4OH → ____ HOH + ____ $(NH_4)_2SO_4$

Type of reaction: _____

7) ____ N_2 + ____ H_2 → ____ NH_3

Type of reaction: _____

Which is a correctly balanced chemical equation?

A $K_2CO_3 + BaCl_2 \rightarrow KCl + BaCO_3$

B $K_2CO_3 + BaCl_2 \rightarrow 2KCl + BaCO_3$

C $K_2CO_3 + 2BaCl_2 \rightarrow 2KCl + BaCO_3$

D $K_2CO_3 + 2BaCl_2 \rightarrow KCl + 2BaCO_3$

Which is the correctly balanced equation?

A $Cl_2 + 2NaI \rightarrow 2NaCl + I_2$

B $Cl_2 + 2NaI \rightarrow NaCl + 2I_2$

C $Cl_2 + NaI \rightarrow NaCl + I_2$

D $2Cl_2 + NaI \rightarrow 2NaCl + I_2$

Name: _____ Class: _____ Date: _____ ID: A

Quiz: Balancing Equations

____ 1. What does the symbol Δ in a chemical equation mean?
a. Heat is supplied to the reaction.
b. A catalyst is needed.
c. yields
d. precipitate

____ 2. In the chemical equation $H_2O_2(aq) \rightarrow H_2O(l) + O_2(g)$, the O_2 is a ____.
a. catalyst
b. solid
c. product
d. reactant

____ 3. This symbol ($\rightleftharpoons$) indicates that ____.
a. heat must be applied
b. an incomplete combustion reaction has occurred
c. a gas is formed by the reaction
d. the reaction is reversible

____ 4. Which of the following is the correct skeleton equation for the reaction that takes place when solid phosphorus combines with oxygen gas to form diphosphorus pentoxide?
a. $P(s) + O_2(g) \rightarrow PO_2(g)$
b. $P(s) + O(g) \rightarrow P_5O_2(g)$
c. $P(s) + O_2(g) \rightarrow P_2O_5(s)$
d. $P_2O_5(s) \rightarrow P_2(s) + O_2(g)$

____ 5. What are the coefficients that will balance the skeleton equation below?
$AlCl_3 + NaOH \rightarrow Al(OH)_3 + NaCl$
a. 1, 3, 1, 3
b. 3, 1, 3, 1
c. 1, 1, 1, 3
d. 1, 3, 3, 1

____ 6. What are the coefficients that will balance the skeleton equation below?
$N_2 + H_2 \rightarrow NH_3$
a. 1, 1, 2
b. 1, 3, 3
c. 3, 1, 2
d. 1, 3, 2

____ 7. When the equation $Fe + Cl_2 \rightarrow FeCl_3$ is balanced, what is the coefficient for Cl_2?
a. 1
b. 2
c. 3
d. 4

____ 8. When the following equation is balanced, what is the coefficient for HCl?
$Mg(s) + HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$
a. 6
b. 3
c. 1
d. 2

____ 9. Chemical equations must be balanced to satisfy ____.
a. the law of definite proportions
b. the law of multiple proportions
c. the law of conservation of mass
d. Avogadro's principle

____ 10. When the equation $KClO_3(s) \rightarrow KCl(s) + O_2(g)$ is balanced, the coefficient of $KClO_3$ is ____.
a. 1
b. 2
c. 3
d. 4

____ 11. What are the missing coefficients for the skeleton equation below?
$Cr(s) + Fe(NO_3)_2(aq) \rightarrow Fe(s) + Cr(NO_3)_3(aq)$

a. 4, 6, 6, 2
b. 2, 3, 2, 3
c. 2, 3, 3, 2
d. 1, 3, 3, 1

____ 12. What are the missing coefficients for the skeleton equation below?
$Al_2(SO_4)_3(aq) + KOH(aq) \rightarrow Al(OH)_3(aq) + K_2SO_4(aq)$

a. 1, 3, 2, 3
b. 2, 12, 4, 6
c. 4, 6, 2, 3
d. 1, 6, 2, 3

____ 13. The reaction $2Fe + 3Cl_2 \rightarrow 2FeCl_3$ is an example of which type of reaction?

a. combustion reaction
b. single-replacement reaction
c. synthesis reaction
d. decomposition reaction

____ 14. The equation $Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$ is an example of which type of reaction?

a. synthesis reaction
b. single-replacement reaction
c. decomposition reaction
d. double-replacement reaction

____ 15. Which of the following is a balanced chemical equation for the synthesis of NaBr from Na and Br_2?

a. $Na + Br_2 \rightarrow NaBr$
b. $2Na + Br_2 \rightarrow NaBr$
c. $Na + Br_2 \rightarrow 2NaBr$
d. $2Na + Br_2 \rightarrow 2NaBr$

____ 16. What is the molar mass of $(NH_4)_2CO_3$?

a. 144 g
b. 138 g
c. 96 g
d. 78 g

____ 17. How many moles of $CaBr_2$ are in 5.0 grams of $CaBr_2$?

a. 2.5×10^{-2} mol
b. 4.2×10^{-2} mol
c. 4.0×10^{1} mol
d. 1.0×10^{3} mol

____ 18. In a chemical reaction, the mass of the products ____.

a. is less than the mass of the reactants
b. is greater than the mass of the reactants
c. is equal to the mass of the reactants
d. has no relationship to the mass of the reactants

____ 19. Hydrogen gas can be produced by reacting aluminum with sulfuric acid. How many moles of sulfuric acid are needed to completely react with 15.0 mol of aluminum?
$2Al(s) + 3H_2SO_4(aq) \rightarrow Al_2(SO_4)_3(aq) + 3H_2(g)$

a. 0.100 mol
b. 10.0 mol
c. 15.0 mol
d. 22.5 mol

____ 20. The equation below shows the decomposition of lead nitrate. How many grams of oxygen are produced when 11.5 g NO_2 is formed?
$2Pb(NO_3)_2(s) \rightarrow 2PbO(s) + 4NO_2(g) + O_2(g)$

a. 1.00 g
b. 2.00 g
c. 2.88 g
d. 32.0 g

Name: _____ Class: _____ Date: _____ ID: B

Quiz: Balancing Equations

____ 1. What does the symbol Δ in a chemical equation mean?
a. Heat is supplied to the reaction.
b. precipitate
c. A catalyst is needed.
d. yields

____ 2. In the chemical equation $H_2O_2(aq) \rightarrow H_2O(l) + O_2(g)$, the O_2 is a ____.
a. product
b. solid
c. catalyst
d. reactant

____ 3. This symbol ($\rightleftharpoons$) indicates that ____.
a. heat must be applied
b. an incomplete combustion reaction has occurred
c. the reaction is reversible
d. a gas is formed by the reaction

____ 4. Which of the following is the correct skeleton equation for the reaction that takes place when solid phosphorus combines with oxygen gas to form diphosphorus pentoxide?
a. $P(s) + O_2(g) \rightarrow PO_2(g)$
b. $P(s) + O(g) \rightarrow P_5O_2(g)$
c. $P(s) + O_2(g) \rightarrow P_2O_5(s)$
d. $P_2O_5(s) \rightarrow P_2(s) + O_2(g)$

