Q.1.	
(c)	Describe the process by which water passes from the soil into the root hairs.
	[2]
Q2.	
(c)	Explain how oxygen and glucose move from the blood inside the capillary to the tissue fluid in the muscle.
(c)	Explain how oxygen and glucose move from the blood inside the capillary to the tissue fluid in the muscle. oxygen
(c)	fluid in the muscle.
(c)	fluid in the muscle. oxygen
(c)	fluid in the muscle. oxygen
(c)	oxygen
(c)	fluid in the muscle. oxygen glucose

Fig. 6.1 shows a diagram of a plasma (cell surface) membrane. Fig. 6.1 (a) Indicate, by putting a circle, around one of the following, the width of the membrane shown in Fig. 6.1. 7 · 10⁻⁵ m 0.7 nm 7.0 nm 70 nm 700 µm 7.0 µm [1] (b) Outline the functions of the following components of the plasma membrane. L M

N

c)	Some sub does not.	stances m	ay cross p	olasma	membra	nes by s	imple difi	fusion. G	lucose, l	nowe∨er
	Explain w	hy glucose	cannot p	ass acr	oss men	nbranes	by simpl	e diffusio	on.	
)		nvestigation uptake of th concentra	glucose in	ells were	e exposed	d to differ	ent conce	entrations	of glucos	se. The
of gl	of uptake lucose by s/arbitrary s	22		ø	JO	0		_	-0-	
		4 - 2 - 0 0	5	10 concer	15 ntration of	20 f glucose	25 / arbitrary	30 / units	35	40
lea	g the infor that gluco	se enters	cells by f	explain facilitate	ed diffus	ion.		-		
										[2]

(e)	State how active transport differs from facilitated diffusion.
	[1]
	[Total: 10]

Q4.

(d) A student investigated the effect of temperature on beetroot tissue. Beetroot cells contain a dark red pigment known as betalain, which is stored inside their vacuoles.

The student

- · cut the beetroot tissue into cubes of the same size
- · washed the cubes thoroughly in distilled water
- · placed the same number of cubes into distilled water at seven different temperatures.

After 30 minutes, samples of the water were removed and placed in a colorimeter to measure the transmission of light. The lower the percentage transmission the more betalain is present in the water.

The results are shown in Fig. 2.2.

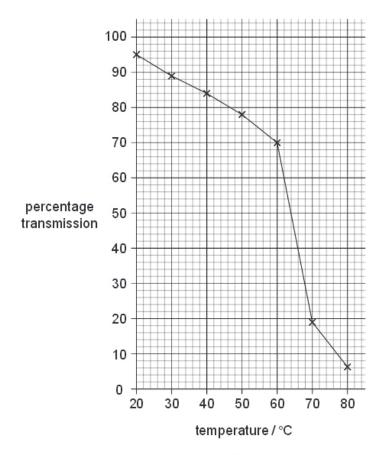


Fig. 2.2

(i)	describe the student's results;	
	[3]	
/iii	ovaloin the affect of increasing temperature on the heatrest tissue	
(ii)	explain the effect of increasing temperature on the beetroot tissue.	
(ii)	explain the effect of increasing temperature on the beetroot tissue.	
(ii)	explain the effect of increasing temperature on the beetroot tissue.	
(ii)		
(ii)		

Q5.

Fig. 3.1 shows a flatworm which lives in ponds, streams and rivers. The dimensions of the flatworm are 12.5 mm long by 3.0 mm wide. Its volume was estimated as 12.6 mm³. Flatworms do not have a transport system for the respiratory gases, oxygen and carbon dioxide.

