Learning by Seeing Osmosis:

Engaging and Extending Student Learning through Inquiry-based Activities

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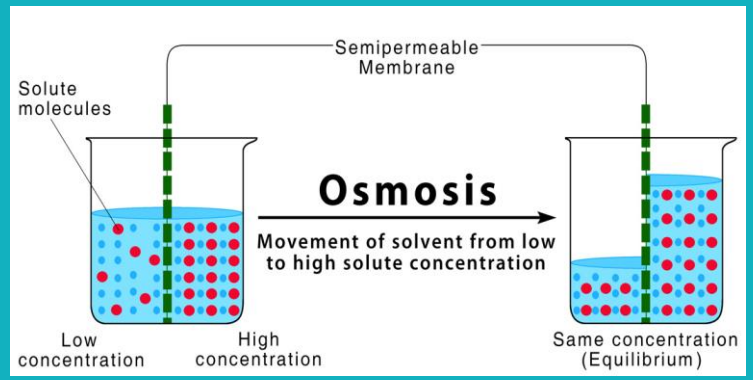
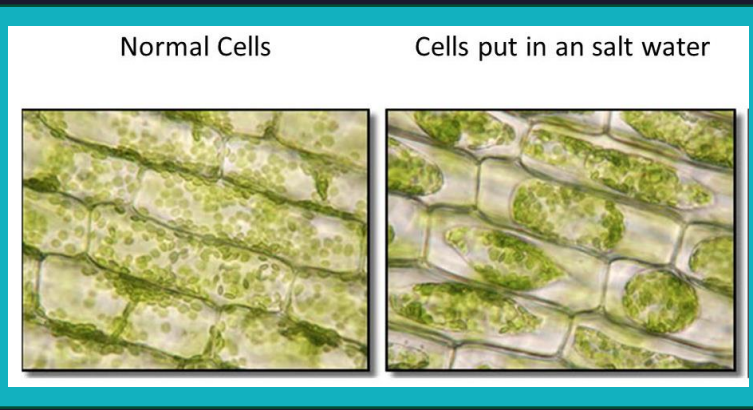
Osmosis

- Learn in S4 HKDSE Biology curriculum
- Involved in many **daily life scenarios**
- Require thorough understanding in **macroscopic**, microscopic and sub-microscopic level
- Fundamental concept that explains many **biological phenomena**

Traditional teaching sequence





Definition of osmosis

Introduction of biological terminologies

Process of osmosis

Static diagram in sub-microscopic level

Osmosis and cell

Appearance of animal and plant cell (microscopic level)

Application of osmosis

Examples of daily-life phenomenon

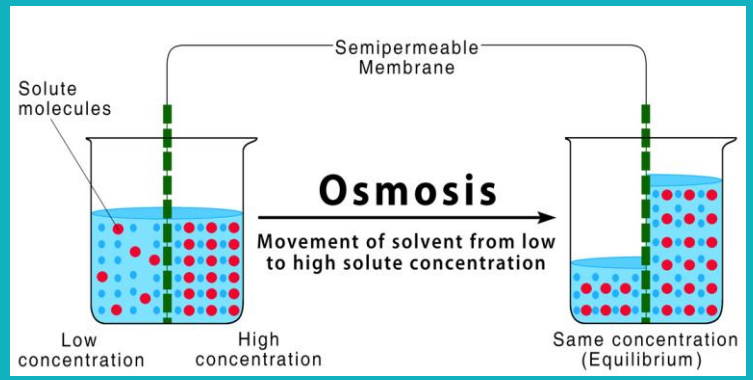
Problems associated with the traditional approach

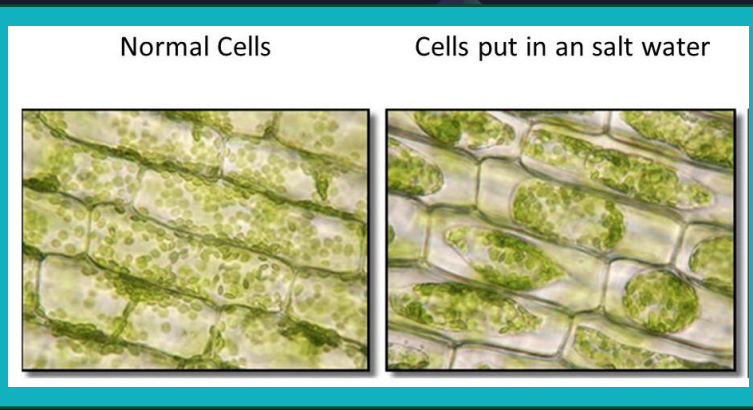
- Introducing the concept of osmosis through abstract evidence or abstract terminologies
  - High language barrier for students, including the gifted
  - Poor linkage with students' prior knowledge
  - We cannot assess students' understanding for their learning in the process. We can only assess at the end of the teaching.

