



CrackingCHEM

GCSE | A-LEVEL

UNDERSTAND • APPLY • SUCCEED

AQA CHEMISTRY 7405

AMOUNT OF SUBSTANCE I

SPECIFICATION-LED STUDENT NOTES



SPEC



CRACK IT



TEST IT



DONE WHEN

OWNED AQA COVERAGE

AQA reference	This CrackingChem unit owns
3.1.2.1	Relative atomic mass, relative molecular mass and relative formula mass
3.1.2.2	The mole, Avogadro constant, molar mass and mass-mole-particle calculations

EVERY OWNED SPECIFICATION POINT. EXPLAINED. PRACTISED. CHECKED OFF.

Written by an experienced AQA examiner and chemistry teacher
Mapped to AQA Chemistry 7405, specification checked August 2026

THE BIG PICTURE

THE PROMISE

By the end, you will move confidently between mass, moles and a named type of particle - without confusing relative mass with molar mass.

THE LEARNING LOOP

 <p>1 SPEC Know exactly what AQA requires.</p>	 <p>2 CRACK IT Translate the chemistry into a route.</p>	 <p>3 TEST IT Use the route immediately.</p>	 <p>4 DONE Prove the skill before moving on.</p>
--	--	--	--

YOUR ROUTE THROUGH THE TOPIC

DEFINE	COUNT	CONVERT	CONNECT
A_r , M_r and formula mass	moles and entities	mass or particle number	mass ↔ moles ↔ particles
BOUNDARY This unit deliberately stops before concentration, reacting masses and equation ratios, empirical or molecular formulae, water of crystallisation, gases, yield and atom economy. Those skills belong to later CrackingChem Amount of Substance units.			
AQA MAP AQA 3.1.2.2 also contains concentration. This booklet owns only the mole, Avogadro, mass and particle calculation part of that specification section.			

FULL-MARK DEFINITION BANK

Quantity	Definition to use in an exam	Unit
Relative atomic mass, A_r	the weighted mean mass of an atom of an element compared with one-twelfth of the mass of an atom of carbon-12.	no unit
Relative molecular mass, M_r	the mean mass of a molecule compared with one-twelfth of the mass of an atom of carbon-12.	no unit
Relative formula mass	the sum of the relative atomic masses of all the atoms shown in the formula.	no unit
Mass, m	the measured mass of the sample being considered.	g
Amount of substance, n	a measure of the number of specified entities present; it is expressed in moles.	mol
One mole	the amount of substance containing the Avogadro constant number of specified entities.	mol
Molar mass, M	the mass per mole of a substance.	g mol^{-1}
Number of specified entities, N	the count of the named entities in the sample: atoms, molecules, formula units, ions or electrons.	no unit
Avogadro constant, N_A	the number of specified entities per mole: $6.02 \times 10^{23} \text{ mol}^{-1}$.	mol^{-1}
FULL-MARK RULE For A_r and M_r , name the correct particle and include the one-twelfth carbon-12 comparison.		

1. Relative masses: what the symbols mean



SPEC 3.1.2.1 Define relative atomic mass and relative molecular mass using the carbon-12 reference. Use relative formula mass for ionic compounds.



CRACK IT

All three relative masses compare particle mass with one-twelfth of the mass of one carbon-12 atom. They are ratios, so they have no unit.

Quantity	Meaning	Use it for	Unit
Relative atomic mass, A_r	weighted mean mass of an atom of an element	an element, because isotopes have different masses	none
Relative molecular mass, M_r	mean mass of a molecule	a simple molecular substance	none
Relative formula mass	sum of the A_r values in one formula unit	an ionic compound or other formula-based solid	none
Molar mass, M	mass of one mole of specified entities	any substance when converting mass and moles	g mol^{-1}

EXAMINER TIP The word weighted is essential in the A_r definition because isotopes do not usually occur in equal abundance.

CRITICAL DISTINCTION $M_r = 44.0$ has no unit. The molar mass of CO_2 is 44.0 g mol^{-1} . The number is the same, but the quantity and unit are different.



TEST IT 1 Definitions and units

- Define relative atomic mass, A_r . [2]
- Define relative molecular mass, M_r . [2]
- State the unit of A_r and M_r . [1]

[5 marks]



DONE WHEN you can define A_r and M_r precisely and state why relative masses have no unit.

2. Calculating M_r and relative formula mass



SPEC 3.1.2.1 Calculate relative molecular or formula mass by adding the A_r value for every atom shown in the formula.