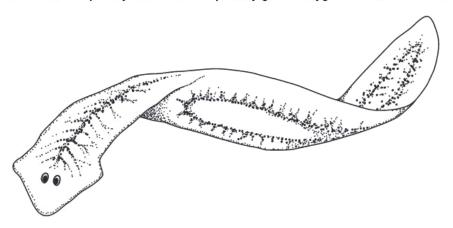


Fig. 3.1

laj		n reference to Fig. 3.1 and the information above, explain how flatworms survive out a transport system for respiratory gases.
		[4]
(b)	This	flatworm lives in freshwater that has a low concentration of sodium ions. The
(b)		vorm's body fluids have a higher concentration of sodium ions than the surrounding
		e1.
	(i)	Suggest how the flatworm retains sodium ions in its body fluids.
	(i)	
	(i) (ii)	Suggest how the flatworm retains sodium ions in its body fluids.
	3	Suggest how the flatworm retains sodium ions in its body fluids. [2]
	3	Suggest how the flatworm retains sodium ions in its body fluids. [2]
	3	Suggest how the flatworm retains sodium ions in its body fluids. [2] State one role of sodium ions in organisms.

Q6.

(ii)	Explain how a phospholipid is suite	ed to its role in cell membranes.	
			[3]
Or	ne role of the cell surface membrane is t	o control the entry and exit of substances.	
(a)	and examples of materials transporte	sport mechanisms across cell surface membra d. ble 1.1	anes
(a)	and examples of materials transporte	d.	
	and examples of materials transporte Tal transport mechanism across cell	ble 1.1 example of material transported across	
	and examples of materials transporte Tal transport mechanism across cell surface membrane	example of material transported across membrane	
	and examples of materials transporte Tal transport mechanism across cell surface membrane	ed. ble 1.1 example of material transported across membrane sodium ions	

Q7.

1

facilitated diffusion

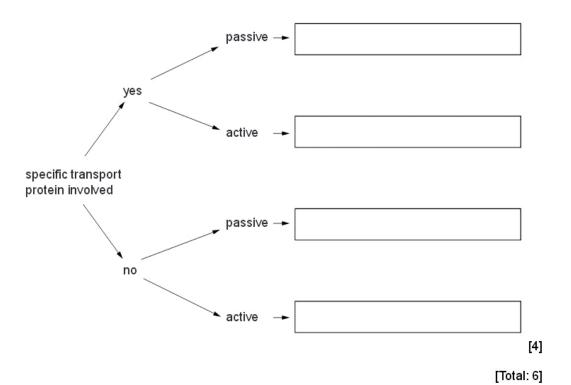
osmosis

[2]

J

(b) Each transport mechanism across cell surface membranes has a characteristic set of features.

In **each** of the boxes below, state **one** example of a transport mechanism that matches the pathway shown.



Q8.

5 Fig. 5.1 shows a section of a cell surface membrane.

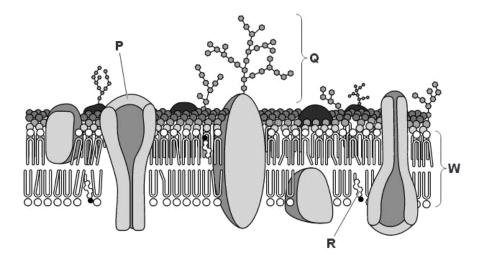


Fig. 5.1

(a)	State the fo	unctions of	structures F	, Q and R.				
	P							
								200.0004.0002
	2220							
								[3]
(b)	Circle the v	width of the	membrane	shown as W	in Fig. 5.1.			
	17.0μm	1.7μm	$0.7\mu m$	70.0 nm	17.0 nm	7.0 nm	0.7 nm	[1]
c)	Membranes structure.	s, such as t	he cell surfa	ace membra	ne, are descr	ribed as hav	/ing a fluid	mosaic
	Explain wh	at is meant	by the term	n fluid mosai	c.			
								[2]

(d		quaporins are membrane channel proteins in plant and animal cells. They permit the ovement of water across membranes. Explain why they are necessary.
	••••	
	•••	
	•••	
	25.56	[3] [Total: 9]
00		[Total. 5]
Q9.		
	the	come organisms, trehalose is used as an energy store and gives protection against harmful effects of very low temperatures. Trehalose is sometimes referred to as a protectant, allowing organisms to survive in freezing conditions.
	Free cell.	ezing temperatures can damage the cell surface membrane and membranes within the
	(c)	Explain the importance of the cell surface membrane to cells.
		[3]
		[0]
Q10.		

