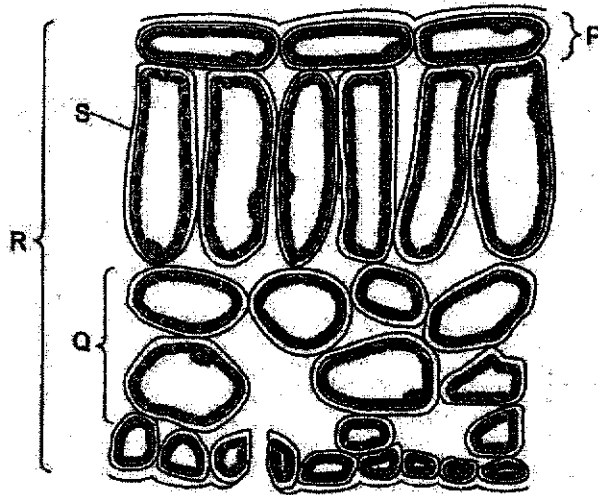


16 The diagram shows a section through a leaf.



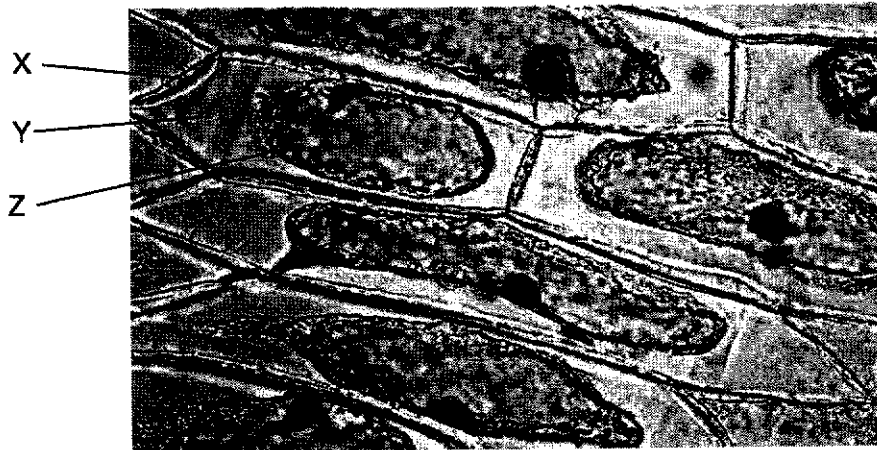
Which is a cell, tissue and organ respectively?

	cell	tissue	organ
A	P	Q	R
B	P	S	Q
C	S	Q	R
D	S	P	Q

17 Which describes the diffusion of molecules?

- A** movement from a region of higher concentration to a region of lower concentration down a concentration gradient
- B** movement from a region of higher concentration to a region of lower concentration up a concentration gradient
- C** movement from a region of lower concentration to a region of higher concentration down a concentration gradient
- D** movement from a region of lower concentration to a region of higher concentration up a concentration gradient

To answer questions 18 and 19, refer to the light micrograph below which shows the appearance of some onion cells that had been placed in concentrated salt solution for some time.



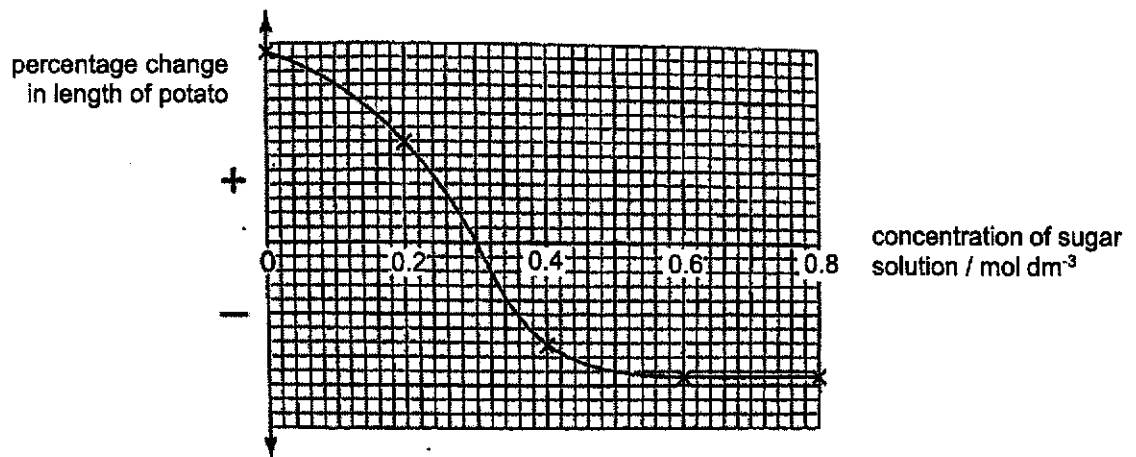
18 Which correctly describes the properties of X and Z?