Highlights of this lesson

- Use of **5-E learning model**
- Use of **simulation** to illustrate osmosis in sub-microscopic level

Traditional teaching sequence





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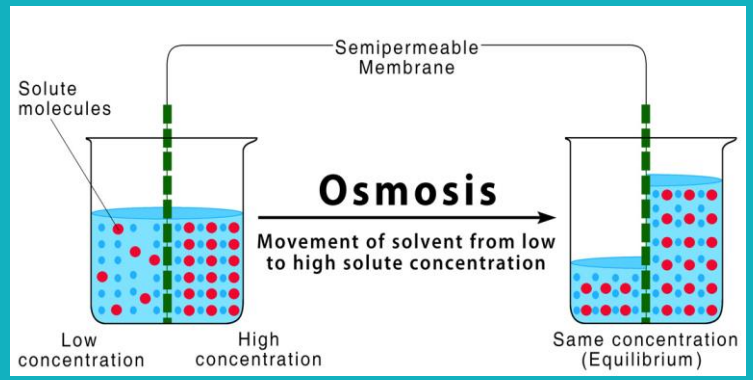
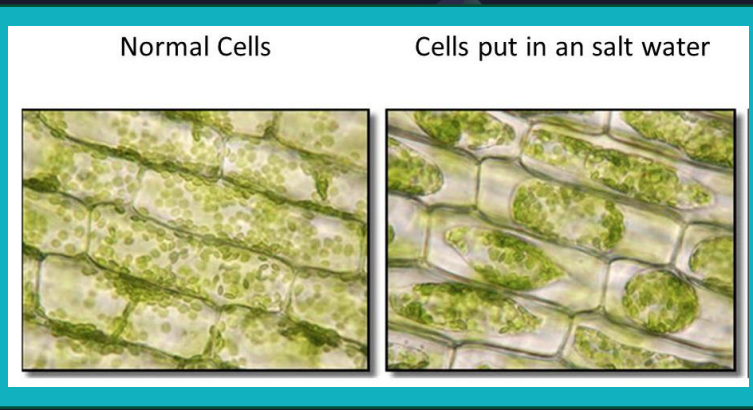
5-E learning model





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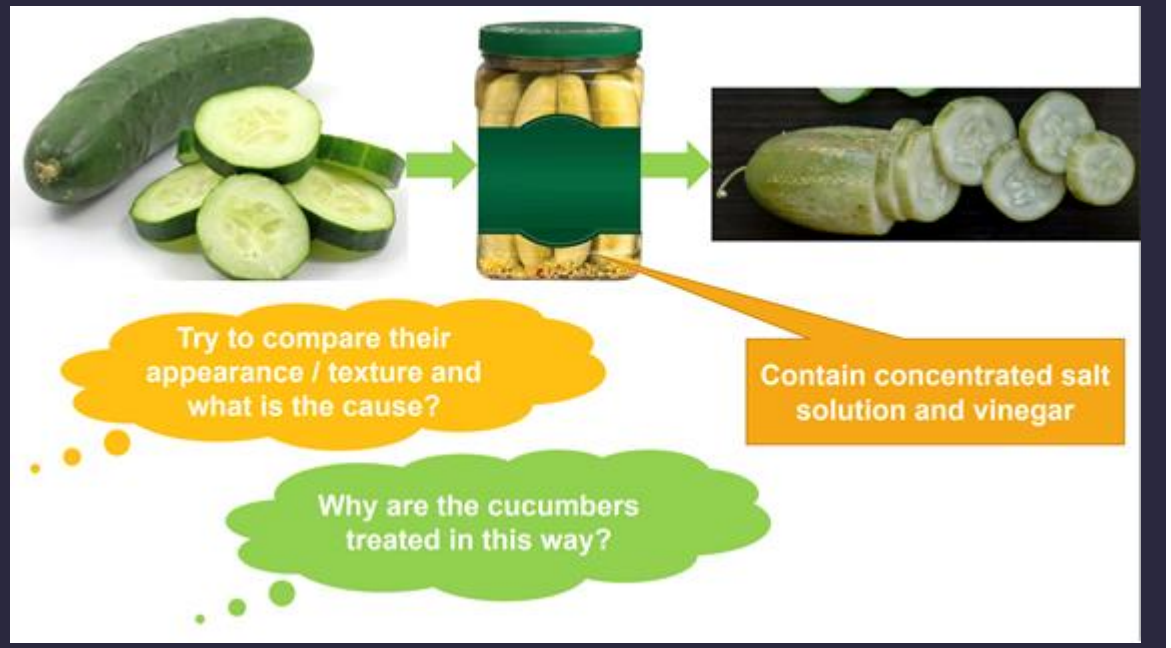
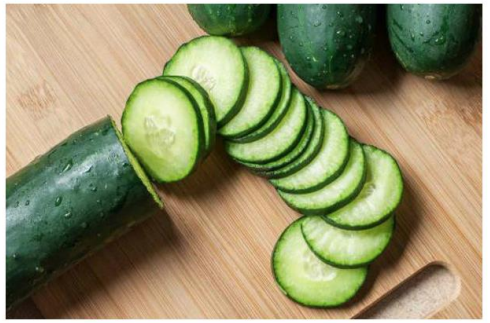
Engage