(c)	The membrane surrounding the vacuole, called the tonoplast, has a fluid mosaic structure.
	Describe the structure of this membrane.
	[4]
(d)	Palisade mesophyll cells have very large vacuoles.
	Explain how water moves from the xylem in the leaf into these vacuoles.
	Explain how water moves from the xylem in the leaf into these vacuoles.

_---

1 Fig. 1.1 is a drawing made from an electron micrograph showing a cross-section of an alveolus and two adjacent capillaries.

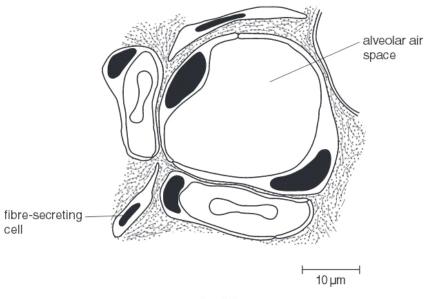


Fig. 1.1

(b)	With reference to Fig. 1.1, describe the process of gaseous exchange in the alveolus.
	[4

Q12.

5	(a)	State the roles of glycoproteins, carrier proteins and cholesterol in the cell surface membrane of an animal cell.
		glycoproteins
		carrier proteins
		cholesterol
		[4]

(b) Fig. 5.1 is a diagram of an animal cell showing the concentrations and direction of movement of an ion (A) and a non-polar molecule (B) on either side of the cell surface membrane.

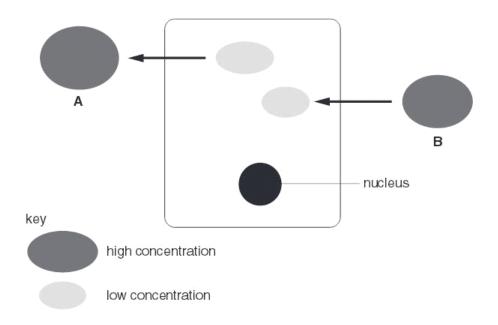


Fig. 5.1

	With reference to Fig. 5.1, explain how A and B cross the cell surface membrane of the cell.
	A
	В
	[4]
(c)	Describe how particles, such as bacteria, are taken up by phagocytes.
	[2]
(d)	Phagocytes contain many lysosomes.
	State the function of lysosomes in phagocytes.
	[1]
	[Total: 11]

Q13.

- 2 Phospholipids are components of cell surface membranes.
 - (a) Describe how phospholipid molecules are arranged in a cell surface membrane.
 You may use the space below for a simple annotated diagram if you wish.

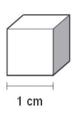
[2]

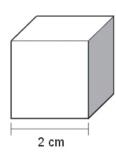
Q14.

5 An experiment was performed to find the effect of surface area:volume ratio on the rate of osmosis.

Pieces of yam were cut into cubes of the following sizes:

- $2 \text{ cm} \times 2 \text{ cm} \times 2 \text{ cm}$ (surface area = 24 cm², volume = 8 cm³)
- 1 cm \times 1 cm \times 1 cm (surface area = 6 cm², volume = 1 cm³)



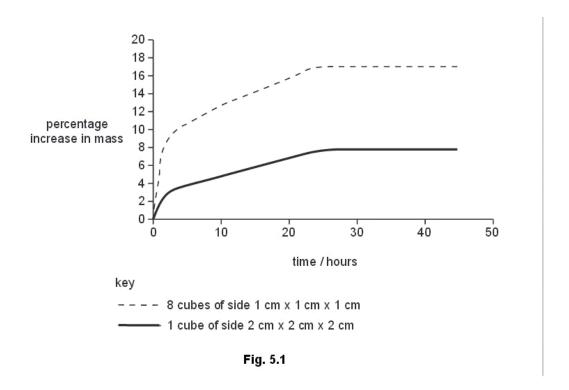


The cubes were carefully blotted dry, weighed and their fresh masses recorded.

