# Grade 11 Chemistry

## Term 1 - 50 complete lesson plans

Ready to teach, in the KICD lesson-plan format | 40-minute lessons | PDF and editable Word

### ABOUT THIS PACK

50 complete, ready-to-teach Grade 11 Chemistry lesson plans for Term 1, covering the mole and non-metals.

### TOPICS IN THIS PACK

| Topic | Name | Lessons |
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| 1.1 | The Mole | 28 |
| 1.2 | Non-metals | 22 |

### INSIDE EVERY LESSON PLAN

- The specific learning outcomes, key inquiry question, core competencies, values and PCIs, and the resources needed.
- A timed lesson flow: what the teacher does and what the learners do, from introduction to summary.
- The key content (a worked example, notes or a practical with its expected results), then four practice questions with the answers for the teacher.
- The common mistake to watch for, and ideas for learners who need support and for those ready for more.
- A four-level CBC assessment rubric (EE, ME, AE, BE), homework, and a blank reflection space to fill in after teaching.

### A TASTE OF LESSON 1

**The mole as a counting unit**

By the end of the lesson, the learner should be able to: a) explain the need for counting units; b) describe the mole as a unit for the amount of substance

> **Counting units**
> Everyday counting units: a PAIR is 2, a DOZEN is 12, a GROSS is 144, a REAM of paper is 500 sheets. Shops weigh nails or rice instead of counting them because the mass of a known number is fixed.
> Atoms, molecules and ions are far too small and too many to count one by one. Chemists use the MOLE (symbol mol), the SI unit for the AMOUNT OF SUBSTANCE. One mole contains 6.0 × 10^23 particles (Avogadro's constant, L).

You also receive this pack as an editable Word file, so you can change any lesson to suit your class before you print it. Lessons follow the order of the KICD curriculum design.

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# The mole as a counting unit

Strand 1.0 Inorganic Chemistry > Sub-strand 1.1 The Mole | Lesson 1 of 28 | 40 minutes

| SCHOOL | TEACHER | DATE |
|---|---|---|
| CLASS / STREAM | TIME | ROLL (B / G) |

## SPECIFIC LEARNING OUTCOME(S)

By the end of the lesson, the learner should be able to: a) explain the need for counting units; b) describe the mole as a unit for the amount of substance

## KEY INQUIRY QUESTION(S)

- How is a mole a real quantity?

## CORE COMPETENCIES, VALUES AND PCIS IN THIS LESSON

| | | |
|---|---|---|
| COMPETENCY | **Communication and collaboration** | Learners explain their thinking to a partner and report their findings to the group. |
| VALUE | **Responsibility** | Learners look after shared materials and finish every task. |
| VALUE | **Social justice** | Every learner gets a turn and a fair chance to answer. |
| PCI | **Waste management** | Learners dispose of the waste from the activity safely and responsibly. |

## LEARNING RESOURCES

Periodic table with relative atomic masses | Scientific calculators | Counters, beans, bottle tops or rice grains for counting activities | Charts of titration apparatus and worked calculations | Notebooks and pencils

## ORGANISATION OF LEARNING

Pairs for calculations; groups of three or four for practicals (roles: reader, measurer, recorder, safety and waste monitor). The teacher dispenses concentrated or harmful reagents.

## KEY WORDS

mole | Avogadro's constant | relative atomic mass | relative formula mass | molar mass | empirical formula | molecular formula | water of crystallisation | standard solution | molarity | concentration | dilution | titration | titre | end point | indicator | redox | molar gas volume

## THE LESSON AT A GLANCE

| Introduction | Teacher models | Guided practice | On their own | Wrap-up |
|---|---|---|---|---|
| 6 min | 9 min | 10 min | 9 min | 6 min |

