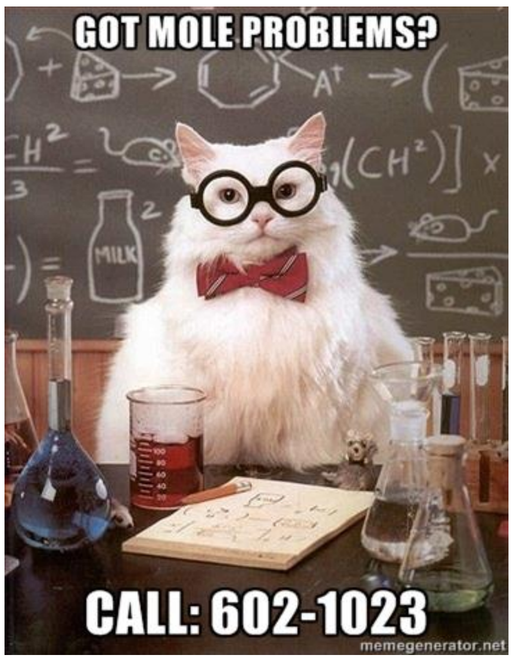
Regents Chemistry:

Practice Packet Unit 7: Moles & Stoichiometry



For each word, provide a short but specific definition from YOUR OWN BRAIN! No boring textbook definitions. Write something to help you remember the word. Explain the word as if you were explaining it to an elementary school student. Give an example if you can. Don't use the words given in your definition! THESE ARE THE WORDS THAT WILL BE ASSESSED ON THE VOCABULARY QUIZ.

Diatomic element: ____________________

Polyatomic ion: ____________________

Binary compound: ____________________

Tertiary compound: ____________________

Subscript: ____________________

Mole: ____________________

Formula Mass: ____________________

Molar Mass (Gram Formula Mass): ____________________

Percent Composition: ____________________

Reaction: ____________________

Reactants: ____________________

Products: ____________________

Species: ____________________

Conservation of mass: ____________________

Conservation of Energy: ____________________

Conservation of Charge: ____________________

Balanced Equation: ____________________

Coefficient (in Reactions): ____________________

Mole Ratio: ____________________

Empirical Formula: ____________________

Molecular Formula: ____________________

Synthesis reaction: ____

Decomposition reaction: ____

Double replacement reaction: ____

Single replacement reaction: ____

LESSON 1: Moles and Molar Mass

Objective:

- ***Calculate Molar Mass (gram formula mass)***

1. Fill in the table below

	Formula	Moles of each atom	Total moles of atoms		Formula	Moles of each atom	Total moles of atoms
a.	$HClO_3$	1 mol of H atoms 1 mol of Cl atoms 3 mol of O atoms	5 mol of atoms	c.	$CaCl_2$		
b.	$Mg(OH)_2$			d.	$Mg_3(PO_4)_2$		

Calculate the <u>GRAM</u> formula mass (molar mass) and don't forget the <u>UNITS</u>!!!

1. CO_2
2. FeS
3. NaCl
4. $Al_2(CO_3)_3$
5. SiO_2
6. H_2SO_4
7. $Al_2(SO_3)_3$
8. $C_{12}H_{22}O_4$
9. Fe_2O_3
10. MgO

ASSESS YOURSELF ON THIS LESSON: __________/10

If you missed more than 2, do the Additional Practice. If not, take the quiz!!

ADDITIONAL PRACTICE LESSON 1:

Find the gram formula mass of the following: (Show all work)

1. MgO
2. $NaHCO_3$
3. $C_6H_{12}O_6$
4. Al_2O_3
5. $Ca(OH)_2$
6. CH_4
7. NH_3
8. H_2O_2

ASSESS YOURSELF ON THIS ADDITIONAL PRACTICE: __________/8

If you missed more than 2 you should see me for extra help and/or re-watch the lesson video assignment

Lesson 2: Percent Composition

Objective:

- ***Calculate Percent Composition***
- ***Calculate Percent composition of a hydrate***

Determine the % composition of all elements in these compounds. Show all work!