One cube, $2 \text{ cm} \times 2 \text{ cm} \times 2 \text{ cm}$, was put into a beaker and covered with distilled water.

Eight cubes each measuring $1 \text{ cm} \times 1 \text{ cm} \times 1 \text{ cm}$ were put into another beaker of distilled water, making sure that they were all covered with distilled water.

At intervals for a period of 45 hours, the cubes were removed from the beakers, blotted dry, reweighed and then replaced into fresh distilled water. The percentage increase in mass was calculated for the eight cubes of side 1 cm and the one cube of side 2 cm. The results are shown in Fig. 5.1.



(a)	Explain why eight cubes of side 1 cm \times 1 cm \times 1 cm were used in this experiment.
	j
	[1]
(b)	Describe the results shown in Fig. 5.1.
	[3]
(c	Explain, in terms of water potential, why all the cubes of yam gained in mass.
	[3]
(d	Explain why the percentage increase in mass for the eight cubes of side 1 cm was faster than that of the cube of sides 2 cm.
	[2]
	[Total: 9]

Q.15.

1 Fig. 1.1 is a photograph taken at low tide in a mangrove swamp in Mozambique.



Fig. 1.1

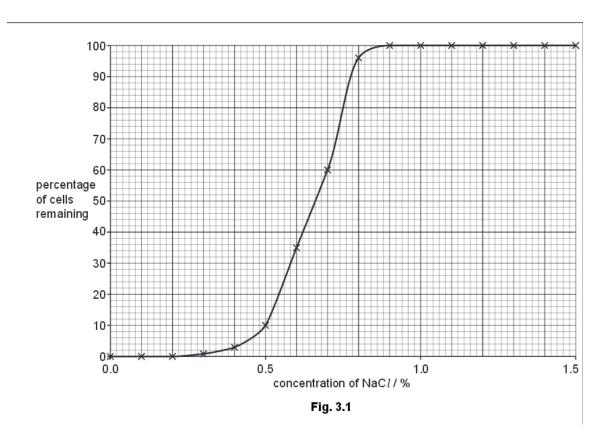
The photograph shows a hermit crab surrounded by the pneumatophores ('breathing roots') of mangrove trees. The hermit crabs live inside the shells of dead molluscs. Large birds, such as Goliath herons, feed on the hermit crabs. The vertical pneumatophores are an adaptation to the soil in the swampy, coastal environment that contains very little oxygen. They are exposed to the air at low tide. The soil has a very high salt content as the sea often covers the area. Some bacteria are able to grow deep in the rich organic mud where the oxygen concentration is very low.

(b)	Explain how the cells in the roots of mangrove trees obtain sufficient oxygen and water in this extreme environment.					
	oxygen					
	water					
	[5]					
Q.16.						
(c)	Other proteins are found in cell surface membranes.					
	Describe three roles of the proteins in cell surface membranes.					
	1					
	2					
	3					
	[3]					
Q.17.						

3 Red blood cells are suspended in plasma which has a concentration equivalent to that of 0.9% sodium chloride (NaC1) solution.

A student investigated what happens to red blood cells when placed into sodium chloride solutions of different concentration.

A small drop of blood was added to $10\,\mathrm{cm^3}$ of each sodium chloride solution. Samples were taken from each mixture and observed under the microscope. The number of red blood cells remaining in each sample was calculated as a percentage of the number in the 0.9% solution. The results are shown in Fig. 3.1.



(a)	With reference to Fig. 3.1, describe the student's results.					
	[3]					

The student also measured the cell volumes of the red blood cells in three of the sodium chloride solutions. The results are shown in Table 3.1.

Table 3.1

Ex

concentration of sodium chloride /%	mean red cell ∨olume /μm³
0.7	120
0.9	90
1.5	65

Fig. 3.2 shows the appearance of some red blood cells removed from the 1.5% sodium chloride solution.

