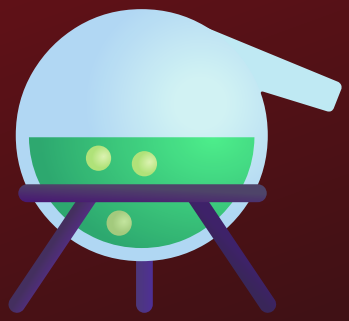
SPM · KSSM FORM 4 + FORM 5 · ENGLISH (DLP)

Chemistry Infographic Notes

One picture page per chapter

- 📄 **13** chapter pages
- ✍️ **39** quick-check questions
- ✅ Worked answers
- 🔤 English–BM glossary
- 📐 Formula / key terms box
- ⚠️ Common mistake box



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1. Look at the picture first
The middle diagram shows the whole chapter. Cover the side cards and explain it out loud.

2. Learn the two boxes
The yellow box has the formulas and key words. The red box shows the mistake most students make.

3. Do the Quick Check
Answer the 3 questions on paper, then check the worked answers at the back.

Matter and the Atomic Structure

Kinetic theory

Matter is made of tiny moving particles. Heat them: they move faster.

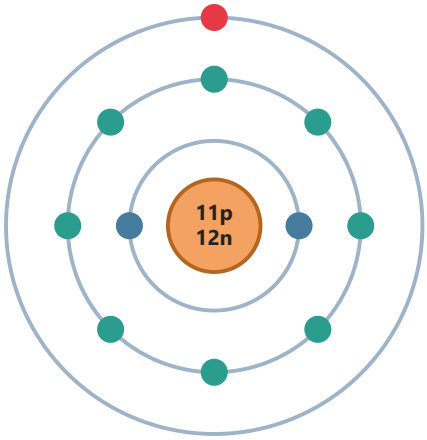
Heating curve

Temperature stays CONSTANT while melting/boiling: the heat breaks forces between particles.

Sub-atomic particles

Proton +1 (nucleus), neutron 0 (nucleus), electron −1 (shells, almost no mass).

Atom of sodium, $^{23}_{11}Na$



electron arrangement 2.8.1

Proton number (Z) = 11 = number of protons
Nucleon number (A) = 23 = protons + neutrons
Neutrons = 23 − 11 = 12
Neutral atom: electrons = protons = 11
1 valence electron → Group 1, 3 shells → Period 3

Isotopes

Same proton number, different nucleon number, e.g. ^{12}C and ^{14}C. Same chemical properties.

Uses of isotopes

C-14 dates fossils; Co-60 kills cancer cells; I-131 treats the thyroid; P-32 tracks plant uptake.

Atomic models

Dalton → Thomson (electron) → Rutherford (nucleus) → Bohr (shells) → Chadwick (neutron).

FORMULA / KEY TERMS

- Nucleon number A = protons + neutrons
- Neutrons = A − Z
- Symbol: $^{A}_{Z}X$ (A on top, Z below)
- Shells hold 2, 8, 8 … electrons (first 20 elements)

COMMON MISTAKE

❌ "During freezing the temperature keeps falling."

✅ It stays CONSTANT: heat lost to the surroundings is balanced by heat released as particles form bonds.

QUICK CHECK (worked answers at the back, page 16)

1. How many protons, neutrons and electrons are in $^{35}_{17}Cl$?
2. Write the electron arrangement of magnesium (Z = 12).
3. Explain why the temperature of naphthalene stays constant while it melts.

CHEMISTRY · FORM 4 · CHAPTER 4

The Periodic Table of Elements

Arranged by

Increasing PROTON number. Groups = columns (1–18), periods = rows.

Group + period

Valence electrons give the group (1, 2, or +10 for 13–18); shells give the period.

Group 1 down

Atoms bigger, valence electron further from nucleus, lost more easily: MORE reactive.

Periodic Table (first 4 periods)

H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
1	2	transition elements														17	18

GROUP 1
alkali metals
soft, react with water
→ alkali + H_2
reactivity ↑ down

GROUP 17
halogens
coloured, exist as X_2
reactivity ↓ down
(harder to gain e^-)

ACROSS Period 3 (Na → Ar):
atomic radius gets smaller
electronegativity increases
oxides: basic → amphoteric (Al_2O_3) → acidic
Group 18: full outer shell, inert, monatomic

Group 17 down

Atoms bigger, harder to attract an electron: LESS reactive. F_2 is the most reactive.

Group 18

Stable duplet/octet: inert. Uses: He in balloons, Ne in signs, Ar in bulbs.

Transition elements

Coloured ions, more than one oxidation number, good catalysts (Fe in Haber, V_2O_5 in Contact).

FORMULA / KEY TERMS

- Group = valence e^- (Groups 1, 2)
- Group = valence e^- + 10 (Groups 13–18)
- Period = number of occupied shells
- Electronegativity: power of an atom to pull shared electrons

COMMON MISTAKE

❌ "Group 17 elements get more reactive going down."

