

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 — it is the whole point of this topic. Predicting: wherever a Part asks you to predict, write a specific number or word and one reason before you touch the tool, in the form “I think ... because ...”. A wrong prediction costs nothing; a prediction made after looking is not a prediction.

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

Move a solute

Move something huge

Sort the scenarios

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? <i>circle one</i>	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. One of those four moves was refused. State which one, and explain why it 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. Describe what passive transport does to a gradient, and what active transport does to one.

3. Starting from a difference of 0, passive transport moved nothing at all while active transport built a gradient. Explain what that shows about where the energy for a gradient has to come from.

Part 3 · Say it in one sentence

4. State the single difference between passive and active transport, in one sentence, mentioning both direction and energy.

5. Passive transport plays a primary role in two things a cell has to do. Name both, and give an example of each.

Part 4 · Something too big for any protein

Move a solute

Move something huge

Sort the scenarios



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 <i>circle one</i>	What happens to the plasma membrane
Exocytosis	in / out	
Endocytosis	in / out	

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

7. In endocytosis the new vesicle is made from the plasma membrane; in exocytosis the vesicle membrane becomes part of the plasma membrane. Explain how that connects this topic to the endomembrane system from Topic 2.1.

Part 5 · Name the process

Move a solute

Move something huge

Sort the scenarios



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 entering a cell through a transport protein, down its gradient, with no ATP used, is passive transport. Explain why needing a protein does not make transport active.**

9. **A root hair cell holds nitrate at a far higher concentration than the soil around it, and keeps taking more in. Identify the process and justify your answer.**

10. A cell is treated with a drug that stops it making ATP. Predict which of the four processes in this tool would stop, and which would continue. Justify each prediction.

Part 6 · Learning check self-report



Scroll down to the **Learning check** at the bottom of the tool. Type each answer in your own words, check it, and tick 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.