	X	Z
A	fully permeable	fully permeable
B	fully permeable	partially permeable
C	partially permeable	fully permeable
D	partially permeable	partially permeable

19 Which of the following can be found in space Y after 30 minutes?

- A cell sap
- B cytoplasm
- C salt solution
- D water

- 20 Potato strips of similar sizes were placed in sugar solutions of different concentrations. After three hours, the change in length of each potato strip was measured. The results are shown in the graph.



From the graph, what is the approximate concentration of the cell sap of the potato?

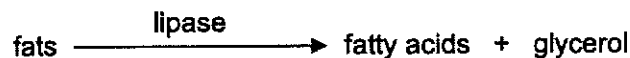
- A 0.00 mol dm⁻³
 B 0.20 mol dm⁻³
 C 0.30 mol dm⁻³
 D 0.60 mol dm⁻³
- 21 Which of the following statements regarding water is true?
- 1 Water constitutes about 70% of the human body.
 - 2 Water cools a surface from which it evaporates.
 - 3 Water is important for the transport of dissolved substances.
 - 4 Water is used as a solvent for all chemicals.
- A 1 and 2 only
 B 1, 2 and 3 only
 C 2, 3 and 4 only
 D 1, 2, 3 and 4

- 22 Food tests were conducted on a sample of food to analyse its contents. The results of the tests are shown in the table below.

food test	result
add Benedict's solution and heat	brick-red precipitate observed
add biuret solution	blue colour observed
add iodine in potassium iodide solution	brown colour observed
shake with ethanol	white emulsion observed

Which of the following is present in the food sample?

- A reducing sugar and fats
 B reducing sugar only
 C proteins and starch
 D starch and fats
- 23 Which enzyme controls a reaction in which both enzyme and substrate can be denatured at high temperature?
- A amylase
 B insulin
 C lipase
 D protease
- 24 The equation below shows an enzyme-catalysed reaction.



According to the 'lock' and 'key' hypothesis, which is the 'lock' and which is the 'key'?

	'lock'	'key'
A	fats	lipase
B	fatty acids and glycerol	lipase
C	lipase	fats
D	lipase	fatty acids and glycerol

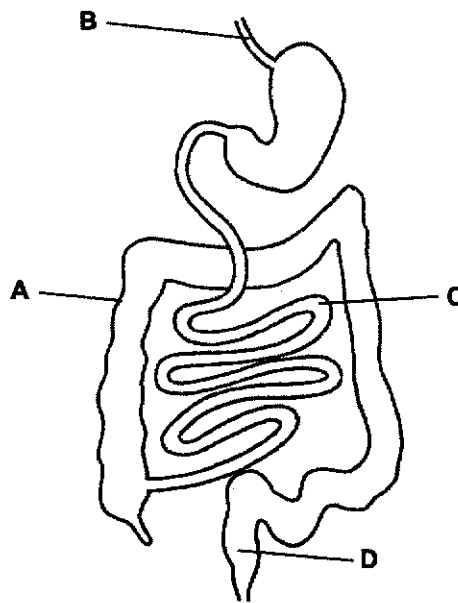
- 25 Which statement is true of all enzymes?
- A They are altered after the chemical reactions they catalysed are completed.
 B They are denatured by temperatures above 40 °C.
 C They are proteins.
 D They digest food in the alimentary canal.