## LESSON FLOW

| Stage | Minutes | The teacher | The learners |
|---|---|---|---|
| **Introduction** | 6 | Greet the class and ask: "How would a shopkeeper sell eggs, paper or nails quickly without counting each one?" Take two or three answers, link them to earlier work, then state today's outcome. | Answer the starter question, recall what they already know and read the outcome aloud. |
| **Step 1: Teacher models** | 9 | Take learners through "Counting units" (key ideas on the next page), explaining as you go. Use periodic table with relative atomic masses, scientific calculators, counters, beans, bottle tops or rice grains for counting activities. Ask learners to predict what comes next before you show it. | Watch, predict the next step, ask questions and note the key steps in their exercise books. |
| **Step 2: Guided practice** | 10 | Give questions 1 and 2. Move round the groups, ask "How do you know?" and correct errors kindly on the spot. | Work in pairs or small groups, explain each step to a partner and check one another's answers. |
| **Step 3: Independent practice** | 9 | Set questions 3 and 4 for individual work. Mark as you walk round and note who needs help in the next lesson. | Work on their own, then swap books with a partner to check. |
| **Summary and conclusion** | 6 | Ask two or three learners to state the key idea in their own words. Give this exit question and check the answers: "20 beans weigh 8 g. How many beans are in 100 g?" | Say the key idea in their own words and answer the exit question in the exercise book. |

## KEY IDEAS

### Counting units

Everyday counting units: a PAIR is 2, a DOZEN is 12, a GROSS is 144, a REAM of paper is 500 sheets. Shops weigh nails or rice instead of counting them because the mass of a known number is fixed.

Atoms, molecules and ions are far too small and too many to count one by one. Chemists use the MOLE (symbol mol), the SI unit for the AMOUNT OF SUBSTANCE. One mole contains 6.0 × 10^23 particles (Avogadro's constant, L).

Activity (groups): weigh 10 beans and find the mass of one bean; then find how many beans are in a 200 g pile without counting. Example: 10 beans have a mass of 5 g, so one bean is 0.5 g; a 200 g pile has 200 ÷ 0.5 = 400 beans. Chemists do the same with atoms using the mole.

## PRACTICE QUESTIONS - WITH ANSWERS FOR THE TEACHER

| No. | Question | Answer |
|---|---|---|
| 1 | How many sheets are in 3 reams of paper? | **3 × 500 = 1500 sheets.** |
| 2 | What is the SI unit for the amount of substance? | **The mole (mol).** |
| 3 | How many particles are in one mole? | **6.0 × 10^23 (Avogadro's constant).** |
| 4 | 20 beans weigh 8 g. How many beans are in 100 g? | **One bean weighs 8 ÷ 20 = 0.4 g; 100 ÷ 0.4 = 250 beans.** |

## WATCH OUT FOR

Learners think a mole is a mass. It is an amount (a number of particles); its mass depends on the substance.

## ASSESSMENT RUBRIC - THE FOUR CBC LEVELS

| Level | What the learner can do |
|---|---|
| **Exceeds expectations (EE)** | Can explain the need for counting units confidently and accurately, explain the method used, and apply the idea to new or unfamiliar problems. |
| **Meets expectations (ME)** | Can explain the need for counting units accurately in familiar situations; notices and corrects slips without help. |
| **Approaches expectations (AE)** | Can partly explain the need for counting units, or does so with prompts from the teacher or a partner; makes some errors. |
| **Below expectations (BE)** | Cannot yet explain the need for counting units without direct help; needs the idea taught again with concrete objects. |

## SUPPORT AND EXTENSION

| | |
|---|---|
| **Learners who need support** | Use the dozen analogy: a dozen eggs and a dozen melons have the same number, different masses. |
| **Learners ready for more** | Why can a mole of sand grains never be counted in practice? (Answer: 6.0 × 10^23 is so large that counting one grain per second would take far longer than the age of the universe) |
| **Inclusion** | Seat learners with low vision near the board and read aloud whatever you write; use large, clear, tactile materials; allow extra time; pair with a patient partner; use gestures or Kenyan Sign Language for the key words. |

## HOMEWORK AND FOLLOW-UP

Redo questions 3 and 4 neatly in the exercise book. Then tell someone at home what you learned about "the mole as a counting unit" and bring one question of your own to ask next lesson.

## TEACHER SELF-CHECK

- Did every learner get a turn to handle materials or explain their thinking?
- Did most learners meet the outcome? Write down the names of those who did not.
- Was the pace right — did any step take too long or too short a time?
- Which competency and value did I see learners showing?
- What will I change the next time I teach this lesson?

## REFLECTION ON THE LESSON / SELF-REMARKS

Write this after teaching - what worked, what to change, which learners need follow-up.

