



Transmembrane Transport

*How do small molecules move
across the cell membrane?*

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Question 1

Which type(s) of transmembrane transport is water transported by through cell membrane?

Question 2

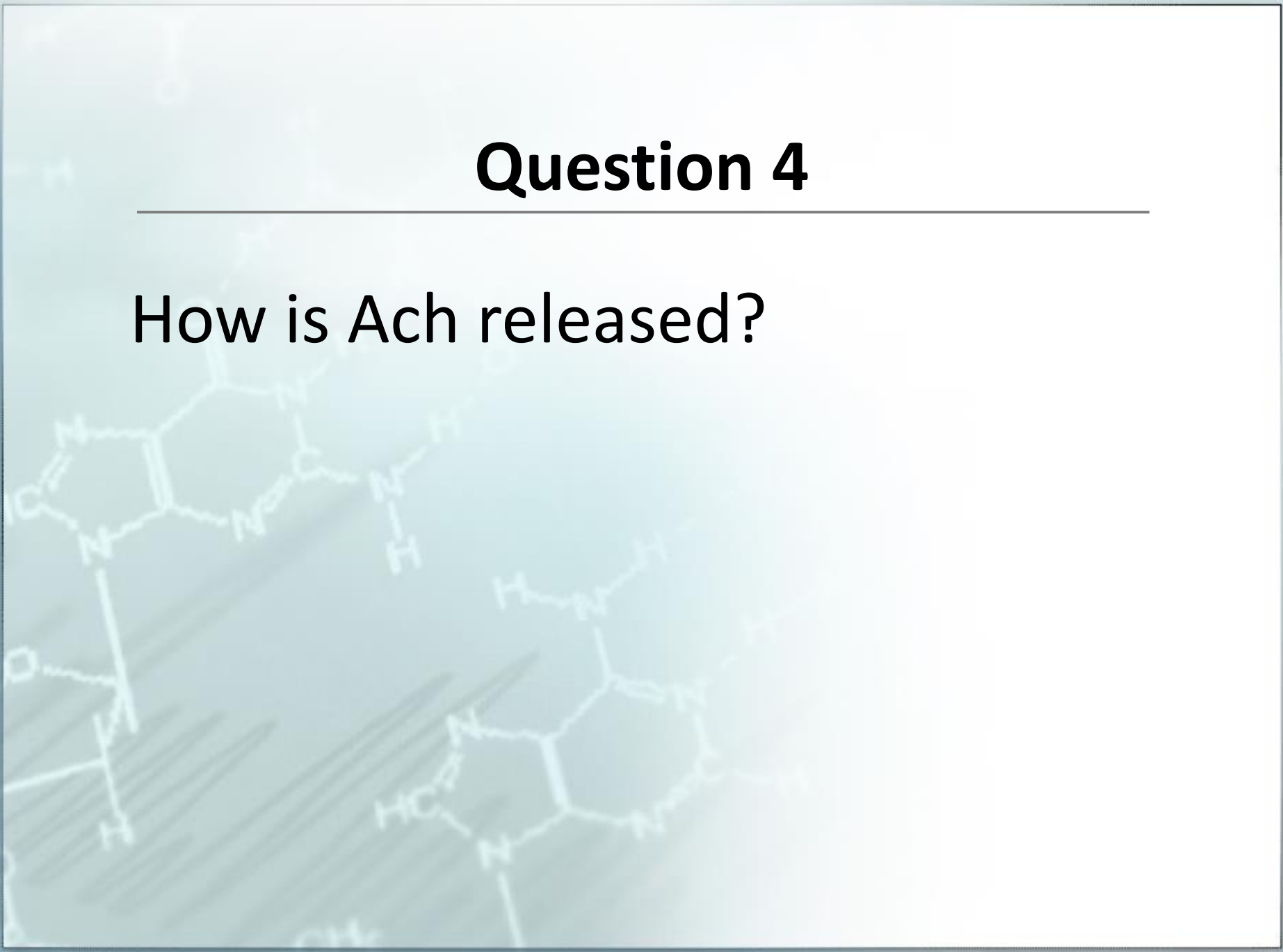
Besides being a receptor, what kind of protein does acetylcholine (Ach) receptor function as?

Question 3

Which type of transmembrane transport does Ach receptor participate in?

Question 4

How is Ach released?

