

Counting atoms with the mole

Chemistry grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · Lab answers

The answers use the sample masses. Your measured values will differ slightly. Check that each target mass equals $0.10 \times M$, then calculate the actual amount from the measured mass. Show units in every line and keep three significant figures where the data allow.

Level: Chemistry grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · **Curriculum:** HS-PS1-7, GCSE C3

Question 1 Check the molar masses

Sucrose: $12 \times 12 + 22 \times 1 + 11 \times 16 = 144 + 22 + 176 = 342$ g/mol. Sodium hydrogencarbonate: $23 + 1 + 12 + 48 = 84$ g/mol.

342 g/mol and 84 g/mol.

Question 2 Target masses

$m = n \times M = 0.10 \times 58.5 = 5.85$ g.

5.85 g

Question 3 Actual amounts

NaCl: $5.87 \div 58.5 = 0.1003$ mol. Sucrose: $34.31 \div 342 = 0.1003$ mol. NaHCO_3 : $8.38 \div 84 = 0.0998$ mol. Water: $1.82 \div 18 = 0.1011$ mol.

0.100 mol, 0.100 mol, 0.0998 mol and 0.101 mol

Question 4 Percentage difference

Water: $(0.1011 - 0.100) \div 0.100 \times 100 = +1.1$ %. NaHCO_3 : $(0.09976 - 0.100) \div 0.100 \times 100 = -0.24$ %.

+1.1 % and -0.24 %

Question 5 Number of particles

$N = 0.100 \times 6.02 \times 10^{23} = 6.02 \times 10^{22}$.

6.02×10^{22} formula units

Question 6 Same number, different mass

The particles have different masses, so the same number of particles has a different total mass. A sucrose molecule is much heavier than a water molecule, with $M = 342$ g/mol compared with 18 g/mol.

Different particles have different masses.

Question 7 Biggest error

The target mass for water is only 1.80 g, so a balance error of 0.02 g is a larger fraction of the sample: $0.02 \div 1.80 = 1.1\%$. For sucrose the same 0.01 g error is less than 0.1 % of 34.2 g.

Small samples give larger percentage errors.