

Exercise walk-through

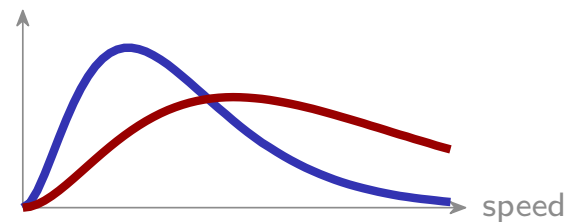
3.5

Kinetic Molecular Theory

AP Chemistry

What we will cover

- 1 Intermolecular forces
- 2 Types of solids
- 3 States of matter and the gas law
- 4 Kinetic molecular theory
- 5 Solutions and solubility
- 6 Separation methods
- 7 Spectroscopy and Beer-Lambert



Why each kind of solid behaves as it does

metallic

conducts electricity and heat, **malleable** and **ductile**
– all because the **free valence electrons** are delocalised across the lattice

ionic

hard and brittle, high melting point; conducts only when molten or dissolved, because the ions must be free to move

covalent network

very high melting point – breaking it means breaking covalent bonds

molecular

low melting point – only the intermolecular forces are broken, not the bonds

the states

differ in how tightly particles are held; rising **temperature** raises average kinetic energy until it overcomes the attractions

Every property follows from **what has to be broken** and **what can move**. Answer those two questions and the property follows.

Drawing a particulate diagram of a solution

what it shows

the **solute** and **solvent** particles, at the particle level

an ionic solute

show it fully **dissociated** into **separate ions**, each surrounded by solvent molecules

the orientation

water's δ^- oxygen faces the cations, its δ^+ hydrogens face the anions

a molecular solute

show whole molecules, not fragments – sugar does not dissociate

a strong acid

fully ionised: no intact HCl molecules should appear

the marks

come from correct **ratio**, **dissociation and orientation**, not from artistic quality

Count the particles you draw. A diagram showing the wrong stoichiometric ratio loses the mark however neat it is.

Exercises 2.1-2.3

2.1 What is proportional to the absolute temperature of a gas? [1]

2.2 At the same temperature, which moves faster: He or Ar? Give a reason. [2]

2.3 What happens to the Maxwell-Boltzmann curve when temperature rises? [1]

Exercises 2.1-2.3

2.1 What is proportional to the absolute temperature of a gas? [1]

2.1

- The average kinetic energy of the particles
-

2.2 At the same temperature, which moves faster: He or Ar? Give a reason. [2]

2.2

- He – it has a smaller molar mass, so at equal kinetic energy it moves faster
-

2.3 What happens to the Maxwell-Boltzmann curve when temperature rises? [1]

2.3

- The peak shifts to higher speed and the curve flattens/broadens

Exercise 3.1

3.1 According to kinetic molecular theory, collisions between ideal-gas particles are [1]

☐

A inelastic (energy lost)

B elastic (no energy lost)

C impossible

D always head-on

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3.1 B

- elastic collisions

Exercise 3.2 (a)

3.2 Two gases, H_2 and O_2 , are at the same temperature.

(a) Compare their average kinetic energies.

[1]

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[1]

(a)

- Equal – average kinetic energy depends only on temperature

Exercise 3.2 (b)

3.2 Two gases, H_2 and O_2 , are at the same temperature.

(b) Compare their average speeds, with a reason.

[2]

Exercise 3.2 (b)

3.2 Two gases, H_2 and O_2 , are at the same temperature.

(b) Compare their average speeds, with a reason.

[2]

(b)

- H_2 is faster; it has a smaller mass, so for the same $KE = \frac{1}{2}mv^2$ it has a larger v

Exercise 3.3

3.3 Describe how the Maxwell-Boltzmann speed distribution changes when a gas is heated, and what stays the same. [3]

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3.3

- Heating shifts the peak to a higher speed and lowers/broadens it (a wider spread with more fast molecules); the total area (number of molecules) stays the same