NAME _____ CLASS _____ DATE _____

AP BIOLOGY · 2.5, 2.6, 2.8

Membrane transport

Notes to fill in alongside the guide. Each numbered block matches a chapter of the guide, and of the lesson slides. Write in the gaps, answer the cues, annotate the figures, and sum up each section in your own words.

BY THE END YOU CAN

- [ ] Describe diffusion and passive transport down a concentration gradient, and their role in taking in materials and getting rid of wastes 2.5.A
- [ ] Explain why charged and large polar molecules need channel or carrier proteins, including aquaporins for water and channels for Na+ and K+ 2.6.A
- [ ] Explain how gated ion channels and the movement of ions polarize a membrane 2.6.A
- [ ] Describe active transport and the sodium-potassium pump, and explain why it needs ATP 2.5.A
- [ ] Describe endocytosis, phagocytosis and exocytosis, and why they need energy 2.5.B
- [ ] Identify the mechanism that moves a given substance across a membrane, including cotransport, and justify it 2.8.A

01 Downhill, for free 2.5.A

CUES

Predict: Oxygen is at a higher concentration inside a leaf cell in sunlight than in the air spaces around it. Which way does it move, and what does it cost the cell?

What is meant by diffusion?

What is meant by concentration gradient?

What is meant by passive transport?

NOTES

1 Where there are more of them on one side than the other, more happen to wander from the crowded side to the empty side than the other way. That net movement from a higher to a lower concentration is _____, and the difference in concentration is a _____.

2 Any movement across a membrane that goes this way is _____.

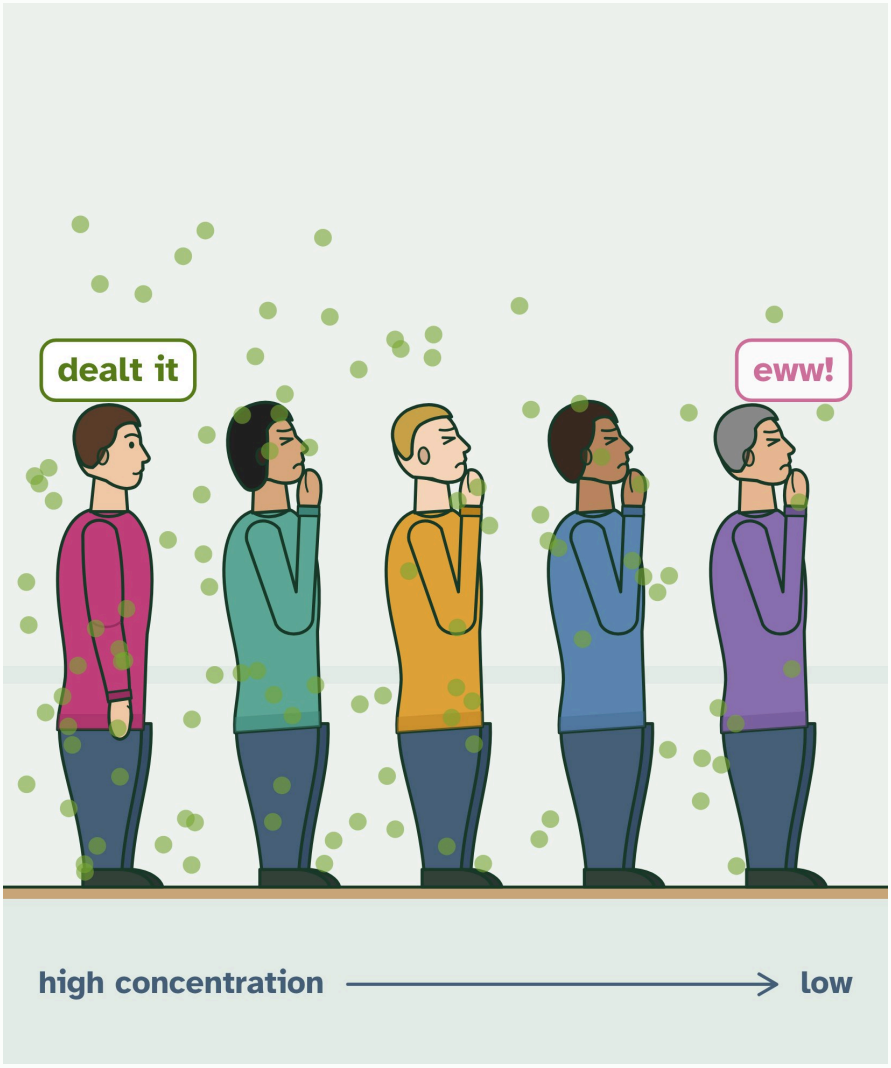
3 _____: net movement from higher to lower concentration.

