

# The Mole, and Percent Composition by Mass

1. A mole is a certain \_\_\_\_\_  
You could have a mole of \_\_\_\_\_
2. A mole is \_\_\_\_\_ of something. Which could be written as \_\_\_\_\_
3. \_\_\_\_\_ is Avogadro's Number, it is named for \_\_\_\_\_
4. How many atoms are in one mole of mercury? \_\_\_\_\_ atoms
5. How many atoms are in one half mole of carbon? \_\_\_\_\_ atoms
6. One atom of Hg has a weighted average mass of \_\_\_\_\_ amu from the periodic table.
7. In our class we'd round that to this nearest whole number: \_\_\_\_\_
8. 1 mole, or:  $6.02 \times 10^{23}$  atoms of mercury has mass of \_\_\_\_\_
9. Determine the mass of...  
1.0 mole of carbon = \_\_\_\_\_  
  
2.0 moles of aluminum \_\_\_\_\_      3.0 moles of helium \_\_\_\_\_  
  
0.50 moles magnesium \_\_\_\_\_
10. What's the mass of 1.0 mole of oxygen gas? \_\_\_\_\_
11. The HONClBrIF Twins need special attention. The molar mass in grams for each is:  
H<sub>2</sub> \_\_\_\_\_ g      O<sub>2</sub> \_\_\_\_\_ g      N<sub>2</sub> \_\_\_\_\_ g      Cl<sub>2</sub> \_\_\_\_\_ g  
  
Br<sub>2</sub> \_\_\_\_\_ g      I<sub>2</sub> \_\_\_\_\_ g      F<sub>2</sub> \_\_\_\_\_ g

12. What is the mass of one mole of magnesium oxide? (we'll figure this out soon)

12b. I could also have asked you, what is the molar mass of magnesium oxide? (that means the samething)

14. \_\_\_\_\_ of a substance = it's \_\_\_\_\_. That's vocabulary.

15. MgO

MgO has a molar mass = \_\_\_\_\_ or \_\_\_\_\_ = \_\_\_\_\_

16. An important note about the HONCIBrIF Twins, when bonded into a compound, like MgO, or as CO carbon monoxide...

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17.  $\text{CCl}_2$  Determine the molar mass of carbon dichloride.

\_\_\_\_\_

18. What is the mass of 2.70 moles of sulfur? (do what's below first)

19. The molar mass of sulfur is: \_\_\_\_\_

20. Which means, one mole sulfur = \_\_\_\_\_ grams of sulfur (Now do #18 below)

What is the atomic mass of beryllium? What is the molar mass of beryllium?  
Keeping these clear in your head is critical.

The atomic mass of Be is \_\_\_\_\_ The molar mass of Be is \_\_\_\_\_

21. What is the mass of 0.356 moles of lead?

21b. What's her name? \_\_\_\_\_

22. What is the mass of 6.15 moles of boron?

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Mole class #2

Calculating Molar Masses, and numbers of atoms in any mass of an element or compound

23. What's the name for  $\text{Al}(\text{MnO}_4)_3$  ? \_\_\_\_\_

24. What is the Molar Mass for this compound?



25A+B. NYS Regents likes vocabulary. Instead of always saying molar mass, like they could, sometimes they like to use extra words like...

Gram Molecular Mass = molar mass of \_\_\_\_\_

Or

Gram Formula Mass = molar mass of \_\_\_\_\_

26. What is the molar mass of 1-octanol?

C<sub>8</sub>H<sub>16</sub>OH

(one mole of this = \_\_\_\_\_ molecules C<sub>8</sub>H<sub>16</sub>OH)

27. Calculate the gram formula mass (molar mass) of sodium sulfate. (write formula correctly first)

\_\_\_\_\_

28. If you have 183.2 g of Sodium sulfate, how many moles do you have?

29. You find a small nugget of gold and it is 551 grams of gold? How many moles of gold is that?

30. 37.33 g of silicon is how many moles of silicon?

31. How many moles of zinc are in  $1.25 \times 10^{23}$  atoms?

32. How many moles of xenon gas are in  $8.75 \times 10^{24}$  atoms of Xe?

33. If you find 50.0 grams of pure silver, how many atoms of silver did you find? (two steps!)

Mole Class #3 Objective: \_\_\_\_\_

Review

34. One mole = \_\_\_\_\_

One mole = \_\_\_\_\_

NEW

35. One Mole ALSO = \_\_\_\_\_ \*

\*

\_\_\_\_\_

36. (MAP) don't draw ahead, listen first.

37. How many liters of neon gas are in 65.3 grams of neon? (first we look at the map and make a plan)

38. You win exactly  $3.58 \times 10^{24}$  atoms of aluminum in a contest. How many grams did you win? (fun prize!)

39. You find a canister labeled “exactly”  $7.99 \times 10^{25}$  molecules of carbon dioxide gas ( $\text{CO}_2$ ).  
What is the mass of this gas?

