

# Exercise walk-through

Membrane Transport ■ 2.5

eXercise

## You must be able to

- distinguish **passive** 被动运输 (no ATP, down the gradient) from **active** 主动运输 (uses ATP, against the gradient)
- give examples of each
- explain the role of the concentration gradient

## Method — Passive transport

**Passive transport** moves substances **down** their concentration gradient (high  $\rightarrow$  low) with **no energy** needed. Examples: diffusion, osmosis, facilitated diffusion.

## Method — Active transport

**Active transport** moves substances **against** the gradient (low  $\rightarrow$  high) and **requires ATP**. A pump protein uses energy to push the substance the “wrong” way.

## Method — A worked example

The **sodium-potassium pump** uses ATP to push  $\text{Na}^+$  out and  $\text{K}^+$  in, both against their gradients — active transport.

## Method — Deciding which

Ask: is it moving **down** the gradient (passive, free) or **up** the gradient (active, needs ATP)? That tells you which type it is.

## Practice 2.1 ■ 1 mark

Does passive transport require ATP?

## Solution 2.1

Method: Passive transport

### Worked steps

No **B1**.

## Practice 2.2 ■ 1 mark

In which direction (relative to the gradient) does active transport move a substance?

## Solution 2.2

Method: Active transport

### Worked steps

Against the gradient (low  $\rightarrow$  high) **B1**.

## Practice 2.3 ■ 1 mark

Give one example of active transport.

## Solution 2.3

Method: A worked example

### Worked steps

The sodium-potassium pump (or any pump moving ions against the gradient) **B1**.

## Exam-style 3.1 ■ 1 mark

Active transport differs from passive transport because it

- A** moves substances down the gradient
- B** requires ATP and moves against the gradient
- C** never uses proteins
- D** only moves gases

## Solution 3.1

- A** moves substances down the gradient
- B** requires ATP and moves against the gradient 
- C** never uses proteins
- D** only moves gases

### Worked steps

**B** — requires ATP and moves against the gradient.

## Exam-style 3.2 ■ 1 mark

A cell pumps calcium ions out against their concentration gradient.

- (a) State whether this is active or passive transport.
- (b) Explain why ATP is needed.

## Solution 3.2

Method: Passive transport

### Worked steps

(a) Active transport **B1**. (b) Moving ions against their gradient does not happen spontaneously, so energy from ATP is needed to power the pump **M1** **A1**.

## Exam-style 3.3 ■ 2 marks

Diffusion of oxygen into a cell needs no energy, but importing glucose against its gradient does. Explain the difference.

## Solution 3.3

### Worked steps

Oxygen moves **down** its gradient (passive, spontaneous, no energy); glucose is moved **against** its gradient, which is not spontaneous and requires ATP (active transport) **M1** **A1**.