4 _____: down the gradient, no energy from the cell.

Your own notes

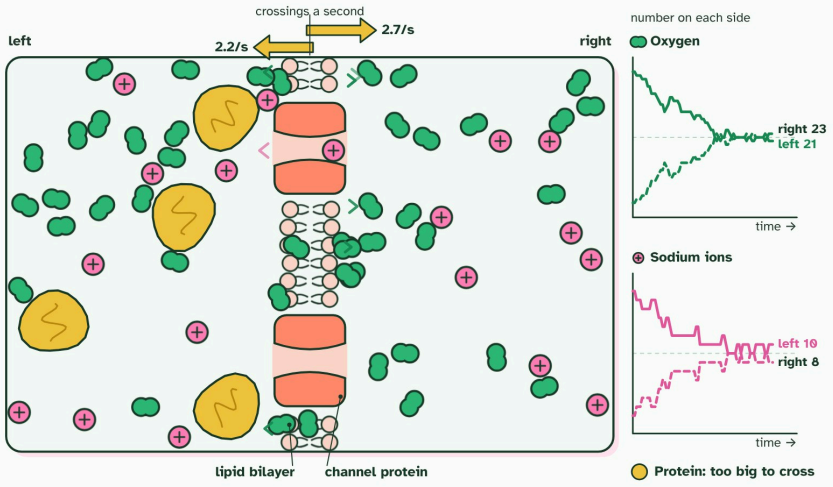
ANNOTATE THE FIGURE

Annotate this still from the animation (Who smelled it first?): what is happening, and why?



ANNOTATE THE FIGURE

Annotate this still from the animation (Diffusion across a membrane): what is happening, and why?



SPOT THE MISTAKE

What do students often get wrong about membrane transport? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 01 in two or three sentences of your own.

02 A door through the bilayer

2.6.A

CUES

Predict: Glucose enters a red blood cell through a carrier protein. What happens to the rate of entry as the glucose outside rises higher and higher?

What is meant by facilitated diffusion?

What is meant by channel protein?

What is meant by carrier protein?

NOTES

1 Ions and large polar molecules cannot cross the hydrophobic core, but many still move down their gradients through proteins. That is _____: still passive, still downhill, no energy spent, but it needs a protein.

2 A _____ is a tunnel with a hydrophilic lining, shaped and charged to let one kind of particle through: a potassium channel passes K^+ and not the smaller Na^+.

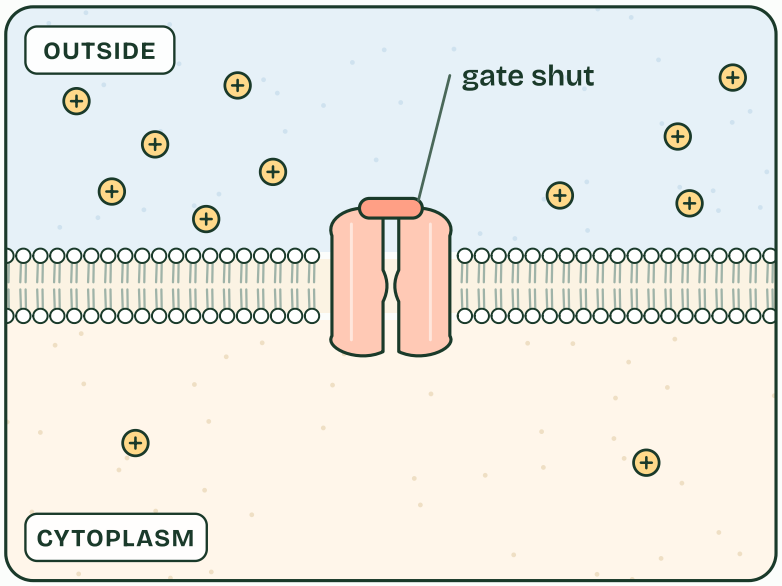
3 A _____ binds its molecule, such as glucose, on one side and changes shape to release it on the other.

4 _____: passive, down the gradient, through a protein.