1) **ammonium sulfite**

Formula: $(NH_4)_2SO_3$	Mass of N _______	%N _________
Molar mass _______	Mass of H _______	%H _________
	Mass of S _______	%S _________
	Mass of O _______	%O _________

2) **aluminum acetate**

Formula: $Al(C_2H_3O_2)_3$	Mass of Al _______	%Al _________
Molar mass _______	Mass of C _______	%C _________
	Mass of H _______	%H _________
	Mass of O _______	%O _________

3) **sodium bromide**

Formula: NaBr	Mass of Na _______	%Na _________
Molar mass _______	Mass of Br _______	%Br _________

Percent Composition of a Hydrate

4. Determine the percent by mass of water in the following hydrates using the **chemical formula**.

a. $Na_2CO_3 \bullet 10H_2O$ (GFM = 286g)

b. $MgSO_4 \bullet 7H_2O$ (GFM = 246 g)

Determine the percent by mass of water in the following hydrates using the **experimental data (masses)**.

c. Initial mass of hydrate: 9.5 g
Final mass of anhydrous salt: 3.77 g

d. Initial mass of hydrate: 5.3 g
Final mass of anhydrous salt: 4.1 g

5. What is the percent composition of water in $FeCl_3 \cdot 6H_2O$?

ASSESS YOURSELF ON THIS LESSON: __________/5

If you missed more than 1, do the Additional Practice. If not, go on to the next hw video!!!

ADDITIONAL PRACTICE LESSON 2

1. **copper (II) hydroxide**

Formula $Cu(OH)_2$	Mass of Cu _______	%Cu ________
Molar mass _______	Mass of O _______	%O _________
	Mass of H _______	%H _________

2. **magnesium carbonate**

Formula: $MgCO_3$	Mass of Mg _______	%Mg ________
Molar mass _______	Mass of C _______	%C _________
	Mass of O _______	%O _________

2. If 125 grams of $BaCl_2 \cdot 2H_2O$ is completely dehydrated, how many grams of anhydrous Barium Chloride will remain?

ASSESS YOURSELF ON THIS ADDITIONAL PRACTICE: __________/3

If you missed any problems you should see me for extra help and/or re-watch the lesson video assignment

Lesson 3: Calculating Moles

Objective:

- ***Calculate the number of moles given the grams***
- ***Calculate the number of grams given the moles***

***Solve for the mass** given the moles. (Show your work)*

1. 2.00 moles of $C_6H_{12}O_6$

2. 5.00 moles of $SrSO_4$

3. 0.250 moles of CH_4

4. 12.0 moles of SiO_2

5. 0.330 moles of FeS

6. 1.50 moles of MgO

7. 0.500 moles of $ZnCl_2$

***Find the number of moles** in the following measurements: (Show your work)*

8. 900. grams $C_6H_{12}O_6$

9. 24.5 grams H_2SO_4

10. 192 grams SiO_2

11. 450. grams of $ZnCl_2$

12. 22 grams of CO_2

13. 20. grams of Fe_2O_3

14. 840. grams of $NaHCO_3$

ASSESS YOURSELF ON THIS LESSON: __________/14

If you missed more than 3, do the Additional Practice. If not, go on to the next hw video!!!

ADDITIONAL PRACTICE LESSON 3

1. What is the total number of moles in 80.0 grams of C_2H_5?
2. How many grams are in 0.500 moles of CH_4?
3. How many grams are in 0.500 moles of $ZnCl_2$
4. What is the total number of moles in 10. grams of Fe_2O_3?
5. What is the total number of moles in 3.40 grams of H_2O_2
6. How many grams are in 0.100 moles of NH_3

ASSESS YOURSELF ON THIS ADDITIONAL PRACTICE: __________/6

If you missed more than 2 you should see me for extra help and/or re-watch the lesson video assignment

Lesson 4: Balancing Reactions

Objective:

- ***Assess and Balance chemical reactions using coefficients***

1. Which equation represents conservation of mass?

   (1) $H_2 + Cl_2 \rightarrow HCl$ (2) $H_2 + Cl_2 \rightarrow 2HCl$ (3) $H_2 + O_2 \rightarrow H_2O$ (4) $H_2 + O_2 \rightarrow 2H_2O$

