CELL PHYSIOLOGY

1. 1989 Q14 P1

The table below shows the concentration of some ions in pond water and in the cell sap of an aquatic plant growing in the pond.

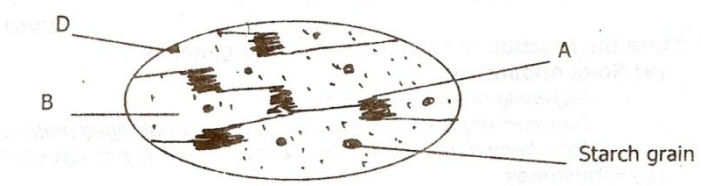
Ions	Concentration in pond water	Concentration in cell
Sodium	50	30
Potassium	2	
Calcium	15	1
Chloride	180	200

(a) Name the process by which the following ions could have been taken up by this plant
   (i) Sodium ions
   (ii) Potassium ions

(b) For each processes named in (a) (i) and (ii) above, state one condition necessary for the process to take place.

2. 1990 Q4 P1

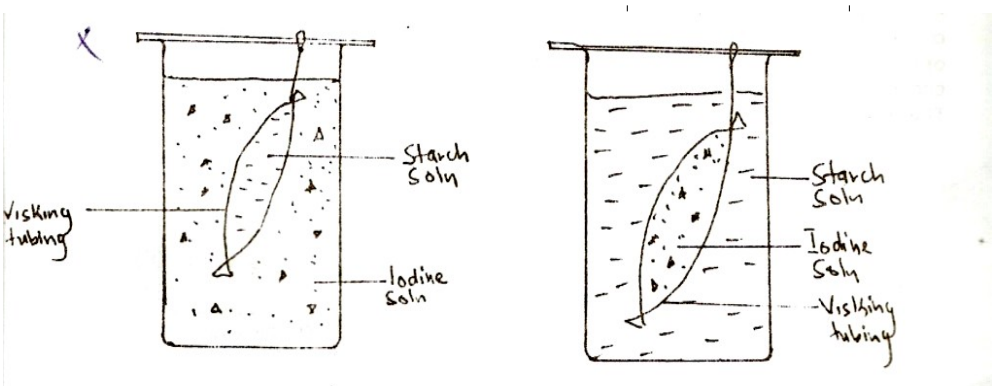
The diagram below represents a section through a chloroplast as seen under the electron microscope.



a) Name the structure labeled D
b) In which labeled structure would you expect to find chlorophyll molecules?
c) In which of the labeled structures does carbon dioxide fixation occurs?

3. 1991 Q14 P1

A group of students set up an experiment to demonstrate a certain process. The experiment was set up as shown in the diagram below.



I II

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After 10 minutes the students recorded their observation in a table as shown below.

SET UP	Observation inside the tube	Outside the tube
I	Blue and Black colour	No colour change
II	No colour change	Blue

(a) State the process being demonstrated in this experiment.
(b) Explain the result in experiment set up
(c) What results would be expected if the experiment was repeated using starch solution which had been boiled with dilute hydrochloric acid for 5 minutes?

4. 1993 Q12 P1

An experiment was carried out to investigate the effect of different concentrations of sodium chloride on human red blood cells. Equal amounts of blood were added to equal volumes of the salt solution but of different concentrations. The results are shown in the table below.

		Number of red blood cells	
Set up	**sodium Chloride concentration**	**At start of experiment**	**At end of experiment**
A	0.9%	Normal	No change in number
B	0.3%	Normal	Fewer in Number

(a) Account for the results set up in A and B

(b) If the experiment was repeated using 1.4% sodium chloride solution state the expected results with reference to
(i) The number of red blood cells
(ii) The appearance of red blood cell if viewed under the microscope

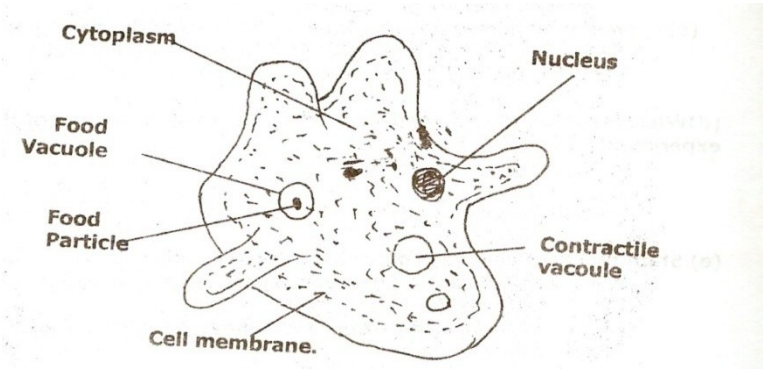
5. 1994 Q6 P1

Give a reason for each of the following
a) A mature plant cell does not lose its shape even after losing water.
b) Xylem vessels do not collapse even when they do not contain water.