Your own notes

ANNOTATE THE FIGURE

The figure shows it as Channel shut, Channel open and Pump. Note what changes each time.



SPOT THE MISTAKE

What do students often get wrong about facilitated diffusion? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 02 in two or three sentences of your own.

03 Water in single file

2.6.A

CUES

Predict: A frog's egg normally takes in little water. Scientists inject it with mRNA for an aquaporin and drop it in pure water. What happens?

What is meant by aquaporins?

NOTES

1 Most cells need far more than that. _____ are channel proteins for water: a narrow pore lets water molecules through one at a time, billions a second, while blocking ions, even H^+.

2 A little water crosses the bilayer; _____ let large amounts through.

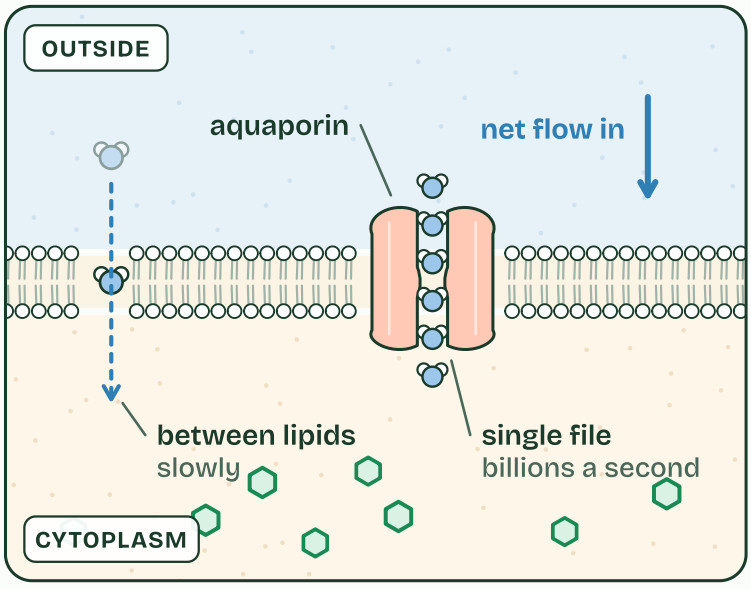
3 _____ are channels: passive, specific, single file.

4 Cells change their water permeability by the number of _____.

Your own notes

ANNOTATE THE FIGURE

Number the 3 steps on the figure and note what happens at each: 1 between the phospholipids; 2 aquaporin; 3 net flow in.



SPOT THE MISTAKE

What do students often get wrong about facilitated diffusion? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 03 in two or three sentences of your own.

04 Charge across a membrane

2.6.A

CUES

Predict: A toxin from pufferfish blocks the voltage-gated sodium channels of nerve cells. What happens to the nerves?

What is meant by membrane potential?

NOTES

1 Many of these are _____: shut until something opens them.

2 A _____ channel opens when a signal molecule binds to it, as at a synapse when acetylcholine arrives.

3 A _____ channel opens when the charge across the membrane changes, as when a nerve impulse passes.

4 Most cells keep the inside negative compared with the outside, a difference called the _____.

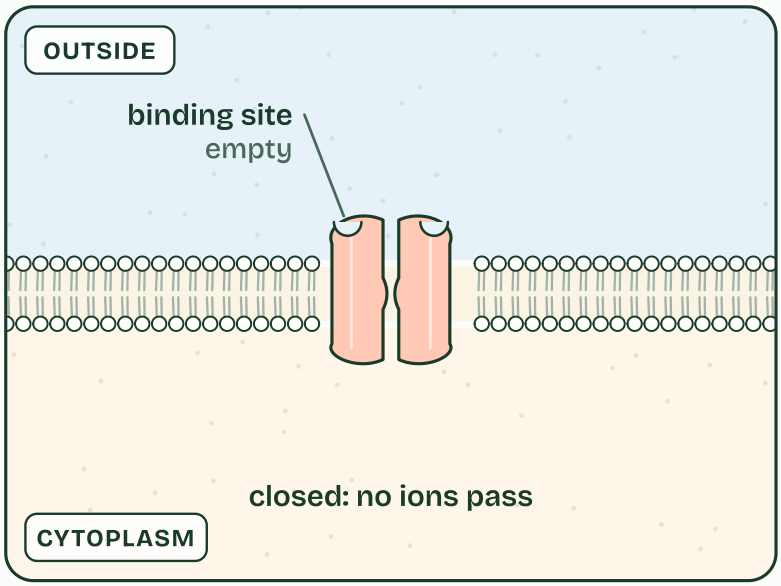
5 The membrane is _____.