____ 5. What are the coefficients that will balance the skeleton equation below?
$AlCl_3 + NaOH \rightarrow Al(OH)_3 + NaCl$
a. 1, 1, 1, 3
b. 3, 1, 3, 1
c. 1, 3, 3, 1
d. 1, 3, 1, 3

____ 6. What are the coefficients that will balance the skeleton equation below?
$N_2 + H_2 \rightarrow NH_3$
a. 1, 1, 2
b. 3, 1, 2
c. 1, 3, 2
d. 1, 3, 3

____ 7. When the equation $Fe + Cl_2 \rightarrow FeCl_3$ is balanced, what is the coefficient for Cl_2?
a. 4
b. 2
c. 3
d. 1

____ 8. When the following equation is balanced, what is the coefficient for HCl?
$Mg(s) + HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$
a. 2
b. 6
c. 3
d. 1

____ 9. Chemical equations must be balanced to satisfy ____.
a. Avogadro's principle
b. the law of conservation of mass
c. the law of multiple proportions
d. the law of definite proportions

____ 10. When the equation $KClO_3(s) \rightarrow KCl(s) + O_2(g)$ is balanced, the coefficient of $KClO_3$ is ____.
a. 1
b. 3
c. 4
d. 2

____ 11. What are the missing coefficients for the skeleton equation below?
$Cr(s) + Fe(NO_3)_2(aq) \rightarrow Fe(s) + Cr(NO_3)_3(aq)$

a. 2, 3, 3, 2
b. 1, 3, 3, 1
c. 4, 6, 6, 2
d. 2, 3, 2, 3

____ 12. What are the missing coefficients for the skeleton equation below?
$Al_2(SO_4)_3(aq) + KOH(aq) \rightarrow Al(OH)_3(aq) + K_2SO_4(aq)$

a. 4, 6, 2, 3
b. 1, 3, 2, 3
c. 2, 12, 4, 6
d. 1, 6, 2, 3

____ 13. The reaction $2Fe + 3Cl_2 \rightarrow 2FeCl_3$ is an example of which type of reaction?

a. combustion reaction
b. single-replacement reaction
c. synthesis reaction
d. decomposition reaction

____ 14. The equation $Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$ is an example of which type of reaction?

a. decomposition reaction
b. double-replacement reaction
c. single-replacement reaction
d. synthesis reaction

____ 15. Which of the following is a balanced chemical equation for the synthesis of NaBr from Na and Br_2?

a. $2Na + Br_2 \rightarrow 2NaBr$
b. $Na + Br_2 \rightarrow 2NaBr$
c. $Na + Br_2 \rightarrow NaBr$
d. $2Na + Br_2 \rightarrow NaBr$

____ 16. What is the molar mass of $(NH_4)_2CO_3$?

a. 138 g
b. 144 g
c. 96 g
d. 78 g

____ 17. How many moles of $CaBr_2$ are in 5.0 grams of $CaBr_2$?

a. 1.0×10^3 mol
b. 2.5×10^{-2} mol
c. 4.0×10^1 mol
d. 4.2×10^{-2} mol

____ 18. In a chemical reaction, the mass of the products ____.

a. is less than the mass of the reactants
b. is greater than the mass of the reactants
c. is equal to the mass of the reactants
d. has no relationship to the mass of the reactants

____ 19. Hydrogen gas can be produced by reacting aluminum with sulfuric acid. How many moles of sulfuric acid are needed to completely react with 15.0 mol of aluminum?
$2Al(s) + 3H_2SO_4(aq) \rightarrow Al_2(SO_4)_3(aq) + 3H_2(g)$

a. 0.100 mol
b. 10.0 mol
c. 15.0 mol
d. 22.5 mol

____ 20. The equation below shows the decomposition of lead nitrate. How many grams of oxygen are produced when 11.5 g NO_2 is formed?
$2Pb(NO_3)_2(s) \rightarrow 2PbO(s) + 4NO_2(g) + O_2(g)$

a. 1.00 g
b. 32.0 g
c. 2.00 g
d. 2.88 g

STOICHIOMETRY: MIXED PROBLEMS

Name _____

1. $N_2 + 3H_2 \rightarrow 2NH_3$
   What volume of NH_3 at STP is produced if 25.0 g of N_2 is reacted with an excess of H_2?

   _____

2. $2KClO_3 \rightarrow 2KCl + 3O_2$
   If 5.0 g of $KClO_3$ is decomposed, what volume of O_2 is produced at STP?

   _____

3. How many grams of KCl are produced in Problem 2?

   _____

4. $Zn + 2HCl \rightarrow ZnCl_2 + H_2$
   What volume of hydrogen at STP is produced when 2.5 g of zinc react with an excess of hydrochloric acid?

   _____

5. $H_2SO_4 + 2NaOH \rightarrow H_2O + Na_2SO_4$
   How many molecules of water are produced if 2.0 g of sodium sulfate are produced in the above reaction?

   _____

6. $2AlCl_3 \rightarrow 2Al + 3Cl_2$
   If 10.0 g of aluminum chloride are decomposed, how many molecules of Cl_2 are produced?

   _____

STOICHIOMETRY: MOLE-MOLE PROBLEMS

Name _____

1. $N_2 + 3H_2 \rightarrow 2NH_3$
   How many moles of hydrogen are needed to completely react with two moles of nitrogen?

   _____

2. $2KClO_3 \rightarrow 2KCl + 3O_2$
   How many moles of oxygen are produced by the decomposition of six moles of potassium chlorate?

   _____

3. $Zn + 2HCl \rightarrow ZnCl_2 + H_2$
   How many moles of hydrogen are produced from the reaction of three moles of zinc with an excess of hydrochloric acid?

   _____

4. $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$
   How many moles of oxygen are necessary to react completely with four moles of propane (C_3H_8)?

   _____

5. $K_3PO_4 + Al(NO_3)_3 \rightarrow 3KNO_3 + AlPO_4$
   How many moles of potassium nitrate are produced when two moles of potassium phosphate react with two moles of aluminum nitrate?

   _____

STOICHIOMETRY: VOLUME-VOLUME PROBLEMS

Name _____

1. $N_2 + 3H_2 \rightarrow 2NH_3$

   What volume of hydrogen is necessary to react with five liters of nitrogen to produce ammonia? (Assume constant temperature and pressure.)

   _____

2. What volume of ammonia is produced in the reaction in Problem 1?

   _____

3. $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

   If 20 liters of oxygen are consumed in the above reaction, how many liters of carbon dioxide are produced?

   _____

4. $2H_2O \rightarrow 2H_2 + O_2$

   If 30 mL of hydrogen are produced in the above reaction, how many milliliters of oxygen are produced?

   _____

5. $2CO + O_2 \rightarrow 2CO_2$

   How many liters of carbon dioxide are produced if 75 liters of carbon monoxide are burned in oxygen? How many liters of oxygen are necessary?