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6. 1994 Q12 P1

Below is a diagram of an organism



(a) (i) Name the phylum to which the organism belong
(ii) Give reasons for your answer in a (i) above
(b) Outline the process by which the food particles got into the organism.
(c) Describe what happens to the food particles eventually.

7. 1995 Q4 P1

Explain what would happen to red blood cells if they are placed in a concentrated salt solution (2 marks)

8. 1995 Q10 P1

An experiment was carried out to investigate the rate of reaction shown below

Sucrose → Fructose + Glucose

For the products fructose and glucose to be formed, it was found that substance K was to be added and the temperature maintained at 37^0C. When another substance L was added, the reaction slowed down and eventually stopped.

(a) Suggest the identify of substances K and L (2 marks)
(b) Other than temperature state three ways by which the rate of reaction could be increased (3 marks)
(c) Explain how substance L slowed down the reaction (2 marks)

9. 1999 Q15 P1

An experiment was carried out to investigate haemolysis of human red blood cells. The red blood cells were placed in different concentrations of sodium chloride solution. The percentage of haemolysed cells was determined. The results were as shown in the table below.

Salt concentration g/100cm^3 (%)	0.33	0.36	0.38	0.39	0.42	0.44	0.48
Red blood cells Haemolysed (%)	100	91	82	69	30	15	0

a) i) On the grid provided, plot a graph of haemolysed red blood cells against salt concentration. (6 marks)

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ii) At what concentration of salt solution was the proportion of haemolysed cells equal to non-haemolysed cells? (1 mark)

iii) State the percentage of cells haemolysed at salt concentration of 0.45% (1 mark)

b) Account for the results obtained at:

i) 0.33 percent salt concentration. (3 marks)

ii) 0.48 percent salt concentration. (3 marks)

c) What would happen to the red blood cells if they were placed in 0.50 percent salt solution? (3 marks)

d) Explain what would happen to onion epidermal cells if they were placed in distilled water. (3 marks)

10. 2000 Q8 P1

Why is oxygen important in the process of active transport in cells?

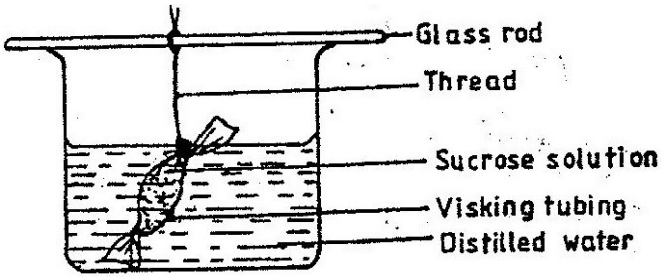
11. 2004 Q16 P1

12. 2005 Q7 P1

State the importance of osmosis in plants. (3 marks)

13. 2006 Q12 P1

An experiment was set up in the experiment as show below.



The set up was left for 30 minutes.

a) State the expected results. (1 mark)

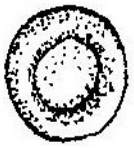
b) Explain your answer in (a) above (3 marks)

14. 2007 Q5 P1

Distinguish between diffusion and osmosis (2 marks)

15. 2008 Q4 P1

The diagrams below show a red blood cell that was subjected to a certain treatment



At start



At the end of experiment

(a)Account for shape of the cell at the end of the experiment (2 marks)

(b)Draw a diagram to illustrate how a plant cell would appear if subjected to the same treatment (1 mark)

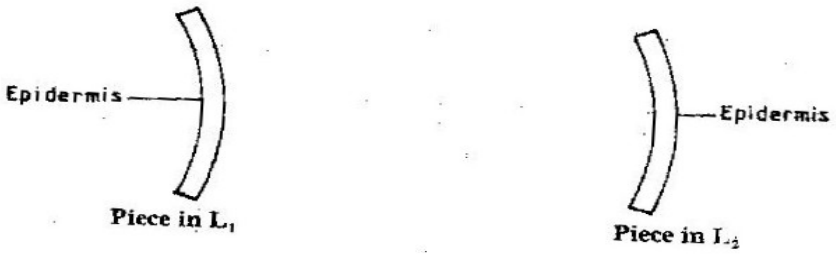
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16. 2008 Q5 P2

A freshly obtained dandelion stem measuring 5cm long was split lengthwise to obtain two similar pieces.