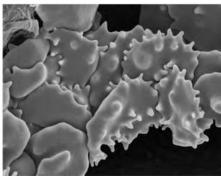


Fig. 3.2

(b)	Explain the results shown in Fig. 3.1, Table 3.1 and Fig. 3.2, in terms of water potential.					
	0% NaC1 solution					
	0.7% NaCl solution					
	1.5% NaCl solution					
	1.5% NACT SOLUTION					
	iei –					
Q.18						
(15)	Describe the process of everyteeis					
(D)	Describe the process of exocytosis.	Ex				
	[3]					

Q.19

(c) A student carried out an investigation into osmosis using red blood cells.

Red blood cells were placed in sodium chloride (salt) solutions at five different concentrations. For each concentration, a sample was added immediately to a microscope slide and the cells were viewed using a light microscope for a period of time. The observations recorded are shown in Table 3.1.

Table 3.1

concentration of salt solution/%	observation of red blood cells
0.0	swell and burst, numbers decrease
0.4	increase in size
0.9	remain the same size
1.5	decrease in size
3.0	smaller and shrivelled

Explain, in terms of water potential and osmosis, the results that the student obtained.
[4]

(d) The student also carried out a similar investigation using plant cells with cell walls removed. These cells were suspended in a 12% mannitol solution so that the water potential inside and outside of the cells was equal.

Fig. 3.1 is a photomicrograph of these cells.

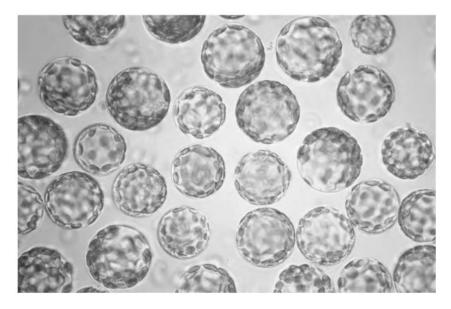


Fig. 3.1

The student removed a sample of these cells. The sample was placed into distilled water and was viewed using a light microscope.

rescribe what you would expect the student to observe and explain why this would not ccur with normal plant cells.
[2]

Q.20.

1 Fig. 1.1 shows a diagram of part of a cell surface membrane.

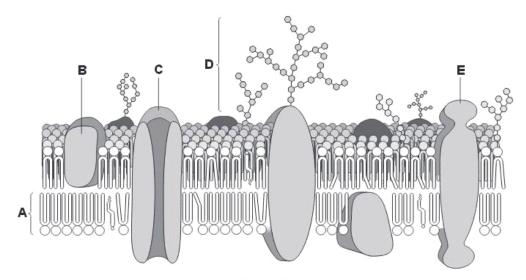


Fig. 1.1

(a)	(i)	Name molecules A and B.
		A
		B[2]
	(ii)	Explain how the features of molecules of ${\bf A}$ cause them to form a layer in the membrane as seen in Fig. 1.1.
		[3]

(b) State the functions of C and

С	 	 	
•••	 	 	
D	 	 	
	 	 	 [2]

(c) Structure E is a protein composed of 588 amino acids.

Calculate the minimum number of nucleotide base pairs required in the gene coding for this protein. Show your working.

Answer =[2]

[Total: 9]

Q.21.