CRACK IT

Read the formula before adding. A subscript multiplies the atom immediately before it; a subscript outside brackets multiplies everything inside the brackets.

$$\text{relative mass} = \Sigma (A_r \times \text{number of each atom})$$

Σ means add all of the contributions.

WORKED EXAMPLE H_2SO_4

Calculate M_r using $\text{H} = 1.0$, $\text{S} = 32.1$ and $\text{O} = 16.0$.

1. Count atoms: 2 H, 1 S and 4 O.
2. Write every contribution: $2(1.0) + 32.1 + 4(16.0)$.
3. Add without a unit: $2.0 + 32.1 + 64.0 = 98.1$.

ANSWER $M_r(\text{H}_2\text{SO}_4) = 98.1$

WORKED EXAMPLE $\text{Ca}(\text{NO}_3)_2$

Calculate the relative formula mass using $\text{Ca} = 40.1$, $\text{N} = 14.0$ and $\text{O} = 16.0$.

1. The outside 2 multiplies N and O: $\text{Ca}_1\text{N}_2\text{O}_6$.
2. $40.1 + 2(14.0) + 6(16.0) = 40.1 + 28.0 + 96.0$.

ANSWER relative formula mass = 164.1

FORMULA CHECK For $\text{Al}_2(\text{SO}_4)_3$, the atom counts are $\text{Al}_2\text{S}_3\text{O}_{12}$. Expand the brackets before using A_r values.



TEST IT 2 Relative mass calculations

Use $\text{H} = 1.0$, $\text{N} = 14.0$, $\text{O} = 16.0$, $\text{Al} = 27.0$ and $\text{S} = 32.1$.

- a) Calculate M_r of HNO_3 . [2]
- b) Calculate the relative formula mass of $\text{Al}_2(\text{SO}_4)_3$. [3]

[5 marks]

.....

.....

.....



DONE WHEN you can expand brackets, count every atom once and give a relative mass with no unit.

3. The mole and the Avogadro constant



SPEC 3.1.2.2 Use the mole as an amount of substance and the Avogadro constant as the number of specified entities in one mole.



CRACK IT

A mole is a counting amount. A dozen always means 12 objects; one mole always means 6.02×10^{23} specified entities.

EVERYDAY COUNT

1 dozen = 12

eggs, pencils or molecules

CHEMISTRY COUNT

1 mol = 6.02×10^{23}

atoms, molecules, ions, formula units or electrons

$$N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$$

Avogadro constant: the number of specified entities per mole.

The symbol n means amount of substance, measured in mol. The symbol N means the number of specified entities and has no unit.

AQA EXAM TIP You are not expected to recall the value of N_A . Use the value supplied in the question or data information.

MEMORY AID A mole does not name the particle. Always finish the sentence: "0.20 mol of what?"



TEST IT 3 Moles and entities

- a) State what the Avogadro constant represents and give its unit. [2]
 b) Name the best entity for each: Fe, O₂, CO₂, MgCl₂ and a transferred charge in a half-equation. [5]

[7 marks]

.....

.....

.....



DONE WHEN you can explain a mole, use N_A and name the entity being counted.

4. Name the specified entity first



SPEC 3.1.2.2 Apply the mole to electrons, atoms, molecules, ions and formula-based particles, using the wording of the question.



CRACK IT

The calculation depends on what N counts. Write the entity beside N before choosing an equation.

Example	Entity to count	Why
Fe	atoms	metallic element
O ₂ or CO ₂	molecules	simple molecular substance
NaCl or MgCl ₂	formula units	ionic solid - not molecules
Na ⁺ or Cl ⁻	ions	a named ion
e ⁻	electrons	electron count or transfer

EXAM TRAP NaCl does not contain NaCl molecules. A solid sample contains formula units in a giant ionic lattice.

Subscripts create a second counting step. One H₂O molecule contains 2 H atoms and 1 O atom, so one mole of H₂O molecules contains 2 mol H atoms and 1 mol O atoms.

COUNT MOLECULES	COUNT H ATOMS	COUNT ALL ATOMS
0.250 mol H₂O 0.250 mol molecules	2 × 0.250 mol 0.500 mol H atoms	3 × 0.250 mol 0.750 mol atoms
<div>  TEST IT 4 Molecules or atoms? For 0.250 mol H₂O, use N_A = 6.02 × 10²³ mol⁻¹ to calculate: a) the number of H₂O molecules; b) the number of H atoms; c) the total number of atoms. [5] </div> <div style="text-align: right;">[5 marks]</div> <div> </div>		



DONE WHEN you state the entity first and use subscripts only when the question asks for a component particle.

