

Competency 5 Practice Problems

Work out on notebook paper. Show all work.

1. Moles problems:

- Calculate the molar masses of sulfuric acid, SO_2 , and $\text{C}_2\text{H}_5\text{OH}$.
- How many moles are there in 64.0 g of SO_2 ? How many molecules?
- What mass of sulfuric acid contains the same number of molecules as 64.0 g of SO_2 ?
- If a certain number of carbon atoms had a mass of 0.0066 g, what would be the mass of the same number of SO_2 molecules?

2. Moles problems:

- If 1.00 mol of a substance has a mass of 33.4 g, calculate the mass of 5.27 mol.
- If 0.227 mol of a substance has a mass of 11.3 g, what is its molar mass?
- If a substance has a molar mass of 55.5, then calculate the number of moles in 13.3 g.
- If 0.45 mol of a substance has a mass of 64.3g, then how many mol are there in 17.5 g?
- How many molecules are there in 3.00×10^{-6} g of the substance in (d) above?

3. Calculate the % of nitrogen in the fertilizers ammonia and urea, $\text{CO}(\text{NH}_2)_2$.

4. Phenacyclidine is $\text{C}_{17}\text{H}_{25}\text{N}$. A sample suspected of being this drug was found to have a % composition of 83.71% carbon, 10.42% hydrogen, and 5.6% nitrogen. Is the sample probably phenacyclidine? (Calculate the % of each element to 4 sig digs.)

5. Percentage composition empirical and molecular:

- What is the percent of sulfur in SO_3 ?
- A compound consisting only of phosphorus and oxygen is found to contain 56.34% oxygen. What is the mass of each element in an 18.0 g sample?
- What is the empirical formula of this compound in (b)?
- Given that the molar mass of this compound is 284, what is the molecular formula?

6. Percentage composition and molar mass:

- A 1.023 g sample of a compound containing sulfur is converted to 1.509 g of BaSO_4 . Calculate the percent sulfur in the original compound.
- A metal M forms an oxide M_2O_3 containing 68.4% of the metal by mass. Calculate the molar mass of M.

7. Aluminum oxide, Al_2O_3 , occurs naturally in nature as a mineral called corundum, which is noted for its hardness and resistance to attack by acids. Its density is 3.97 g/cm³. Calculate the number of atoms of aluminum in 15.0 cm³ of corundum.