

Exercise walk-through

3.1

Diffusion

IGCSE Biology

Down a gradient, and why water matters

The gradient

Particles spread from where they are crowded to where they are not: they move **down a concentration gradient**, and no energy is needed.

Why water

Water is the solvent of life. This matters for **digestion** (food must dissolve before it can be used), **excretion** (wastes leave dissolved in water) and **transport** (substances travel dissolved in blood and sap).

Where it stops

Diffusion is fast over micrometres and hopeless over centimetres – which is why large organisms need a transport system.

Always say *down* the gradient, and say what is moving. “Particles move” on its own scores nothing.

The four factors that change the rate of diffusion

the gradient

a steeper concentration difference means faster **net movement down the gradient**

surface area

more area means more molecules crossing per second

distance

a **thinner barrier** is quicker to cross

temperature

warmer molecules have more kinetic energy, so they move faster

where it matters

alveoli, villi and root hairs all maximise the first two and minimise the third

the gases

oxygen
alone

in and **carbon dioxide**

out both move by diffusion

Every “how is this surface adapted” answer is these four factors applied. Name the factor, then the feature that exploits it.

Exam tips

- Always write **net** movement: particles move both ways, but the overall flow is down the gradient (for diffusion and osmosis).
- Osmosis moves **water only**, and **only** through a partially permeable membrane. Diffusion can move many kinds of particle.
- Only **active transport** uses energy from respiration, and only it goes **against** the gradient.
- For the potato or plant experiment: water in → turgid, longer and heavier; water out → flaccid, shorter and lighter; equal concentration → no change.
- A larger surface area, higher temperature, steeper concentration gradient and shorter distance all make diffusion faster.

Exercises 2.1-2.2

2.1 Define diffusion.

[2]

2.2 State where the energy for diffusion comes from.

[1]

Exercises 2.1·2.2

2.1 Define diffusion.

[2]

2.1

- net movement of particles from **higher** to **lower** concentration
 - **down a concentration gradient**
-

2.2 State where the energy for diffusion comes from.

[1]

2.2

- the energy comes from the **kinetic energy** of the particles' random movement

Exercise 3.1

3.1 Diffusion is faster when the temperature is:

[1]

☐

A lower

B higher

C at freezing point

D it has no effect

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3.1 Diffusion is faster when the temperature is:

[1]

☐

A lower

B higher

C at freezing point

D it has no effect

3.1 B

- **higher** temperature makes particles move faster, so diffusion is faster
- A and C slow it; D is false

Exercise 3.2 (a)

3.2 Oxygen moves from the air in the alveoli into the blood.

(a) Name the process.

[1]

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[1]

(a)

- oxygen moves down its concentration gradient: **diffusion**

Exercise 3.2 (b)

3.2 Oxygen moves from the air in the alveoli into the blood.

(b) State two factors that would increase the rate of this movement.

[2]

Exercise 3.2 (b)

3.2 Oxygen moves from the air in the alveoli into the blood.

(b) State two factors that would increase the rate of this movement. [2]

(b)

- any **two** of: larger surface area / higher temperature / steeper gradient / shorter distance

Exercise 3.3

3.3 Explain why diffusion does not require energy from respiration.

[2]

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[2]

3.3

- particles move using their own **random (kinetic) energy**
- so **no extra energy from respiration** is needed