

8. EMPIRICAL FORMULAS

CH30S

UNIT 1 – ELEMENTS & COMPOUNDS

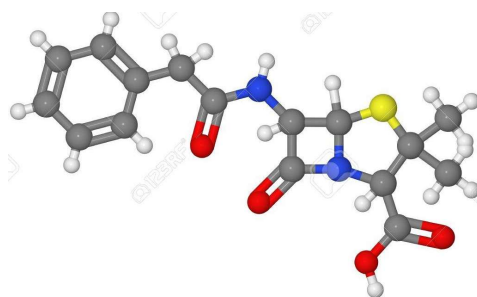
1

REVIEW

Penicillin is an antibiotic molecule that has saved millions of lives from bacterial infection.

Alexander Fleming accidentally discovered it in 1928, when he came back from a vacation and found that a green mold called *Pennicilium notatum* had contaminated Petri dishes in his lab and were killing some of the bacteria he'd been growing.

Black = Carbon White = Hydrogen
 Blue = Nitrogen Red = Oxygen
 Yellow = Sulphur



1. Write the chemical formula of penicillin.
2. Determine the molar mass.
3. What is the percent composition of penicillin?
4. A vet gives your dog 75 mg of penicillin. How many moles is this? How many molecules are in the dose?

2

REVIEW ANSWERS

3

TYPES OF CHEMICAL FORMULAS

Every compound has 3 formulas that represent it:

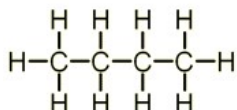
1. Empirical formula: the lowest whole number ratio of atoms or moles of atoms in a compound.
2. Molecular formula: the true number of atoms or moles of atoms of each element in the formula of a compound.
3. Structural formula: a diagram of the arrangement of the atoms in a molecule of that chemical.

4

FOR EXAMPLE

BUTANE

- Structural Formula:

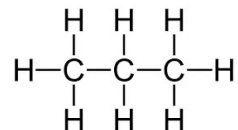


- Molecular Formula:

- Empirical Formula:

PROPANE

- Structural Formula:



- Molecular Formula:

- Empirical Formula:

5

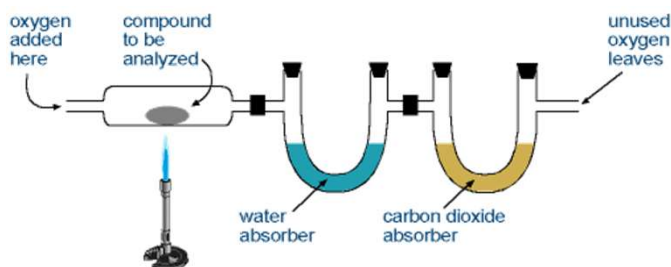
QUICK CHECK...

Structural Formula	Molecular Formula	Empirical Formula
$ \begin{array}{c} \text{H} \quad \text{O} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{O}-\text{H} \\ \\ \text{H} \end{array} $		
$ \begin{array}{c} \text{O} \quad \text{O} \\ \quad \\ \text{H}-\text{O}-\text{C}-\text{C}-\text{O}-\text{H} \end{array} $		

6

EMPIRICAL FORMULAS

- Chemists can take an unknown compound and determine the % composition of each element in the compound through a process called combustion analysis.
- From these % compositions, the empirical formula can be determined, and the compound can be identified.



7

EXAMPLE # 1

RDX is an organic explosive used extensively in World War II in combination with TNT. It is still used today by the military in many countries.

The percent composition of RDX was found to be 16.2% carbon, 2.73% hydrogen, 37.8% nitrogen, and the remainder is oxygen. Determine the empirical formula of RDX.



8

EXAMPLE #2

Nicotine is an addictive ingredient found in tobacco products. It is linked to many different health problems, including cancer, lung disease, and aneurysms. The percent composition of nicotine was found to be 74.02 % carbon, 8.71% hydrogen, and the remainder is nitrogen. Determine the empirical formula of nicotine.

