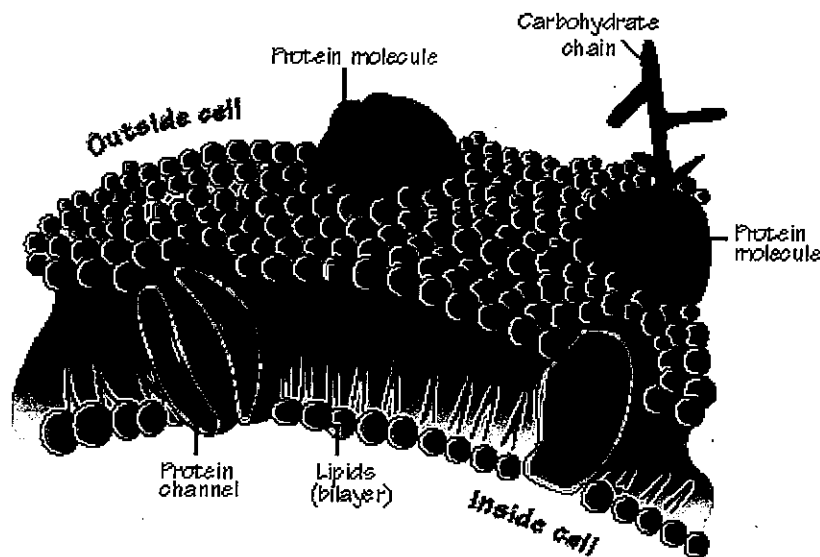


Year 11 Biology

FUNCTIONING MEMBRANES

PRACTICALS



Prac A – Diffusion

Prac E – Turgid or Flaccid

Prac 2.11 – Osmosis in Living Tissue

Prac 2.14 – Turgor and plasmolysis in plant cells

Prac 2.12 – Osmosis in a Model Cell

Name: _____

Moving A

Introduction

You might have experienced some of the following situations:

- You walk in the front door, tired and hungry after a hard day at school, to be met by the mouth-watering smell of your favourite dish cooking, yet the kitchen is at the other end of the house.
- The front door bell rings just after you have put a tea bag in a mug of boiling water. When you come back a few moments later, the tea is ready even though you haven't 'jiggled' the tea bag.
- After they have been soaking in water, you find that the raisins and sultanas you are going to use in the Christmas cake have taken up a lot of water and have swollen up.

These are everyday examples of two important ways by which molecules are able to move. The processes are **diffusion** and **osmosis**, and each plays a significant role in the correct functioning of living organisms.

Purpose

- 1 To observe and describe an example of diffusion.
- 2 To observe and describe the effects of a selectively permeable membrane on the process of diffusion.
- 3 To observe and describe a model for osmosis.
- 4 To investigate osmosis in living cells.

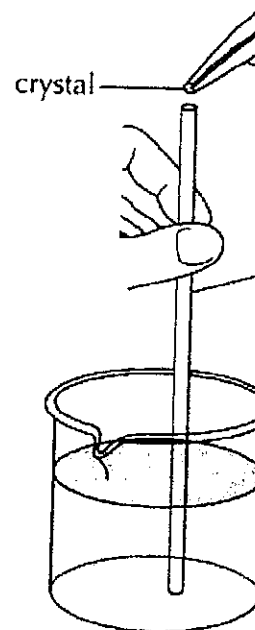


FIGURE 1
Placing the crystal of permanganate in the procedure should be little disturbance to t

Molecules

A Diffusion

Procedure

- 1 Label two 600 mL beakers with your group identification. Label one beaker 'cold' and the other 'hot'.
- 2 Three-quarters fill each beaker as labelled with cold water and the hottest water from the tap, respectively.
- 3 Put the two beakers next to each other in a place where they can be left undisturbed for at least 24 hours. Leave them to settle.
- 4 Place the drinking straw into the cold water so that it touches the bottom of the beaker and is about in the centre. Hold the straw steady. Using forceps, drop one large crystal of potassium permanganate down the straw and let it sink to the bottom. Remove the straw with minimum disturbance to the water (Figure 1).
- 5 Repeat procedure step 4 with the hot water beaker.



forceps

drinking straw
(must be held very still)

beaker

potassium
water. Note: the
carried out with as
e water as possible.