The pieces were placed in solutions of different concentrations in Petri dishes for 20 minutes.

The appearance after 20 minutes is as shown



(a) Account for the appearance of the pieces in solutions L_1 and L_2 (6 marks)

(b) State the significance of the biological process involved in the experiment (2 marks)

17. 2009 Q13 P1

18. 2009 Q15 P1

Name the type of movement that occurs within a plant cell (1 mark)

19. 2010 Q7 P1

Distinguish between haemolysis and plasmolysis. (2 marks)

20. 2011 Q6 P2

(a)An experiment was carried out to investigate the population of a certain micro-organism. Two Petri-dishes were used. Into the Petri – dish labeled M, $60cm^3$ of a culture medium was placed while $30cm^3$ of the same culture medium was placed in Petri-dish labeled N. Equal numbers of the micro-organisms were introduced in both Petri-dishes. The set-ups were then incubated at 35^0C. The number of micro-organisms in each Petri-dish was determined at irregular intervals for a period of 60hours. The results were as shown in the table below.

Relative number of micro-organisms	M	40	40	180	280	1200	1720	1600	1840	1566	6000
	N	40	40	120	200	680	560	560	600	6004	400
Time in hours		0	5	10	15	23	30	35	42	45	60

i) On the same axis, draw the graphs of relative number of micro-organisms against time on the grid provided.

ii) After how many hours was the difference between the two populations greatest? (1 mark)

iii) Work out the difference between the two populations at 50 hours. (2 marks)

iv) With a reason state the effect on the population of micro-organisms in Petri – dish M if the temperature was raised at 60^0C after 20 hours. (2 marks)

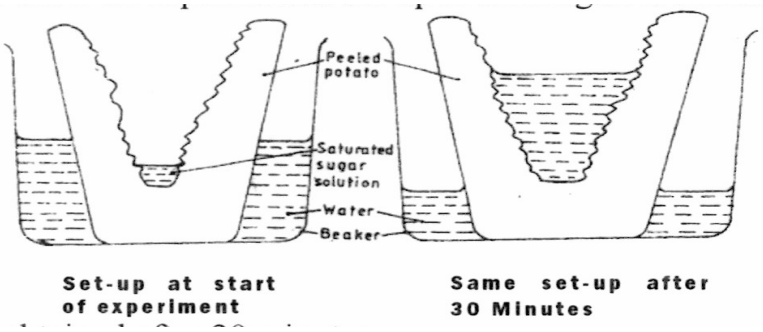
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v) Account for the shape of the curve for population in petri-dish N between 46 hours and 59 hours

(b) Explain how the osmotic pressure in the human blood is maintained at normal level (5 marks)

21. 2011 Q7 P1

The diagrams below show an experimental set-up to investigate a certain process in a plant tissue.



Explain the results obtained after 30minutes (4 marks)

22. 2012 Q4 P1

In an investigation, a student extracted three pieces of pawpaw cylinders using a cork borer. The cylinders were cut back to 50mm length and placed in a beaker containing a solution. The results after 40mins were as shown in the table below.

Feature	**Result**
Average length of cylinders (mm)	56mm
Stiffness of cylinders	stiff

(a) Account for results in the table above. (3 marks)

(b) What would be a suitable control set-up for the investigation? (2 marks)

23. 2012 Q13 P1

State three factors that affect the rate of diffusion (3 marks)

