

The Mole, and Percent Composition by Mass

1. A mole is a certain _____
You could have a mole of _____
2. A mole is _____ of things. That is _____
3. _____ is called Avogadro's Number, it is named for _____
4. How many atoms are in one mole of mercury? _____ atoms
5. How many atoms are in 0.50 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: 6.02×10^{23} atoms of mercury has mass of _____
9. Determine the mass of... 1.0 mole of carbon = _____

2.0 moles of aluminum _____ 4.0 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:

H₂ _____ g O₂ _____ g N₂ _____ g Cl₂ _____ g

Br₂ _____ g I₂ _____ g F₂ _____ 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 same thing)

14. _____ of a substance = it's _____. That's vocabulary.

15. MgO

MgO has a molar mass = _____ or _____ = _____

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

_____ in these compounds.

17. CCl₂ 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)

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?

Mole class #2

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

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

24. What is the Molar Mass for this compound?



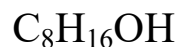
25A+B. NYS Regents likes vocabulary. Instead of always saying molar mass, like they could, sometimes they like to use extra words like...

Gram Molecular Mass = molar mass of _____

Or

Gram Formula Mass = molar mass of _____

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



(one mole of this = _____ molecules C₈H₁₆OH)

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. How many moles of gold is 551 grams of gold?

30. How many moles of silicon is 37.33 grams of silicon?

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

32. How many moles of xenon gas are in 8.75×10^{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 3.58×10^{24} atoms of aluminum in a contest. How many grams did you win? (fun prize!)

39. You find a canister labeled “exactly” 7.99×10^{25} molecules of carbon dioxide gas (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?

H₂O

% 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?

CuSO₄

% Comp

43. So, imagine that you have a pocketful of this copper (II) sulfate, say, 86.5 grams. That's just more than a pound. How many grams of your pocketful of crystals is just copper? Or oxygen? Or sulfur?

$$86.5 \text{ g} \times \underline{\hspace{2cm}} \text{ copper} = \underline{\hspace{2cm}} \text{ grams copper by mass}$$

$$86.5 \text{ g} \times \underline{\hspace{2cm}} \text{ sulfur} = \underline{\hspace{2cm}} \text{ grams sulfur}$$

$$86.5 \text{ g} \times \underline{\hspace{2cm}} \text{ oxygen} = \underline{\hspace{2cm}} \text{ grams oxygen by mass}$$

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?

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 g water X $\underline{\hspace{2cm}}$ = $\underline{\hspace{2cm}}$ g oxygen
(disregarding SF here, this is conceptual)

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

47. You find a box with a bar of metal that has stamped into it *PURE GOLD*.
The bar weighs 324.8 grams EXACTLY. How many atoms of gold do you have?

48. If you have 64.35 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 are _____. They are written like chemical formulas to confuse you.

51. The empirical formula of octane, or: C_8H_{18} is _____

52. C_4H_9 _____

53. CHEMICAL FORMULAS	Ratio then reduced ratio	EMPIRICAL FORMULAS
C_6H_{14} (hexane)	6:14 \rightarrow 3:7	C_3H_7
$C_6H_{12}H_6$ (glucose)		
$C_{24}H_{48}$ (candle wax)		
C_2H_2 (acetylene gas)		
H_2O_2 (hydrogen peroxide)		
C_6H_6 (cyclohexene)		
$C_{10}H_{22}$ (decane)		
C_5H_{10} (pentene)		
$C_5H_{10}O_5$ (pentose)		
H_2O (water)	“already reduced”	
CH_4 (methane)	“already reduced”	
CO_2 (carbon dioxide)	“already reduced”	

54. If you find 8.251 moles of platinum, and is selling for \$32.67 per gram, are you rich or just happy?

The slide show continues, and for review, YOU are going to finish up these problems, and bring back problems you have figuring them out. Try hard, but feel free to ask questions. Skipping them would be a foolish choice. Do these, I beseech you.

55. Convert 4.87×10^{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}