2. A 4.86-gram sample of calcium reacted completely with oxygen to form 6.80 grams of calcium oxide. This reaction is represented by the balanced equation below. Determine the total mass of Oxygen that reacted.

$$2Ca(s) + O_2(g) \rightarrow 2CaO(s)$$

Balance the Following Reactions: Sum of Coefficients:

a) ____$C(s)$ + ___$H_2(g)$ $\rightarrow$ ___ CH_4 (g) ________

b) ____$Fe(s)$ + ____$O_2\,(g)$ $\rightarrow$ ___$Fe_2O_3(s)$ _______

c) ____$NaI\,(s)$ $\rightarrow$ ___$Na\,(s)$ + ____$I_2\,(s)$ _______

d) ____$C_6H_{12}O_6\,(s)$ $\rightarrow$ ___$C\,(s)$ + ____$H_2O\,(l)$ _______

e) ____$AgNO_3(aq)$ + ____$Cu(s)$ $\rightarrow$ ____$Ag(s)$ + _____$Cu(NO_3)_2(aq)$ ________

f) ____Na_2CO_3(aq) + ___HCl(aq) → _____NaCl(aq) + _____H_2O(l) + ____CO_2(g) ________

g) ____H_2(g) + ____Cl_2(g) → _______HCl(g) ________

h) ____N_2(g) + ____O_2(g) → _______N_2O_4(g) ________

i) ____CH_4(g) + ____O_2(g) → _______CO_2(g) + _____H_2O(g) ________

ASSESS YOURSELF ON THIS LESSON: ___________/12

If you missed more than 4, do the Additional Practice. If not, go on to the next hw video!!!

ADDITIONAL PRACTICE LESSON 4

j) ___$H_2(g)$ + ___$Cl_2(g)$ → _____$HCl(g)$ _______

k) ___$H_2O_2(g)$ → ___$H_2O(l)$ + _____$O_2(g)$ _______

l) ___$Al_2O_3(s)$ → ___Al + _____ $O_2(g)$ _______

m) ___$CuO(s)$ + ___$C(s)$ → + ___$Cu(s)$ + _____$CO_2(g)$ _______

n) ___$Ca(OH)_2(aq)$ + ___ HCl (aq) → ___$CaCl_2(aq)$ + _____$H_2O(l)$ _______

18. Challenge:

____Fe_2O_3 + ____CO → ___Fe + ___CO_2

Types of Reactions

	Equation	Reactant(s)	Product(s)	Type of Reaction
1.	$Cl_2 + 2NaI \rightarrow 2NaCl + I_2$	Cl_2 and NaI	NaCl and I_2	Single replacement
2.	$HNO_3 + LiOH \rightarrow HOH + LiNO_3$			
3.	$2NaN_3 \rightarrow 2Na + 3N_2$			
4.	$Ba(NO_3)_2 + K_2SO_4 \rightarrow 2KNO_3 + BaSO_4$			
5.	$BaO + SO_3 \rightarrow BaSO_4$			
6.	$2Al + Fe_2O_3 \rightarrow Al_2O_3 + 2Fe$			
7.	$P_4 + 6Cl_2 \rightarrow 4PCl_3$			
8.	$2CH_3OH_{(g)}+3O_{2(g)}\rightarrow 2CO_{2(g)}+4H_2O_{(g)}$			
9.	$2CuO(s) + C(s) \rightarrow 2Cu(s) + CO_2$			
10.	$2C_8H_{18(l)}+25O_{2(g)}\rightarrow 16CO_{2(g)}+18H_2O_{(g)}$			

ASSESS YOURSELF ON THIS LESSON: __________/10

If you missed more than 2, do the Additional Practice. If not, go on to the next hw video!!!