✅ They get LESS reactive: the bigger atom attracts an extra electron less strongly.

QUICK CHECK (worked answers at the back, page 16)

1. Element X has electron arrangement 2.8.2. State its group and period.
2. Explain why potassium is more reactive than sodium.
3. Why is argon used to fill light bulbs?

Acid, Base and Salt

Strong vs weak

Strong acid ionises COMPLETELY in water (HCl). Weak acid only partly (CH_3COOH).

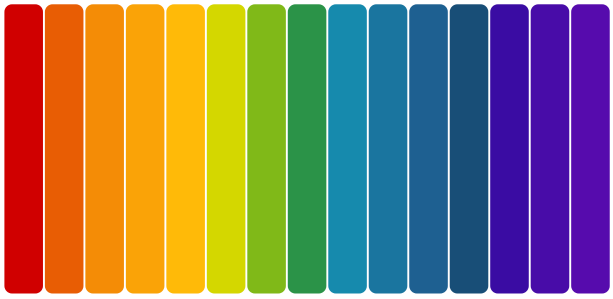
Concentration

Moles of solute in 1 dm^3 of solution (mol dm^{-3}). Not the same as "strong".

Titration

Add acid from a burette to alkali + indicator until the colour just changes (end point).

The pH scale



0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
ACID						NEUTRAL				ALKALI				

stomach acid pH 1–2	vinegar pH 3	pure water pH 7	soap pH 10	NaOH pH 14

Acid: gives H^+ ions in WATER
Alkali: base that dissolves to give OH^-
Neutralisation: $H^+ + OH^- \rightarrow H_2O$
acid + base → salt + water
Lower pH = more H^+ = more acidic

Soluble salts

Acid + alkali / metal / metal oxide / metal carbonate. Crystallise from the solution.

Insoluble salts

Mix two solutions: precipitation (double decomposition), e.g. $BaSO_4$, PbI_2, AgCl.

Ion tests

CO_2 turns limewater chalky; Cl^- + $AgNO_3$ → white ppt; SO_4^{2-} + $BaCl_2$ → white ppt.

FORMULA / KEY TERMS

- pH = −log[H^+] · pOH = −log[OH^-] · pH + pOH = 14
- M = n ÷ V(dm^3)
- Dilution: $M_1V_1 = M_2V_2$
- Titration: $M_aV_a \div M_bV_b$ = a ÷ b (mole ratio)

COMMON MISTAKE

❌ "A strong acid is the same as a concentrated acid."

✅ STRONG = ionises fully. CONCENTRATED = lots of acid per dm^3. A dilute strong acid is possible.

QUICK CHECK (worked answers at the back, page 16)

1. Find the pH of 0.01 mol dm^{-3} HCl.
2. What volume of 0.1 mol dm^{-3} NaOH neutralises 25 cm^3 of 0.1 mol dm^{-3} H_2SO_4?
3. Suggest how to prepare barium sulphate. Explain your choice.

Rate of Reaction

Collision theory

Particles must collide with enough energy (≥ activation energy) and the right orientation.

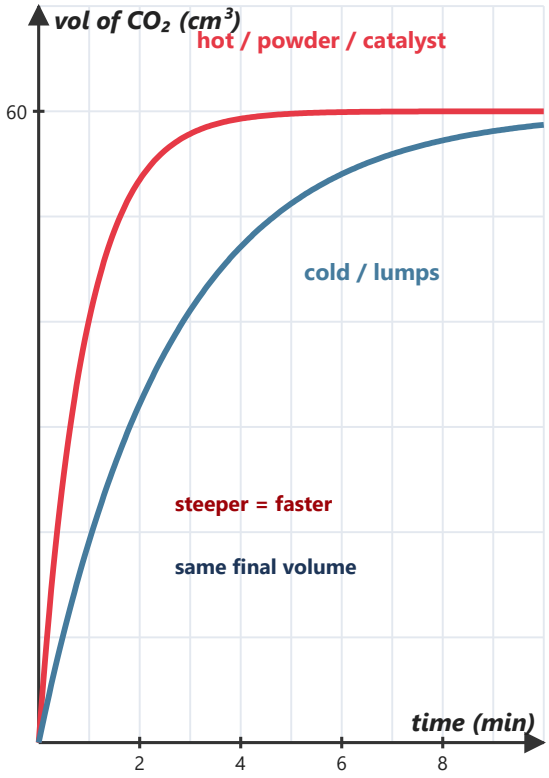
Size

Smaller pieces → bigger total surface area → more collisions per second.

Concentration

More particles per unit volume → higher frequency of collisions.

Same reactants, different rates



Temperature

Particles move faster: more collisions AND more of them have enough energy.

Catalyst

Gives a path with LOWER activation energy. Not used up; same amount of product.

Pressure (gases)

Higher pressure squeezes gas particles closer: more collisions.

