AP BIOLOGY · UNIT 2 · TOPIC 2.5

Membrane Transport

Learning objectives 2.5.A Describe the mechanisms that organisms use to maintain solute and water balance. 2.5.B Describe the mechanisms that organisms use to transport large molecules across the plasma membrane.

Name: Date: Period:

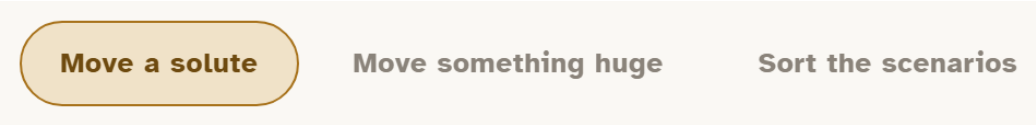
Use the tool **Down or Up the Gradient**. Work on the **Move a solute** tab for Parts 1 to 3, **Move something huge** for Part 4, and **Sort the scenarios** for Part 5. Watch the ATP counter throughout, because energy is what separates the two kinds of transport.

switch tab *scroll down* *record from the tool*

score yourself *reset the tool*

The purple bar in the margin names the AP science practice a question uses.

Part 1 · Try the same move both ways



Use the **Move a solute** tab. It is the one showing when the tool opens.

Set the starting difference to **60**, so there is more outside than inside. Then try each of these four moves and record what happens. **Drag the particle**. Do not press Let it run yet.

Mechanism	**Direction I dragged**	**Did it move?** *circle one*	**ATP spent**
Passive	Outside → inside (down)	yes / no	
Passive	Inside → outside (up)	yes / no	
Active	Outside → inside (down)	yes / no	
Active	Inside → outside (up)	yes / no	

1. (a) Identify the move in the Part 1 table that the tool refused.

(b) Explain why that move cannot happen.

Part 2 · Where each one ends up

Stay on the **Move a solute** tab.

Now press **Let it run** and let each mechanism go to completion. Reset between runs.

Start	Mechanism	Final outside	Final inside	ATP spent
Difference 60	Passive			
Difference 60	Active			
Difference 0	Passive			
Difference 0	Active			

2. (a) Describe the effect of passive transport on a concentration gradient.

(b) Describe the effect of active transport on a concentration gradient.

SP 6 : ARGUMENTATION

3. When the starting difference was 0, passive transport moved no particles, but active transport spent ATP and built a concentration gradient. Based on these results, explain why active transport could build a concentration gradient but passive transport could not.

Part 3 · Passive versus active

4. Describe the difference between passive and active transport in terms of the direction of movement relative to the concentration gradient and the input of energy.

5. Passive transport plays a primary role in the import of resources and the export of wastes.
(a) Identify one resource that a cell imports by passive transport.

(b) Identify one waste that a cell exports by passive transport.

Part 4 · Something too big for any protein



Click the **Move something huge** tab at the top of the tool.

Play both processes all the way through. Watch what happens to the plasma membrane at each step.

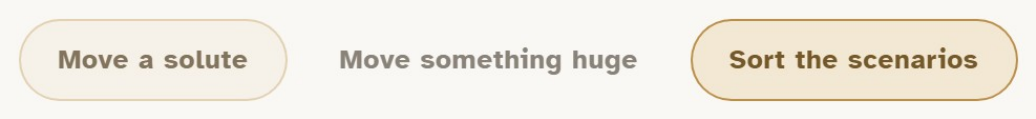
Process	**Direction** *circle one*	**What happens to the plasma membrane**
Exocytosis	in / out	
Endocytosis	in / out	

SP 1 · CONCEPT EXPLANATION

6. Explain why a cell moves a macromolecule in a vesicle instead of through a transport protein.

7. In endocytosis, a new vesicle forms from the plasma membrane. In exocytosis, the vesicle membrane becomes part of the plasma membrane. Explain how endocytosis and exocytosis connect the plasma membrane to the endomembrane system (Topic 2.1).

Part 5 · Name the process



Click the **Sort the scenarios** tab at the top of the tool.

Work the **Sort the scenarios** cards, then answer these in complete sentences.

8. Glucose enters a cell through a transport protein, moving down its concentration gradient, and no ATP is used. Explain why this transport is passive even though it requires a protein.

9. A root hair cell contains nitrate at a much higher concentration than the surrounding soil, and the cell continues to take in nitrate.
(a) Identify the transport process the cell uses to take in nitrate.

(b) Provide reasoning to justify your identification.

SP 6 : ARGUMENTATION

10. Researchers treat a cell with a drug that blocks ATP production.
(a) Predict the effect of the drug on each of the four processes in the tool: passive transport, active transport, endocytosis and exocytosis.

(b) Justify each prediction.

Part 6 · Learning check self-report

Scroll down to the **Learning check** at the bottom of the tool. Type an answer to each question, check it against the rubric, and check off the points you earned. Then record your score here and, for every point you did not earn, write what the rubric asked for that your answer left out.

Question	Points possible	Points I earned	Missed opportunities (what the rubric wanted that I left out)
1	2		
2	2		
3	2		
4	2		
Total	**8**		

What the model simplifies

ATP is counted as one unit per particle moved. Real pumps have their own ratios: the sodium-potassium pump in Topic 2.8 moves five ions per ATP, not one.

Concentrations are shown as plain counts out of 100 in two well-mixed compartments. Real cells have volumes, and moving a particle changes concentration by an amount that depends on the volume it moves into.

The tool refuses a passive move up the gradient outright. In reality individual particles do sometimes move the “wrong” way; what cannot happen without energy is a sustained net flow up a gradient.

The vesicle diagram shows one macromolecule and one vesicle in four steps. Real endocytosis and exocytosis handle many molecules at once and involve proteins that shape and target the vesicle.