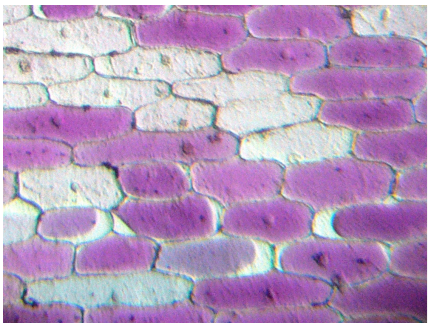
DIFFUSION AND OSMOSIS





Introduction

It is easy to show diffusion as a thermodynamic phenomenon using hot water, cold water and drops of food colour. In hot water the water molecules move very fast while in cold water move relatively slow. In hot water the colour pigments have more and strong collisions with water molecules than in cold water. Because of such collisions, the colour pigments will be dispersed very fast in hot water.

If we have dialysis tube (Visking® semi-permeable cellulose tube), it is not difficult to observe osmosis in non-living materials. In order to see osmosis in living tissues we usually use coloured epidermis of plants such as purple onion epidermis. Applying 20% sugar solution to onion epidermal cells we can observe clear plasmolysis within several minutes.

Materials and tools



Diffusion: hot (above 80 degrees Celsius) water in a vacuum flask, cold water with ice in another vacuum flask, two beakers, two white ceramic tiles, a dropper, a lab thermometer and food colour.

Osmosis in non-living tissue (one demonstration set) : A roll of Visking tube (15.9mm diameter), a pair of scissors, a ruler, twelve rubber corks suitable to seal the tube ends, four transparent box containers, four 30cm long 6mm outer diameter glass tubes, four 2cm long 6mm inner diameter silicone tubes, four plastic transparent cups, rubber bands, four retort stands and four clamps, 10ml plastic syringes, 4mm diameter plastic straws, food colour, 1.5 litre saturated salt water and water .

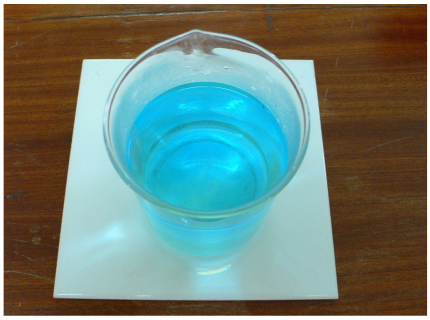
Osmosis in living tissue: an onion, a kitchen knife, improvised beakers, small diameter glass Petri dishes, droppers, a balance, sugar, a spoon or lab spoon, a 100ml measuring cylinder, tap water and microscope observation sets

Common tools: colour pencils

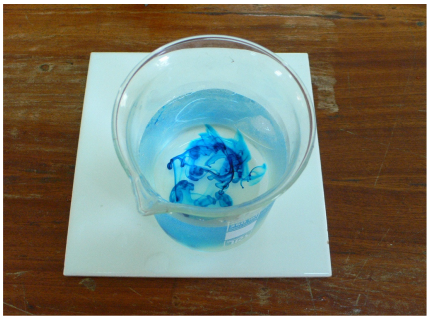
Activity 1

Diffusion

1. Place two 250ml glass beakers on white ceramic plate respectively. Pour hot water in one of the beaker and pour cold water in another. Drop a drop of food colour in the beakers with a very little interval. Make students observe the diffusion in the beakers carefully. After the observation make them illustrate and describe what happened in the beakers.
2. Make some students present their observation.
3. Make students explain the difference of diffusion between hot water and colder water.