26 Which digestive processes take place in the mouth?

	dissolving of substances	chemical digestion	mechanical digestion
A	no	yes	yes
B	yes	no	yes
C	yes	yes	no
D	yes	yes	yes

27 The diagram shows the alimentary canal.

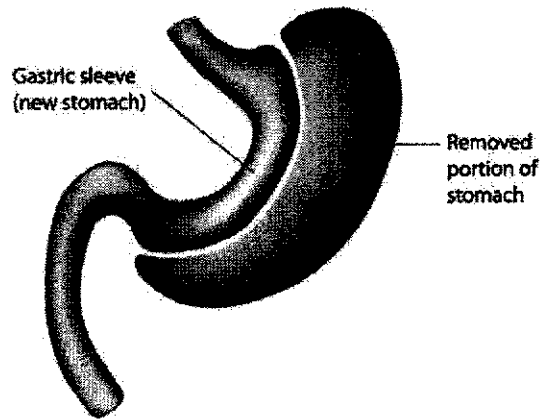
In which region does both digestion and absorption occur?



28 Which statement explains why starch digestion occurs in the mouth and small intestines but not in the stomach?

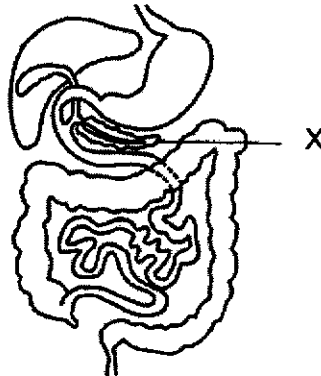
- A** All the starch has been digested before it reaches the stomach.
- B** The pH in the stomach causes the shape of the amylase to be altered.
- C** The stomach juices do not contain amylase.
- D** The temperature in the stomach is too high for amylase to function.

- 29 The diagram below illustrates a 'gastric sleeve' surgical procedure in which part of the stomach is removed, reducing it to about 15% of its original size.



What are the possible outcomes of this procedure?

- A digestion of food occurs faster
 - B earlier sensation of fullness
 - C increased absorption of nutrients
 - D increased egestion of food
- 30 The diagram shows part of the human alimentary canal.



If structure X is removed, which of the following substance will **not** be digested in the small intestines?

- A fat
- B maltose
- C polypeptides
- D starch

END



PASIR RIS CREST SECONDARY SCHOOL
Mid-Year Examination
Secondary Three Express

CANDIDATE
NAME

CLASS

	/	
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INDEX
NUMBER

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Science (Biology)

Paper 4

5078/04

15 May 2019

1 hour

READ THESE INSTRUCTIONS FIRST

Write your candidate name, class and index number on all the work you hand in.
Write in dark blue or black pen.
You may use a HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Section A (30 marks) and Section B (20 marks)

Answer all questions.

Write your answers in the spaces provided on the question paper.

Electronic calculators may be used.

The number of marks is given in brackets [] at the end of each question or part question

For Examiner's Use
50
Parent's Signature

This document consists of 10 printed pages.

[Turn over

Section A (30 marks)

Answer all questions in the spaces provided.

1 Fig. 1.1 shows a diagram of an animal cell as viewed under an electron microscope.

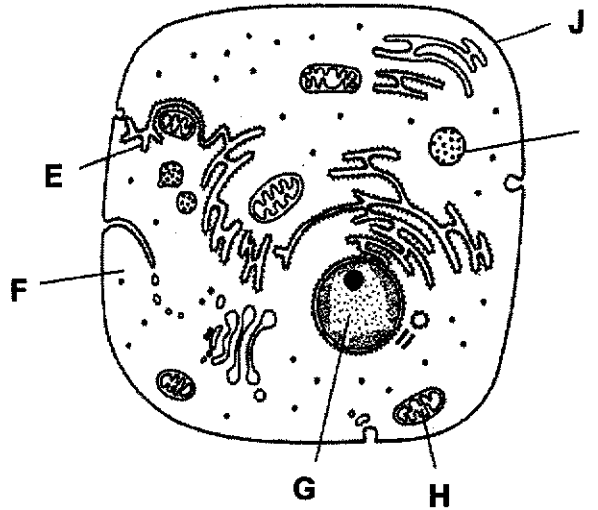


Fig. 1.1

(a) Match the structures E, F, G, H, I and J to the correct description below.

- (i) synthesises proteins
- (ii) releases energy through aerobic respiration
- (iii) carries genetic information
- (iv) where chemical reactions take place
- (v) controls movement of substances in and out of the cell
- (vi) stores water and substances [3]

(b) Ribosomes are only visible when a cell is viewed using an electron microscope.