5. Mass and amount in moles



SPEC 3.1.2.2 Calculate amount of substance from mass and relative mass information, with correct units.



CRACK IT

Molar mass, M , is the mass of one mole. Its numerical value comes from A_r , M_r or relative formula mass, but M carries the unit g mol^{-1} .

$$n = m \div M \quad \text{and} \quad m = n \times M$$

n in mol | m in g | M in g mol^{-1}

Substance	Relative value - no unit	Molar mass - has a unit
Mg atoms	$A_r(\text{Mg}) = 24.3$	$M(\text{Mg}) = 24.3 \text{ g mol}^{-1}$
O_2 molecules	$M_r(\text{O}_2) = 32.0$	$M(\text{O}_2) = 32.0 \text{ g mol}^{-1}$
NaCl formula units	formula mass = 58.5	$M(\text{NaCl}) = 58.5 \text{ g mol}^{-1}$

WORKED EXAMPLE mass $\rightarrow$ moles

Calculate the amount in 9.81 g H_2SO_4 . $M(\text{H}_2\text{SO}_4) = 98.1 \text{ g mol}^{-1}$.

- Choose $n = m \div M$.
- Substitute with units: $n = 9.81 \text{ g} \div 98.1 \text{ g mol}^{-1}$.

ANSWER $n = 0.100 \text{ mol}$

WORKED EXAMPLE moles $\rightarrow$ mass

Calculate the mass of 0.350 mol CaCO_3 . $M = 100.1 \text{ g mol}^{-1}$.

- Choose $m = n \times M$.
- $m = 0.350 \text{ mol} \times 100.1 \text{ g mol}^{-1} = 35.035 \text{ g}$.
- Round at the end to 3 significant figures.

ANSWER $m = 35.0 \text{ g}$

SENSE CHECK Less than 1 mol should have a mass smaller than the molar mass. Here 0.350 mol must weigh less than 100.1 g.



TEST IT 5 Mass and moles

- Calculate the amount in 7.10 g Cl_2 . $M = 71.0 \text{ g mol}^{-1}$. [2]
- Calculate the mass of 0.350 mol CaCO_3 . $M = 100.1 \text{ g mol}^{-1}$. [2]

[4 marks]

.....

.....

.....



DONE WHEN you select divide for mass $\rightarrow$ moles, multiply for moles $\rightarrow$ mass, and keep units visible.

6. Moles and specified particles



SPEC 3.1.2.2 Use the Avogadro constant to convert between amount in moles and the number of specified entities.



CRACK IT

The Avogadro constant is a conversion factor. Multiply by N_A when leaving moles for a particle count; divide by N_A when returning to moles.

$$N = n \times N_A \quad \text{and} \quad n = N \div N_A$$

N has no unit | n in mol | N_A in mol^{-1}

WORKED EXAMPLE moles → particles

Calculate the number of NH_3 molecules in 0.0750 mol. Use $N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$.

1. Name the entity: NH_3 molecules.
2. $N = nN_A = 0.0750 \times 6.02 \times 10^{23}$.
3. Keep the power of ten until the final answer.

ANSWER $N = 4.52 \times 10^{22} \text{ NH}_3 \text{ molecules}$

WORKED EXAMPLE particles → moles

Calculate the amount represented by 1.204×10^{24} Ne atoms.

1. Name the entity: Ne atoms.
2. $n = N \div N_A = (1.204 \times 10^{24}) \div (6.02 \times 10^{23})$.

ANSWER $n = 2.00 \text{ mol Ne atoms}$

DIRECTION CHECK A particle count is normally enormous. Multiplying by 10^{23} should make the number much larger; dividing by 10^{23} should make it much smaller.

CALCULATOR ENTRY Use brackets when dividing standard-form numbers: $(1.204 \text{ EXP } 24) \div (6.02 \text{ EXP } 23)$.



TEST IT 6 Moles and particles

Use $N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$.

- a) Calculate the number of NH_3 molecules in 0.0750 mol. [2]
- b) Calculate the amount in moles of 1.204×10^{24} Ne atoms. [2]

[4 marks]

.....

.....

.....



DONE WHEN you can move in either direction between moles and a clearly named entity.

7. Use formula subscripts exactly once



SPEC 3.1.2.2 Count atoms, ions, formula units and electrons by linking the specified entity to the chemical formula or charge.



CRACK IT

First calculate moles of the whole molecule or formula unit. Then multiply by the relevant subscript only if the question asks for a particle inside it.