   _____

   _____

STOICHIOMETRY: MASS-MASS PROBLEMS

Name _____

1. $2KClO_3 \rightarrow 2KCl + 3O_2$

   How many grams of potassium chloride are produced if 25 g of potassium chlorate decompose?

   _____

2. $N_2 + 3H_2 \rightarrow 2NH_3$

   How many grams of hydrogen are necessary to react completely with 50.0 g of nitrogen in the above reaction?

   _____

3. How many grams of ammonia are produced in the reaction in Problem 2?

   _____

4. $2AgNO_3 + BaCl_2 \rightarrow 2AgCl + Ba(NO_3)_2$

   How many grams of silver chloride are produced from 5.0 g of silver nitrate reacting with an excess of barium chloride?

   _____

5. How much barium chloride is necessary to react with the silver nitrate in Problem 4?

   _____

STOICHIOMETRY QUIZ

How many molecules are in 10g of Magnesium Phosphate?

How many moles of water are produced from 70 moles of hydrogen gas?

$2H_2 + O_2 \rightarrow 2H_2O$

How many molecules of aluminum are needed to react with 64L of oxygen gas?

$4\ Al_{(s)} + 3\ O_{2(g)} \longrightarrow 2\ Al_2O_{3(s)}$

How many grams of ammonia are produced by 60g of nitrogen gas?

$N_{2(g)} + 3\ H_{2(g)} \longrightarrow 2\ NH_{3(g)}$

How many moles of water form when 100g of propane is combusted in an excess of oxygen?

$C_3H_{8(g)} + 5\ O_{2(g)} \longrightarrow 4\ H_2O_{(g)} + 3\ CO_{2(g)}$

STOICHIOMETRY QUIZ

What is the mass of 3.5×10^{19} molecules of Calcium Phosphate?

How many moles of water are produced from 3 moles of hydrogen gas?

$2H_2 + O_2 \rightarrow 2H_2O$

How many molecules of aluminum oxide are produced from 64L of oxygen gas?

$4\ Al_{(s)} + 3\ O_{2(g)} \longrightarrow 2\ Al_2O_{3(s)}$

How many grams of ammonia are produced by 100g of nitrogen gas?

$N_{2(g)} + 3\ H_{2(g)} \longrightarrow 2\ NH_{3(g)}$

How many moles of carbon dioxide form when 700g of propane is combusted in an excess of oxygen?

$C_3H_{8(g)} + 5\ O_{2(g)} \longrightarrow 4\ H_2O_{(g)} + 3\ CO_{2(g)}$

RCENTAGE COMPOSITION

Name _____

ermine the percentage composition of each of the compounds below.

$KMnO_4$

K = _____

Mn = _____

O = _____

HCl

H = _____

Cl = _____

$Mg(NO_3)_2$

Mg = _____

N = _____

O = _____

$(NH_4)_3PO_4$

N = _____

H = _____

P = _____

O = _____

$Al_2(SO_4)_3$

Al = _____

S = _____

O = _____

---

e the following problems.

How many grams of oxygen can be produced from the decomposition of 100. g of $KClO_3$? _____

How much iron can be recovered from 25.0 g of Fe_2O_3? _____

How much silver can be produced from 125 g of Ag_2S? _____

COMPOSITION OF HYDRATES

Name _____

A hydrate is an ionic compound with water molecules loosely bonded to its crystal structure. The water is in a specific ratio to each formula unit of the salt. For example, the formula $CuSO_4 \bullet 5H_2O$ indicates that there are five water molecules for every one formula unit of $CuSO_4$. Answer the questions below.

1. What percentage of water is found in $CuSO_4 \bullet 5H_2O$?

_____

2. What percentage of water is found in $Na_2S \bullet 9H_2O$?

_____

3. A 5.0 g sample of a hydrate of $BaCl_2$ was heated, and only 4.3 g of the anhydrous salt remained. What percentage of water was in the hydrate?

_____

4. A 2.5 g sample of a hydrate of $Ca(NO_3)_2$ was heated, and only 1.7 g of the anhydrous salt remained. What percentage of water was in the hydrate?

_____

5. A 3.0 g sample of $Na_2CO_3 \bullet H_2O$ is heated to constant mass. How much anhydrous salt remains?

_____

6. A 5.0 g sample of $Cu(NO_3)_2 \bullet nH_2O$ is heated, and 3.9 g of the anhydrous salt remains. What is the value of n?

_____

DETERMINING EMPIRICAL FORMULAS

Name _____

What is the empirical formula (lowest whole number ratio) of the compounds below?

1. 75% carbon, 25% hydrogen

_____

2. 52.7% potassium, 47.3% chlorine

_____

3. 22.1% aluminum, 25.4% phosphorus, 52.5% oxygen

_____

4. 13% magnesium, 87% bromine

_____

5. 32.4% sodium, 22.5% sulfur, 45.1% oxygen

_____

6. 25.3% copper, 12.9% sulfur, 25.7% oxygen, 36.1% water

_____

DETERMINING MOLECULAR FORMULAS (TRUE FORMULAS)

Name _____

Solve the problems below.

1. The empirical formula of a compound is NO_2. Its molecular mass is 92 g/mol. What is its molecular formula?

_____

2. The empirical formula of a compound is CH_2. Its molecular mass is 70 g/mol. What is its molecular formula?

_____

3. A compound is found to be 40.0% carbon, 6.7% hydrogen and 53.5% oxygen. Its molecular mass is 60. g/mol. What is its molecular formula?

_____

4. A compound is 64.9% carbon, 13.5% hydrogen and 21.6% oxygen. Its molecular mass is 74 g/mol. What is its molecular formula?

_____

5. A compound is 54.5% carbon, 9.1% hydrogen and 36.4% oxygen. Its molecular mass is 88 g/mol. What is its molecular formula?

_____

Find the percent oxygen in $Mg(NO_3)_2$.

If you had a 2500g sample of the above compound, what mass of oxygen would it contain?

Page 1

A 40g compound of oxygen and nitrogren contains 22g of nitrogen. What is the percent composition of the compound?

Page 2

What is the empirical formula of a compound that is 22.1% Aluminum, 25.4% Phosphorus, and 52.5% Oxygen?

Page 3

What is the molecular formula of a compound with a molar mass of 92 g/mol and an empirical formula of NO_2?

Page 4

A compound is found to be 40% Carbon, 6.7% Hydrogen, and 53.5% Oxygen. Its molecular mass is 60 g/mol. What is its molecular formula?

Page 5

What is the volume of 10mol of NH_3?

How many moles are in 5.3E20 atoms of Xe?

What is the mass of 300mol of H_2SO_4?

Page 6

Balance:

$AlBr_3 + K_2SO_4 \rightarrow KBr + Al_2(SO_4)_3$

Page 7

$2AlBr_3 + 3K_2SO_4 \rightarrow 6KBr + Al_2(SO_4)_3$

How many molecules of Potassium Bromide can be produced from 64g of Aluminum Bromide?

What volume of Potassium Sulfate is needed to produce 55mol of Potassium Bromide?

How many moles of $AlBr_3$ can be made from 50mol KBr?