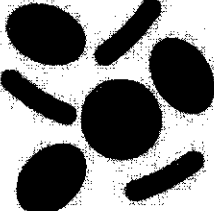
(i) Name another organelle that only becomes visible when viewed under the electron microscope.
 [1]

(ii) Suggest a type of tissue in the human body in which the cells contain a large quantity of this organelle.
 [1]

[total: 5]

- 2 In an experiment, red blood cells were placed in salt solutions of varying concentrations of 0.01 M, 0.15 M and 1.0 M.

After 10 minutes, the red blood cells were observed under the light microscope.

solution	appearance of red blood cells after 10 minutes
P	
Q	
R	red blood cells not visible

- (a) Given that solution P is 1.0 M salt solution, suggest the concentrations of solutions Q and R.

Solution Q M

Solution R M

[1]

- (b) Describe and explain the appearance of the red blood cells in solution P.

.....

.....

.....

.....

.....

[4]

[Turn over

(c) Suggest what happened to the red blood cells in solution R. Explain your answer.

.....
.....
.....
.....

[3]
[total: 8]

3 Oxygen is carried in the blood by red blood cells.

Sickle cell anaemia is a genetic disease in which there is a mutation in the gene responsible for the production of haemoglobin. The abnormal haemoglobin causes the red blood cell to have a sickle shape.

Fig. 3.1 shows the red blood cells from a healthy person and a person with sickle cell anaemia.

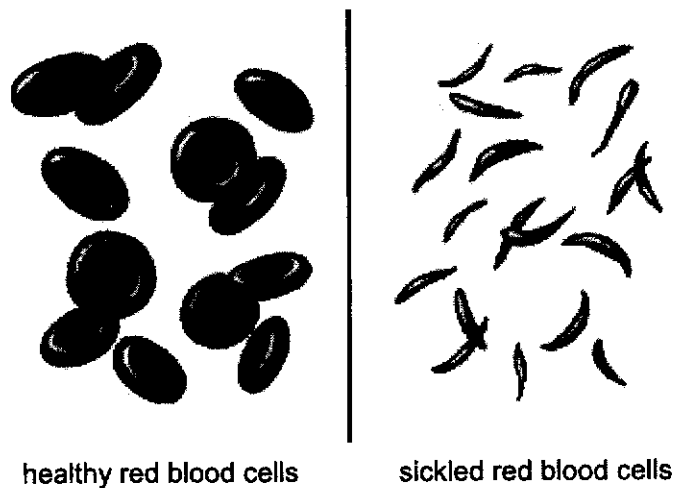


Fig. 3.1

(a) Describe two ways in which the structure of the healthy red blood cells is adapted to carry the maximum amount of oxygen.

.....
.....
.....
.....

[2]

(b) A patient with sickle cell anaemia looks pale, often feels dizzy and faints. By referring to the structure of the red blood cell, explain why a person with sickle cell anaemia suffers from these symptoms.

.....
.....
.....

[2]

(c) Define the term gene.

.....
.....
.....

[2]

(d) Haemoglobin is a protein. Suggest how a mutation in the gene producing haemoglobin can cause sickle cell anaemia.

.....
.....
.....
.....

[3]

(e) The red blood cell has special structural adaptations to perform its function. Suggest **one** specialized cell from plants and explain how the cell has adaptations to perform its function.

.....
.....
.....

[2]

[total: 11]

[Turn over

4 A student is interested in building more body mass and decides to complement his body-building regime by consuming a body-building supplement drink.

(a) (i) The student wishes to confirm the main type of nutrient in the supplement drink.

Describe the procedure of the test that the student should conduct.

.....
.....
.....
.....

[2]

(ii) State the expected positive and negative test results.

Positive test

.....

Negative test

.....

[2]

(b) The student had his gall bladder removed some time ago. He read on the warning label of the supplement drink that people with the gall bladder removed should consume only half the recommended daily dosage.

Suggest why this is so and explain your answer.

.....
.....
.....

[2]

[total: 6]

Section B (20 marks)

Answer **all** questions in the spaces provided.

5 (a) Draw and label a nucleotide in the space below.

[2]

(b) Describe the structure and function of DNA.

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.....
.....
.....
.....
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.....
.....

[5]

(c) Using the rule of complementary base pairing, state the complementary strand for the DNA segment below.