24. 2013 Q1 P1

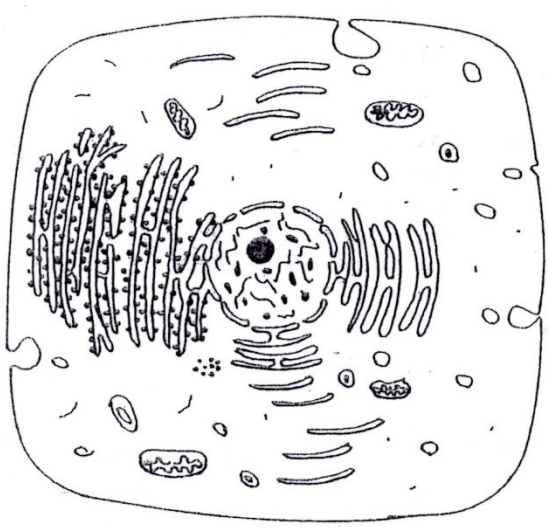
(a) What is meant by the term wilting? (1 mark)

(b)Explain how an increase in temperature affects the rate of active transport? (2 marks)

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25. 2013 Q2 P1

The diagram represents a cell as seen under an electron microscope.



(a) Based on the diagram, state whether it represents an animal cell or a plant cell. (1 mark)

(b) Give two reasons for your answer in 2(a) above. (2 marks)

(c) Why is the palisade layer a tissue? (1 mark)

26. 2013 Q5 P1

Describe how turgor pressure builds up? (3 marks)

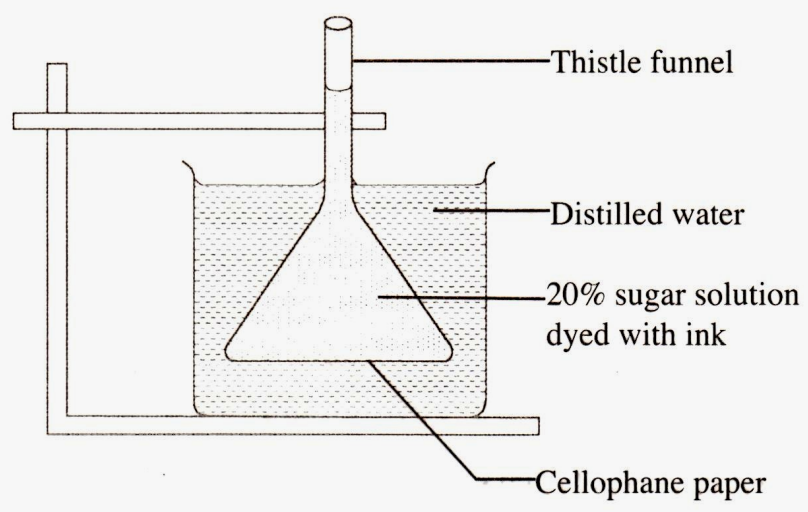
27. 2013 Q30 P1

State two ways in which osmosis is significant to plants. (2 marks)

28. 2014 Q5 P1

The diagram below shows a set up for an experiment to demonstrate a certain physiological process.

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(a) What nature of solution is represented by20% sugar solution? (1 mark)

(b) Explain the observation made on the set up after one hour. (2 marks)

29. 2014 Q10 P1

(a) Explain **two** roles of diffusion in human (4 marks)

(b) What is meant by each of the following terms?

(i) Crenated cell. (1 mark)

(ii) Flaccid cell (1 mark)

30. 2014 Q26 P1

The table provided show the concentration of sodium and iodine in sea water and cell sap of a plant.

	Sodium ion concentration	Iodine concentration
sea Water	250	35
cell sap	100	550

a)(i) Name the process through which the plant cells take up sodium ions. (1 mark)

ii) Give a reason for your answer in (a) (i) above (1 mark)

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CELL PHYSIOLOGY
MARKING SCHEME

1. 1989 Q14 P1

a) i) Sodium ions- Diffusion
ii) Potassium ions – Active Transport

b) Diffusion - A concentration gradient between sodium ions in a sap and those in the pond

Active Transport – Energy in the form of ATP must be available/oxygen and food in the living tissues for respiration to provide energy.

2. 1990 Q4 P1

a) Chloroplast membrane
b) A
c) B

3. 1991 Q14 P1

a) – Semi-permeability/selective Permeability/diffusion/differential permeability

b) Visking tubing is semi permeable therefore allows passage of iodine molecules (from beaker) into visking tubing thus producing a blue black colour with starch solution,starch molecules are too large to pass through the walls of the visking tubing into solution into beaker; therefore the iodine solution does not change.

c) Expected result: No colour change inside and outside the visking tubing; in both set ups. Dil HCL hydrolyses starch into sugar which don't change with iodine solution to produce the blue black/colour of iodine (Brown) will be observed in the visking tubing in set up 1 and in the beaker set up 2 with sugar colour of iodine(brown) will be observed in both set ups.