# Avogadro's constant, the mole and molar mass

Strand 1.0 Inorganic Chemistry > Sub-strand 1.1 The Mole | Lesson 2 of 28 | 40 minutes

| SCHOOL | TEACHER | DATE |
|---|---|---|
| CLASS / STREAM | TIME | ROLL (B / G) |

## SPECIFIC LEARNING OUTCOME(S)

By the end of the lesson, the learner should be able to: a) relate Avogadro's constant, the mole and molar mass; b) state the molar mass of elements

## KEY INQUIRY QUESTION(S)

- How is a mole a real quantity?

## CORE COMPETENCIES, VALUES AND PCIS IN THIS LESSON

| | | |
|---|---|---|
| COMPETENCY | **Communication and collaboration** | Learners explain their thinking to a partner and report their findings to the group. |
| VALUE | **Responsibility** | Learners look after shared materials and finish every task. |
| VALUE | **Social justice** | Every learner gets a turn and a fair chance to answer. |
| PCI | **Waste management** | Learners dispose of the waste from the activity safely and responsibly. |

## LEARNING RESOURCES

Periodic table with relative atomic masses | Scientific calculators | Counters, beans, bottle tops or rice grains for counting activities | Charts of titration apparatus and worked calculations | Notebooks and pencils

## ORGANISATION OF LEARNING

Pairs for calculations; groups of three or four for practicals (roles: reader, measurer, recorder, safety and waste monitor). The teacher dispenses concentrated or harmful reagents.

## KEY WORDS

mole | Avogadro's constant | relative atomic mass | relative formula mass | molar mass | empirical formula | molecular formula | water of crystallisation | standard solution | molarity | concentration | dilution | titration | titre | end point | indicator | redox | molar gas volume

## THE LESSON AT A GLANCE

| Introduction | Teacher models | Guided practice | On their own | Wrap-up |
|---|---|---|---|---|
| 6 min | 9 min | 10 min | 9 min | 6 min |

## LESSON FLOW

| Stage | Minutes | The teacher | The learners |
|---|---|---|---|
| **Introduction** | 6 | Greet the class and ask: "If one mole of carbon atoms has a mass of 12 g, what is the mass of one mole of magnesium atoms?" Take two or three answers, link them to earlier work, then state today's outcome. | Answer the starter question, recall what they already know and read the outcome aloud. |
| **Step 1: Teacher models** | 9 | Take learners through the key ideas on the next page, explaining as you go. Use periodic table with relative atomic masses, scientific calculators, counters, beans, bottle tops or rice grains for counting activities. Ask learners to predict what comes next before you show it. | Watch, predict the next step, ask questions and note the key steps in their exercise books. |
| **Step 2: Guided practice** | 10 | Give questions 1 and 2. Move round the groups, ask "How do you know?" and correct errors kindly on the spot. | Work in pairs or small groups, explain each step to a partner and check one another's answers. |
| **Step 3: Independent practice** | 9 | Set questions 3 and 4 for individual work. Mark as you walk round and note who needs help in the next lesson. | Work on their own, then swap books with a partner to check. |
| **Summary and conclusion** | 6 | Ask two or three learners to state the key idea in their own words. Give this exit question and check the answers: "How many atoms are in 56 g of iron?" | Say the key idea in their own words and answer the exit question in the exercise book. |

## KEY IDEAS

**One MOLE of any substance contains 6.0 × 10^23 particles (atoms, molecules or ions). This number was chosen so that one mole of an element has a mass in grams equal to its relative atomic mass.**
MOLAR MASS (M) is the mass of one mole of a substance in g/mol. Examples: carbon 12 g/mol; magnesium 24 g/mol; oxygen atoms 16 g/mol; oxygen molecules (O2) 32 g/mol.
So 12 g of carbon, 24 g of magnesium and 40 g of calcium each contain 6.0 × 10^23 atoms - the same number, but different masses because the atoms have different masses.
Activity: in groups, weigh out one mole of carbon (charcoal powder), of sulphur and of iron filings (12 g, 32 g, 56 g) and compare the heaps.

## PRACTICE QUESTIONS - WITH ANSWERS FOR THE TEACHER

| No. | Question | Answer |
|---|---|---|
| 1 | What is the molar mass of sodium? | **23 g/mol.** |
| 2 | What is the mass of one mole of chlorine molecules (Cl2)? | **35.5 × 2 = 71 g.** |
| 3 | Which contains more atoms: 24 g of magnesium or 40 g of calcium? | **Both contain one mole, so the same number of atoms.** |
| 4 | How many atoms are in 56 g of iron? | **One mole: 6.0 × 10^23 atoms.** |