ATGGACCTGTTA

.....

[1]

[Turn over

- (d) A particular sample of DNA was found to contain 23% guanine. Calculate the percentage composition of the other bases.

.....

.....

.....

[2]

[total: 10]

- 6 (a) Catalase is an enzyme found in many tissues. Catalase breaks down hydrogen peroxide, forming water and oxygen gas. The rate of catalase enzyme activity can thus be measured by measuring the volume of oxygen gas produced.

Fig. 6.1 shows the apparatus used to investigate the effect of pH on the activity of catalase. The gas syringe was used to measure the volume of oxygen gas produced at each pH.

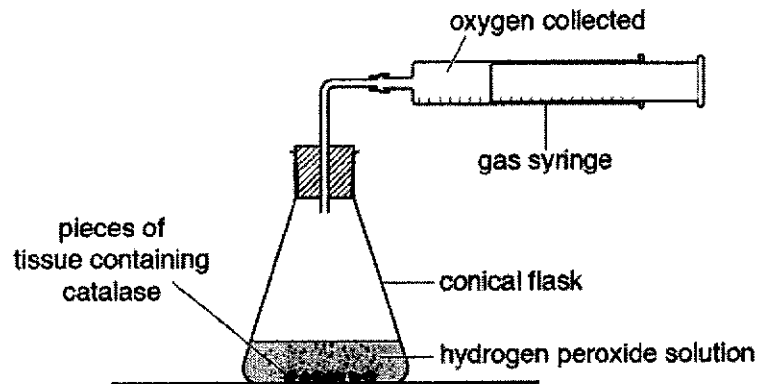


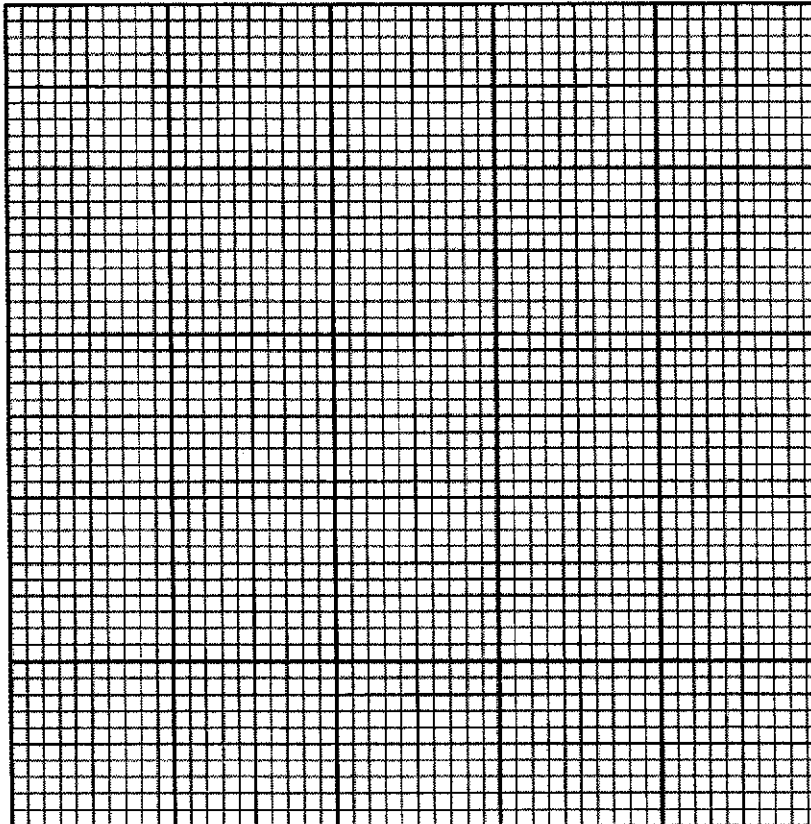
Fig. 6.1

Hydrogen peroxide solutions of pH 5.0, 6.0, 7.0, 8.0 and 9.0 were each mixed with the same mass of fresh tissue containing catalase. The volume of oxygen gas produced during five minutes was recorded in Table 6.1.

Table 6.1

pH	volume of oxygen produced during five minutes / cm ³
5.0	14
6.0	48
7.0	90
8.0	54
9.0	9

- (i) Using the results in Table 6.1, plot a graph to show the effect of pH on the activity of catalase. Use a curved line of best fit and label the axes appropriately.