M A T E R I A L S

- Two 600 mL beakers
- Marking pen or labels
- Two drinking straws
- Fine forceps
- Two large crystals (of a similar size) of potassium permanganate (Condy's crystals)
- Access to a supply of hot water
- *Movement Across Membranes* interactive activity from *Heinemann Queensland Science Project-eBiology: A Contextual Approach*
- Reference texts such as *Biology: A Contextual Approach*

Moving Molecules

RESULTS

PART A: DIFFUSION

COLD (first $\frac{1}{2}$ Hour)

COLD (2 Hours)

HOT (first $\frac{1}{2}$ Hour)

HOT, (2 hours)

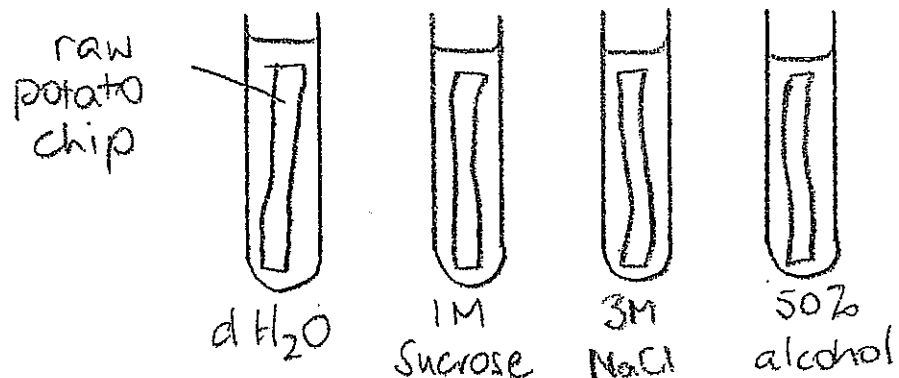
E TURGID or FLACID

PROCEDURE

- 1 Cut five long, thin potato chips from the potato provided. Place each chip in a test tube.
- 2 Fill four of the five tubes to a level where the chip is covered with the following solutions: distilled water, 1M sucrose, 3M salt (NaCl) solution and a 50% ethanol solution and label accordingly. Leave the fifth chip without any solution in the tube; this is the CONTROL.
- 3 Allow chips to soak in their respective solutions for at least 30 minutes.
- 4 Remove each chip from the tubes and assess the chips flexibility by attempting to tie the chip into a simple knot.

MATERIALS

- Potato
- Sharp knife
- 5 test tubes
- distilled water
- 1M sucrose
- 3M NaCl
- 50% alcohol



PART E: TURGID OR FLACID

1. Describe what has happened to each chip using your knowledge of how substances enter and leave cells

2. Rank the chips in order of most turgid to most flacid.

3. Explain the process and which substance has passed through the membrane in each case

▶ 2.11 Osmosis in living tissue

■ Object _____

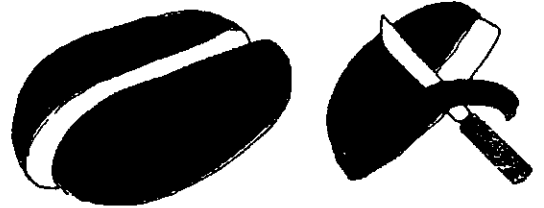
To demonstrate osmosis in living tissues.

