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PHYSICS & CHEMISTRY

# Chemistry

## Preliminary Course

Module 2  
Introduction to Quantitative Chemistry

Module 2: Introduction to Quantitative Chemistry

Topic 2.3: The Mole Concept

————— **Foundation** —————

1. Define the term “molecular formula”.

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2. Define the term “empirical formula”.

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3. Fill in the following table by identifying the molecular and empirical formula of each substance.

Substance	Molecular Formula	Empirical Formula
Octane	$C_8H_{18}$	
Glucose	$C_6H_{12}O_6$	
Hydrogen peroxide	$H_2O_2$	
Carbon dioxide		
Dinitrogen tetroxide		
Water		

4. Which substance(s) has a chemical formula that must always be an empirical formula?

- (a) Covalent molecular substances
- (b) Covalent network lattices
- (c) Ionic compounds
- (d) Two of the above

————— Development —————

1. Gravimetric analysis was carried out on samples of different compounds to determine their elemental composition.

Determine the empirical formula of each compound if the samples were found to contain:

- (a) 11.5 g of sodium and 8.00 g of sulfur.

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- (b) 0.700 g of hydrogen, 11.4 g of sulfur and 22.9 g of oxygen.

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- (c) 3.60 g of carbon, 21.3 g of chlorine and 11.4 g of fluorine.

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★  $\text{Na}_2\text{S}$ ,  $\text{H}_2\text{SO}_4$ ,  $\text{CCl}_2\text{F}_2$  ★

2. A compound with a molar mass of  $80.07 \text{ g mol}^{-1}$  was analysed gravimetrically and found to contain 40.0% sulfur and 60.0% oxygen.

(a) Determine the empirical formula of this compound.

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(b) Determine the molecular formula of this compound.

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★  $\text{SO}_3$ ,  $\text{SO}_3$  ★

3. Ethylene glycol is an organic compound with a molar mass of  $62.07 \text{ g mol}^{-1}$ . A small sample of ethylene glycol was analysed for its elemental composition and it was found to contain 3.96 g of carbon, 1.01 g of hydrogen and 5.28 g of oxygen.

(a) Determine the empirical formula of ethylene glycol.

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(b) Determine the molecular formula of ethylene glycol.

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★  $\text{CH}_3\text{O}$ ,  $\text{C}_2\text{H}_6\text{O}_2$  ★