1 Fig. 1.1 is a diagram of a cell surface membrane.

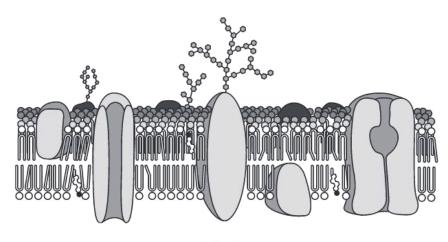


Fig. 1.1

		(a)	Us	e a label line and the appropriate letter to label each of the following on Fig. 1.1.	_
			P	protein for active uptake of potassium ions	
			Q	protein for facilitated diffusion of polar molecules	
			R	receptor site for a hormone	
			s	hydrophilic heads of phospholipids on the internal surface of the membrane	
			Т	molecule that modifies the fluidity of the membrane [5]
		(b)	So	me cells take in bacteria by endocytosis.	
			Ех	plain how endocytosis occurs at a cell surface membrane.	
					\$100 =
					•
				[3]
				[Total: 8]
Q.22) <u>.</u>				
3	One	feat	ure c	rinelandii is a bacterium found in the soil that is able to fix atmospheric nitrogen. of nitrogen-fixing bacteria is the ability to synthesise the enzyme nitrogenase, a and iron-containing, protein complex.	
	(a)	(i)	ions	ybdenum is a mineral ion found in the soil solution. It enters the cell as molybdate , through membrane transport proteins. The proteins have the ability to bind to, hydrolyse, ATP.	
			Nam	ne and describe the mechanism of transport of molybdate ions into the cell.	
				[3]	8

(a)

2 Thale cress, Arabidopsis thaliana, is used to study the roles of genes and proteins in plants.

For Examin Use

The cell membranes of the root hairs of *A. thaliana* contain proteins called aquaporins that allow the movement of water between the soil and the cytoplasm as shown in Fig. 2.1.

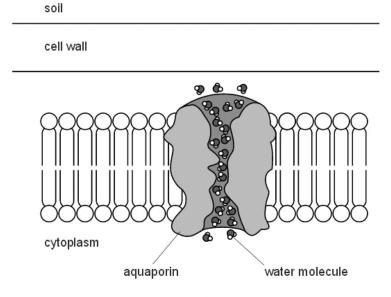


Fig. 2.1

Witl	n reference to Fig. 2.1:
(i)	explain how water is absorbed by root hairs of A. thaliana
	[3]
(ii)	state why aquaporins are necessary in cell surface membranes.
	[1]

(b)			be the pathway taken by water from the cytoplasm of the root hair cell to a xyler in the centre of the root.	n
				••
				••
	••••		[3	3]
Q.24.				
2			d mosaic model of membrane structure was first proposed in 1972 by Singer and n. The model describes in detail how the components of a membrane are organised.	; Ex ai
	(a)	Son	ne of the components of the cell surface membrane are:	(
		•	phospholipid molecules	
		•	protein molecules	
		•	cholesterol molecules.	
		(i)	In the box below, draw a labelled diagram of a section through a cell surface membrane to show how the above components are organised within the membrane.	
			The diagram should include other named components of the membrane.	
			Label the inner and outer surfaces of the membrane.	

		[5]
	175	
(ii)	Suggest why 'fluid mosaic' is an appropriate term to use to structure.	describe membran
	Structure.	

Q.25.

(c) Some pea plants were grown with their roots in a solution of mineral ions. The solution was kept aerated for three days.

Ex

The concentrations of five ions in the solution and in the root tissue were determined after the three days. The results are shown in Table 2.2.

Table 2.2

- CON	concentration / mmol dm ⁻³					
ion	surrounding solution	root tissue				
potassium (K ⁺)	1.0	75.0				
magnesium (Mg ²⁺)	0.3	3.5				
calcium (Ca ²⁺)	1.0	2.0				
phosphate (PO ₄ ³⁻)	1.0	21.1				
sulfate (SO ₄ ²⁻)	0.3	19.7				

responsible for the concentrations of ions in the roots compared to the surrounding solution.
[5]

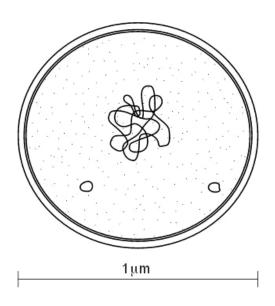


Fig. 4.1

(D)	different water potential.	8
	Suggest and explain what would happen to bacteria placed in a solution with a water potential more negative than their cell contents.	

Q.27.

 (a) Cell surface membranes are involved with the movement of substances into and out of cells.

Calcium pumps in cell surface membranes maintain a concentration of calcium ions inside the cytoplasm that is a thousand times lower than outside the cell.

Fig. 1.1 shows the movement of calcium ions across a cell surface membrane.