■ Method A: Potato _____

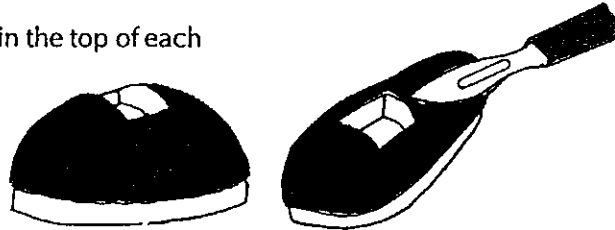
■ Materials _____

3 potato halves
Scalpel or knife
3 petri dish bases
Labels

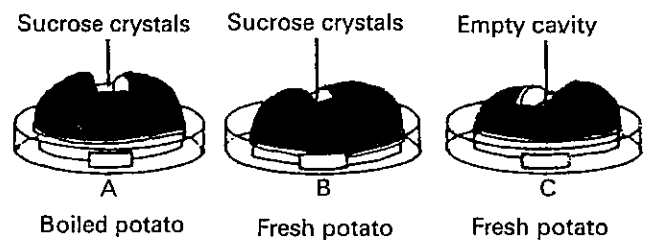
Beaker
Tripod/wire gauze
Bunsen
Sugar



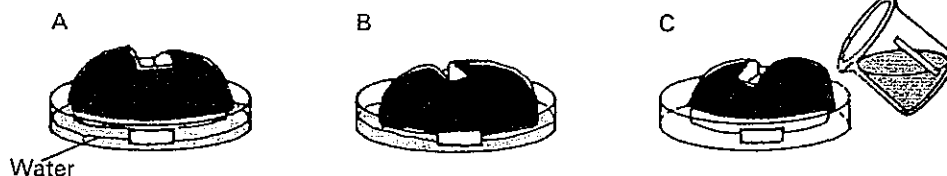
- 1 Obtain 3 potato halves. Peel round each half about 1 cm back from the cut.
- 2 Make a neat cavity in the top of each potato, like this:



- 3 Boil one potato half in water for 10 minutes. This disrupts the cell membranes.
- 4 Label 3 petri dish bases with your initials and A, B and C. Put the boiled potato into dish A and the others into dishes B and C.
- 5 Put some sucrose (sugar) crystals into the cavities of potato halves A and B. Leave C empty.



- 6 Pour water into the petri dishes. Put aside for 24 hours.



- 7 Examine the cavities and record the results.

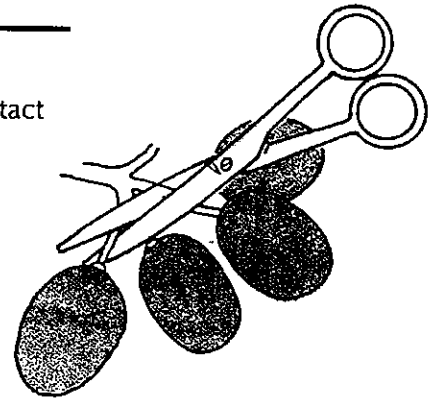
Think about it!

- 1 What effect does the sucrose have on the water concentration in the cavity?
- 2 Where is water concentration highest in each dish?
- 3 Define osmosis.
- 4 Into which cavity did water move? Why?
- 5 Are semi-permeable membranes needed for this to happen? Explain.
- 6 Explain the result in C in terms of water concentration.

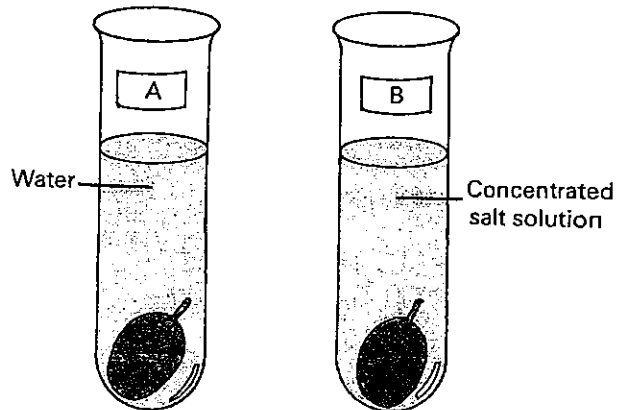
Method B: Grapes

Materials

- 2 fresh, unblemished grapes cut from the bunch to leave a few mm of stalk intact
- 2 large boiling tubes
- Test tube rack
- Labels
- Saturated salt solution



- 1 Use scissors to cut 2 undamaged grapes from a bunch. Make sure the stalks are left intact.
- 2 Label 2 boiling tubes with your initials. On one, write 'A-water'. On the other write 'B-salt'.
- 3 Two-thirds fill tube A with water and tube B with concentrated salt solution. Put a grape in each tube.
- 4 Leave aside for 48 hours (longer if possible).



- 5 Draw what has happened. Examine each grape. Note its condition — normal, swollen, shrunken.

