CLASS 9 SCIENCE · 2026-27

The mole concept and atomic structure

Chemistry

29	35	3
QUESTIONS	MINUTES	EXERCISES

This belongs to _____ **Date** _____

WHAT YOU'LL GET GOOD AT

- Calculates moles from mass and mass from moles
- Converts between moles and number of particles
- Distinguishes molecules from atoms when counting
- Writes electronic configuration and deduces valency
- Distinguishes isotopes from isobars

Take your time, and have a go at every one. If you get stuck, look at the orange box — Ollie has already done one for you.

The mole concept and atomic structure

Chemistry · 29 questions · tick each box as you finish

Exercise 1 of 3 · 11 questions Calculate. Show the molar mass you used.

WRITE THE ANSWER

HERE'S ONE DONE FOR YOU

Moles = given mass ÷ molar mass, so 22 g of CO_2 is 22 ÷ 44 = 0.5 mol. Write the molar mass as its own line before dividing - that is where the marks are and where the errors are. If your child cannot say what a mole counts, stop and say it: a mole is 6.022×10^{23} particles, the way a dozen is twelve. The formulas make sense afterwards and not before.

1) How many moles are there in 44 g of carbon dioxide?

2) How many moles are there in 22 g of carbon dioxide?

3) How many moles are there in 9 g of water?

4) What is the mass of 2 moles of oxygen gas, O_2?

5) How many moles are there in 117 g of sodium chloride?

6) How many moles are there in 36 g of water?

7) How many moles are there in 80 g of sodium hydroxide?

8) How many moles are there in 56 g of nitrogen gas?

9) What is the mass of 0.5 mole of calcium carbonate?

10) How many moles are there in 34 g of ammonia?

11) What is the mass of 0.5 mole of sulphuric acid?

Exercise 2 of 3 · 8 questions Calculate the number of particles, or the mass. Watch whether the question asks for atoms or molecules.

WRITE THE ANSWER

HERE'S ONE DONE FOR YOU

One mole of O2 contains 6.022×10^{23} molecules but 1.2044×10^{2}tatoms, because each molecule holds two atoms. This is the single most common error in the chapter, and the fix is a habit rather than knowledge: underline the word 'atoms' or 'molecules' in the question before starting. The arithmetic is identical; only that word decides whether to multiply by two.

1) How many molecules are there in 0.5 mol of carbon dioxide?

2) How many atoms are there in 1 mole of oxygen gas, O2?

3) How many moles are there in 12 g of carbon?

4) What is the mass of 3.011×10^{23} molecules of water?

5) How many molecules are there in 0.25 mole of a gas?

6) What is the mass of 0.5 mole of carbon dioxide?

7) How many atoms are there in 0.5 mole of sodium?

8) How many molecules are there in 36 g of water?

Exercise 3 of 3 · 10 questions Give the number of protons, neutrons and electrons, the electronic configuration, and the valency.

WRITE THE ANSWER

HERE'S ONE DONE FOR YOU

For sodium, neutrons = mass number - atomic number = 23 - 11 = 12. The configuration 2, 8, 1 then gives the valency directly: with one electron in the outermost shell, sodium loses it, so the valency is 1. Chlorine's 2, 8, 7 needs one more to fill the shell, so its valency is also 1 - by gaining rather than losing. Valency is never something to memorise; it falls out of the configuration every time.

1) Sodium: atomic number 11, mass number 23

2) Chlorine: atomic number 17, mass number 35

3) Magnesium: atomic number 12, mass number 24

4) Oxygen: atomic number 8, mass number 16

5) Are $^{1}_{w}C^{3}_{3}5$ and $^{1}_{w}C^{3}_{3}7$ isotopes or isobars? What about $^{2}_{p}Ca^{4}_{4}0$ and $^{1}_{x}Ar^{4}_{4}0$?

6) Nitrogen: atomic number 7, mass number 14.

7) Calcium: atomic number 20, mass number 40.

8) Aluminium: atomic number 13, mass number 27.

9) What is the difference between an isotope and an isobar?