Formula	Particle link	Mole link
O ₂	1 molecule contains 2 O atoms	$n(\text{O atoms}) = 2n(\text{O}_2)$
H ₂ SO ₄	1 molecule contains 2 H atoms	$n(\text{H atoms}) = 2n(\text{H}_2\text{SO}_4)$
CaCl ₂	1 formula unit contains 2 Cl ⁻ ions	$n(\text{Cl}^-) = 2n(\text{CaCl}_2)$
Al ₂ (SO ₄) ₃	2 Al ³⁺ and 3 SO ₄ ²⁻ ions	5 ions in total per formula unit

DO NOT MULTIPLY TWICE If you have already converted 0.250 mol H₂O into 0.500 mol H atoms, use $N = 0.500N_A$. Do not multiply by 2 again.

WORKED EXAMPLE ions in an ionic formula

For 0.120 mol Al₂(SO₄)₃, find the amount of each ion and the total number of ions.

- $n(\text{Al}^{3+}) = 2 \times 0.120 = 0.240 \text{ mol}$.
- $n(\text{SO}_4^{2-}) = 3 \times 0.120 = 0.360 \text{ mol}$.
- Total ion amount = 0.600 mol, so $N = 0.600 \times 6.02 \times 10^{23}$.

ANSWER 3.61×10^{23} ions in total

For electrons in an ion, calculate electrons per ion from atomic number and charge. Al has atomic number 13, so each Al³⁺ ion has $13 - 3 = 10$ electrons.



TEST IT 7 Ions and electrons

- a) For 0.120 mol Al₂(SO₄)₃, calculate $n(\text{Al}^{3+})$, $n(\text{SO}_4^{2-})$ and the total number of ions. [5]
 b) Calculate the number of electrons in 0.0200 mol Al³⁺ ions. Use $N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$. [3]

[8 marks]

.....

.....

.....

.....



DONE WHEN you use formula subscripts or ionic charge once, and only after identifying the requested entity.

8. The master mass-mole-particle route



SPEC 3.1.2.2 Combine mass, molar mass and the Avogadro constant in multi-step calculations involving a specified entity.



CRACK IT

MOLES ARE THE BRIDGE



Write the entity beside N before you touch the calculator.

Mass and particle number are never linked directly. Move through moles in the centre.

WORKED EXAMPLE mass → formula units → ions

Calculate the number of chloride ions in 5.85 g NaCl. $M = 58.5 \text{ g mol}^{-1}$; $N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$.

1. Mass → moles: $n(\text{NaCl}) = 5.85 \div 58.5 = 0.100 \text{ mol}$.
2. Name the target: Cl^- ions.
3. Each NaCl formula unit has one Cl^- ion, so $n(\text{Cl}^-) = 0.100 \text{ mol}$.
4. Moles → ions: $N = 0.100 \times 6.02 \times 10^{23}$.

ANSWER $N = 6.02 \times 10^{22}$ chloride ions



TEST IT 8 Mass → moles → particles

Calculate the number of Cl^- ions in 5.85 g NaCl. $M(\text{NaCl}) = 58.5 \text{ g mol}^{-1}$ and $N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$. [5]

[5 marks]

.....

.....

.....

.....



DONE WHEN you always route mass-particle questions through moles and label the final entity.

9. Reverse and unfamiliar multi-step problems



SPEC 3.1.2.2 Rearrange the mass-mole-particle relationships and select a route from the information given.



CRACK IT

THE RELIABLE SIX-STEP METHOD

1. Circle what is given and underline what is required.
2. Write the specified entity beside every particle count.
3. Calculate or copy the molar mass, M , with unit g mol^{-1} .
4. Move to moles using $\div M$ or $\div N_A$.
5. Apply a formula subscript only if the target entity requires it.
6. Move to the target, then add units, entity label and sensible significant figures.

WORKED EXAMPLE particles $\rightarrow$ moles $\rightarrow$ mass

Calculate the mass of 3.01×10^{22} CO_2 molecules. $M(\text{CO}_2) = 44.0 \text{ g mol}^{-1}$.

1. Particles $\rightarrow$ moles: $n = (3.01 \times 10^{22}) \div (6.02 \times 10^{23}) = 0.0500 \text{ mol}$.
2. Moles $\rightarrow$ mass: $m = nM = 0.0500 \times 44.0$.