- Provide a scenario: Pickled cucumber
- Make observation: Notice-and-Wonder T Chart



Task 1

Complete the notice-and-wonder T chart by examining some slices of fresh cucumber and pickled cucumber.



Fresh cucumber

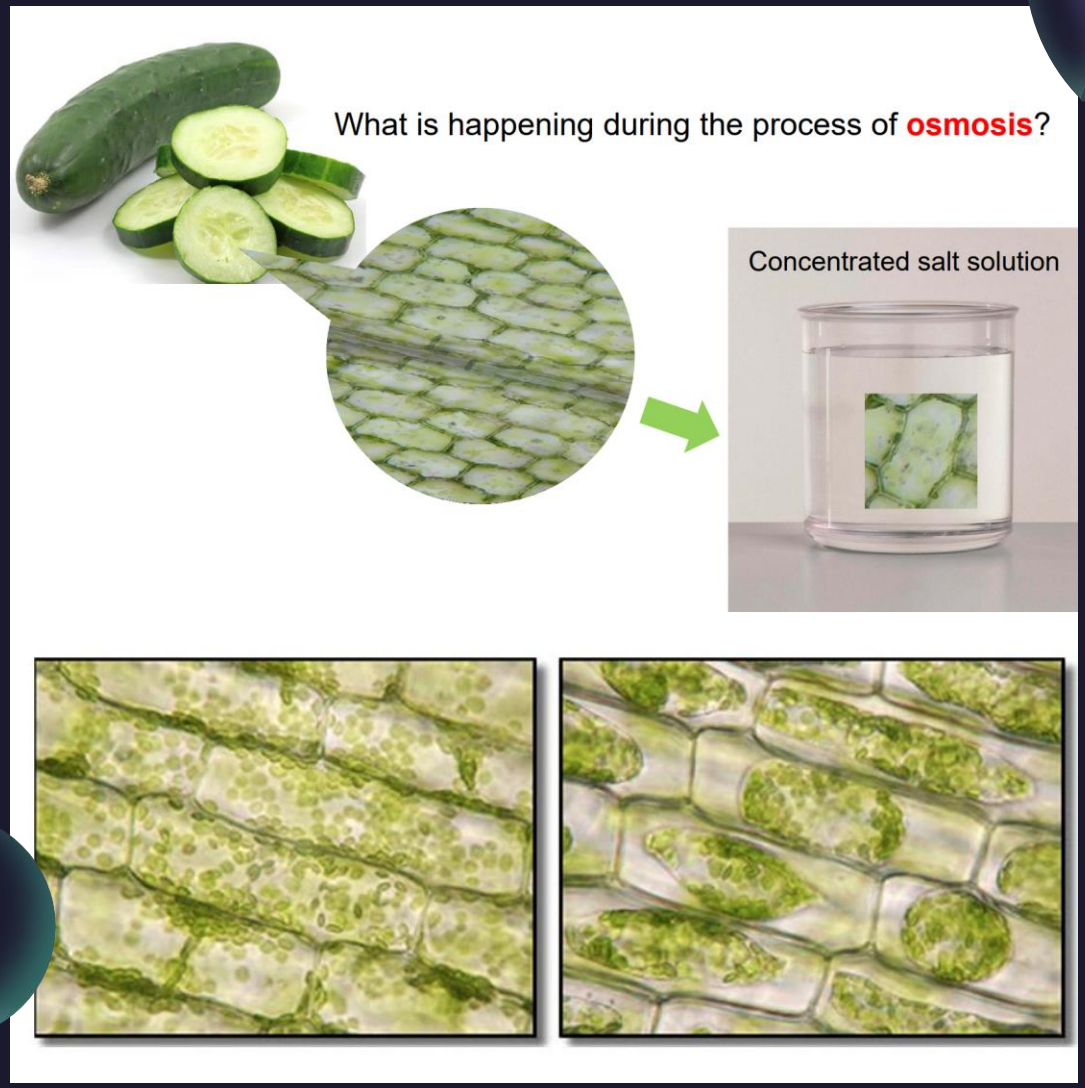
Pickled cucumber

What did you notice?	What did you wonder?

Explore

- Zooming in:

  From macroscopic to submicroscopic



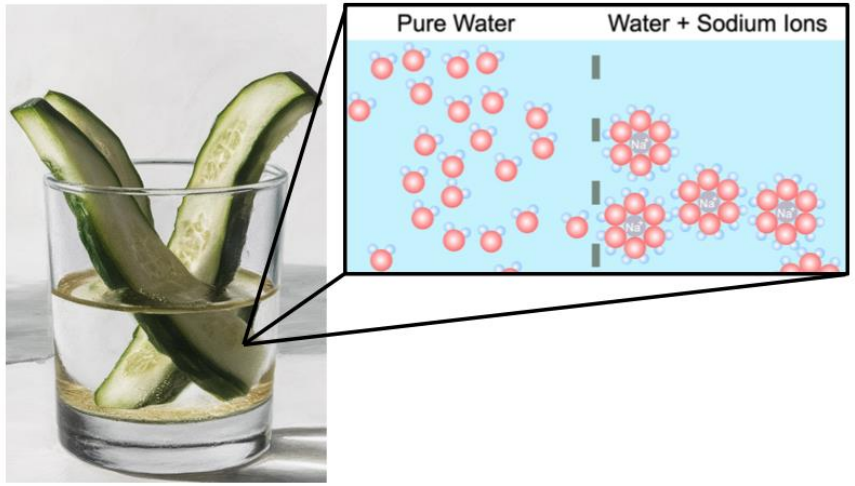
Explore