10) Why is the mass of an atom concentrated in its nucleus?

All done? How did that feel?

Colour in a star. Three stars means you could teach it to someone else.

☆ ☆ ☆ Tricky · Getting there · Easy now

Answer key

For grown-ups

The mole concept and atomic structure · keep this page back until your child has finished.

1. Calculate. Show the molar mass you used.

1) Molar mass of CO_2 = 12 + 32 = 44 g/mol. So 44 g is exactly 1 mole.
2) 22 ÷ 44 = 0.5 mol.
3) Molar mass of H_2O = 18 g/mol. So 9 ÷ 18 = 0.5 mol.
4) Molar mass of O_2 = 32 g/mol. So 2 × 32 = 64 g.
5) Molar mass of NaCl = 23 + 35.5 = 58.5 g/mol. So 117 ÷ 58.5 = 2 mol.
6) Molar mass of H_2O = 18 g/mol. 36/18 = 2 moles.
7) Molar mass of NaOH = 40 g/mol. 80/40 = 2 moles.
8) Molar mass of N_2 = 28 g/mol. 56/28 = 2 moles.
9) Molar mass of $CaCO_3$ = 100 g/mol. 0.5 × 100 = 50 g.
10) Molar mass of NH_3 = 17 g/mol. 34/17 = 2 moles.
11) Molar mass of H_2SO_4 = 98 g/mol. 0.5 × 98 = 49 g.

2. Calculate the number of particles, or the mass. Watch whether the question asks for atoms or molecules.

1) $0.5 \times 6.022 \times 10^{23} = 3.011 \times 10^{23}$ molecules.
2) 1 mole of O_2 contains 6.022×10^{23} molecules, and each molecule has 2 atoms - so 1.2044×10^{2}atoms.
3) Atomic mass of carbon is 12, so 12 ÷ 12 = 1 mol.
4) 3.011×10^{23} is half of 6.022×10^{23}, so 0.5 mol. Mass = 0.5 × 18 = 9 g.
5) $0.25 \times 6.022 \times 10^{23} = 1.5055 \times 10^{23}$ molecules.
6) Molar mass of CO_2 = 44 g/mol, so 0.5 × 44 = 22 g.
7) $0.5 \times 6.022 \times 10^{23} = 3.011 \times 10^{23}$ atoms.
8) 36 g is 2 moles, so $2 \times 6.022 \times 10^{23} = 1.2044 \times 10^{2}$molecules.

3. Give the number of protons, neutrons and electrons, the electronic configuration, and the valency.

1) 11 protons, 11 electrons, 23 - 11 = 12 neutrons. Configuration 2, 8, 1. Valency 1, since it loses one electron.

2) 17 protons, 17 electrons, 35 - 17 = 18 neutrons. Configuration 2, 8, 7. Valency 1, since it gains one electron.

3) 12 protons, 12 electrons, 24 - 12 = 12 neutrons. Configuration 2, 8, 2. Valency 2.

4) 8 protons, 8 electrons, 16 - 8 = 8 neutrons. Configuration 2, 6. Valency 2.

5) Cl-35 and Cl-37 are isotopes - same atomic number, different mass number. Ca-40 and Ar-40 are isobars - same mass number, different atomic number.

6) 7 protons, 7 neutrons, 7 electrons.

7) 20 protons, 20 neutrons, 20 electrons.

8) 13 protons, 14 neutrons, 13 electrons.

9) Isotopes have the same atomic number but different mass numbers; isobars have the same mass number but different atomic numbers.

10) Because protons and neutrons both sit in the nucleus and each is about 1,836 times heavier than an electron, so the electrons contribute almost nothing to the mass.

WHILE YOUR CHILD WORKS

- Ask what a mole counts before any formula. If your child cannot answer, that is the whole problem, and it takes two minutes to fix.
- Underline 'atoms' or 'molecules' in every question. That word alone decides whether to multiply by the number of atoms per molecule.
- Valency comes from the configuration. If it is being memorised, the chapter has not landed.