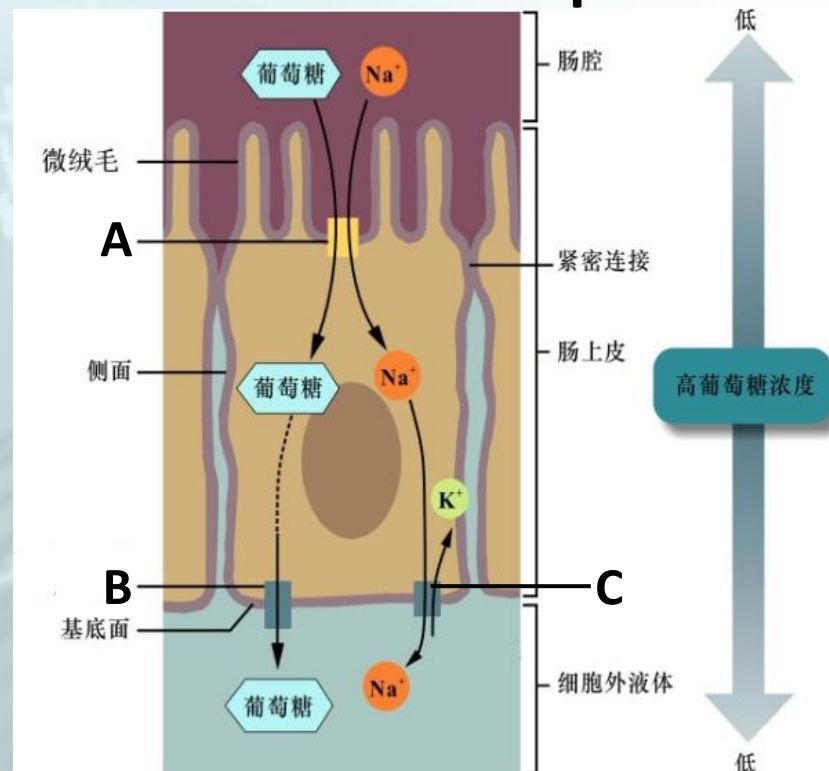


Question 5

Where does the energy utilized by secondary active transport come from?

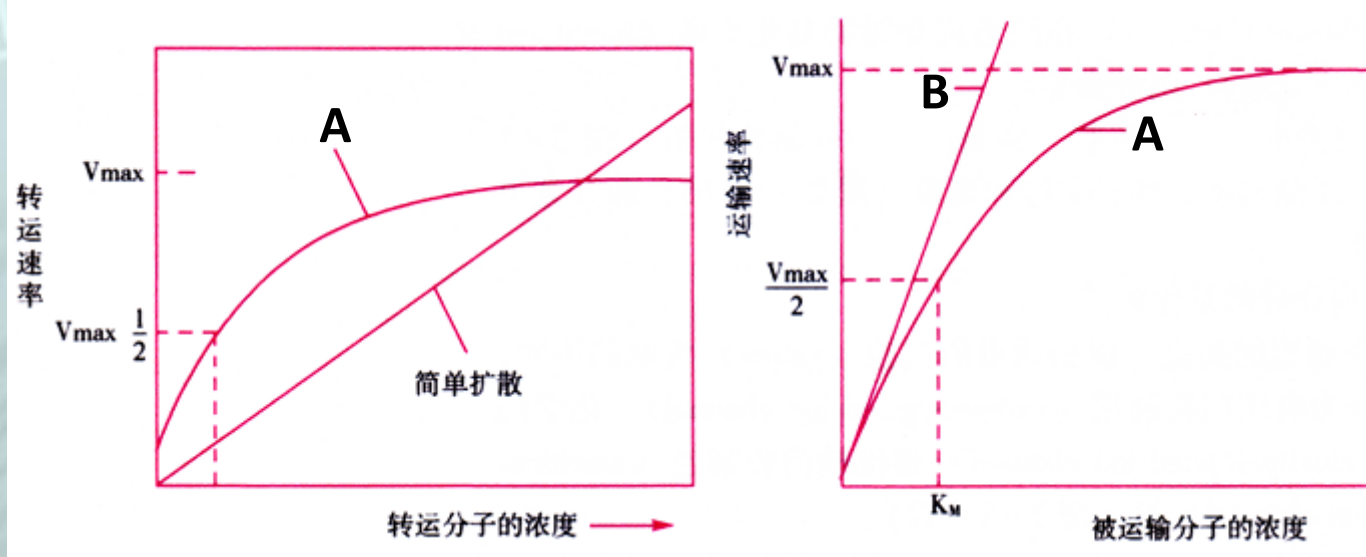
Question 6

Point out ALL types of transmembrane transport in the graph.



