

Facilitated Diffusion

Learning objective 2.6.A Explain how the structure of a molecule affects its ability to pass through the plasma membrane.

Name:

Date:

Period:

Use the tool **Through the Channel**. Work on the **Find the right door** tab for Parts 1 and 2, **Why carriers run out** for Part 3, and **Polarize the membrane** for Part 4. Predict before you press anything — the tool is more useful when you have committed to an answer first. 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



predict first



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 • Which door fits which solute

Find the right door

Why carriers run out

Polarize the membrane



Use the **Find the right door** tab. It is the one showing when the tool opens.



Select each solute in turn and drag it at **every** one of the four proteins. Record which protein accepts it, if any.

Solute	Which protein accepts it	Channel or transport protein? <i>circle one</i>
Potassium ion K^+		channel / transport protein / none
Sodium ion Na^+		channel / transport protein / none
Chloride ion Cl^-		channel / transport protein / none
Glucose $C_6H_{12}O_6$		channel / transport protein / none
Water H_2O		channel / transport protein / none

1. One solute has no protein at all in this membrane. Name it, and state what that means for its ability to cross.

2. A sodium ion is smaller than a potassium ion, and yet it will not go through the potassium channel. Explain what that tells you about how a channel protein is selective.

Part 2 · Prove it is still passive



Stay on the **Find the right door** tab and scroll down to **the section headed The thing students get wrong**.



Open **The thing students get wrong** and use the small flow model. Predict each result before pressing **Run it**.

Starting condition	What I predict	Final outside / inside	ATP used
Outside 90, inside 10			
Outside 50, inside 50			

3. State where the flow stopped when it started from a gradient, and explain why it stopped there.

4. Starting from equal concentrations, nothing moved at all. Explain why that result shows facilitated diffusion is passive and not active.

5. Explain why needing a protein does not make a process require energy.

Part 3 · The graph that separates them

Find the right door

Why carriers run out

Polarize the membrane

-  Click the **Why carriers run out** tab at the top of the tool.
-  Move the gradient slider through the values below and record both rates.

Gradient	Channel rate	Carrier rate	Which is faster?
10			
40			
80			
160			

6. Describe the shape of each curve in words.

7. At a small gradient the carrier is faster; at a large one the channel is. Explain the crossover.

8. Explain why a transport protein has a maximum rate and a channel protein does not. Refer to what each protein has to do for every molecule it moves.

Part 4 · Make a charge difference

Find the right door

Why carriers run out

Polarize the membrane



Click the **Polarize the membrane** tab at the top of the tool.



For each row, predict which way each ion will move and whether a charge difference will build up. Then open those channels, press **Let ions cross**, wait until the flow stops on its own, and record the reading **Inside relative to outside**. Press **Reset** between rows.

Channels open	Which way will each ion move? (predict)	Polarized? (predict) <i>circle one</i>	Inside relative to outside (actual), and polarized?
K ⁺ only		yes / no	
Na ⁺ only		yes / no	
Cl ⁻ only		yes / no	
K ⁺ and Na ⁺ together		yes / no	
K ⁺ and Cl ⁻ together		yes / no	

9. State the rule for when a membrane becomes polarized and when it does not.

10. Explain how the selective permeability of a membrane can produce a difference in electrical charge across it, and name one other thing selective permeability makes possible.

11. The ions stopped crossing on their own, before the concentration difference was gone. Explain what stopped them.

Part 5 · 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

Each protein here carries exactly one substance. Real channels and transporters vary in how selective they are, and some carry more than one thing at once.

The carrier's saturating curve is a smooth mathematical relationship rather than a simulation of individual proteins binding and cycling. The shape is right; the numbers are arbitrary units.

Membrane potential is shown as a plain count of net charges, not in millivolts. A real membrane potential also depends on the membrane's capacitance, and on the fact that only a tiny fraction of the ions present actually cross.

The resting populations (potassium higher inside, sodium and chloride higher outside) are the usual animal-cell picture with made-up counts. The electrical pull on an ion is a single opposing term: each unit of net charge across the membrane counts the same as one ion of concentration difference, so the flow slows and stops at a simple balance point rather than at a true equilibrium potential.