4. 1993 Q12 P1

a) A – (no change in number) because 0.9% NaCl solution is isotonic to redblood cell (ac. Concentrations being equal)

B- (Fewer in number) because 0.3% NaCl solution is hypotonic to red blood Cells are hypotonic to water therefore some water was drawn into the red blood cell by osmosis leading to haemolysis bursting of the red blood cells.

b) i) will not change (Acc. Remain normal.)
ii) Red blood cell will appear small in size/wrinkled/crenated.
(Acc shrunk/irregular. Rej Flaccid)

5. 1994 Q6 P1

a) Has a cellulose cell wall
b) Have lignified cell walls. Rej Dead cells

6. 1994 Q12 P1

a) i) PROTOZOA
ii) Single celled/Unicellular(animal); protozoan
b) Phagoastasis/pseudopodia extended to surrounded the food particles;

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(membrane pinches off from the cell membrane) to form a food vacuole.

c) It is digested: by secretion of enzymes/correct examples of enzymes into food vacuoles; the soluble food material is absorbed/diffused and exocystosis/egestion of indigestible material/merging of vacuole membrane with cell membrane releasing indigestible material

7. 1995 Q4 P1

Water in RBC moves out by osmosis and the RBC shrinks

8. 1995 Q10 P1

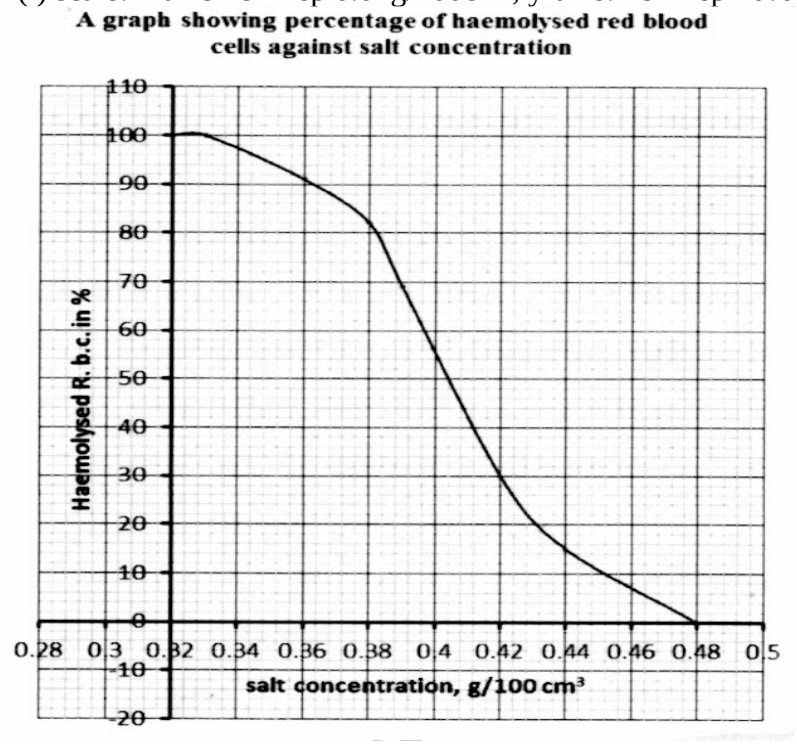
(a) K-Enzymes/ Sucrose/ Invertase/ Saccharise
L- Inhibitor Acceptance any example e.g. any acid

(b) – Addition of sucrose/ substrate
- Optimum/ suitable/ correct / right pH
- Removal of products

(c) - Competed with substance: for active site (of K)
- Acc. L made the medium acidic; unsuitable for K
- L occupies active sites

9. 1999 Q15 P1

a) (i) scale: x-axis 1cm rep 0.02g/100cm^3, y-axis: 1cm rep 10%



ii) 0.402; 0.403; 0.404; $\pm$ 0.002
iii) 9-10-11%

b) Account for the results obtained at:
(i) 0.33 percent salt contration.

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Less concentration // hypotonic // dilute than blood cells cytoplasm/ red blood cells; water is drawn in by osmosis the cells swells and eventually burst.

(ii) 0.48

(ii) 0.48 percent salt concentration.