Question 7

Name different types of passive transport according to the curves.



Outlines



**Passive
Transport**

1



**Active
Transport**

2

4 Different Ways of Transmembrane Transport

Passive Transport:

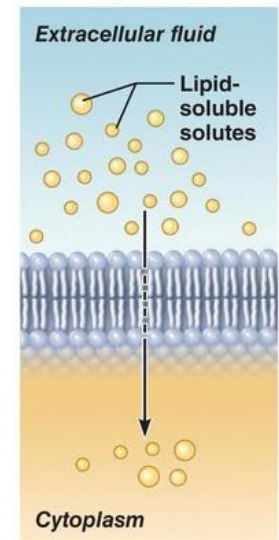
- 1) Simple Diffusion &
- 2) Facilitated Diffusion

Active Transport:

- 3) Primary Active Transport &
- 4) Secondary Active Transport

Simple Diffusion

- Water, urea, oxygen, carbon dioxide, alcohols ... either **non-polar (lipid-soluble) molecules** or **small polar molecules without charges**.
- From **high** concentrations to **low** conc.
- Do **NOT** consume ATP



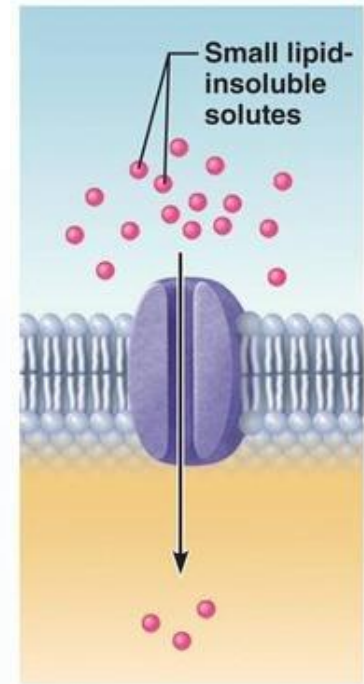
(a) Simple diffusion of fat-soluble molecules directly through the phospholipid bilayer

Facilitated Diffusion

- Water, ions, sugars, amino acids, alcohols ...
lipid-insoluble molecules.
- From **high** concentrations to **low** conc.
- Facilitated by **channels/carriers**
- Do **NOT** consume ATP

Facilitated Diffusion

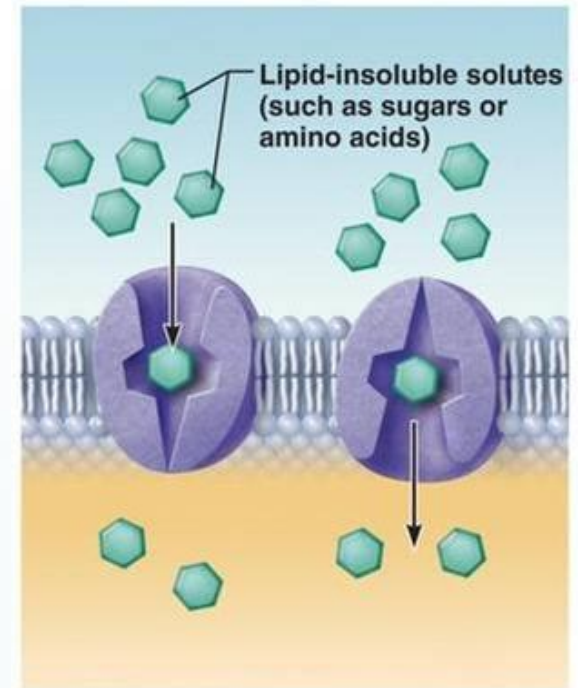
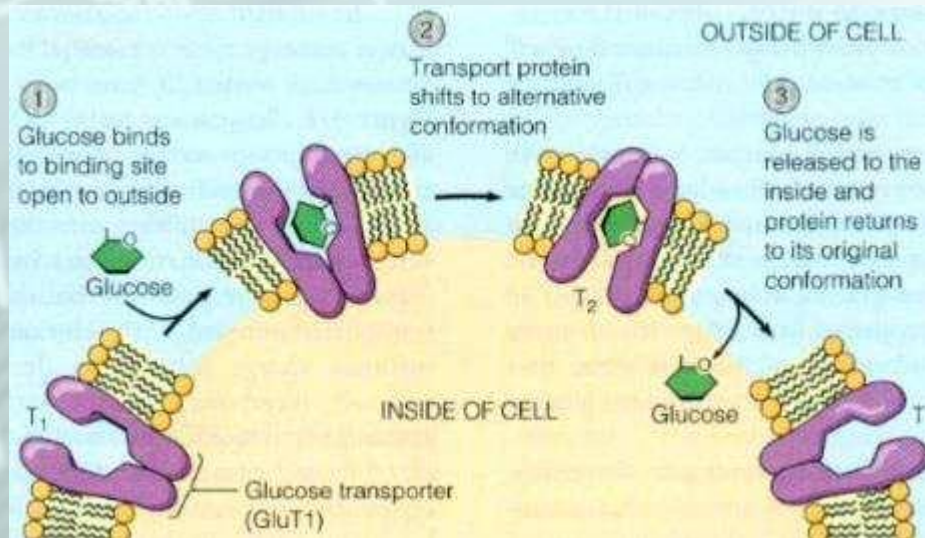
- 4 types of Channels
 1. **Voltage-gated** ion channel
 2. **Ligand-gated** ion channel
 3. **Mechanically-gated** ion channel
 4. **Water channel - aquaporin**