Page 8

Tell the reaction type for each of the following:

1) $NaOH + KNO_3 \rightarrow NaNO_3 + KOH$
2) $CH_4 + 2\ O_2 \rightarrow CO_2 + 2\ H_2O$
3) $2\ Fe + 6\ NaBr \rightarrow 2\ FeBr_3 + 6\ Na$
4) $CaSO_4 + Mg(OH)_2 \rightarrow Ca(OH)_2 + MgSO_4$
5) $Pb + O_2 \rightarrow PbO_2$
6) $Na_2CO_3 \rightarrow Na_2O + CO_2$

Page 9

Predict Products

$AgNO_3 + MgCl_2 \rightarrow$

Page 10

8 More MSL Problems...

Page 11

How many moles of nitrogen gas are in 135 L of nitrogen gas at Standard Temperature and Pressure (STP)?

A **4.82 moles of N_2**

B **5.53 moles of N_2**

C **6.02 moles of N_2**

D **9.64 moles of N_2**

Page 12

The chemical equation below represents an unbalanced chemical reaction:

$$Fe + O_2 \rightarrow Fe_2O_3$$

When the equation is balanced, what coefficient is needed for Fe_2O_3?

A 1

B 2

C 3

D 4

Page 13

When $AgNO_3$ (*aq*) is mixed with NaCl (*aq*), which type of reaction will occur?

A single replacement

B synthesis

C decomposition

D double replacement

Page 14

How much mass is in a 3.25-mole sample of NH_4OH?

A 10.8 g

B 34.0 g

C 35.1 g

D 114 g

Page 15

The equation below represents a balanced chemical reaction:

$$2Mg\ (s) + O_2\ (g) \rightarrow 2MgO\ (s)$$

How many moles of MgO are produced when 7.2 moles of O_2 react with excess Mg?

A 3.6 moles

B 14 moles

C 22 moles

D 29 moles

Page 16

Which represents the formula for iron(III) chromate?

A $Fe_2(CrO_4)_3$

B $Fe_2(CrO_4)_2$

C $Fe_3(CrO_4)_2$

D $Fe_3(CrO_4)_3$

Page 17

What is the IUPAC name for the chemical formula PbO_2?

A lead oxide

B lead(II) oxide

C lead(IV) oxide

D lead dioxide

Page 18

Old Material Review

Page 19

How many protons and electrons are in a $^{64}_{29}Cu^{2+}$ ion?

A 27 protons, 29 electrons

B 27 protons, 31 electrons

C 29 protons, 27 electrons

D 29 protons, 31 electrons

Page 20

What is the name of the compound with the chemical formula $CrCl_3$?

A chromium tetrachloride

B chromium trichloride

C chromium(II) chloride

D chromium(III) chloride

Page 21

If two oxygen atoms combine to make a molecule, what type of bond will they form?

A an ionic bond

B a hydrogen bond

C a double covalent bond

D a metallic bond

Page 22

How does an S^{2-} ion differ from an electrically neutral sulfur atom?

A mass number

B atomic number

C nuclear charge

D number of electrons

Page 23

A gas under a pressure of 74 mmHg and at a temperature of 75°C occupies a 500.0-L container. How many moles of gas are in the container?

A 1.7 moles

B 7.9 moles

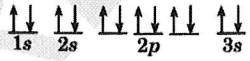
C 13 moles

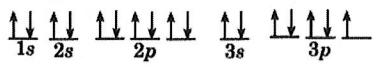
D 59 moles

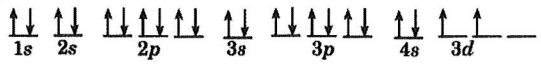
Page 24

Which orbital notation represents an *s*-block element in the third period?

A 

B 

C 

D 

Page 25

What is the volume of 2.00 moles of nitrogen gas (N_2) at STP?

A 11.2 L

B 28.0 L

C 44.8 L

D 56.0 L

Page 26

According to this balanced chemical equation, what volume of C_2H_2 is required to form 40.0 L of CO_2?

$$2C_2H_2(g) + 5O_2(g) \rightarrow 2H_2O(g) + 4CO_2(g)$$

A 20.0 L

B 44.8 L

C 80.0 L

D 100 L

Page 27

In an experiment, 2.62 g of iron react completely with 1.50 g of sulfur. What is the empirical formula for the compound produced?

A FeS

B FeS_2

C Fe_2S

D Fe_2S_3

Page 28

What do the ions K^+, Ca^{2+}, and Cl^- have in common?

A They have the same number of protons.

B They will form covalent bonds with oxygen.

C They have the same electron configuration as argon.

D They are larger than their corresponding atoms.

Page 29

When $^{42}_{19}K$ undergoes radioactive decay, the result is two products, one of which is calcium-42. What is the other product?

A $^{4}_{2}He$

B $^{2}_{4}He$

C $^{1}_{1}e$

D $^{0}_{-1}e$

Page 30

What type of chemical reaction is represented by this balanced equation?

$$S_8\,(s) + 8O_2\,(g) \rightarrow 8SO_2\,(g)$$

A synthesis

B decomposition

C single replacement

D double replacement

Page 31

Which chemical equation is balanced?

A $LiOH + CO_2 \rightarrow Li_2CO_3 + H_2O$

B $2LiOH + CO_2 \rightarrow Li_2CO_3 + H_2O$

C $LiOH + 3CO_2 \rightarrow 2Li_2CO_3 + H_2O$

D $4LiOH + CO_2 \rightarrow Li_2CO_3 + 2H_2O$

Page 32

What is the correct chemical formula for sodium sulfate?

A $NaSO_4$

B Na_2SO_4

C $Na(SO_4)_2$

D $Na_2(SO_4)_2$

Page 33

Which compound contains both covalent and ionic bonds?

A $CaCO_3$

B CO_2

C H_2O

D NaCl

Page 34

Which ***best*** describes the current atomic theory?

A Atoms consist of electrons circling in definite orbits around a positive nucleus.

B Atoms are composed of electrons in a cloud around 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.

Page 35

What is the nuclear composition of uranium-235?

A 92 electrons + 143 protons

B 92 protons + 143 electrons

C 143 protons + 92 neutrons

D 92 protons + 143 neutrons

Page 36

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 number of electrons.

D The number of neutrons is greater than the number of protons.

Page 37

What is the name of the compound PbO_2?

A lead oxide

B lead(II) oxide

C lead oxide(II)

D lead(IV) oxide

Page 38

What is the name of HCl (*aq*)?

A chloric acid

B hydrochloric acid

C hydrogen chloride

D perchloric acid

Page 39

What is the chemical formula for calcium nitrate?

A $CaNO_3$

B $Ca(NO_2)_2$

C $Ca(NO_3)_2$

D Ca_3N_2

Page 40

Which is the correct formula for dinitrogen pentoxide?

A N_4O

B NO_2

C N_2O_5

D NO_4

Page 41

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 crystalline solids at room temperature.

A covalent

B ionic

C hydrogen

D metallic

Page 42

Which 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 many atoms creating a sea of electrons.

