
How to Calculate the Empirical Formula and Molecular Formula

Diaprof Camp ProWS 001

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1.(i) The simplest formula of a compound formed when combining 36 g of magnesium and 14 g of nitrogen is:

- A. MgN
- B. Mg₂N
- C. Mg₃N₂
- D. MgN₂
- E. Mg₄N₂ (NECTA, 2021).

(ii) The empirical formula of a certain compound is CH₃. Its molar mass is 30g. What will be its molecular formula?

- (a) CH₄
- (b) C₂H₄
- (c) C₂H₆
- (d) C₂H₈
- (e) C₄H₁₂ (Shinyanga 2020).

(iii) Substance L has a percentage composition 54.6% carbon, 9.1% hydrogen and the rest is oxygen. The empirical formula of the substance L is:

- A. C₂H₄O
- B. CH₄
- C. CH₂O
- D. C₂H₆O
- E. C₂HO₂ (St. Clara, 2019).

(iv) Some zinc sulphate crystals were heated to a constant mass with the following results.

Mass of crucible = 20.00g

Mass of crucible + crystals = 25.74g

Mass of crucible + residual = 23.22g

From the data, the value of X in ZnSO₄.XH₂O is

- A. 5
- B. 6
- C. 10
- D. 7
- E. 8

(St. Clara 2020)

(v) 0.08 moles of 11.76 g of hydrated calcium chloride contain 3.2 g calcium, 5.68 g chlorine and the rest is for water of crystallization. The formula of crystal is

- A. $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$
- B. $\text{CaCl}_2 \cdot 3\text{H}_2\text{O}$
- C. $\text{CaCl}_2 \cdot 5\text{H}_2\text{O}$
- D. $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$
- E. $\text{CaCl}_2 \cdot 7\text{H}_2\text{O}$

(St. Clara 2020).

(vi) The empirical formula of a certain hydrocarbon is CH_3 . Its vapour density is 15. What will be its molecular formula?

- A) CH_4
- B) C_2H_4
- C) C_2H_6
- D) C_2H_8
- E) C_4H_{12} (Tamongsco, 2019).

2. (a) What do you understand by the following terms?

- (i) Empirical formula
- (ii) Relative atomic mass

(b) A certain compound K contains 15.8% carbon and 84.2% sulphur. The molar mass of K is 76 g/mol. Determine its:

- (i) simplest formula
- (ii) molecular formula (FTNA, 2013).

3. A compound consists of 85.7% carbon and 14.3% hydrogen by mass. If its relative molecular mass is 56. Calculate:

- (i) Empirical formula.
- (ii) Molecular formula (FTNA, 2015).

4. A compound consists of 40% carbon, 6.67% hydrogen and 53.33% oxygen. If its relative molecular mass is 60, calculate the following:

- (i) Empirical formula
- (ii) Molecular formula (FTNA, 2018).

5. A certain gaseous compound contains 30.4% of nitrogen and 69.6% of oxygen by mass. If the molar mass of the compound is 92, calculate the molecular formula (FTNA, 2019).

6. A pure oxide of lead (Pb) contains 13.4% of oxygen. Calculate the empirical formula of the compound (FTNA, 2021).

7. An organic compound P consists of 52.2% of carbon, 13% of hydrogen and 34.8% of oxygen. The vapour density of P is 23. Calculate the molecular formula of the compound P and write possible isomer(s) from the molecular formula determined (NECTA, 2014).

8. Compound X contains 24.24% carbon, 4.04% hydrogen and 71.72% chlorine. Given that, the vapour density of X is 49.5.

- (i) Calculate the molecular formula of the compound X.
- (ii) Draw and name the displayed/open structure formula of the possible isomer(s) from the molecular formula determined (NECTA, 2015).

9. Determine the empirical formula of a substance that has the following composition by mass: 49.5% manganese and 50.5% oxygen (NECTA, 2016).

10. You are provided with a compound of 22.2% zinc, 11.6% sulphur, 22.3% oxygen, and the

rest percentage is water of crystallization. Calculate the molecular formula of the compound if its molecular mass is 283 (NECTA, 2019).

11. A certain compound having a relative molecular mass of 76 was found to contain 15.8% of carbon and 84.2% of sulphur. Based on this information:

(a) Determine the empirical formula and molecular formula of the compound.

(b) Give the IUPAC name of the compound (NECTA, 2020).

12. A certain compound with the molecular mass of 28 was analyzed and found to be composed of 0.6 g of carbon and 0.1 g of hydrogen.

