

UNIT 5 STUDY GUIDE: Moles / Balancing Equations / Types of Reactions (CH 10-11)

For the test, you should be able to:

- 1) Define: **Avogadro's Number** **Mole** **Molar Mass** **Molar Volume** **STP**
- 2) List the conditions for STP (temperature & pressure)
- 3) Describe the molar volume of a gas (1 mole of any gas at STP = _____ L)
- 4) Distinguish between the empirical formula and the molecular formula of a compound.
- 5) Calculate the molar mass of a substance (element or compound) using the Periodic Table.
- 6) Calculate the number of representative particles in a given amount of a substance.
- 7) Perform the following conversions and calculations

Moles to Mass**Volume to # of particles****Mass to # of particles****Moles to Volume****Volume to Moles****Mass to Moles****Moles to # of particles****Volume to Mass****Mass to Volume****# of particles to Volume****# of particles to Moles****# of particles to Mass**

8) Calculate the percent composition of a compound (given a specific amount in grams of a compound, or given the formula of a known compound)

9) Calculate the empirical and/or the molecular formula of a compound, given its percent composition or other data.

Problems: Show your work and include correct units in your answers!

1) How many moles is each of the following?

A) 5.55×10^{19} atoms CuB) 1.67×10^{26} molecules NBr_3

2) How many molecules (or formula units for ionic compounds) are in each of the following?

A) 0.000558 mol NaCl

B) 17.7 mol $\text{C}_6\text{H}_{12}\text{O}_6$ 3) Determine the **molar mass** (g/mol) of:A) barium sulfate, BaSO_4 C) aluminum nitrate, $\text{Al}(\text{NO}_3)_3$

E) strontium sulfide, SrS

B) iron(III) carbonate, $\text{Fe}_2(\text{CO}_3)_3$ D) nitrogen trichloride, NCl_3 F) phosphoric acid, H_3PO_4

4) Convert the following masses to moles for each substance.

A) 15.5 g SiO_2

C) 5.96 g KOH

B) 0.088 g AgCl

D) 937 g NH_4NO_2

5) Find the mass of each of the following:

A) 1.50 mol C_5H_{12}

C) 0.770 $\text{Ca}(\text{CN})_2$

B) 5.60 mol NaOH

D) 0.00321 mol NiSO_4

6) Find the **volume (L)** of each of the following (assume STP for all gases):

A) 7.22 mol He gas

B) 0.00557 mol CO_2 gas

7) How many **moles** are in each of the following?

A) 10.5 L Ne gas

B) 135.7 L CO_2 gas

8) How many **individual oxygen atoms** are in 17.3 g of cobalt(III) nitrate, $\text{Co}(\text{NO}_3)_3$?

9) How many liters are occupied by:

A) 71.2 g of hydrogen gas (H_2) at STP?

B) 2.45×10^{24} carbon dioxide molecules (CO_2) at STP?

10) What is the mass of:

A) 9.31×10^{23} molecules of CCl_4 ?

B) 6557 L methane gas (CH_4) at STP?

11) How many representative particles are in each of the following?

A) 422.6 g $\text{Fe}_2(\text{CrO}_4)_3$?

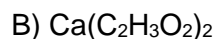
B) 0.887 L N_2O gas (at STP)?

12) A gas at STP has a volume of 300.0 mL and a mass of 1.447 g. What is the molar mass of the gas?

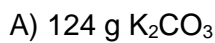
13) Morphine contains 71.56% carbon, 6.71% hydrogen, 4.91% nitrogen and 16.82% oxygen. It has a molar mass of 285.33 g/mol.

- A) Determine the empirical formula for morphine.
- B) Determine the molecular formula for morphine.

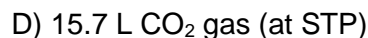
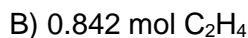
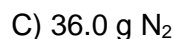
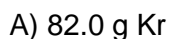
14) Calculate the percent composition of each element in the following compounds:



15) **Using the results from the previous question**, calculate the **mass (grams) of OXYGEN** present in the following amounts of the above compounds:



16) Which of the following contains the largest number if **INDIVIDUAL ATOMS**?



17) If a reaction is run using 16 grams of oxygen and 24 grams of magnesium, what is the percent composition of oxygen and magnesium in this experiment?

18) A hydrated crystal had an original mass of 32.5 grams. After heating, the anhydrous crystal had a mass of 25.1 grams. What was the percent composition of H_2O in the hydrated crystal?

19) What is the empirical formula of a compound that is 40.7% carbon, 54.2% oxygen, and 5.1% hydrogen?

20) What is the empirical formula of a compound formed by the reaction of 102.6 grams of Ca and 97.4 grams of F?

21) What is the density (in grams per liter) at STP of the gas sulfur hexafluoride, SF₆?

22) If the density of an unknown gas Z is 4.50 g/L at STP, what is the molar mass (g/mol) at STP?

23) Calculate the **molecular formulas** of the compounds with the following empirical formulas and molecular masses:

A) C₂H₅, 58 g/mol;

B) CH, 78 g/mol;

C) HgCl, 236.1 g/mol

24) Balance the following chemical equations & indicate which type of reaction each one is:

						Type of Reaction:
K ₃ PO ₄	+	Al(NO ₃) ₃	→	KNO ₃	+ AlPO ₄	_____
C ₆ H ₁₄	+	O ₂	→	CO ₂	+ H ₂ O	_____
Al ₂ O ₃	+	H ₂ O	→	Al(OH) ₃		_____
Fe ₂ O ₃	→			Fe	+ O ₂	_____
Zn	+	SnCl ₂	→		Sn + ZnCl ₂	_____
Cu(NO ₃) ₂	+	Na ₂ S	→	CuS	+ NaNO ₃	_____
Al(OH) ₃		+	H ₂ SO ₄	→	Al ₂ (SO ₄) ₃ + H ₂ O	_____
SF ₆	→			S	+ F ₂	_____
N ₂	+	H ₂	→	NH ₃		_____
KClO ₃	→	KCl	+	O ₂		_____
NaCl	+	F ₂	→	NaF	+ Cl ₂	_____