Think about it!

- 1 In A, where is water concentration higher — inside or outside the grape?
- 2 In B, where is water concentration higher — inside or outside the grape?
- 3 Define osmosis.
- 4 Which grape got lighter? How do you know it did? Why would you expect it to get lighter?
- 5 Which grape got heavier? How do you know it did? Why would you expect it to get heavier?

▶ 2.14 Turgor and plasmolysis in plant cells

■ Object _____

To induce, observe and reverse plasmolysis in plant cells.

■ Materials _____

Onion separated into layers and cut into 1 cm squares, or pieces of rhubarb petiole (stalk)

■ Material per group/pupil _____

Microscope, slides, cover slips
Tissues
Filter paper triangles
Mounted needle

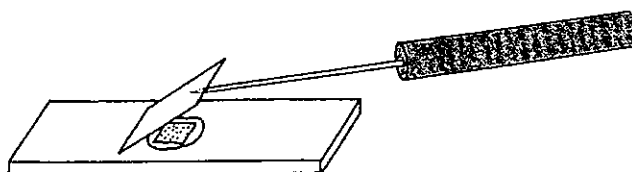
20% sucrose solution with dropper
Water with dropper
Scalpel
Forceps

■ Method A: Onion epidermis _____

- 1 Remove a layer from an onion. Cut it into small (1 cm²) pieces.

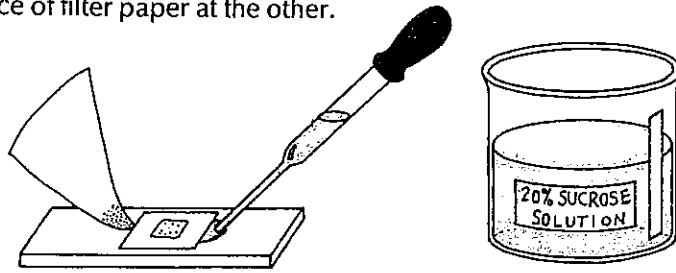


- 2 Peel off the thin inside epidermis (skin) and place it (torn side down) on to a microscope slide.
- 3 Add a drop of water to the skin.
- 4 Slowly lower a cover slip over the specimen, squeezing out air bubbles as you do so.



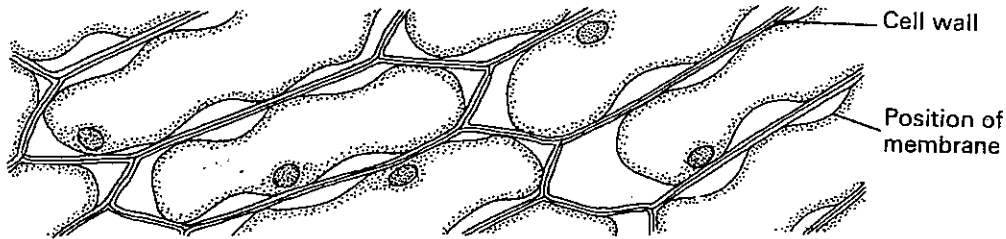
- 5 Examine the epidermis under the microscope for a few minutes. Carefully draw a few of the cells. Draw such that the cells are 2–3 cm long!

- 6 Place a drop of 20% sucrose solution at one side of the cover slip and a piece of filter paper at the other.



The paper will suck up the water, drawing the sugar solution across. Keep adding sugar solution until the water has been replaced. This is known as **irrigating** the slide.

- 7 Observe the tissue again. Try to find the same cells as before. Watch them for several minutes. Look out for cells which look like this:

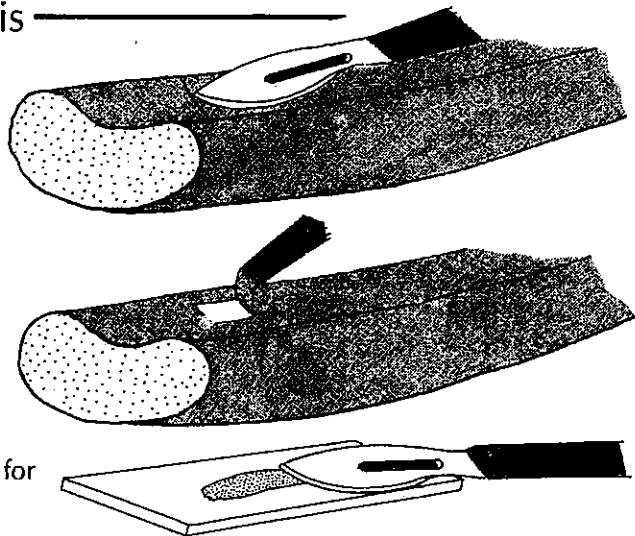


This condition is called **plasmolysis**.