ANSWER $m = 2.20 \text{ g CO}_2$



TEST IT 9 Particles $\rightarrow$ mass

Calculate the mass of 3.01×10^{22} CO_2 molecules. $M = 44.0 \text{ g mol}^{-1}$ and $N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$. [4]

[4 marks]

.....

.....

.....

WORKED EXAMPLE find an unknown molar mass

A sample has mass 1.83 g and contains 2.50×10^{22} molecules. Calculate M .

1. Find moles: $n = N \div N_A = (2.50 \times 10^{22}) \div (6.02 \times 10^{23}) = 0.04153 \text{ mol}$ (retain the calculator value).
2. Rearrange $n = m/M$ to $M = m/n$.
3. Use the unrounded n value: $M = 1.83 \div n$.

ANSWER $M = 44.1 \text{ g mol}^{-1}$



TEST IT 10 Find molar mass

A molecular sample has mass 1.83 g and contains 2.50×10^{22} molecules. Calculate its molar mass. Use $N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$. [4]

[4 marks]

.....

.....

.....



DONE WHEN you can work backwards from any starting point without inventing a direct mass-particle equation.

10. Standard form, units and significant figures



SPEC 3.1.2.2 + MS 0.1, 0.4, 1.1 Report numerical answers in an appropriate form and precision, using correct units and scientific notation.



CRACK IT

Quantity	Unit	Example
amount of substance, n	mol	0.250 mol
mass, m	g	9.81 g
molar mass, M	g mol^{-1}	98.1 g mol^{-1}
particle number, N	no unit	1.51×10^{23} molecules
Avogadro constant, N_A	mol^{-1}	$6.02 \times 10^{23} \text{ mol}^{-1}$
A_r , M_r , relative formula mass	no unit	$M_r = 44.0$

Standard form has one non-zero digit before the decimal point: $602\,000\,000\,000\,000\,000\,000 = 6.02 \times 10^{23}$.

- Keep unrounded calculator values during the route. Round only the final answer.
- Match the significant figures of the least precise measured or supplied value.
- Formula subscripts are exact counts, so they do not limit significant figures.
- Attach the entity word to N : atoms, molecules, formula units, ions or electrons.

COMMON TRAPS Using M_r as if it has g mol^{-1} ; multiplying when converting particles to moles; rounding after the first step; writing NaCl molecules; forgetting a formula subscript; multiplying by that subscript twice.

FINAL SENSE CHECK Ask three questions: Is the direction sensible? Is the power of ten sensible? Have I named the entity?



TEST IT 11 Finish like an examiner

- Write 0.003045 mol in standard form. [1]
- Give 7.849×10^{22} to 3 significant figures. [1]
- State the units of n , M , N and N_A . [4]
- Correct this statement: "To find particles from moles, use $N = n \div N_A$." [2]

[8 marks]



DONE WHEN every final answer has the correct equation, unit or entity label, power of ten and precision.

FINAL MASTERY CHECK

THE PROMISE CHECK Can you move confidently between mass, moles and a named type of particle without confusing relative mass with molar mass?

mass ↔ moles ↔ specified particles

÷M then ×N_A to move right | ÷N_A then ×M to move left

✓	I can...	Map
☐	I can define A _r using weighted mean mass and the carbon-12 reference.	3.1.2.1
☐	I can define M _r using mean molecular mass and the carbon-12 reference.	3.1.2.1
☐	I can calculate M _r or relative formula mass, including brackets.	3.1.2.1
☐	I know A _r , M _r and relative formula mass have no unit.	3.1.2.1
☐	I can distinguish relative mass from molar mass in g mol ⁻¹ .	3.1.2.2
☐	I can explain a mole and the Avogadro constant.	3.1.2.2
☐	I identify atoms, molecules, formula units, ions or electrons before calculating.	3.1.2.2
☐	I use $n = m/M$ and $m = nM$ with correct units.	3.1.2.2
☐	I use $N = nN_A$ and $n = N/N_A$ in the correct direction.	3.1.2.2
☐	I use formula subscripts exactly once when counting component particles.	3.1.2.2
☐	I can solve mass → mole → particle and reverse problems.	3.1.2.2
☐	I round at the end and report standard form, units and entity labels correctly.	MS

FORMULA STRIP

Route	Equation	Remember
mass → moles	$n = m \div M$	m in g; M in g mol ⁻¹
moles → mass	$m = n \times M$	answer in g
moles → particles	$N = n \times N_A$	name the entity
particles → moles	$n = N \div N_A$	N has no unit

NEXT Amount of Substance II will introduce balanced-equation mole ratios, reacting masses, empirical and molecular formulae, and water of crystallisation.