Page 43

Which pair of elements would ***most likely*** bond to form a covalently bonded compound?

A sodium and fluorine

B barium and chlorine

C phosphorus and oxygen

D magnesium and sulfur

Page 44

Based on the VSEPR theory, what is the molecular geometry of a molecule of PI_3 ?

A linear

B tetrahedral

C trigonal planar

D trigonal pyramidal

Page 45

A compound with a molecular mass of 78 g/mol contains the elements carbon and hydrogen in a ratio of 1 carbon : 1 hydrogen. Answer the questions using the data provided. Show your work.

- What is the empirical formula for this compound?
- What is the molecular formula for this compound?
- What is the percent composition of carbon in this compound?

Page 46

Ionization energy of an element is one of many trends found on the periodic table.

- Describe ionization energy trends of the elements in the periodic table.
- List the elements beryllium, boron, carbon, fluorine, nitrogen, and oxygen based on ***increasing*** ionization energy.

Page 47

Percent Composition Quiz

1. What is the percent composition of Nitric Acid?

2. If you had 660g of nitric acid, what mass of nitrogen would you have?

3. What is the molecular formula for a compound that is 50.7% C, 4.2% H, 45.1% O with a molar mass of 142g?

4. A 20g compound of nitrogen and sulfur is decomposed to produce 14g of nitrogen. What is the percent composition of the compound?

5. Tell the reaction type for each of the following:

   a. $Na_2S + Cd(NO_3)_2 \rightarrow CdS + 2NaNO_3$

   b. $HgO(s) \rightarrow Hg(l) + O_2(g)$

   c. $K(s) + H_2O(l) \rightarrow KOH(aq) + H_2(g)$

   d. $Zn + Cu(NO_3)_2 \rightarrow Cu(s) + Zn(NO_3)_2$

Chemistry Test 3: Moles, Stoichiometry, Balancing, Percent Composition, Empirical & Molecular Formulas

1. A compound consists of 40.% sulfur and 60.% oxygen by mass. What is the empirical formula of this compound?
   A) SO C) SO_3
   B) SO_2 D) SO_4

2. What is the mass number of an atom that contains 19 protons, 19 electrons, and 20 neutrons?
   A) 19 C) 20
   B) 58 D) 39

3. What is the percent by mass of sulfur in sulfur dioxide?
   A) 32 C) 67
   B) 33 D) 50

4. Given the reaction:

   $$C_3H_8(g) + 5\ O_2(g) \rightarrow 3\ CO_2(g) + 4\ H_2O(g)$$

   At STP, what is the total number of liters of CO_2 produced when 5.0 liters of $C_3H_8(g)$ burns completely?
   A) 1.0 L C) 3.0 L
   B) 5.0 L D) 15 L

5. The electrons in a bond between two iodine atoms (I_2) are shared
   A) equally, and the resulting bond is polar
   B) equally, and the resulting bond is nonpolar
   C) unequally, and the resulting bond is nonpolar
   D) unequally, and the resulting bond is polar

6. Which equation illustrates conservation of mass?
   A) $H_2 + O_2 \rightarrow H_2O$ C) $H_2 + O_2 \rightarrow 2\ H_2O$
   B) $H_2 + Cl_2 \rightarrow 2\ HCl$ D) $H_2 + Cl_2 \rightarrow HCl$

7. When the equation

   $$\_\_Al(s) + \_\_O_2(g) \rightarrow \_\_Al_2O_3(s)$$

   is correctly balanced using the smallest whole numbers, the coefficient of Al(s) is
   A) 1 C) 3
   B) 2 D) 4

8. Given the unbalanced equation:

   $$\_\_Al_2(SO_4)_3 + \_\_Ca(OH)_2 \rightarrow \_\_Al(OH)_3 + \_\_CaSO_4$$

   When the equation is completely balanced using the smallest whole number coefficients the sum of the coefficients is
   A) 5 C) 3
   B) 9 D) 4

9. Which substance will conduct electricity in both the solid phase and the liquid phase?
   A) HCl C) Ag
   B) AgCl D) H_2

10. Which sequence of elements is arranged in order of decreasing atomic radii?
    A) Al, Si, P C) Cl, Br, I
    B) Li, Na, K D) N, C, B

11. Given the unbalanced equation:

    $$\_\_Al_2(SO_4)_3 + \_\_Ca(OH)_2 \rightarrow \_\_Al(OH)_3 + \_\_CaSO_4$$

    What is the coefficient in front of the $CaSO_4$ when the equation is completely balanced with the smallest whole-number coefficients?
    A) 1 C) 3
    B) 2 D) 4

12. Which is the formula for the compound that forms when magnesium bonds with phosphorus?
    A) Mg_2P C) MgP_2
    B) Mg_2P_3 D) Mg_3P_2

13. What type of bonding is found in the molecule HBr?
    A) polar covalent C) metallic
    B) ionic D) nonpolar covalent

14. Which equation is correctly balanced?

A) $Ca(OH)_2 + 2H_3PO_4 \rightarrow Ca_3(PO_4)_2 + 3H_2O$
B) $Cu + H_2SO_4 \rightarrow CuSO_4 + H_2O + SO_2$
C) $CaO + 2H_2O \rightarrow Ca(OH)_2$
D) $NH_3 + 2O_2 \rightarrow HNO_3 + H_2O$

15. In the reaction

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

what is the total number of moles of CO used to produce 112 grams of iron?

A) 1.0 C) 3.0
B) 2.0 D) 4.0

16. Given the reaction:

$$2\ H_2 + O_2 \rightarrow 2\ H_2O$$

The total number of grams of O_2 needed to produce 54 grams of water is

A) 61 C) 75
B) 36 D) 48

17. Which element forms a diatomic molecule containing a triple covalent bond?

A) Cl_2 C) N_2
B) O_3 D) H_2

18. A compound contains 40% calcium, 12% carbon, and 48% oxygen by mass. What is the empirical formula of this compound?

A) $CaCO_3$ C) CaC_2O_4
B) CaC_3O_6 D) $CaCO_2$

19. Given the reaction:

$$Mg + 2\ HCl \rightarrow MgCl_2 + H_2$$

What is the total number of grams of Mg consumed when 0.50 mole of H_2 is produced?

A) 6.0 g C) 3.0 g
B) 12 g D) 24 g

20. A substance was found to be a soft, non-conducting solid at room temperature. The substance is most likely

A) a network solid C) a metallic solid
B) an ionic solid D) a molecular solid

21. Which sample contains the same number of atoms as 24 grams of carbon?

A) 10. g Ne C) 24 g Mg
B) 80. g Ar D) 4.0 g He

22. Given the reaction:

$$2\ Al + 3\ H_2SO_4 \rightarrow 3\ H_2 + Al_2(SO_4)_3$$

The total number of moles of H_2SO_4 needed to react completely with 5.0 moles of Al is

A) 9.0 moles C) 2.5 moles
B) 5.0 moles D) 7.5 moles

23. What is the total mass in grams of 0.75 mole of SO_2?

A) 16 g C) 32 g
B) 24 g D) 48 g

24. When a sodium atom becomes an ion, the size of the atom

A) increases by losing an electron
B) increases by gaining an electron
C) decreases by gaining an electron
D) decreases by losing an electron

25. Which atom has the strongest attraction for electrons?

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

26. Given the reaction:

$$Mg(s) + 2\ AgNO_3(aq) \rightarrow Mg(NO_3)_2(aq) + 2\ Ag(s)$$

Which type of reaction is represented?