(c) Channel-mediated facilitated diffusion through a channel protein; mostly ions selected on basis of size and charge

Facilitated Diffusion

- Carriers
 1. Conformational change
 2. Saturation

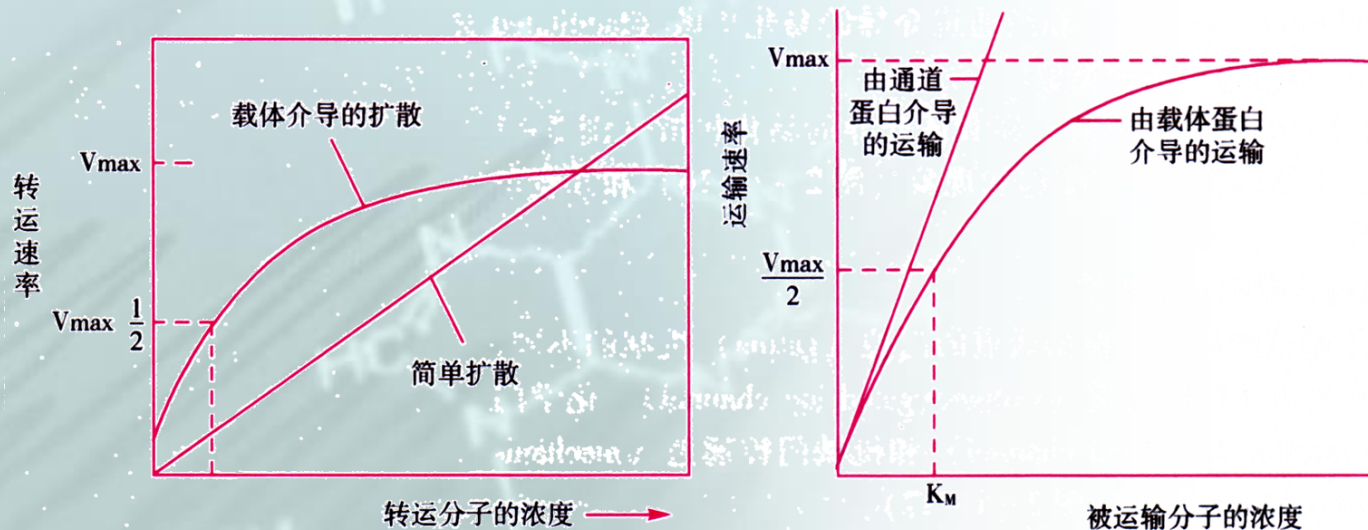


(b) Carrier-mediated facilitated diffusion
via protein carrier specific for one chemical; binding of substrate causes transport protein to change shape