ADDITIONAL PRACTICE LESSON 5

Identify the type of reaction (for practice, balance them as well):

1. $NO + O_2 \rightarrow NO_2$ ______________________________

2. $Ag + S \rightarrow Ag_2S$ ______________________________

3. $Cu(OH)_2 \rightarrow CuO + H_2O$ ______________________________

4. $KClO_3 \rightarrow KCl + O_2$ ______________________________

5. $Al + O_2 \rightarrow Al_2O_3$ ______________________________

6. $CO + O_2 \rightarrow CO_2$ ______________________________

ASSESS YOURSELF ON THIS ADDITIONAL PRACTICE: __________/6

If you missed more than 2 problems you should see me for extra help and/or re-watch the lesson video assignment

Lesson 6: Mole to Mole Ratios

Objective:

- ***Calculate mole ratios in a chemical formula***

Use the formula below to answer questions 1- 4

$$3Cu + 8HNO_3 \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$$

1. What is the mole ratio of copper to nitrogen monoxide in this reaction?

2. If 1.50 moles of copper are used, how many moles of NO are produced?

3. If 4.50 moles of HNO_3 are used, how many moles of copper (II) nitrate are produced?

4. If 0.200 moles of NO are produced, how many moles of copper (II) nitrate produced?

Use the formula below to answer questions 5-7

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

5. What is the mole ratio of Iron (III) oxide to carbon monoxide in this reaction?

6. If 3.00 moles of Iron (III) oxide are used, how many moles of Iron are formed?

7. If 8.56 moles of iron were produced, how many moles of the iron ore were used?

Use the formula below to answer questions 8-10

$$3Cu + 8HNO_3 \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$$

8. If 0.50 moles of water are produced, how many moles of copper were used?

9. If 0.300 moles of copper are mixed with 0.800 moles of HNO_3, how many moles of NO will be formed?

10. If 20.0 moles of HNO_3 react with 7.5 moles of copper, how many moles of water are produced?

ASSESS YOURSELF ON THIS LESSON: __________/10

If you missed more than 3, do the Additional Practice. If not, go on to the next hw video!!!

ADDITIONAL PRACTICE LESSON 6:

1. Given the balanced equation: $\mathbf{CaCO_{3(s)} + 2HCl_{(aq)} \rightarrow CaCl_{2(aq)} + H_2O_{(l)} + CO_{2(g)}}$
   What is the total number of moles of CO_2 produced when 20. Moles of HCl is completely consumed?

2. Given the balanced equation: $\mathbf{F_{2(g)} + H_{2(g)} \rightarrow 2HF_{(g)}}$
   a. What is the total mole ratio of $H_{2(g)}$ to $HF_{(g)}$ in the reaction? ______________________

   b. What is the total number of moles of H_2 required to produce 2.5 Moles of HF ?

ASSESS YOURSELF ON THIS ADDITIONAL PRACTICE: __________/2

If you missed any problems you should see me for extra help and/or re-watch the lesson video assignment

Lesson 7: Determining empirical and molecular formulas

Objective:

- ***Determine the empirical formula from the molecular formula***
- ***Determine the molecular formula from the empirical formula***

Below is a list of formulas. Write the empirical formula (if not already empirical)

	Formula	**Empirical formula (simplest ratio)**
1.	C_4H_{10}	
2.	C_3H_6	
3.	N_2O_4	
4.	Na_2SO_4	
5.	C_6H_{10}	
6.	Al_2O_3	
7.	NH_4NO_3	
8.	$C_{11}H_{22}O_{11}$	

Calculate the molecular formula from the empirical

9. What is the molecular formula of a compound that has a mass of 276 and an empirical formula of NO_2?

10. What is the molecular formula of a compound that has a mass of 56g and an empirical formula of CH_2?

11. What is the molecular formula of a compound that has a mass of 51g and an empirical formula of HO?

12. What is the molecular formula of a compound that has a mass of 289g and an empirical formula of NH_3?

13. What is the molecular formula of a compound with a mass of 760g and an empirical formula of Cr_2O_3?

ASSESS YOURSELF ON THIS LESSON: __________/13

If you missed more than 3, do the Additional Practice. If not, go on to the next hw video!!!