A) single replacement C) synthesis
B) double replacement D) decomposition

27. The percent by mass of aluminum in Al_2O_3 is approximately

A) 35.4 C) 47.1
B) 52.9 D) 18.9

28. The percent by mass of oxygen in $H_2C_2O_4$ is equal to

A) $\frac{4}{8} \times 100$

B) $\frac{8}{90} \times 100$

C) $\frac{90}{64} \times 100$

D) $\frac{64}{90} \times 100$

29. What is the percent by mass of hydrogen in NH_3 (formula mass = 17.0)?

A) 21.4%
C) 82.4%
B) 5.9%
D) 17.6%

30. Which quantity is equivalent to 39 grams of LiF?

A) 1.0 mole
C) 0.50 mole
B) 2.0 moles
D) 1.5 moles

31. What is the total number of moles of atoms represented by the formula $Al(C_2H_3O_2)_3$?

A) 22
C) 8
B) 11
D) 4

32. A compound contains 53% Al and 47% O by mass. What is the empirical formula of this compound?

A) AlO
C) Al_2O_3
B) Al_3O_2
D) AlO_2

33. Given the balanced equation:

$$NaOH + HCl \rightarrow NaCl + H_2O$$

What is the total number of grams of H_2O produced when 116 grams of the product, NaCl, is formed?

A) 36 g
C) 9.0 g
B) 18 g
D) 54 g

34. Given the reaction:

$$2\ KClO_3(s) \rightarrow 2\ KCl(s) + 3\ O_2(g)$$

What is the total number of moles of $KClO_3(s)$ needed to produce 6 moles of $O_2(g)$?

A) 1
C) 3
B) 2
D) 4

35. Which formula represents a substance that contains covalent bonds?

A) CO_2
C) K_2O
B) LiCl
D) $CaCl_2$

36. The Group 17 element with the highest electronegativity is

A) fluorine
C) chlorine
B) bromine
D) iodine

37. What is the empirical formula of a compound that contains 28% iron, 24% sulfur, and 48% oxygen by mass?

A) $FeSO_3$
C) $FeSO_4$
B) $Fe_2(SO_4)_3$
D) $Fe_2(SO_3)_3$

38. Which compound has the empirical formula CH?

A) CH_4
C) C_2H_4
B) C_3H_8
D) C_6H_6

39. What is the mass of 3.0×10^{23} atoms of neon?

A) 10. g
C) 0.50 g
B) 1.0 g
D) 20. g

40. Given the unbalanced equation:

$$\_\_C_3H_8(g) + \_\_O_2(g) \rightarrow \_\_H_2O(g) + \_\_CO_2(g)$$

When the equation is completely balanced using smallest whole numbers, the coefficient of O_2 is

A) 5
C) 3
B) 2
D) 10

41. A sample of a compound contains 24 grams of carbon and 64 grams of oxygen. What is the empirical formula of this compound?

A) C_2O_4
C) C_2O_2
B) CO
D) CO_2

42. $Mg(s) + 2\ HCl(aq) \leftrightarrow MgCl_2(aq) + H_2(g)$

What type of reaction is shown above?

A) double replacement C) synthesis

B) decomposition D) single replacement

43. Compared to an atom of $^{12}_{6}C$, an atom of $^{14}_{6}C$ has

A) fewer protons C) fewer neutrons

B) more neutrons D) more protons

44. A compound whose empirical formula is NO_2 could have a molecular mass of

A) 120 C) 23

B) 39 D) 92

45. Which sample of O_2 contains a total of 3.01×10^{23} molecules at STP?

A) 1.00 mole C) 16.0 grams

B) 2.00 moles D) 32.0 grams

46. A compound has a molecular mass of 54 and an empirical formula of C_2H_3. What is the molecular formula of the compound?

A) C_2H_3 C) C_6H_{10}

B) C_4H_6 D) C_5H_8

47. What is the empirical formula of a compound with the molecular formula $C_6H_{12}O_6$?

A) $C_3H_6O_3$ C) CH_2O

B) $C_4H_8O_4$ D) $C_2H_4O_2$

48. Given the reaction

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

How many liters of ammonia, measured at STP, are produced when 28.0 grams of nitrogen is completely consumed?

A) 22.4 C) 5.60

B) 11.2 D) 44.8

49. What is the gram formula mass of $(NH_4)_2SO_4$?

A) 66.0 g C) 94.0 g

B) 132 g D) 114 g

50. $2\ SO_3(g) \leftrightarrow 2\ SO_2(g) + O_2(g)$

What type of reaction is shown above?

A) double replacement C) decomposition

B) single replacement D) synthesis

51. An 8.24-gram sample of a hydrated salt is heated until it has a constant mass of 6.20 grams. What was the percent by mass of water contained in the original sample?

A) 14.1% C) 75.2%

B) 24.8% D) 32.9%

52. $N_2(g) + 3\ H_2(g) \leftrightarrow 2\ NH_3(g)$

What type of reaction is shown above?

A) decomposition C) single replacement

B) double replacement D) synthesis

53. When the equation

$$\_\_\ C_2H_4 + \_\_\ O_2 \rightarrow \_\_\ CO_2 + \_\_\ H_2O$$

is balanced using smallest whole numbers, what is the coefficient of the O_2?

A) 1 C) 3

B) 2 D) 4

54. Which type of bonding involves positive ions immersed in a sea of mobile electrons?

A) metallic C) polar covalent

B) nonpolar covalent D) ionic

55. A 4.4 gram sample of a hydrate was heated until the water of hydration was driven off. The anhydrous compound remaining had a mass of 3.3 grams. What is the percentage by mass of water in the hydrate?

A) 33% C) 67%

B) 25% D) 75%

56. Which is a property of network solids but *not* molecular solids?

A) electrical insulators C) high malleability

B) water soluble D) high melting points

57. $Ba(NO_3)_2(aq) + Na_2SO_4(aq) \rightarrow 2\ NaNO_3(aq) + BaSO_4(s)$

What type of reaction is shown above?