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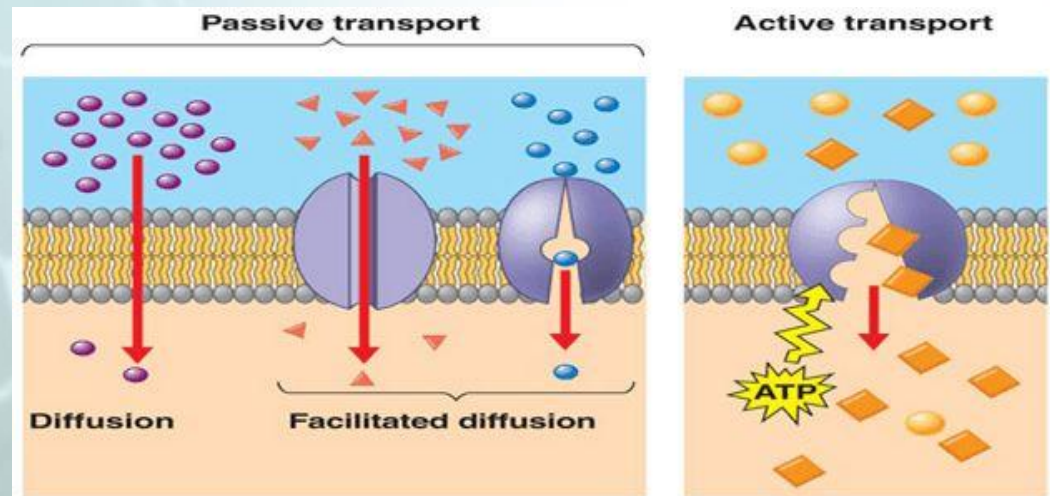
Summary of Passive Transport

Transport methods	Transport direction	Transport protein	ATP consumption	Transport substances	Transport rate
Simple diffusion					?
Facilitated diffusion					?



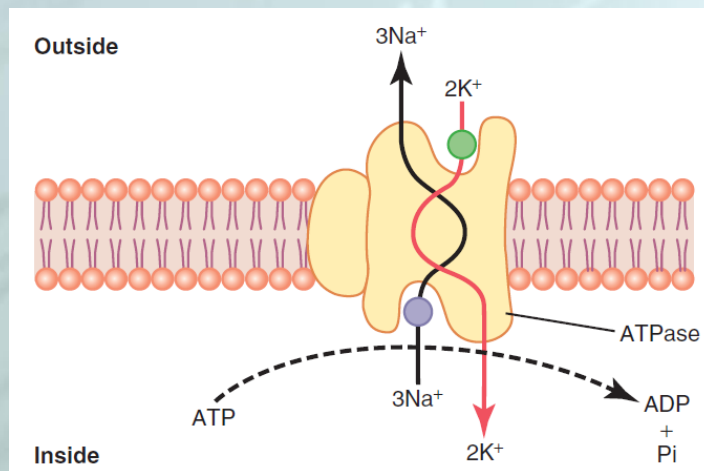
Active Transport

- **Active** vs. **Passive** transport
- 2 main differences
 1. Transport direction
 2. Energy consumption



Primary Active Transport

- Consume ATP **directly**
- Also utilizes **carriers** to transport, but they are **enzymes hydrolyzing ATP**.



Na⁺-K⁺ pump transports 3Na⁺ out of and 2K⁺ into the cell against the ionic gradients, by converting ATP into ADP. Therefore, Na⁺-K⁺ pump is also called Na⁺-K⁺ ATPase.

Secondary Active Transport

- Consume energy **stored in ionic gradients**
- Also utilizes **carriers** to transport, but they are **cotransporters/exchangers**.

Summary

- 4 different ways of transmembrane transport
 - 2 are **passive transport**, including **simple diffusion** & **facilitated diffusion**
 - 2 are **active transport**, including **primary active transport** & **secondary active transport**

Vesicular Transport

- Transmembrane transport of large molecules
- **Exocytosis:**
 - **constitutive** exocytosis & **regulated** exocytosis
- **Endocytosis:**
 - **Phagocytosis** (solid) & **Pinocytosis** (liquid)

Assignments

- How is water transported across the cell membrane? Which way do you think is **more efficient**? Explain.
- Give **two** examples of **secondary active transport**, one example for **cotransport**, another for **exchange**. Draw **diagrams** to describe the transport processes.