6 Unequal ions make a _____: the membrane is polarized.

Your own notes

ANNOTATE THE FIGURE

The figure shows it as No acetylcholine, Acetylcholine bound and Voltage-gated. Note what changes each time.



SPOT THE MISTAKE

What do students often get wrong about facilitated diffusion? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 04 in two or three sentences of your own.

05 Uphill, for a price

2.5.A

CUES

Predict: A drug stops a cell making ATP. Which kind of movement across its membrane stops first?

What is meant by active transport?

What is meant by sodium-potassium pump?

NOTES

1 Moving a substance _____ its gradient, from low to high concentration, is _____.

2 The best known pump is the _____ (Na^+/K^+ ATPase).

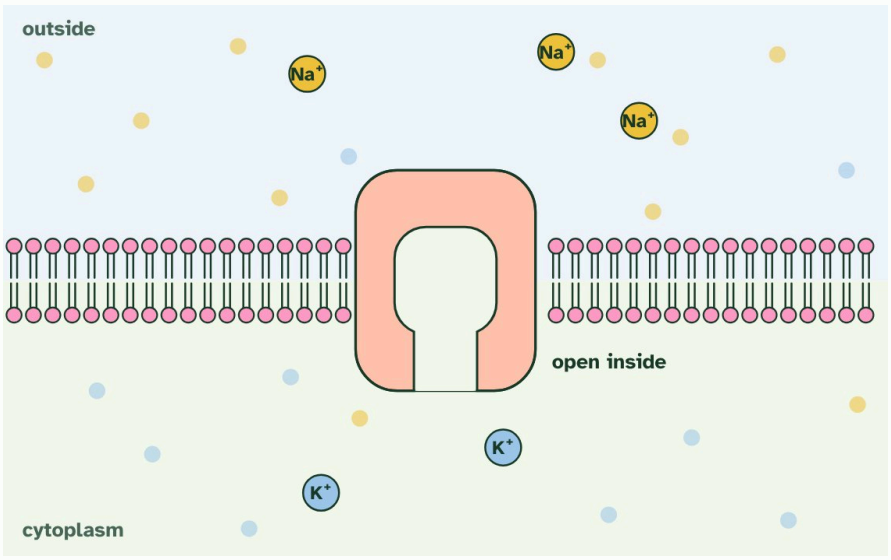
3 _____: against the gradient, with a pump and energy (ATP).

4 The Na+/K+ pump: _____.

Your own notes

ANNOTATE THE FIGURE

Annotate this still from the animation (The sodium-potassium pump): what is happening, and why?



SPOT THE MISTAKE

What do students often get wrong about membrane transport? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 05 in two or three sentences of your own.

06 Riding a gradient

2.8.A

CUES

Predict: Oral rehydration solution, for people losing water through diarrhea, contains salt and glucose together. Why glucose?

What is meant by cotransporter?

NOTES

1 A _____ lets an ion flow back down its gradient and uses that flow to carry another substance with it, even against that substance's own gradient.

2 A pump builds an ion gradient; a _____ uses it.

3 Sodium-glucose cotransport:

_____.

4 On the blood side, the _____ _____ _____ _____ _____ uses ATP and keeps Na^+ low inside the cell.

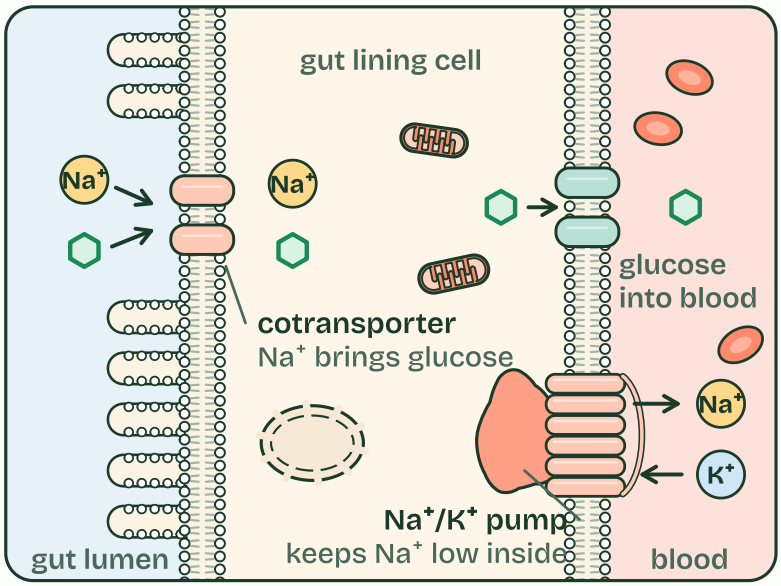
5 On the gut side, the _____ lets Na^+ in down its gradient, and glucose comes with it.