FORMULA / KEY TERMS

- Rate = change in amount ÷ time taken
- Average rate = total change ÷ total time
- Rate at an instant = gradient of the tangent
- Effective collision: one that makes a reaction happen

COMMON MISTAKE

❌ "A catalyst makes MORE product."

✅ A catalyst only makes the SAME amount of product form FASTER.

QUICK CHECK (worked answers at the back, page 16)

1. Why does powdered calcium carbonate react faster with acid than lumps of the same mass?
2. Use collision theory to explain why raising the temperature increases the rate.
3. 60 cm^3 of gas is collected in the first 2 minutes. Find the average rate.

Worked Answers (1/2)

Form 4 Chapter 1: Introduction to Chemistry

1. Manipulated: temperature of water. Responding: time for the tablet to dissolve. Fixed: volume of water, size/type of tablet, stirring.
2. Wash it at once under plenty of running water, then tell the teacher.
3. Their vapour is poisonous; the fume chamber sucks the vapour away so nobody breathes it in.

Form 4 Chapter 2: Matter and the Atomic Structure

1. Protons 17, electrons 17, neutrons 35 − 17 = 18.
2. 2.8.2
3. The heat taken in is used to overcome the forces of attraction between the particles, not to raise their kinetic energy, so the temperature does not rise.

Form 4 Chapter 3: The Mole Concept, Chemical Formula and Equation

1. M_r CO_2 = 12 + 2(16) = 44. n = 8.8 ÷ 44 = 0.2 mol.
2. V = 0.5 × 24 = 12 dm^3.
3. Mg: 2.4 ÷ 24 = 0.1 mol; O: 1.6 ÷ 16 = 0.1 mol. Ratio 1 : 1, so the empirical formula is MgO.

Form 4 Chapter 4: The Periodic Table of Elements

1. 2 valence electrons → Group 2; 3 shells → Period 3.
2. K has more shells, so its valence electron is further from the nucleus and less strongly attracted; it is lost more easily.
3. Argon is inert (stable octet): it does not react with the hot tungsten filament, so the filament does not burn.

Form 4 Chapter 5: Chemical Bond

1. MgO is ionic: strong electrostatic forces between Mg^{2+} and O^{2-} ions need a lot of heat energy to overcome.
2. Naphthalene is made of simple molecules held by weak van der Waals forces; little heat is needed to overcome them.
3. Each N atom (2.5) needs 3 more electrons, so the two atoms share 3 pairs of electrons: a triple covalent bond N≡N.

Form 4 Chapter 6: Acid, Base and Salt

1. HCl is strong: $[H^+]$ = 0.01. pH = −log(0.01) = 2.
2. H_2SO_4 + 2NaOH → Na_2SO_4 + $2H_2O$. Mol acid = 0.1 × 0.025 = 0.0025; mol NaOH = 0.005; V = 0.005 ÷ 0.1 = 0.05 dm^3 = 50 cm^3.
3. $BaSO_4$ is insoluble, so use precipitation: mix barium chloride solution with sodium sulphate solution, filter, rinse with distilled water, dry.

Form 4 Chapter 7: Rate of Reaction

1. Powder has a bigger total surface area exposed, so the frequency of collisions between acid particles and $CaCO_3$ is higher; more effective collisions per second.
2. Particles gain kinetic energy and move faster, so they collide more often, and more collisions have energy ≥ activation energy; frequency of effective collisions rises.
3. 60 ÷ 2 = 30 cm^3 min^{-1} (or 0.5 cm^3 s^{-1}).

Key Terms: English – Bahasa Melayu (1/2)

Form 4. Use the English words in your DLP answers; the BM words help when you read BM books or past papers.

English	Bahasa Melayu
matter	jirim
atom	atom
molecule	molekul
ion	ion
element	unsur
compound	sebatian
proton number	nombor proton
nucleon number	nombor nukleon
isotope	isotop
electron arrangement	susunan elektron
valence electron	elektron valens
melting point	takat lebur
boiling point	takat didih
mole	mol
molar mass	jisim molar
molar volume	isi padu molar
empirical formula	formula empirik
molecular formula	formula molekul
chemical equation	persamaan kimia
periodic table	jadual berkala
group	kumpulan
period	kala
alkali metal	logam alkali
halogen	halogen
noble gas	gas adi
transition element	unsur peralihan
electronegativity	keelektronegatifan
ionic bond	ikatan ion
covalent bond	ikatan kovalen
dative bond	ikatan datif
hydrogen bond	ikatan hidrogen
metallic bond	ikatan logam
acid	asid
base	bes
alkali	alkali
neutralisation	peneutralan
salt	garam
precipitate	mendakan
titration	pentitratan
end point	takat akhir
concentration	kepekatan
rate of reaction	kadar tindak balas
catalyst	mangkin
activation energy	tenaga pengaktifan
effective collision	perlanggaran berkesan
surface area	jumlah luas permukaan
alloy	aloi
composite material	bahan komposit

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