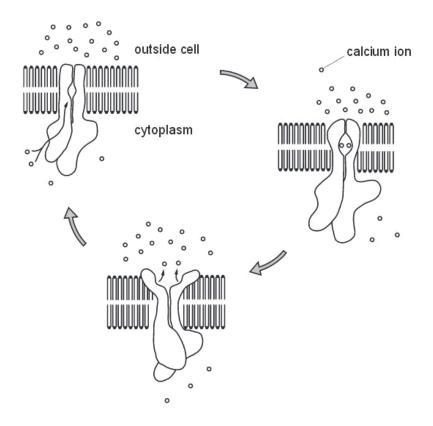


Fig. 1.1

With reference to Fig. 1.1,

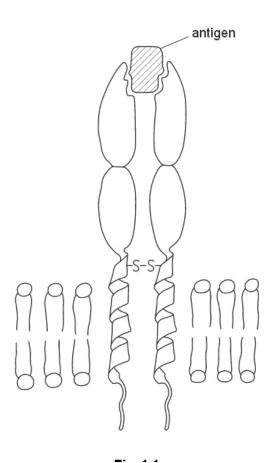
i)	explain why calcium ions do not pass through the phospholipid bilayer;
	[2]

	(ii)	name ar membrar		cribe 1	he pr	ocess	by whi	ch calci	um ior	s are	moved	across	the
		name											
		descripti	on										
													[3]
(b)	Phag	ocytosis is	the p	rocess	by wh	nich ba	icteria a	re inge	sted by	cells.			
(b)		ocytosis is	8		-			100	•				
(b)		ibe the ro	le of th	ne cell	surfac	e mer	nbrane (100	hagoc	/tosis.			
(b)	Desci	ibe the ro	le of ti	ne cell	surfac	e mer	nbrane	during p	hagoc	/tosis.			
(b)	Desci	ibe the ro	le of th	ne cell	surfac	e mer	nbrane (during p	hagoc	/tosis.			•••••
(b)	Desci	ibe the ro	le of th	ne cell	surfac	e mer	nbrane (during p	hagoc	/tosis.			•••••
(b)	Desci	ibe the ro	le of ti	ne cell	surfac	ce mer	nbrane (during p	hagoc	/tosis.			

(c)	Phagocytic cells contain many lysosomes.
	Describe the function of lysosomes in destroying ingested bacterial cells.
	[4]
	[Total: 12]

Q.28.

- 1 Receptor proteins are part of the fluid mosaic structure of cell surface (plasma) membranes of T-lymphocytes. Each type of receptor protein is specific to a particular antigen.
 - Fig. 1.1 shows a receptor protein and the surrounding phospholipids of a cell surface membrane of a T-lymphocyte.



(ii) Draw a bracket (}) on Fig. 1.1 to indicate the width of the phospholipid bilayer. [1]

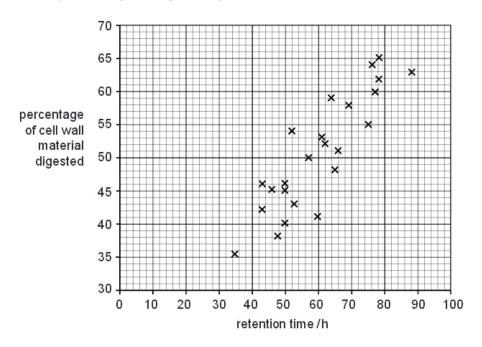
(ii) Explain the term *fluid mosaic*.

- -
 - 3

Q.29.

Animals do not have the ability to produce enzymes to digest cellulose. Most herbivores have bacteria in their digestive systems that can digest cellulose.

Fig. 5.1 shows the results of a study on 24 different herbivores. The percentage of cell wall material that was digested by each animal was determined. The time taken for the plant material to pass through the digestive system, the retention time, was also recorded.



(c)	Digested material in animals is absorbed using both facilitated diffusion and active transport.
	State two similarities $$ and $$ two differences between facilitated diffusion and active transport.
	similarities:
	Ī
	2
	differences:
	1
	2