

Question 9 (Answer: **B**)

- A molecular formula is also the empirical formula only when it cannot be simplified.
- CH_4 and C_3H_8 have no common factor, so they are already simplest.
- C_2H_6 simplifies to CH_3 and C_3H_6 to CH_2 , so those two are not.

Question 11 (Answer: **B**)

- The percentages give the empirical formula CH_2O , exactly as in the earlier question.
- CH_2O has a mass of $12 + 2 + 16 = 30$.
- $60/30 = 2$, so the molecular formula is $\text{C}_2\text{H}_4\text{O}_2$.

Question 9 (Answer: **D**)

- A molecular formula equals the empirical formula only when it has no common factor.
- Butane C_4H_{10} simplifies to C_2H_5 , but-1-ene C_4H_8 to CH_2 , butanoic acid $\text{C}_4\text{H}_8\text{O}_2$ to $\text{C}_2\text{H}_4\text{O}$.
- Butan-1-ol is $\text{C}_4\text{H}_{10}\text{O}$, which has no common factor, so it cannot be simplified.

Question 10 (Answer: **C**)

- The sulfate ion always carries a $2-$ charge.
- Three of them give $6-$ in total, so the two chromium ions must supply $6+$.
- That is $3+$ on each chromium.

Question 8 (Answer: **D**)

- Work out each molecular formula: propanoic acid $\text{C}_3\text{H}_6\text{O}_2$, lactic acid $\text{C}_3\text{H}_6\text{O}_3$, glucose $\text{C}_6\text{H}_{12}\text{O}_6$.
- Lactic acid and glucose both reduce to the same empirical formula, CH_2O .
- Propanoic acid does not, and none of the three is a structural isomer of another.

Question 8 (Answer: **D**)

- Aluminium oxide is Al_2O_3 and iron(III) oxide is Fe_2O_3 – get the formulae right first.
- Balancing gives $2\text{Al} + \text{Fe}_2\text{O}_3 \rightarrow \text{Al}_2\text{O}_3 + 2\text{Fe}$.
- Check both sides: 2 Al, 2 Fe and 3 O each.

Question 8 (Answer: **B**)

- Divide each percentage by the relative atomic mass: C $85.7/12 = 7.14$, H $14.3/1 = 14.3$.
- The ratio is $7.14 : 14.3$, which is $1 : 2$.
- So the empirical formula is CH_2 – C_2H_4 is a molecular formula, not the simplest ratio.

Question 9 (Answer: **A**)

- Ca^{2+} and O^{2-} balance one to one, so calcium oxide is CaO .
- Cobalt(II) chloride is CoCl_2 and sulfur dioxide is SO_2 .
- Anhydrous copper(II) sulfate is CuSO_4 , since Cu^{2+} balances SO_4^{2-} one to one.

Question 11 (Answer: **B**)

- Oxygen makes up $100 - 40.0 - 6.7 = 53.3\%$.
- Divide each by its relative atomic mass: C $40.0/12 = 3.33$, H $6.7/1 = 6.7$, O $53.3/16 = 3.33$.
- The simplest ratio is $1 : 2 : 1$, so CH_2O – D is a multiple of it, not the simplest form.