Hot water

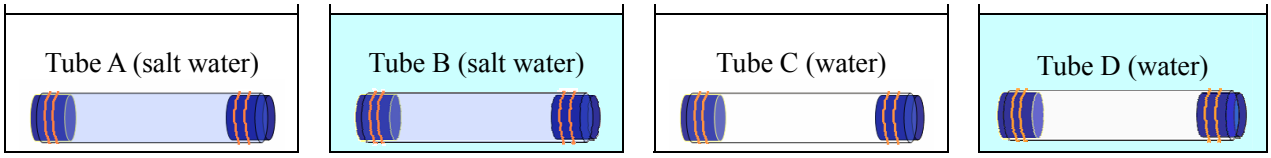


Cold water

Activity 2

Osmosis in non-living materials 1

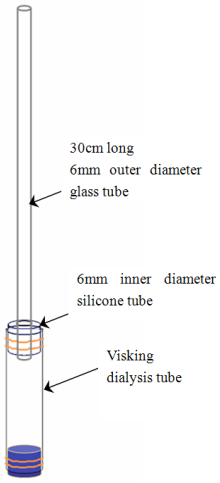
1. Add small amount of food colour in the saturated salt water.
2. Cut the Visking tube into 7cm short tubes.
3. Put the short tubes in water and rub it with your fingers to open the ends.
4. Seal one end of the tube with a rubber cork and a rubber band. Then pour salt water (or water) in the tube. After that seal the opposite end. Prepare the following tubes.
   Tube A and B filled with salt water.
   Tube C and D filled with water.
5. Place four containers (box 1 to 4) on the lab table. Pour water in box 1 and 3 and pour saturated salt water in box 2 and 4.
6. Put tube A in box 1, tube B in box 2, tube C in box 3 and tube D in box 4.



Box 1 (water) Box 2 (salt water) Box 3 (water) Box 4 (salt water)

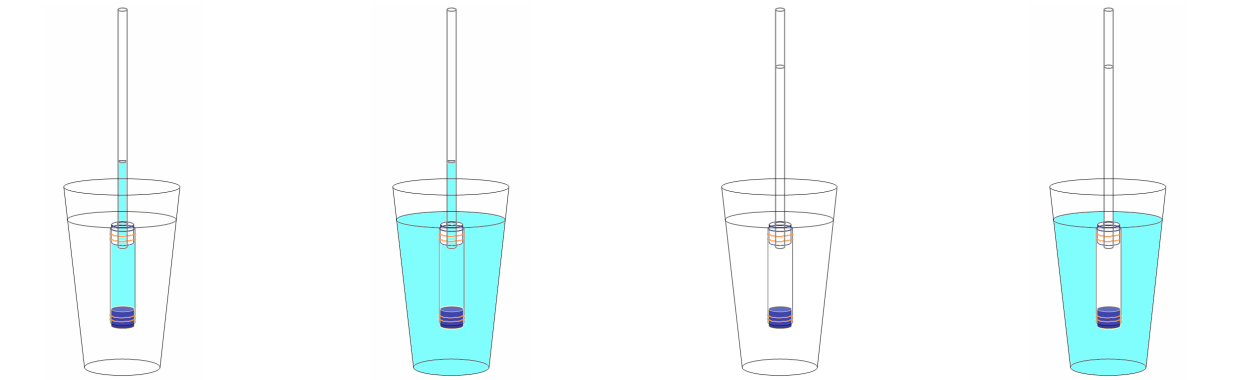
7. Leave the tubes in the liquid at least 20 minutes. Make students keep observing the tubes if they have expansion or shrinkage and record the result of the experiment on their activity sheets.

Osmosis in non-living materials 2



1. Cover one of the ends of each glass tube with a 2cm silicone tube.
2. Seal one end of 7cm long Visking short tube with a rubber cork and a rubber band.
3. Insert a 6mm diameter glass tube's silicone end in the open end of the Visking tube and fix them using a rubber band.
4. Pour the following liquid in the tubes using plastic straws and syringes.
   Tube A and B: pour salt water up to 2 cm above the silicone end of the glass tubes.
   Tube C and D: pour water up to 2 cm below the top of the glass tubes.
5. Set the tube using the retort stands and clamps like figure below.