ADDITIONAL PRACTICE LESSON 7

	Formula	Empirical formula (simplest ratio)
1.	$K_2S_2O_3$	
2.	S_2O_4	
3.	CH_4	
4.	$C_6H_{12}Cl_2O_2$	

5. What is the molecular formula of a compound that has a mass of 126g and an empirical formula of SO_2?

6. What is the molecular formula of a compound that has a mass of 248g and an empirical formula of NO_3?

7. Determine the empirical formula of $C_6H_{12}O_6$

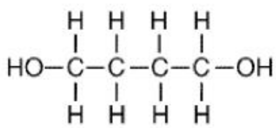
ASSESS YOURSELF ON THIS ADDITIONAL PRACTICE: __________/7

If you missed more than 1 problem you should see me for extra help and/or re-watch the lesson video assignment

6 Which pair consists of a molecular formula and its corresponding empirical formula?

A) C_2H_2 and CH_3CH_3
B) C_6H_6 and C_2H_2
C) P_4O_{10} and P_2O_5
D) SO_2 and SO_3

7 Given the structural formula:



8 What is the empirical formula of this compound?

A) CH_3O
B) C_2H_5O
C) $C_4H_{10}O_2$
D) $C_8H_{20}O_4$

The molecular formula of glucose is $C_6H_{12}O_6$. What is the empirical formula of glucose?

A) CHO
B) CH_2O
C) $C_6H_{12}O_6$
D) $C_{12}H_{24}O_{12}$

9 Which pair of compounds has the same empirical formula?

A) C_2H_2 and C_6H_6
B) C_2H_6 and C_3H_8
C) CH_3OH and C_2H_5OH
D) CH_3CHO and CH_3COOH

10 A compound has the empirical formula CH_2O and a gram-formula mass of 60. grams per mole. What is the molecular formula of this compound?

A) CH_2O
B) $C_2H_4O_2$
C) C_3H_8O
D) $C_4H_8O_4$

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

A) 23 B) 39 C) 92 D) 120

12 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 B) C_4H_6 C) C_5H_8 D) C_6H_{10}

13 Which chemical formula is both an empirical formula and a molecular formula?

A) CH_4
B) C_2H_6
C) CH_3COOH
D) $CH_3CH_2COOCH_3$

14 The empirical formula of a compound is CH_2. The molecular formula of this compound could be

A) CH_4 B) C_2H_2 C) C_2H_4 D) C_3H_3

A compound contains nitrogen and oxygen in the mole ratio of 1:1. The molecular mass of this compound could be

A) 14 B) 16 C) 30 D) 40

19. Which equation shows a conservation of mass?

A) $Na + Cl_2 \rightarrow NaCl$ B) $Al + Br_2 \rightarrow AlBr_3$
C) $H_2O \rightarrow H_2 + O_2$ D) $PCl_5 \rightarrow PCl_3 + Cl_2$

20. All chemical reactions have a conservation of

A) mass, only
B) mass and charge, only
C) charge and energy, only
D) mass, charge, and energy

Given the incomplete equation for the combustion of ethane:

21. $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6$ ___
What is the formula of the missing product?

A) CH_3OH B) $HCOOH$
C) H_2O D) H_2O_2

22. Which chemical equation is correctly balanced?

A) $H_2(g) + O_2(g) \rightarrow H_2O(g)$
B) $N_2(g) + H_2(g) \rightarrow NH_3(g)$
C) $2NaCl(s) \rightarrow Na(s) + Cl_2(g)$
D) $2KCl(s) \rightarrow 2K(s) + Cl_2(g)$

23. Given the unbalanced equation:

___ Fe_2O_3 + ___ CO → ___ Fe + ___ CO_2

When the equation is correctly balanced using the *smallest* whole-number coefficients, what is the coefficient of CO?

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

24. Given the unbalanced equation:

___ Al + ___ $CuSO_4$ → ___ $Al_2(SO_4)_3$ + ___ Cu

25. When the equation is balanced using the *smallest* whole-number coefficients, what is the coefficient of Al?

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

Given the unbalanced equation:

___ $Mg(ClO_3)_2(s)$ → ___ $MgCl_2(s)$ + ___ $O_2(g)$

26. What is the coefficient of O_2 when the equation is balanced correctly using the *smallest* whole number coefficients?

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