6 Glucose leaves on the blood side by _____.

Your own notes

ANNOTATE THE FIGURE

Number the 3 steps on the figure and note what happens at each: 1 Na+/K+ pump; 2 cotransporter; 3 facilitated diffusion.



SPOT THE MISTAKE

What do students often get wrong about mechanisms of transport? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 06 in two or three sentences of your own.

07 Moving it in bulk

2.5.B

CUES

Predict: A cell in the pancreas secretes insulin, a protein of 51 amino acids. How does insulin leave the cell?

What is meant by endocytosis?

What is meant by exocytosis?

NOTES

1 In _____ the plasma membrane folds in around material outside the cell and pinches off as a vesicle inside.

2 When the material is a large particle, such as a bacterium taken in by a white blood cell, it is called _____.

3 In _____ a vesicle from inside the cell fuses with the plasma membrane and opens to the outside, releasing its contents: insulin from the pancreas, neurotransmitters at a synapse, mucus in the gut.

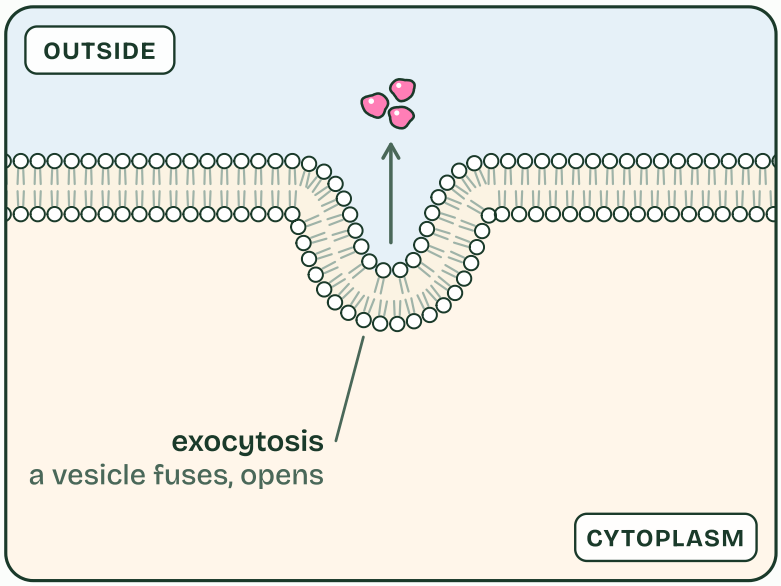
4 _____: membrane folds in and pinches off a vesicle. Phagocytosis: large particles.

5 _____: a vesicle fuses and releases its contents outside.

Your own notes

ANNOTATE THE FIGURE

Number the 4 steps on the figure and note what happens at each.



SPOT THE MISTAKE

What do students often get wrong about membrane transport? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 07 in two or three sentences of your own.

08 Which way, and what it costs

2.8.A

CUES

Predict: A root hair cell takes in nitrate ions from soil water where nitrate is 100 times less concentrated than inside the cell. How?

NOTES

1 Down the gradient, no energy: _____.

2 Against the gradient: _____.

3 Large molecules: _____.

Your own notes

SPOT THE MISTAKE

What do students often get wrong about mechanisms of transport? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 08 in two or three sentences of your own.

Check yourself

The check for this guide is online: a fresh paper of past-paper style questions from the exam bank on 2.5, 2.6, 2.8 each time, marked as you go, and saved to your Exam practice progress when you are signed in. Scan the code, or type the link.

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How this was made. The course structure, the activities and the teaching choices come from my own classroom, my presentations and my years of teaching IB and AP Biology. I use Claude, an AI, to help write and build the interactive guides, lesson plans, slides and practice questions, and to draw the diagrams and code the interactives. I direct the work and review it against the IB and AP specifications before it goes live.