TEST IT ANSWERS 1-6

MARKING Award one mark for each distinct correct point or stage unless the question states otherwise.

1 Definitions and units [5]

- a) A_r is the weighted mean mass of an atom of an element compared with one-twelfth of the mass of one carbon-12 atom. [2]
- b) M_r is the mean mass of a molecule compared with one-twelfth of the mass of one carbon-12 atom. [2]
- c) Neither A_r nor M_r has a unit. [1]

2 Relative mass calculations [5]

- a) $M_r(\text{HNO}_3) = 1.0 + 14.0 + 3(16.0) = 63.0$. [2]
- b) Relative formula mass $\text{Al}_2(\text{SO}_4)_3 = 2(27.0) + 3[32.1 + 4(16.0)] = 342.3$. [3]

3 Moles and entities [7]

- a) N_A is the number of specified entities per mole; unit mol^{-1} . [2]
- b) Fe atoms; O_2 molecules; CO_2 molecules; MgCl_2 formula units; transferred charge counted as electrons. [5]

4 Molecules or atoms? [5]

- a) $N(\text{H}_2\text{O molecules}) = 0.250 \times 6.02 \times 10^{23} = 1.51 \times 10^{23}$. [2]
- b) $N(\text{H atoms}) = 2 \times 1.505 \times 10^{23} = 3.01 \times 10^{23}$. [1]
- c) Total atoms $= 3 \times 1.505 \times 10^{23} = 4.52 \times 10^{23}$. [2]

5 Mass and moles [4]

- a) $n(\text{Cl}_2) = 7.10 \div 71.0 = 0.100 \text{ mol}$. [2]
- b) $m(\text{CaCO}_3) = 0.350 \times 100.1 = 35.035 \text{ g} = 35.0 \text{ g (3 s.f.)}$. [2]

6 Moles and particles [4]

- a) $N(\text{NH}_3 \text{ molecules}) = 0.0750 \times 6.02 \times 10^{23} = 4.52 \times 10^{22}$. [2]
- b) $n(\text{Ne atoms}) = (1.204 \times 10^{24}) \div (6.02 \times 10^{23}) = 2.00 \text{ mol}$. [2]

TEST IT ANSWERS 7-11

7 Ions and electrons [8]

a) $n(\text{Al}^{3+}) = 2 \times 0.120 = 0.240 \text{ mol}$; $n(\text{SO}_4^{2-}) = 3 \times 0.120 = 0.360 \text{ mol}$. Total ion amount = 0.600 mol, so $N(\text{total ions}) = 0.600 \times 6.02 \times 10^{23} = 3.61 \times 10^{23}$ ions. [5]

b) Each Al^{3+} ion has $13 - 3 = 10$ electrons. $n(e^-) = 10 \times 0.0200 = 0.200 \text{ mol}$; $N(e^-) = 0.200 \times 6.02 \times 10^{23} = 1.20 \times 10^{23}$ electrons. [3]

8 Mass → moles → particles [5]

$n(\text{NaCl}) = 5.85 \div 58.5 = 0.100 \text{ mol}$. Each formula unit contains one Cl^- ion, so $n(\text{Cl}^-) = 0.100 \text{ mol}$. $N(\text{Cl}^-) = 0.100 \times 6.02 \times 10^{23} = 6.02 \times 10^{22}$ chloride ions. [5]

9 Particles → mass [4]

$n(\text{CO}_2) = (3.01 \times 10^{22}) \div (6.02 \times 10^{23}) = 0.0500 \text{ mol}$. $m = nM = 0.0500 \times 44.0 = 2.20 \text{ g CO}_2$. [4]

10 Find molar mass [4]

$n = (2.50 \times 10^{22}) \div (6.02 \times 10^{23}) = 0.04153 \text{ mol}$. Using the unrounded value, $M = m \div n = 44.1 \text{ g mol}^{-1}$. [4]

11 Finish like an examiner [8]

a) $3.045 \times 10^{-3} \text{ mol}$. [1]

b) 7.85×10^{22} . [1]

c) n: mol; M: g mol^{-1} ; N: no unit; N_A : mol^{-1} . [4]

d) Particles from moles requires multiplication: $N = n \times N_A$. [2]

SPECIFICATION AUDIT Covered here: AQA 3.1.2.1 and the mole, Avogadro, mass and specified-particle calculation content of 3.1.2.2. Deferred by design: concentration and all later Amount of Substance content.



DONE WHEN you can complete every TEST IT question without reopening the teaching pages.