[3]

- (ii) Using your graph in (a)(i), describe the effect of pH on the activity of catalase.

.....

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.....

[3]

[Turn over

- (b) Enzymes like protease are added to biological detergents used to wash clothes. Fig. 6.2 shows the effect of temperature on the activity of a protease enzyme.

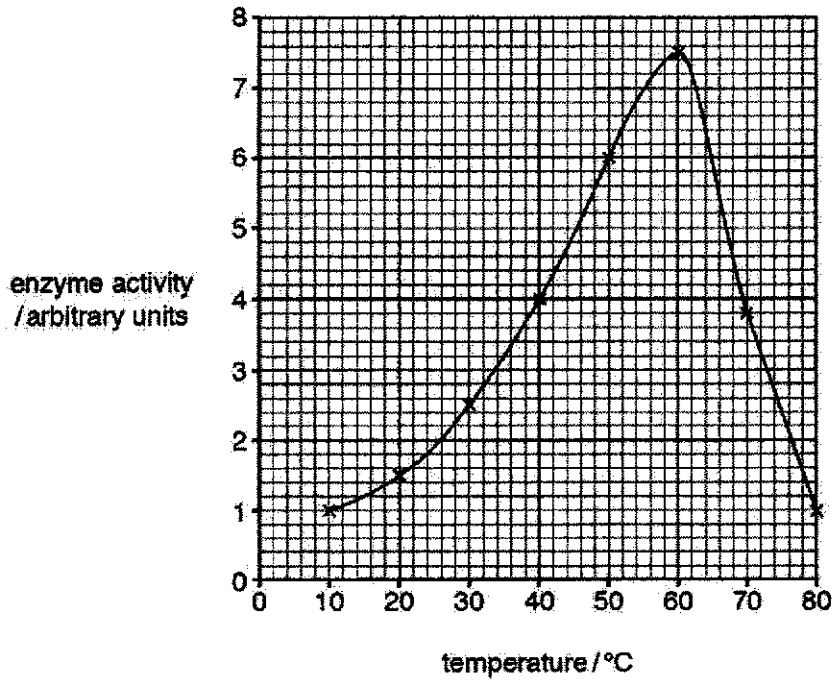


Fig. 6.2

- (i) It is suggested to soak the clothes with tough stains in the biological detergent for an hour. Suggest how protease works in the washing process to remove stains in the clothes.

.....
.....
.....
.....

[2]

- (ii) With reference to the graph in Fig. 6.2, state the optimal temperature of the protease activity.

Optimal temperature : °C

[1]

- (iii) Explain why this protease is not a human enzyme.

.....
.....

[1]

[total: 10]

End of Paper 4

**Pasir Ris Crest Secondary School
3E Science (Biology) 5078 Mid-Year 2019**

Paper 1: Multiple Choice Questions (Total Marks: 15)

1 mark given to each correct answer.

Question No.	Answer	Question No.	Answer
16	C	26	D
17	A	27	C
18	B	28	B
19	C	29	B
20	C	30	D
21	B		
22	A		
23	D		
24	C		
25	C		

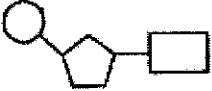
Paper 4

Section A (Total Marks: 30)

Qn No.	Answer	Marks
1(a)	(i) E (ii) H (iii) G (iv) F (v) J (vi) I	2 correct – 1 mark 4 correct – 2 marks 6 correct – 3 marks
(b)	(i) mitochondria (ii) muscle tissue	1 1 [total: 5]
2(a)	Solution Q <u>0.15 M</u> Solution R <u>0.01 M</u>	both correct – 1 mark
(b)	Describe: the red blood cells are <u>crenated</u> . [1] Explain: <u>Osmosis</u> occurs; the 1.0 M solution has a <u>lower water potential</u> than the cytoplasm of the red blood cell; <u>Water molecules leave</u> the red blood cell, through the partially permeable cell membrane, and move into the salt solution; <u>Volume of cytoplasm decreases</u> .	1 any 3 points, max 4 marks
(c)	Describe: the red blood cells <u>burst</u> ; Explain: the solution has a <u>higher water potential</u> than the cytoplasm of the red	1 1