(a) Work out its empirical formula and molecular formula.

(b) Classify the compound to its homologous series (NECTA, 2022).

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13. You are provided with a compound of 24.8% zinc, 27% chlorine and the rest is of water crystallization. Calculate the molecular formula of the compound if its molecular mass is 262 (GEITA, MOCK 2020).

14. You are provided with a compound composed of 40.5% zinc, 19.6% sulphur and 39.9% oxygen. Calculate the molecular and empirical formula, if its molecular mass is 161 (CSSC, 2020).

15. A compound was found to have the following percentage by mass: 23% zinc, 11% sulphur, 22% oxygen and 44% water. What is the empirical formula of this compound? (Dar-es-Salaam, 2019).

16. (a) An hydrocarbon Q constitutes of 85.71% by carbon. Since its vapour density is 14.

Calculate its:

(i) Empirical formula

(ii) Molecular formula

(b) By showing balanced chemical equation and stating necessary conditions, show how Q can be converted into a second member of saturated hydrocarbon (TAHOSSA ILEMELA, 2020).

17. A compound M is composed of 52.2% carbon, 13% hydrogen and the rest is oxygen. If the vapour density of the compound M is 23. Then,

i. Calculate Empirical formula of a compound M.

ii. Find its Molecular formula (TAHOSSA LUDEWA, 2018).

18. Determine the empirical formula of a substance that has the following composition by mass: 49.5% manganese and 50.5% oxygen (MAU, 2020).

19. The empirical formula of the compound Q is CH_2 . If its vapour density is 21, what will be its molecular formula?

20. A compound of sulphur and oxygen whose vapour density is 40 consists of 40.1% Sulphur by mass. (Mwanza, 2020)

a) What is the empirical formula of the compound?

b) Calculate the molecular formula of the compound (Morogoro Mock, 2020).

21. (a) The chemical analysis shows that the empirical formula of a compound "Q" is CH_2O and has a relative molar mass of 60.

(i) Write down the molecular formula of the compound.

- (ii) Write the balanced chemical equation when compound Q reacts with sodium metal, sodium hydroxide and methanol.
- (b) Draw the open structure of compound Q above (Pwani Mock, 2020).
- 22.(i) Define the term molecular formula
- ii) An organic compound contains 26.7% carbon, 2.2% hydrogen and 71.1% oxygen. If its molecular mass is 90. Determine its molecular formula.(Ruvuma Mock 2019)
23. An organic compound contains 26.7% carbon, 2.2% hydrogen and the rest is oxygen. If its vapor density is 45. Determine its molecular formula.(Ruvuma Mock 2020)
24. A compound of molecular mass 248g/mol contains 18.55% sodium, 25.80% sulphur, 19.35% oxygen and the rest is for water of crystallization.
- i) Determine the empirical formula of the compound
- ii) Determine the molecular formula of the compound
- iii) Name the compound (St. Clara Mlali, 2019).
- 25.A compound X is made up of 30.43% nitrogen and 69.57% oxygen. If the vapour density of X is 46. Determine the molecular formula of X (St. Clara 2019).
26. An experiment showed that 13.88g of calcium chloride were obtained from the combination of 5g of calcium with an unknown relative mass of chlorine.
- (a)What is the simplest formula of calcium chloride?
- (b)What kind of bond exists between calcium and chloride?
- (c) Give two properties of the bond you mentioned in (ii) above (Tamongsco, 2018).
27. (a) Give the meaning of the following: i) Empirical Formula
- ii) Molecular Formula
- (b) Compound Z has 8.32g of lead (Pb), 1.28g sulphur (S) and 2.56g of Oxygen (O). What is the simplest formula and molecular formula of Z if the molecular weight of compound Z is 303g/mol? (Tanga 2019)
28. On heating 0.3585g of oxide of metal X strongly in a stream of hydrogen, 0.3105g of pure metal remained. Suggest the empirical formula of the oxide, if the molar mass of X is 207. (UPEO, 2019).
29. Compound Z has a molecular mass of 84. It has the following percentage composition by mass: 28.6% magnesium, 14.3% carbon, and the rest is oxygen.
- (i) Find the molecular formula of compound Z.
- (ii) Write a balanced chemical equation between Z and dilute hydrochloric acid (Dar-es-Salaam 2020).
30. A certain compound contains 20% by mass of Mg, and 26% of Sulphur and Y% of Oxygen.
- (i) Find the value of Y.
- (ii) The empirical formula of this compound is (Mg=24, S=32, O=16) (Inter-Islamic, 2020).