6. Make students observe and record the phenomena using their activity sheets.



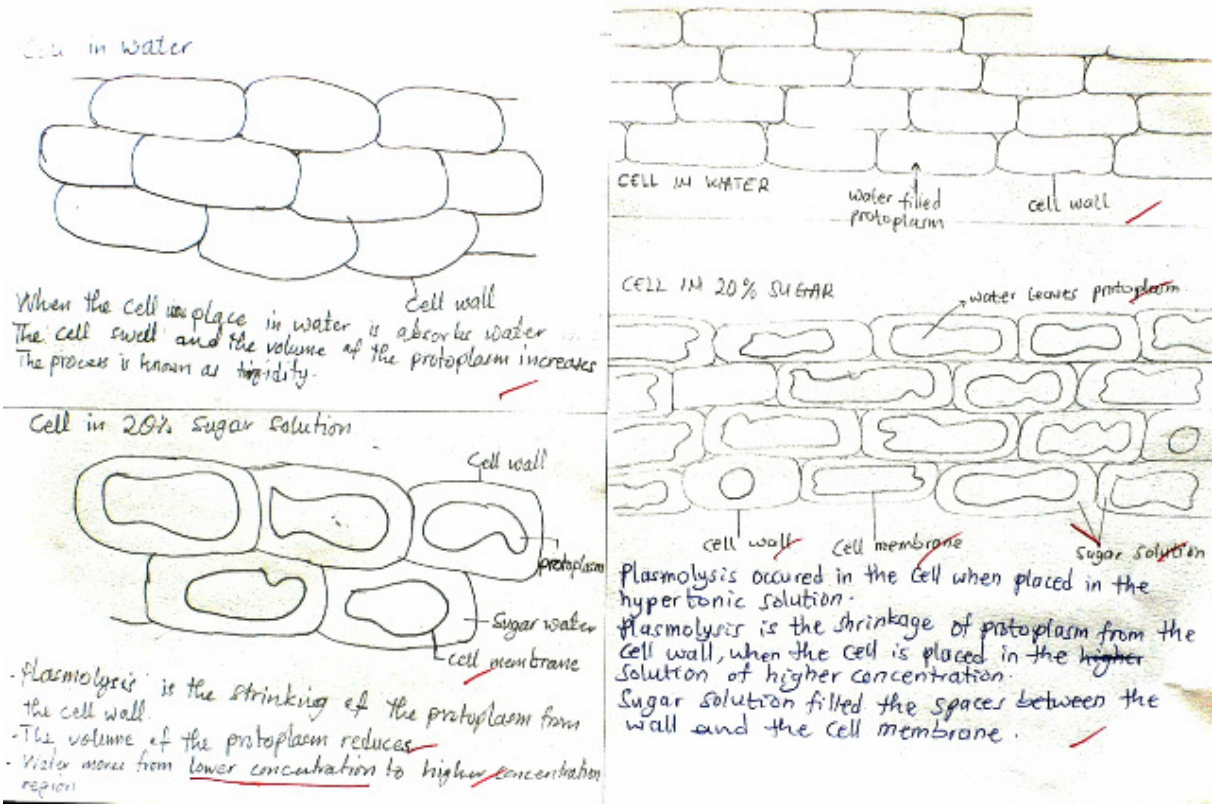
Tube A in water cup | Tube B in salt water cup | Tube C in water cup | Tube D in salt water cup

Activity 3 (second week)

Osmosis in living tissues

1. Make students prepare 100g of 20% (w/w) sugar solution. Pour the solution in the Petri dishes.
2. Peel a sheet of epidermis from a purple onion.
3. Immerse the epidermis in 20% (w/w) sugar water at least for five minutes.
4. Put a small sheet of epidermis on a glass slide then drop water on the tissue, after that seal the tissue with a cover slip. Observe and draw some typical cells on A5 paper.
5. Put the epidermis immersed in sugar water on another slide and cover it with a cover slip. Observe and draw some typical plasmolyzed cells.

Sample of students' drawings



DIFFUSION AND OSMOSIS

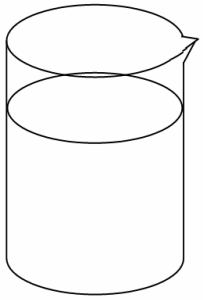
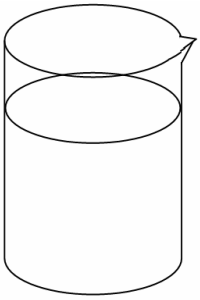
Class: _____ Group: _____ Date: _____

Names of group member (fill in block letters)

Index number	First name	Middle name	Last name

Diffusion

1. Illustrate and describe what went on in the beaker with hot water and the beaker with cold water.

Hot water (initial temperature C°)	Cold water (initial temperature C°)
	