Concentration of cytoplasm same as concentration of salt solution/isotonic; therefore no net movement of water; hence no heomolysis.

c) Percentage of cells haemolysed would still be zero? Becomes turgid; but does not burst; due to the cell wall.

d) The cells would absorb water due to osmosis, swell and become turgid. The cell sap move conc. than surrounding water gate into the cell by osmosis; the cell swells/becomes turgid; but does not burst due to the cell wall

10. 2000 Q8 P1

Oxygen is required for respiration that produces energy necessary for active transport e.g. oxidation of food for respiration

11. 2004 Q16 P1

(a) The movement of molecules; from a region of high concentration to a region of low concentration; until the molecules are uniformly distributed in the medium) Acc. Particles for molecules; Rej substance for molecules

(b) (i) The higher diffusion gradient between (two points) the rate of diffusion; acc converse.

(ii) The higher the surface area: Volume ratio, the faster is the rate of diffusion; acc converse

(iii) Increasing temperature increases the rate of diffusion; acc converse.

(c) Reabsorption of glucose/ some salts in the kidney/ by kidney tubules;
- Absorption of digested food/ from the alimentary canal
- Reabsorption of useful material in the blood stream
- Accept sodium pump mechanism in the nervous system, the nerve cell Rej. Sodium pump mechanism alone.

12. 2005 Q7 P1

-Absorption of water to the soil
- Support in seedlings, leaves and herbaceous plants.
-Opening and closing of Stomata
-Distribution of water from cell to cell

13. 2006 Q12 P1

(a) Visking tubing will become turgid; accept will increase in volume / bulges/ swells / becomes bigger/ expands.

(b) Sucrose solution is hypertonic/ water is hypotonic; water moves from beaker into visking tube by osmosis though semi permeable visking tubing, making visking tubing turgid.
Or water moves from beaker into visking tubing by osmosis, through semi permeable visking tubing; with hypertonic solution.

14. 2007 Q5 P1

Diffusion	**Osmosis**
• Involves movement of particles of molecules of liquids or gas • It may be through a membrane or in air • Not affected by PH changes	• Involves movements of solvent molecules • It takes place though a semi permeable membrane • Rate affected by PH changes

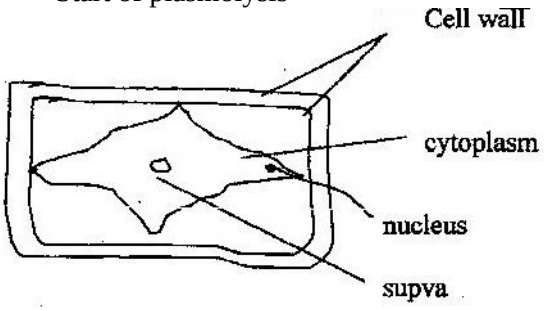
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15. 2008 Q4 P1

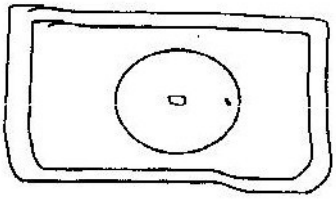
(a) The red blood cell was placed in a hypotonic solution it lost water by osmosis

(b)

Start of plasmolysis



End of Plasmolysis



16. 2008 Q5 P2

(a) L_1

Inner cells gained water by Osmosis; hence increased in length; epidermal cells did not gain water because they are covered by a water proof cuticle leading to curvature.

L_2

Inner cells lost water by osmosis; leading to (flaccidity) decrease in length; epidermal cells did not lose water due to waterproof leading to curvature

(b) Support in (herbaceous) plants
Absorption of water
Opening and closing of stomata
Movement of water from cell to cell
Leading in infectious plants
Folding of leaves in the Mimosa

17. 2009 Q13 P1

(a) In diffusion (*Rej: Movement of water molecules)* molecules move from a highly conc. Region to a lowly conc. Region while in active transport molecules move a lowly concentration region to a highly concentrated region; on diffusion molecules move along conc. gradient while in active transport molecules move against conc.

Gradient; / No energy is required in diffusion while energy is required in active transport / active transport requires carrier molecules while carrier molecule not required in diffusion.

