

Density, Ions, & Percent Composition

(Honors Chemistry)

Density is expressed in grams/mL and molar mass is expressed in grams/mole. Show all work!
 Density, molar mass, and percent composition DO NOT need to be in scientific notation!

1. If the molar mass of a gas is 34.0 grams, what is the density @ STP?

$34.0 - g$	1 mol	$1 - L$	$1.52 \times 10^{-3} \text{ g/mL}$
1 mol	$22.4 - L$	$1000 - mL$	

2. What is the density of chlorine gas @ STP?

$71 - g$	1 mol	$1 - L$	$3.17 \times 10^{-3} \text{ g/mL}$
1 mol	$22.4 - L$	$1000 - mL$	

3. If the density of a gas @ STP is 4.83 g/L, what is the molar mass?

4.83 g	$22.4 - L$	108 g/mole
$1 - L$	1 mol	

4. What is the density of CO₂ @ STP?

44 g	1 mol	$1 - L$	$1.96 \times 10^{-3} \text{ g/mL}$
1 mol	$22.4 - L$	$1000 - mL$	

5. What is the density of a 75.9-gram sample of NH₃ gas @ STP?

$17 - g$	1 mol	$1 - L$	$7.59 \times 10^{-4} \text{ g/mL}$
1 mol	$22.4 - L$	$1000 - mL$	

6. You have a 2-liter bottle filled with 2.86 grams of oxygen gas @ STP. What is the molar mass of oxygen?

$2.86 - g$	$22.4 - L$	32.0 g/mol
$2 - L$	1 mol	

7. What is the density of 6.02×10^{23} molecules of carbon monoxide gas @ STP?

$6.02 \times 10^{23} \text{ molecules CO} = 28 \text{ g}$	1 mole	$1 - L$	$1.26 \times 10^{-3} \text{ g/mL}$
1 mole	$22.4 - L$	1000 mL	

8. Is the unknown gas NO, N₂O, N₂O₅, NO₂, or N₂O₃ if 75.3-g of it occupies a 38.4-L container at STP?

$75.3 - g$	$22.4 - L$	$44.0 \text{ g/mol} = \text{N}_2\text{O}$
$38.4 - L$	1 mol	

9. How many hydrogen atoms are in 4.32 moles of the molecule, NH_3 ?

$$\frac{4.32 \text{ mol NH}_3}{1 \text{ mol}} \times \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ molecule NH}_3} \times \frac{3 \text{ atoms H}}{1 \text{ molecule NH}_3} = 7.80 \times 10^{24} \text{ atoms H}$$

10. How many oxygen ions are present in 7.21 moles of the formula unit, Al_2O_3 ?

$$\frac{7.21 \text{ mol Al}_2\text{O}_3}{1 \text{ mol}} \times \frac{6.02 \times 10^{23} \text{ fu}}{1 \text{ fu Al}_2\text{O}_3} \times \frac{3 \text{ O-ions}}{1 \text{ fu Al}_2\text{O}_3} = 1.30 \times 10^{25} \text{ Oxygen ions}$$

11. You have an unknown gas with a density of 1.25 g/L at STP. Is the gas O_2 , N_2 , CH_4 , CO_2 , or NH_3 ?

$$\frac{1.25 \text{ g}}{\text{L}} \times \frac{22.4 \text{ L}}{1 \text{ mol}} = 28 \text{ g/mol} = \text{N}_2$$

12. What is the density of CH_4 gas at STP?

$$\frac{16 \text{ g}}{\text{mol}} \times \frac{1 \text{ mol}}{22.4 \text{ L}} \times \frac{1 \text{ L}}{1000 \text{ mL}} = 7.14 \times 10^{-4} \text{ g/mL}$$

13. Calculate the percent composition of each element in the compound KMnO_4 . Molar Mass = 158

$$\text{K} = \frac{39}{158} \times 100 = 24.7\% \quad \text{Mn} = \frac{55}{158} \times 100 = 34.8\% \quad \text{O} = \frac{64}{158} \times 100 = 40.5\%$$

14. Calculate the percent composition of each element in the compound $\text{Pb}(\text{NO}_3)_4$. Molar Mass = 455

$$\text{Pb} = \frac{207}{455} = 45.5\% \quad \text{N} = \frac{56}{455} = 12.3\% \quad \text{O} = \frac{192}{455} = 42.2\%$$

15. Calculate the percent composition of each element in the compound CuSO_4 . Molar Mass = 160

$$\text{Cu} = \frac{64}{160} = 40.0\% \quad \text{S} = \frac{32}{160} = 20.0\% \quad \text{O} = \frac{64}{160} = 40.0\%$$

16. Calculate the percent composition of each element in the compound $\text{Mg}_3(\text{PO}_4)_2$. Molar Mass = 262

$$\text{Mg} = \frac{72}{262} = 27.5\% \quad \text{P} = \frac{62}{262} = 23.7\% \quad \text{O} = \frac{128}{262} = 48.9\%$$

17. Calculate the percent composition of each element in the compound $\text{C}_2\text{H}_6\text{O}$. Molar Mass = 46

$$\text{C} = \frac{24}{46} = 52.2\% \quad \text{H} = \frac{6}{46} = 13.0\% \quad \text{O} = \frac{16}{46} = 34.8\%$$

18. Calculate the percent composition of each element in the compound NaHCO_3 . Molar Mass = 84

$$\text{Na} = \frac{23}{84} = 27.4\% \quad \text{H} = \frac{1}{84} = 1.2\% \quad \text{C} = \frac{12}{84} = 14.3\% \quad \text{O} = \frac{48}{84} = 57.1\%$$