Class #3 Objective: introduction to the idea of percent composition by mass. THINK:

If a tart is 100% blueberries, the mass is 100% blueberries.

If a tart has 16 ounces of fruit, and 8 are strawberries, 3 are blueberry and 5 are kiwi, there's a math problem!

Strawberries are  $\frac{8}{16}$  of the whole amount of fruit, the strawberries make up \_\_\_\_\_ % of the fruit by mass.

The blueberries are  $\frac{3}{16}$  of the whole amount of fruit, the blueberries make up \_\_\_\_\_ % of the fruit by mass.

The kiwi makes up  $\frac{5}{16}$  of the ounces of fruit. They make up \_\_\_\_\_ % of the fruit's total mass.

40. How do we determine the percent composition by mass of hydrogen and oxygen in water?

H<sub>2</sub>O

% Comp

41. What's the percent composition by mass of sodium and chlorine in sodium chloride?

NaCl

% Comp

42. What's the percent composition by mass for Copper (II) sulfate?

CuSO<sub>4</sub>

% Comp



43. So, imagine that you have a pocketful of this copper (II) sulfate, say, 456 grams. That's just more than a pound. How many grams of your pocketful of crystals is just copper? Or oxygen? Or sulfur?

$$456 \text{ g} \times \underline{\hspace{2cm}} \text{ copper} = \underline{\hspace{2cm}} \text{ grams copper by mass}$$

$$456 \text{ g} \times \underline{\hspace{2cm}} \text{ sulfur} = \underline{\hspace{2cm}} \text{ grams sulfur}$$

$$456 \text{ g} \times \underline{\hspace{2cm}} \text{ oxygen} = \underline{\hspace{2cm}} \text{ grams oxygen by mass}$$

44. There are 2 atoms of hydrogen for every one atom of oxygen. Why is the percent comp by mass so low for hydrogen? Shouldn't this be higher?

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45. You fill up a water balloon to 275 mL. (275 mL = 275 g). How many of those grams are just oxygen?

Water is always 89% oxygen, so:  $275 \text{ g water} \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}} \text{ g oxygen}$   
*(disregarding SF here, this is conceptual)*

46. What's the % composition by mass of aluminum in aluminum hydroxide monohydrate?

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47. You find a box with a bar of metal that has stamped into it - *PURE GOLD*. The bar weighs 500. grams EXACTLY. How many atoms of gold do you have?
48. If you have 50.0 g of sodium hydroxide, how many grams of those are oxygen?
49. Calculate the mass of the neon in the balloon of 346 liters.

50. Empirical Formulas \_\_\_\_\_

51. The empirical formula of  $C_6H_{12}O_6$  is \_\_\_\_\_

52.  $CH_2O$  \_\_\_\_\_

53. Let's practice empirical formulas now...

CHEMICAL FORMULAS	EMPIRICAL FORMULAS
$C_6H_{12}O_6$ (glucose)	
$C_8H_{18}$ (octane)	
$C_{24}H_{48}$ (candle wax)	
$C_2H_2$ (acetylene gas)	
$H_2O_2$ (hydrogen peroxide)	
$C_6H_6$ (cyclohexene)	
$C_{10}H_{22}$ (decane)	
$C_6H_{14}$ (hexane)	
$C_5H_{10}O_5$ (pentose)	

54. If you find 11.200 moles of gold and gold is selling for about \$40.39/gram, are you rich or just happy, or does it not matter all that much? (*hint, how many grams are in that many moles?*)

55. Convert  $4.87 \times 10^{24}$  formula units of sodium chloride to grams.
56. You have 125 grams of carbon dioxide gas in a balloon at STP. What is its volume in liters?
57. If you happen to have 888 g of copper (II) sulfate, how many FU's Cu do you have?
58. You have 67.2 g of water, how many of those grams are just hydrogen?

59. What is the percent composition by mass of nickel in the compound nickel (II) carbonate?

60. What are the empirical formulas for the following compounds?

COMPOUND NAME	CHEMICAL FORMULA	EMPIRICAL FORMULA
paraffin wax	$C_{26}H_{54}$	
ethene	$C_2H_4$	
decene	$C_{10}H_{20}$	
sucrose	$C_{12}H_{22}O_{11}$	
heptane	$C_7H_{16}$	
hydrogen monochloride		
potassium sulfite		
cobalt (II) phosphate		

61. How many electrons in a  $Mg^{+2}$  cation? Many will choose  $12 e^-$  \_\_\_\_\_

62. How many electrons in the following species?

$Al^{+3}$	Al	$Co^{+3}$	$Co^{+2}$
$Pb^{+2}$	$Pb^{+4}$	$F^{-1}$	$S^{-2}$
$N^{-3}$	$Au^{+1}$	$Au^{+3}$	Cu
$Cl^{-1}$	Fe	$Na^{+1}$	$Mn^{+7}$