Acc: if table of companion used

(b) (i) Absorption of water from the cell by root hair cells / ,movement of water between plant cells / from cell to cell / opening one closing of stomata / support in herbecious plants due to turgidity / feeding in insectivorous plant

(ii) Water reabsorption by blood capillaries from renal tubules / Absorption of water in colour / dicututary canal / gut / movement of water from cell to cell in animals

18. 2009 Q13 P1

Cytoplasmic streaming

19. 2010 Q7 P1

Haemolysis – process by which red blood cells take in water till they burst; while

Plasmolysis – loss of water from plant cells until the cell membrane is detached from the

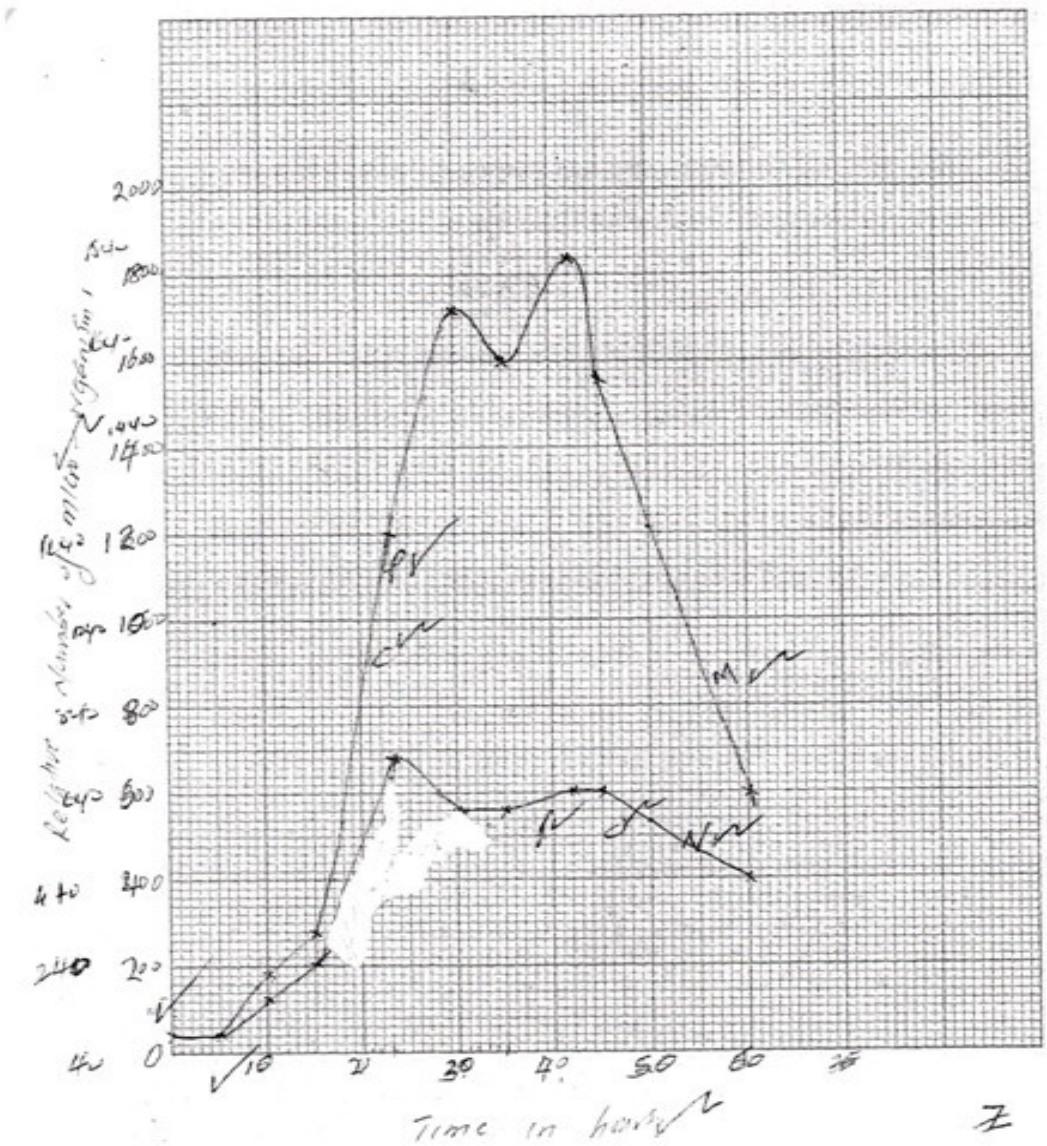
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cell wall/ until the cell become flaccid.