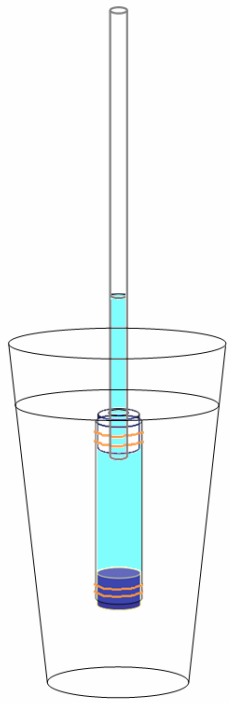
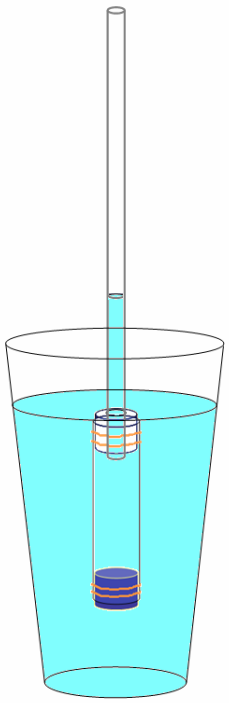
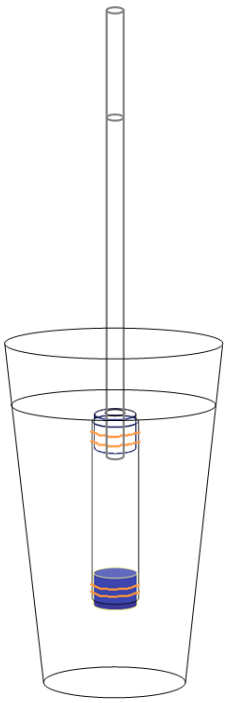
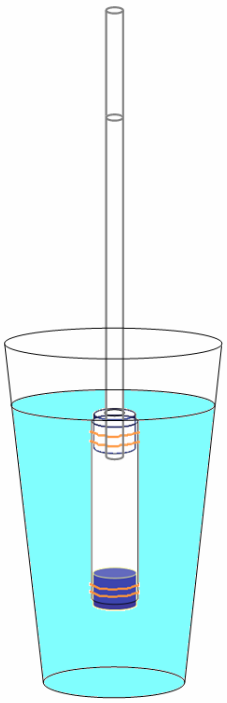
2. Explain the difference of diffusion between hot water and cold water.

Osmosis in non-living materials

1. Illustrate how dialysis tube (semi-permeable membrane tube) sets had been and illustrate how they were after twenty minutes in the designated liquids.

Dialysis tube with salt water		Dialysis tube with water	
			
Before dropping in water	Before dropping in salt water	Before dropping in water	Before dropping in salt water
After twenty minutes in water	In salt water	After twenty minutes in water	In salt water

2.1. Build set-ups like figures below. You need more items like retort stands and clamps. The word “Set” in the instructions mean a set with a glass tube and a short dialysis tube.

A). Set with salt water in a cup filled with water	B). Set with salt water in a cup filled with salt water	C). Set with water in a cup filled with water	D). Set with water in a cup filled with salt water
			

2.2. Ten minutes after you built the set-ups, observe the liquid level in each glass tube carefully then using arrows, mark new liquid level on figures above.

2.3. Describe the properties of semi-permeable membranes using the following key words; water molecules, pores.

2.4. Summarise how water molecules moved through the semi-permeable membrane respectively.

A)

B)

C)

D)

DIFFUSION AND OSMOSIS

Class: S2D Group: _____ Date: 30/10/09

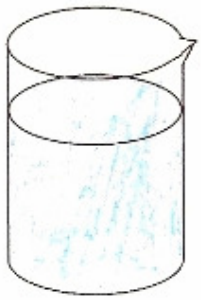
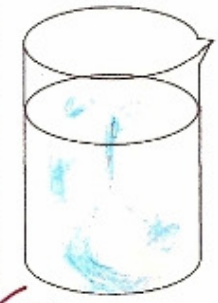
Names of group member (fill in block letters)

Index number	First name	Middle name	Last name
WC/186/2011			
WC/19/2011			
WC/283/2011			

Excellent

Diffusion

1. Illustrate and describe what went on in the beaker with hot water and the beaker with cold water.

Hot water (initial temperature 83 C°)	Cold water (initial temperature 23 C°)
 The food colour was evenly distributed in the hot water.	 The food colour was not evenly distributed in the cold water.

