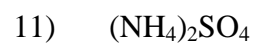


Unit 2

Molar Mass Worksheet

Calculate the molar masses of the following chemicals:



Avogadro's Number and the Mole

- 1) How many moles of water does 6.02×10^{23} molecules represent?
- 2) Convert 3.01×10^{23} molecules of C_2H_6 to moles
- 3) How many moles of glucose does 1.2×10^{24} molecules represent?
- 4) How many moles of CaCl_2 does 2.41×10^{24} formula units represent
- 5) How many atoms does 2.0 moles of He represent?
- 6) How many sodium ions are in 3.0 moles of NaCl?
- 7) How many molecules are in 0.25 moles of CH_4 ?
- 8) How many total atoms are in 1.0 moles of H_2O ?

Mass and the Mole

- 1) How many moles are in 15 grams of lithium?
- 2) How many grams are in 2.4 moles of sulfur?
- 3) How many moles are in 22 grams of argon?
- 4) How many grams are in 88.1 moles of magnesium?
- 5) How many moles are in 2.3 grams of phosphorus?
- 6) How many grams are in 11.9 moles of chromium?
- 7) How many moles are in 9.8 grams of calcium?
- 8) How many grams are in 238 moles of arsenic?

What are the molecular weights of the following compounds?

- | | |
|-----------------------|---|
| 9) NaOH | 12) H ₃ PO ₄ |
| 10) H ₂ O | 13) Mn ₂ Se ₇ |
| 11) MgCl ₂ | 14) (NH ₄) ₂ SO ₄ |

- 15) How many grams are in 4.5 moles of sodium fluoride, NaF?
- 16) How many moles are in 98.3 grams of aluminum hydroxide, Al(OH)₃?
- 17) How many grams are in 0.02 moles of beryllium iodide, BeI₂?
- 18) How many moles are in 68 grams of copper (II) hydroxide, Cu(OH)₂?
- 19) How many grams are in 3.3 moles of potassium sulfide, K₂S?
- 20) How many moles are in 1.2×10^3 grams of ammonia, NH₃?
- 21) How many grams are in 2.3×10^{-4} moles of calcium phosphate, Ca₃(PO₃)₂?
- 22) How many moles are in 3.4×10^{-7} grams of silicon dioxide, SiO₂?
- 23) How many grams are in 1.11 moles of manganese sulfate, Mn₃(SO₄)₇?

Combined Mole Calculations

- 1) How many molecules are there in 24 grams of FeF_3 ?
- 2) How many molecules are there in 450 grams of Na_2SO_4 ?
- 3) How many grams are there in 2.3×10^{24} atoms of silver?
- 4) How many grams are there in 7.4×10^{23} molecules of AgNO_3 ?
- 5) How many grams are there in 7.5×10^{23} molecules of H_2SO_4 ?
- 6) How many molecules are there in 122 grams of $\text{Cu}(\text{NO}_3)_2$?
- 7) How many grams are there in 9.4×10^{25} molecules of H_2 ?
- 8) How many molecules are there in 230 grams of CoCl_2 ?

- 9) How many molecules are there in 2.3 grams of NH_4SO_2 ?
- 10) How many grams are there in 3.3×10^{23} molecules of N_2I_6 ?
- 11) How many molecules are there in 200 grams of CCl_4 ?
- 12) How many grams are there in 1×10^{24} molecules of BCl_3 ?
- 13) How many grams are there in 4.5×10^{22} molecules of $\text{Ba}(\text{NO}_2)_2$?
- 14) How many molecules are there in 9.34 grams of LiCl ?
- 15) How many grams do 4.3×10^{21} molecules of UF_6 weigh?
- 16) How many molecules are there in 230 grams of NH_4OH ?

More Combined Mole Calculations

1. Calculate the mass of 1.000 mole of CaCl_2
2. Calculate grams in 3.0000 moles of CO_2
3. Calculate number of moles in 32.0 g of CH_4
4. Determine mass in grams of 40.0 moles of Na_2CO_3
5. Calculate moles in 168.0 g of HgS
6. Calculate moles in 510.0 g of Al_2S_3
7. How many moles are in 27.00 g of H_2O
8. Determine the mass in grams of Avogadro number of $\text{C}_{12}\text{H}_{22}\text{O}_{11}$
9. Find mass in grams of 9.03 moles of H_2S
10. Determine grams in 1.204 mole of NH_3

Consider the molecule CuNH_4Cl_3 as you answer 11 - 20.

11. Name the elements present.
12. How many atoms form the molecule?
13. How many of each atom in the molecule?
14. How many hydrogen atoms in one mole of molecules?

15. How many chlorine atoms in six moles of molecules?
16. What is the molar mass of this molecule?
17. What is the mass in grams of one molecule?
18. How many moles would be in 6.84 g of this substance?
19. You need 0.0100 mole of lead (II) chromate. How much should you weigh on the scale?
20. Given 6.40 g of HBr. How many moles is this?

Write the correct formula for calcium acetate and then answer 21 - 23 based on it.

21. What is the mass of exactly one mole of calcium acetate?
22. How many moles are contained in 1.58 g of the substance in #21?
23. How much does 0.400 mole of #21 weigh?
24. Write the formula for oxygen gas.
25. How many atoms (and moles) are represented by the formula in #24?
26. What is the mass of Avogadro Number of oxygen molecules?