- Zooming in:

  From macroscopic to submicroscopic

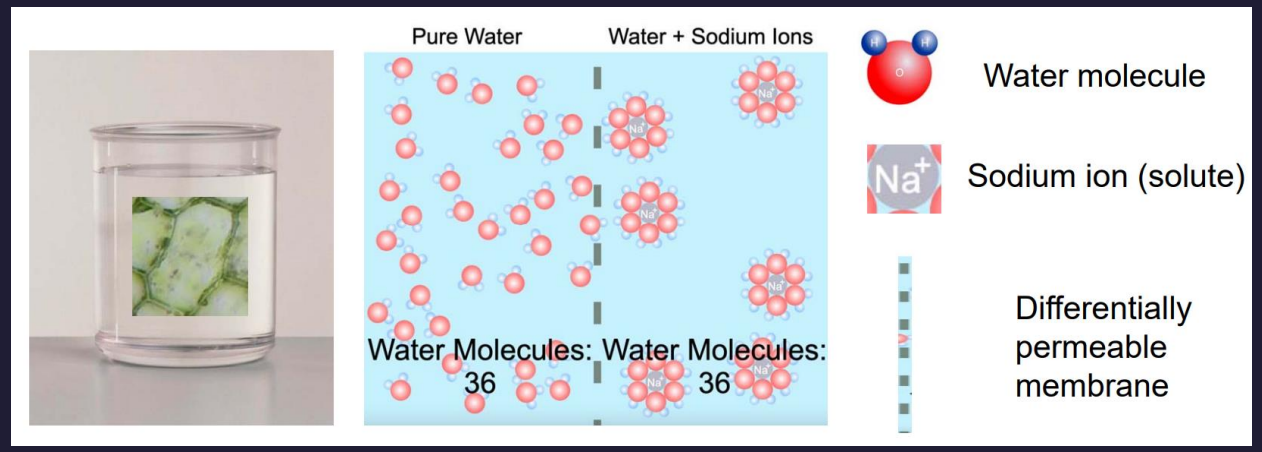
Task 2

Cucumbers are pickled by socking fresh cucumbers in a concentrated salt solution and vinegar. Scan the QR code below and watch the simulation about part of the pickling process at the particle level.



Explore

- Scaffold students by setting different guiding questions



As you watch the simulation, answer the following questions.