A) decomposition
C) synthesis
B) single replacement
D) double replacement

58. What is the gram formula mass of $Na_2CO_3 \cdot 10H_2O$?

A) 106 g
C) 266 g
B) 142 g
D) 286 g

59. One atomic mass unit (1 amu) is equal to the mass of a carbon-12 atom multiplied by the quantity

A) $\frac{1}{1836}$
B) 1836
C) 12
D) $\frac{1}{12}$

60. A compound consists of 25.9% nitrogen and 74.1% oxygen by mass. What is the empirical formula of the compound?

A) NO_2
C) N_2O
B) N_2O_5
D) NO

61. An atom that contains 8 protons, 8 electrons, and 9 neutrons has

A) a mass number of 17
B) an atomic number of 16
C) an atomic number of 9
D) a mass number of 25

Answer Key
Chem T3 mole, stoi, balan [Apr 02, 2014]

1. C
2. D
3. D
4. D
5. B
6. B
7. D
8. B
9. C
10. A
11. C
12. D
13. A
14. D
15. C
16. D
17. C
18. A
19. B
20. D
21. B
22. D
23. D
24. D
25. C
26. A
27. B
28. D
29. D
30. D
31. A
32. C
33. A
34. D
35. A
36. A
37. B
38. D
39. A
40. A
41. D
42. D
43. B
44. D
45. C
46. B
47. C
48. D
49. B
50. C
51. B
52. D
53. C
54. A
55. B
56. D
57. D
58. D
59. D
60. B
61. A

Version B

Chemistry Test 3: Moles, Stoichiometry, Balancing, Percent Composition, Empirical & Molecular Formulas

1. A compound has a molecular mass of 54 and an empirical formula of C_2H_3. What is the molecular formula of the compound?
   A) C_6H_{10} C) C_2H_3
   B) C_4H_6 D) C_5H_8

2. What type of bonding is found in the molecule HBr?
   A) metallic C) ionic
   B) polar covalent D) nonpolar covalent

3. Which sample of O_2 contains a total of 3.01×10^{23} molecules at STP?
   A) 1.00 mole C) 16.0 grams
   B) 2.00 moles D) 32.0 grams

4. One atomic mass unit (1 amu) is equal to the mass of a carbon-12 atom multiplied by the quantity
   A) 12
   B) 1836
   C) $\frac{1}{12}$
   D) $\frac{1}{1836}$

5. Which sample contains the same number of atoms as 24 grams of carbon?
   A) 4.0 g He C) 80. g Ar
   B) 24 g Mg D) 10. g Ne

6. A sample of a compound contains 24 grams of carbon and 64 grams of oxygen. What is the empirical formula of this compound?
   A) CO C) C_2O_2
   B) C_2O_4 D) CO_2

7. Which equation illustrates conservation of mass?
   A) $H_2 + O_2 \rightarrow 2\ H_2O$ C) $H_2 + Cl_2 \rightarrow 2\ HCl$
   B) $H_2 + O_2 \rightarrow H_2O$ D) $H_2 + Cl_2 \rightarrow HCl$

8. $Ba(NO_3)_2(aq) + Na_2SO_4(aq) \rightarrow 2\ NaNO_3(aq) + BaSO_4(s)$

   What type of reaction is shown above?
   A) decomposition C) double replacement
   B) synthesis D) single replacement

9. $N_2(g) + 3\ H_2(g) \leftrightarrow 2\ NH_3(g)$

   What type of reaction is shown above?
   A) single replacement C) double replacement
   B) synthesis D) decomposition

10. What is the total mass in grams of 0.75 mole of SO_2?
    A) 16 g C) 32 g
    B) 24 g D) 48 g

11. In the reaction

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

    what is the total number of moles of CO used to produce 112 grams of iron?
    A) 1.0 C) 3.0
    B) 2.0 D) 4.0

12. Given the reaction:

    $Mg + 2\ HCl \rightarrow MgCl_2 + H_2$

    What is the total number of grams of Mg consumed when 0.50 mole of H_2 is produced?
    A) 6.0 g C) 3.0 g
    B) 12 g D) 24 g

13. A 4.4 gram sample of a hydrate was heated until the water of hydration was driven off. The anhydrous compound remaining had a mass of 3.3 grams. What is the percentage by mass of water in the hydrate?
    A) 25% C) 67%
    B) 33% D) 75%

14. The Group 17 element with the highest electronegativity is
    A) iodine C) chlorine
    B) bromine D) fluorine

15. A compound consists of 25.9% nitrogen and 74.1% oxygen by mass. What is the empirical formula of the compound?

A) NO_2 C) N_2O_5

B) N_2O D) NO

16. $2\ SO_3(g) \leftrightarrow 2\ SO_2(g) + O_2(g)$

What type of reaction is shown above?

A) double replacement C) synthesis

B) single replacement D) decomposition

17. Given the reaction:

$$2\ KClO_3(s) \rightarrow 2\ KCl(s) + 3\ O_2(g)$$

What is the total number of moles of $KClO_3(s)$ needed to produce 6 moles of $O_2(g)$?

A) 1 C) 3

B) 2 D) 4

18. What is the gram formula mass of $(NH_4)_2SO_4$?

A) 132 g C) 114 g

B) 94.0 g D) 66.0 g

19. $Mg(s) + 2\ HCl(aq) \leftrightarrow MgCl_2(aq) + H_2(g)$

What type of reaction is shown above?

A) double replacement C) single replacement

B) synthesis D) decomposition

20. Which formula represents a substance that contains covalent bonds?

A) $CaCl_2$ C) CO_2

B) $LiCl$ D) K_2O

21. Which equation is correctly balanced?

A) $Cu + H_2SO_4 \rightarrow CuSO_4 + H_2O + SO_2$

B) $NH_3 + 2O_2 \rightarrow HNO_3 + H_2O$

C) $CaO + 2H_2O \rightarrow Ca(OH)_2$

D) $Ca(OH)_2 + 2H_3PO_4 \rightarrow Ca_3(PO_4)_2 + 3H_2O$

22. Given the reaction:

$$2\ H_2 + O_2 \rightarrow 2\ H_2O$$

The total number of grams of O_2 needed to produce 54 grams of water is

A) 36 C) 75

B) 48 D) 61

23. When the equation

$$\_\_\ C_2H_4 + \_\_\ O_2 \rightarrow \_\_\ CO_2 + \_\_\ H_2O$$

is balanced using smallest whole numbers, what is the coefficient of the O_2?

A) 1 C) 3

B) 2 D) 4

24. Given the unbalanced equation:

$$\_\_Al_2(SO_4)_3 + \_\_Ca(OH)_2 \rightarrow \_\_Al(OH)_3 + \_\_CaSO_4$$

What is the coefficient in front of the $CaSO_4$ when the equation is completely balanced with the smallest whole-number coefficients?