- 8 Make carefully labelled (wall, position of membrane, protoplasm) drawings of a few plasmolysed cells.
- 9 Irrigate the slide again — this time with water. Observe for 5 minutes or so.

Method B: Rhubarb epidermis

- 1 Make a light cut across a piece of red rhubarb stalk.
- 2 Using tweezers, pull off a strip of red epidermis. This should be very thin. Be careful not to pull away the tissues underneath it.
- 3 Place the epidermis, torn side down, on a microscope slide. Cut it to about 1 cm².
- 4 Prepare the slide and follow the procedure as for onion epidermis, Steps 3 to 9.



Think about it!

- Which bathing liquid caused water to enter the plant cells? Explain why.
- Which bathing liquid caused water to leave the plant cells? Explain why.
- If its cells were plasmolysed, in what condition would the plant be?
- Is plasmolysis a permanent state? If not, how is it reversed?
- When you water a wilted plant, its drooping leaves begin to straighten out. Why?
- Does the cell wall keep out sucrose? Explain your answer.

▶ 2.12 Osmosis in a model cell

■ Object _____

To demonstrate water movement by osmosis into and out of model cells.

■ Materials _____

Tissues
20% sucrose solution, allow 200 ml per group

Beaker
Funnel or syringe to fill bags

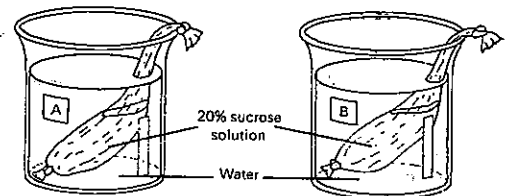
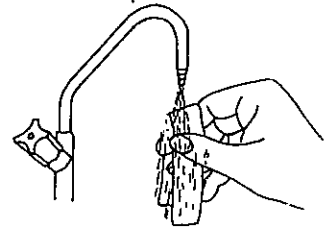
■ Material per group/pupil _____

Dialysis tubing (14 mm diameter), 15 cm length
2 250 ml beakers

Labels
Balance

Note: Dialysis tubing is a type of semi-permeable membrane. It will let water molecules diffuse through it easily, but will hold back larger molecules.

- 1 Cut a piece of dialysis tubing about 15 cm long. Soak it in water, rolling it between your fingers until it opens out to form a tube.
- 2 Tie a tight knot at one end and half-fill the bag with 20% sucrose solution.
- 3 Carefully squeeze out any air and tie a knot at the other end to seal the bag.
- 4 Dry the outside of the bag with a tissue. Weigh the bag. Note the weight.
- 5 Immerse the bag completely in a large beaker of water. Label it A.
- 6 Prepare a second dialysis tubing bag. Half-fill this one with water, seal it, dry the outside and weigh it. Again note the weight.
- 7 Immerse this bag in 20% sucrose solution. Label it B.
- 8 Your experiment now looks like the diagram on the right. Leave the bags for 30 minutes. Take them out, dry and reweigh them. Note the weights.
- 9 Put both bags back into their *correct* solutions and leave them for a further 30 minutes. If this is inconvenient, they can be left for a few days. Remove the bags, dry them and weigh them. Record the weights.



Think about it!

- 1 In A, where is the higher water concentration — inside or outside the bag?
- 2 Which way should water move? Will the bag become heavier or lighter?
- 3 In B, where is the higher water concentration — inside or outside the bag?
- 4 Which way should water move? Will the bag become heavier or lighter?
- 5 If the bag of 20% sucrose solution had been immersed in 15% sucrose solution, what would have happened?