20. 2011 Q7 P1

- Water was hypotonic to cell sap of adjacent cells:
- And these cells absorbed water through osmosis;
- And their cell sap became less concentrated than those of the next cells;
- The process was repeated until water reached the sugar solution

21. 2011 Q6 P2



(ii) 42 hours

(i)

- M at 50hrs= 1240 (1220±20)
- N at 50hrs= 560 (540 ± 20)
- Possible answer 680 ± 40
  640 – 720;

(ii)Population decreases; high temperature kill the micro-organisms/ denature enzymes;

(iii)

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- Population (growth rate) decreases; death rate of (micro-organisms) is higher than (their population) rate of multiplication; due to exhaustion of nutrients; and accumulation of toxic waste; shortage of oxygen; overcrowding / shortage of space;
-

(b)

(When the osmotic pressure of blood increases by the normal level) Osmoreceptors in the hypothalamus detects this and stimulates the (posterior tube) pituitary gland to secrete more ADH; which make kidney tubules more permeable to water and more water is reabsorbed into the blood; reducing the osmotic pressure to normal; when the osmotic pressure of the blood decrease beyond the normal level the osmorecepetors in the hypothalamus detect this.

The pituitary gland is less stimulated; less / little ADH is secreted; which makes kidney tubules less permeable to water; less water is reabsorbed into the blood; raising osmotic pressure to normal;

When there is too much Na^+(ions) in the blood; adrenal cortex responds by secreting less aldosterone; which causes less Na^+ to be absorbed from the gut into the blood; and less Na^+ to be reabsorbed from the kidney tubules into the blood; lowering the Na^+ level.

When O.P is low, where there is too little Na^+ ions in the blood adrenal cortex responds by secreting more aldosterone; which causes more Na+ to be absorbed from the gut into the blood; and more Na^+ ions to be reabsorbed from the kidney tubules into the blood; raising sodium level back to normal.

22. 2012 Q4 P1

(a) The solution was hypotonic/less concentrated compared to the cell sap of pawpaw cylinder cells/cell sap hypertonic to the solution;
The tissue/cells gained water by osmosis;becoming turgid/longer/stiff;

(b) pawpaw cylinders of the same size/length;placed in isotonic solution; Boiled pawpaw cylinders of same size/length,placed in similar solution/isotonic solution

23. 2012 Q13 P1

Temperature, surface area, thickness of membranes/distance that particles have to travel; diffusion/concentration gradient; size/density of molecules; medium of diffusion;surface area to volume ratio; Mark the first three.

24. 2013 Q1 P1

(a) It is a phenomenon in plants where the rate of water loss to the atmosphere is more than that of absorption from the soil hence turgor in cells is reduced and the plant droops.

(b) An increase in temperature activates respiratory enzymes, rate of respiration increases, hence energy needed for active transport rate increases; temperatures above 40°C denature respiratory enzymes, thus no respiration hence no energy and rate of active transport is low or stops.

25. 2013 Q2 P1

(a) Animal cell

(b)
- lack of cell wall / have cell membrane only
- have small vacuoles instead of large centralized one
- nucleus is placed at the centre
- presence of centrioles

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(c) It has many cells of particular type grouped together to carry out the same function as site for photosynthesis.

26. 2013 Q13 P1

As plant cells gain water by osmosis, their sap vacuoles enlarge and exert outward pressure on the cell wall. This pressure increases as more water is taken into the vacuoles which push the cytoplasm against the cell wall.

27. 2013 Q30 P1

- through osmosis, plants absorbs water from the soil using root hair cells.
- control opening and closing of stomata
- feeding in insectivorous plants.
- leads to support in herbaceous plant/non woody stem/seedlings/leaves when cells are turgid.

28. 2014 Q5 P1

(a) -Hypertonic solution

(b) - Volume of sugar solution increases in the (thistle funnel) distilled water in the beaker reduces;

- because the thistle / filter funnel gains distilled water by osmosis.

29. 2014 Q10 P1

a)

- Absorption of materials e.g. diffusion of digested food into the blood stream

- Gaseous exchange e.g. C02 diffuses from capillaries into the alveoli/oxygen diffuses from alveoli to capillaries

b) (i)

Crenated cell is a shrunk animal cell that has lost water by osmosis

(ii)

Flaccid cell is a flabby / shrunk plants cell that has lost her by osmosis

30. 2014 Q26 P1

(a) (i)

-Diffusion

ii)

-Sea water contains a higher concentration of sodium ions than

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