A) 1 C) 3

B) 2 D) 4

25. The percent by mass of oxygen in $H_2C_2O_4$ is equal to

A) $\frac{8}{90} \times 100$ C) $\frac{64}{90} \times 100$

B) $\frac{90}{64} \times 100$ D) $\frac{4}{8} \times 100$

26. Which element forms a diatomic molecule containing a triple covalent bond?

A) Cl_2 C) N_2

B) O_3 D) H_2

27. Which substance will conduct electricity in both the solid phase and the liquid phase?

A) H_2 C) Ag

B) HCl D) $AgCl$

28. The percent by mass of aluminum in Al_2O_3 is approximately

A) 47.1 C) 18.9

B) 52.9 D) 35.4

29. Compared to an atom of $^{12}_{6}C$, an atom of $^{14}_{6}C$ has

A) more neutrons C) fewer neutrons

B) more protons D) fewer protons

30. Which sequence of elements is arranged in order of decreasing atomic radii?

A) Cl, Br, I C) Al, Si, P

B) N, C, B D) Li, Na, K

31. An atom that contains 8 protons, 8 electrons, and 9 neutrons has

A) an atomic number of 16

B) a mass number of 25

C) an atomic number of 9

D) a mass number of 17

32. What is the mass number of an atom that contains 19 protons, 19 electrons, and 20 neutrons?

A) 39 C) 20

B) 19 D) 58

33. Which type of bonding involves positive ions immersed in a sea of mobile electrons?

A) polar covalent C) nonpolar covalent

B) metallic D) ionic

34. What is the mass of 3.0×10^{23} atoms of neon?

A) 1.0 g C) 20. g

B) 10. g D) 0.50 g

35. Which is the formula for the compound that forms when magnesium bonds with phosphorus?

A) Mg_2P C) Mg_2P_3

B) Mg_3P_2 D) MgP_2

36. A compound contains 40% calcium, 12% carbon, and 48% oxygen by mass. What is the empirical formula of this compound?

A) CaC_3O_6 C) $CaCO_3$

B) $CaCO_2$ D) CaC_2O_4

37. A substance was found to be a soft, non-conducting solid at room temperature. The substance is most likely

A) a metallic solid C) a molecular solid

B) an ionic solid D) a network solid

38. Given the reaction:

$$Mg(s) + 2\ AgNO_3(aq) \rightarrow Mg(NO_3)_2(aq) + 2\ Ag(s)$$

Which type of reaction is represented?

A) double replacement C) synthesis

B) single replacement D) decomposition

39. Which is a property of network solids but *not* molecular solids?

A) high melting points C) electrical insulators

B) water soluble D) high malleability

40. Given the reaction:

$$C_3H_8(g) + 5\ O_2(g) \rightarrow 3\ CO_2(g) + 4\ H_2O(g)$$

At STP, what is the total number of liters of CO_2 produced when 5.0 liters of $C_3H_8(g)$ burns completely?

A) 1.0 L C) 3.0 L

B) 5.0 L D) 15 L

41. When the equation

$$\_\_Al(s) + \_\_O_2(g) \rightarrow \_\_Al_2O_3(s)$$

is correctly balanced using the smallest whole numbers, the coefficient of Al(s) is

A) 1 C) 3

B) 2 D) 4

42. What is the total number of moles of atoms represented by the formula $Al(C_2H_3O_2)_3$?

A) 22 C) 8

B) 11 D) 4

43. What is the empirical formula of a compound with the molecular formula $C_6H_{12}O_6$?

A) $C_4H_8O_4$ C) $C_2H_4O_2$

B) $C_3H_6O_3$ D) CH_2O

44. Given the unbalanced equation:

$$\_\_Al_2(SO_4)_3 + \_\_Ca(OH)_2 \rightarrow \_\_Al(OH)_3 + \_\_CaSO_4$$

When the equation is completely balanced using the smallest whole number coefficients the sum of the coefficients is

A) 5 C) 3

B) 9 D) 4

45. Given the reaction

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

How many liters of ammonia, measured at STP, are produced when 28.0 grams of nitrogen is completely consumed?

A) 11.2 C) 5.60

B) 44.8 D) 22.4

46. A compound consists of 40.% sulfur and 60.% oxygen by mass. What is the empirical formula of this compound?

A) SO C) SO_3

B) SO_2 D) SO_4

47. An 8.24-gram sample of a hydrated salt is heated until it has a constant mass of 6.20 grams. What was the percent by mass of water contained in the original sample?

A) 75.2% C) 32.9%

B) 24.8% D) 14.1%

48. Given the unbalanced equation:

$$\_\_C_3H_8(g) + \_\_O_2(g) \rightarrow \_\_H_2O(g) + \_\_CO_2(g)$$

When the equation is completely balanced using smallest whole numbers, the coefficient of O_2 is

A) 5 C) 3

B) 2 D) 10

49. Which compound has the empirical formula CH?

A) CH_4 C) C_6H_6

B) C_3H_8 D) C_2H_4

50. The electrons in a bond between two iodine atoms (I_2) are shared

A) equally, and the resulting bond is polar

B) unequally, and the resulting bond is polar

C) equally, and the resulting bond is nonpolar

D) unequally, and the resulting bond is nonpolar

51. What is the empirical formula of a compound that contains 28% iron, 24% sulfur, and 48% oxygen by mass?

A) $Fe_2(SO_3)_3$ C) $FeSO_4$

B) $FeSO_3$ D) $Fe_2(SO_4)_3$

52. What is the gram formula mass of $Na_2CO_3 \cdot 10H_2O$?

A) 286 g C) 142 g

B) 266 g D) 106 g

53. A compound whose empirical formula is NO_2 could have a molecular mass of

A) 92 C) 120

B) 23 D) 39

54. Given the reaction:

$$2\ Al + 3\ H_2SO_4 \rightarrow 3\ H_2 + Al_2(SO_4)_3$$

The total number of moles of H_2SO_4 needed to react completely with 5.0 moles of Al is

A) 7.5 moles C) 5.0 moles

B) 9.0 moles D) 2.5 moles

55. A compound contains 53% Al and 47% O by mass. What is the empirical formula of this compound?

A) Al_2O_3 C) Al_3O_2

B) AlO D) AlO_2

56. What is the percent by mass of sulfur in sulfur dioxide?

A) 33 C) 50

B) 67 D) 32

57. Which quantity is equivalent to 39 grams of LiF?

A) 1.0 mole C) 0.50 mole

B) 2.0 moles D) 1.5 moles

58. What is the percent by mass of hydrogen in NH_3 (formula mass = 17.0)?

A) 82.4% C) 5.9%

B) 17.6% D) 21.4%

59. When a sodium atom becomes an ion, the size of the atom

A) decreases by losing an electron

B) increases by gaining an electron

C) increases by losing an electron

D) decreases by gaining an electron

60. Given the balanced equation:

$$NaOH + HCl \rightarrow NaCl + H_2O$$

What is the total number of grams of H_2O produced when 116 grams of the product, NaCl, is formed?

A) 54 g C) 9.0 g

B) 18 g D) 36 g

61. Which atom has the strongest attraction for electrons?

A) F C) Br

B) Cl D) I

Answer Key
Chem T3 mole, stoi, balan [Apr 02, 2014]

1. B
2. B
3. C
4. C
5. C
6. D
7. C
8. C
9. B
10. D
11. C
12. B
13. A
14. D
15. C
16. D
17. D
18. A
19. C
20. C
21. B
22. B
23. C
24. C
25. C
26. C
27. C
28. B
29. A
30. C
31. D
32. A
33. B
34. B
35. B
36. C
37. C
38. B
39. A
40. D
41. D
42. A
43. D
44. B
45. B
46. C
47. B
48. A
49. C
50. C
51. D
52. A
53. A
54. A
55. A
56. C
57. D
58. B
59. A
60. D
61. A

Version A