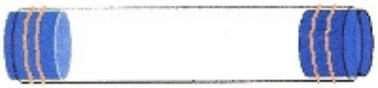
in a few minutes

2. Explain the difference of diffusion between hot water and cold water.

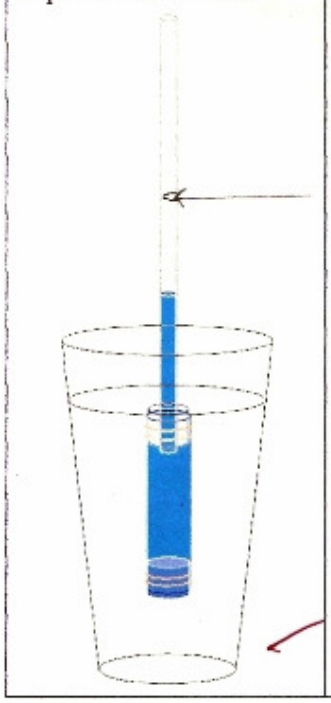
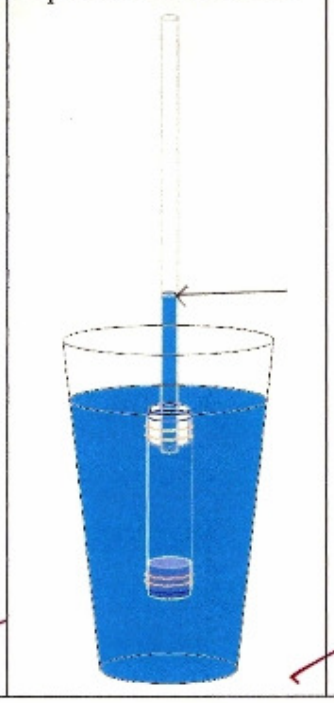
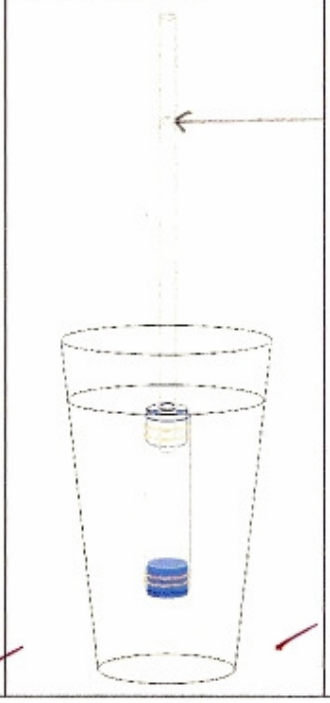
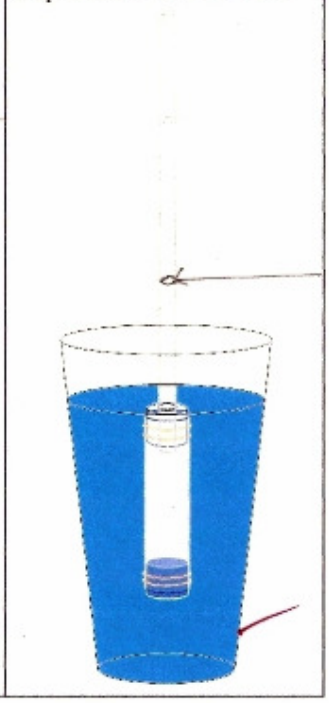
The molecules in the hot water were in high speed movement causing effective colliding with the food colour. In the cold water, the molecules were in low speed movement, there was ~~no~~ lower/lesser effective collision with the food colour.

Osmosis in non-living materials

1. Illustrate how dialysis tube (semi-permeable membrane tube) sets had been and illustrate how they were after twenty minutes in the designated liquids.

Dialysis tube with salt water		Dialysis tube with water	
			
Before dropping in water	Before dropping in salt water	Before dropping in water	Before dropping in salt water
			
After twenty minutes in the water	In salt water	After twenty minutes in the water	In salt water
			

2.1. Build set-ups like figures below. You need some more items like retort stands and clamps. The word "Set" in the instructions mean a set with a glass tube and a short dialysis tube.

A). Set with salt water in a cup filled with water	B). Set with salt water in a cup filled with salt water	C). Set with water in a cup filled with water	D). Set with water in a cup filled with salt water
			

2.2. Ten minutes after you built the set-ups, observe the liquid level in each glass tube carefully then using arrows, mark new liquid level on figures above.

2.3. Describe the properties of semi-permeable membranes using the following key words; water molecules, pores.

The water molecules are smaller than the pores and are able to pass through.

2.4. Summarise how water molecules moved through the semi-permeable membrane respectively.

A) The water molecules moving out from the salt solution are smaller than the water molecules entering the salt solution. The level of the salt solution increases.

B) Since the amount of water that move out from the semi-permeable membrane is equal to the amount that enters the membrane, The volume remains the same.

C) The amount of water moving out and entering the semi-permeable membrane is the same. The level remains the same.

D) More water moves out from the water solution than water moving out from the salt solution. The level of water in the tube decreases.