(a) Complete the table below.

	Number of water molecules		Number of solute particles (i.e., sodium ions)	
Time (second)	Pure water (in the cucumber)	Salt solution (out of the cucumber)	Pure water (in the cucumber)	Salt solution (out of the cucumber)
0 s	36	36		
10 s				
20 s				

(b) Describe the number of solute particles in the solution at each region (i.e., in and out of the cucumber) throughout the simulation.

(c) Compare the number of water molecule between the two regions at the beginning **and** the end of the simulation.

(d) Describe the direction of water molecule movement throughout the simulation.

(e) **Compare** the water level of each region at the end of the simulation.

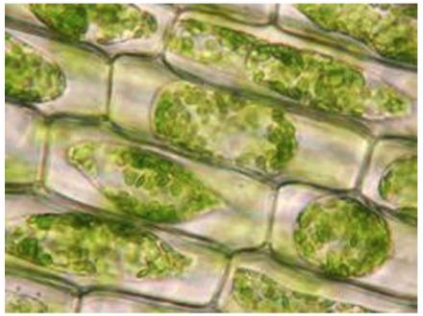
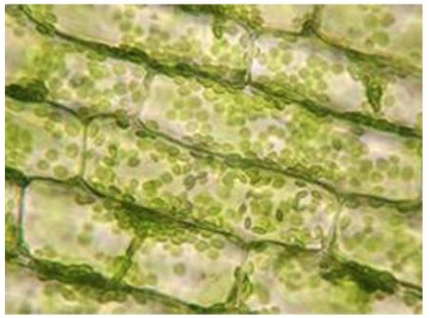
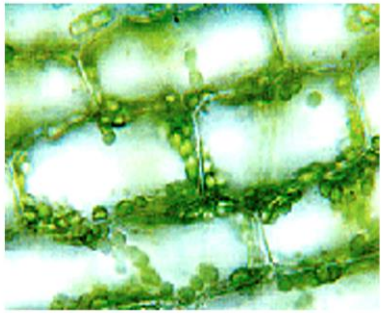
Explain

- Introduce the biological terms required to explain the phenomenon

Osmosis – A special kind of diffusion

Sequence	Mechanism	Events in osmosis
①	Movement of	
②	substance	
③	across cell membrane	from_____water potential to_____water potential region

When a **plant cell** is immersed into solution with different water potential, the cell appearance may change.

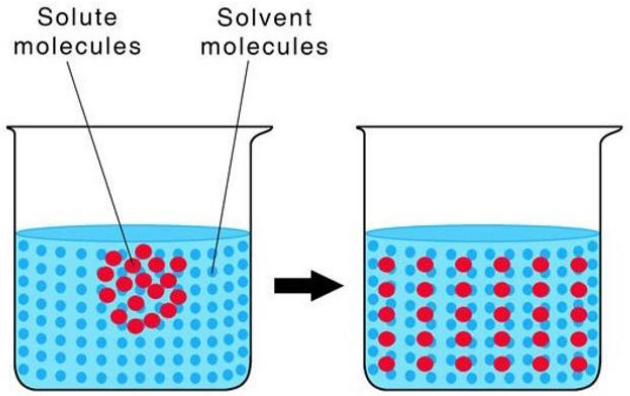
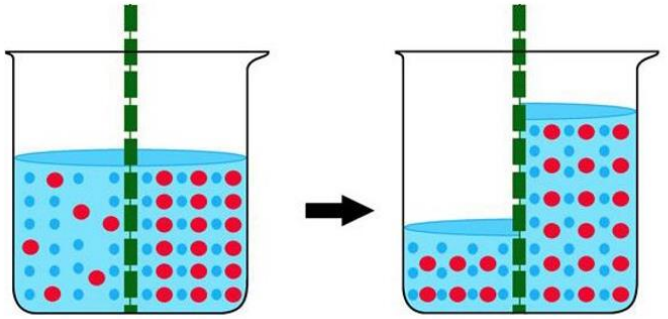
Hypertonic solution	**Iso**tonic solution	Hypotonic solution
		

Evaluate

- Different assessments:
  - Annotation task
  - Explain new scenario / the phenomenon in the engage phase
  - Past-paper question

Task 3

What are the differences between diffusion and osmosis? Annotate your answer on the diagrams below.

Diffusion	Osmosis
	

Reflection

- Simply reversing the teaching sequence may positively impact on students learning motivation
- Use multiple representations to illustrate abstract scientific process
- Use suitable scaffold to ease student's burden

Thank You!

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