The Mole Review

- 1) Define “mole”.
- 2) How many moles are present in 34 grams of $\text{Cu}(\text{OH})_2$?
- 3) How many moles are present in 2.45×10^{23} molecules of CH_4 ?
- 4) How many grams are there in 3.4×10^{24} molecules of NH_3 ?
- 5) How much does 4.2 moles of $\text{Ca}(\text{NO}_3)_2$ weigh?
- 6) What is the molar mass of MgO ?
- 7) How are the terms “molar mass” and “atomic mass” different from one another?
- 8) Which is a better unit for expressing molar mass, “amu” or “grams/mole”?

Empirical Formula

Find the empirical formula for each of the following substances. The concentration is given.

1. 88.8% copper, 11.2% oxygen
2. 40.0% carbon, 6.7% hydrogen, 53.3% oxygen
3. 92.3% carbon, 7.7% hydrogen
4. 70.0% iron, 30.0% oxygen
5. 5.88% hydrogen, 94.12% oxygen
6. 79.90% copper, 20.10% oxygen
7. 56.4% potassium, 8.7% carbon, 34.9% oxygen
8. 10.04 % carbon, 0.84% hydrogen, 89.12% chlorine
9. 42.50% chromium, 57.50% chlorine
10. 15.8% carbon, 84.2% sulfur
11. 30.43% nitrogen, 69.57% oxygen
12. 82.40% nitrogen, 17.60% hydrogen
13. 12.5% hydrogen, 37.5% carbon, 50.0% oxygen
14. 75.0% carbon, 25.0% hydrogen
15. 29.40% calcium, 23.56% sulfur, 47.04% oxygen
16. 38.67: potassium, 13.85% nitrogen, 47.48% oxygen
17. 60.0% magnesium, 40.0% oxygen
18. 52.94% aluminum, 47.06% oxygen
19. 72.40% iron, 27.60% oxygen
20. 52.0% zinc, 9.6% carbon, 38.4 % oxygen

The Mole and Percentage Composition Review

1. Determine the number of moles present in each of the following

- a. 17.4 g Na b. 60.0 g Na₂SO₄ c. 93.5 g CO₂ d. 25.6 g NaNO₃

2. Determine the number of moles present in each of the following

- a. 0.75 mol Ca(OH)₂ b. 2.45 mol Cu(NO₃)₂ c. 1.0 mol H₂O
 d. 0.20 mol KCl e. 0.50 mol H₂O₂

3. Determine the number of molecules in each of the following

- a. 15.0 g SO₂ b. 2.5 mol CO c. 0.40 mol HC₂H₃O₂ d. 0.70 g C₆H₁₂O₆

4. Determine the number of atoms in each of the following

- a. 22g NH₃ b. 2.28 mol Ca₃(PO₄)₂ c. 45.5 g C₃H₈ d. 0.20 mol Na₂S₂O₃

5. Determine the percentage composition for each of the following

- a. PbS b. H₂CO₃ c. CO₂ d. NH₄Cl e. Mg(IO₃)₂ f. KMnO₄

6. Determine the empirical and molecular formulas for each of the following

	Percent Composition	Molar Masses
a.	64.9% C, 13.5% H, 21.6% O	74 g/mol
b.	52.2% C, 13.0% H, 34.8% O	46 g/mol
c.	39.9% C, 6.7% H, 53.4% O	60 g/mol
d.	26.7% C, 2.2% H, 71.7% O	90 g/mol
e.	12.1% C, 16.2% H, 71.1% Cl	99 g/mol
f.	20.2% Al, 79.8% Cl	267 g/mol
g.	40.3% B, 52.2% N, 7.5% H	80 g/mol

7. Acetone, a liquid often used as nail polish remover, is found to contain 62.0% carbon, 10.4% hydrogen, and 27.5% oxygen. If its molecular mass is found to be 58.1 μ, determine its molecular formula.

Final Worksheet Quantities in Chemical Reactions

1. Write the formula for the following:

aluminum phosphate

iron (II) sulfite

silver carbonate

copper (II) bromide

ammonium sulfide

zinc carbonate

calcium acetate

copper (I) sulfate

iron (III) chloride

2. Name the following compounds:

$\text{Fe}(\text{NO}_3)_3$

ZnO

3. Determine the mass in grams of:

5.00×10^{-2} mol CO_2

5.00×10^{25} CO_2 molecules

4. Suppose you have 100.0 g sample of each of the following compounds: NH_3 , MgCl_2 . Which sample contains the smallest number of moles?

5. One molecule of the hormone insulin has a mass of 9.5×10^{-21} g. What is the molar mass of insulin?

6. Determine the molecular formula of a compound with each of the following empirical formulas and molar masses:

SOCl_2 : 118.96u

CH_2 : 70.15u

C_2NH_2 : 120.15u

7. The empirical formula for a compound is either $\text{C}_6\text{H}_6\text{O}$ or $\text{C}_6\text{H}_6\text{O}_2$. If the compound is 65.4% C, which of the two formulas is correct?
8. Ethylenediaminetetraacetic acid EDTA is 41.09% C, 5.53% H, 9.58% N, and 43.8% O. What is the empirical formula of EDTA?
9. The complete combustion of 0.2864 g sample of a compound yielded 0.420 g of CO_2 and 0.172 g of H_2O . The molecular weight was determined to be approximately 60.0 g/mol. What is the molecular formula of this compound if it contains only C, H, and O?

Mole Road Map