	blood cell; <u>Water molecules enter the cell</u> through the partially permeable cell membrane causing the volume of the cell to increase. Thus the cells will burst.	1 [total: 8]
3(a)	1. <u>biconcave shape</u> provides <u>large surface area to volume ratio</u> for <u>faster diffusion of oxygen</u> 2. <u>lack of nucleus</u> provides <u>more space</u> to store more haemoglobin to transport more oxygen 3. <u>contains haemoglobin</u> which binds reversibly with oxygen to carry it to where it is needed around the body 4. <u>elastic and flexible cell membrane</u> allows the cells to <u>squeeze through narrow blood vessels</u> .	1 1 1 1 (Any 2)
(b)	A person with sickle cell anaemia will have <u>less oxygen</u> transported to his/her brain/body tissues; As red blood cells do not have a biconcave shape thus will have a <u>smaller surface area to volume ratio</u> ; /Thus <u>diffusion will be slower</u> .	1 either 1 or 1 (max 2)
(c)	A gene is a sequence of nucleotides, as part of a DNA molecule / a segment of DNA. A gene is a unit of inheritance which controls the production of a specific polypeptide.	1 1
(d)	A mutation in the gene means there is a change in the <u>sequence of nucleotides</u> . Thus, the <u>sequence of amino acids</u> in the protein will be different. This changes the <u>structure of the protein</u> formed. Thus, the function of the protein will also be different, in this case, haemoglobin causes the red blood cell to have a sickle shape.	1 1 1
(e)	root hair cell; <u>long extension/ projection/ protrusion increases surface area to volume ratio</u> for <u>faster</u> absorption of water and (dissolved) mineral salts; OR Xylem vessel; <u>Long, hollow tube</u> without protoplasm allows water to be transported upwards with <u>least resistance/ no obstruction</u> .	1 1 1 1 Max 2 [total: 11]
4(a)(i)	Biuret test / test for proteins 1. To 2 cm ³ of the drink, add 2 cm ³ of <u>sodium hydroxide solution</u> (accept equal volume) and shake well. 2. Add 1% <u>copper(II) sulfate solution drop by drop</u> . Shake well after each drop. 3. Leave the test tube to stand for 5 minutes.	1 1
(a)(ii)	Positive test: biuret solution <u>changes colour from blue to violet</u> . Negative test: biuret solution <u>remains blue</u> .	1 1 [total: 4]
(b)	When the gall bladder is removed, bile <u>can no longer be stored</u> . The <u>amount of bile</u> secreted into the small intestines is <u>reduced</u> . (Reject: no bile produced) There will be <u>slower emulsification</u> of fats; so the <u>rate of fat digestion by lipase</u> will be <u>slower</u> .	1 1 1 1 Any 2 [total: 2]

Section B (Total Marks: 20)

5(a)	 <p>Drawing in correct orientation Labelled (phosphate group, deoxyribose sugar, nitrogenous base) <i>Reject: sugar / base</i> <i>Accept: pentose sugar</i></p>	1 1
(b)	<p>1. DNA has a <u>double helix structure</u>; 2. Made up of <u>two polynucleotide chains</u>; 3. Each polynucleotide chain is made up of <u>many nucleotides</u>; Each nucleotide is made up of a phosphate group, deoxyribose sugar and a nitrogenous base; 4. The two polynucleotide chains / (bases) are joined by <u>complementary base pairing</u> in which <u>adenine always bonds with thymine and guanine always bonds with cytosine</u>. The bases are held by <u>hydrogen bonds</u>.</p> <p>The function of DNA is <u>to carry the genetic information/code</u> of an organism.</p>	1 1 1 1 1 1 1 (max 5)
(c)	TACCTGGACAAT	1
(d)	23% cytosine [1] 27% adenine 27% thymine [1] (<i>ecf not accepted</i>)	1 1 [total: 10]

6(a)(i)	<ul style="list-style-type: none"> - Smooth curve - Points plotted accurately with an 'x' - Axes drawn and labelled, appropriate scale used to occupy grid provided 	1 1 1
(a)(ii)	<p>At low pH of 5.0, the <u>activity of catalase is low</u>. The activity <u>increases</u> from 5.0 to 6.0. pH 7.0 is the <u>optimum pH</u> as the <u>volume of oxygen evolved is the highest</u>. The activity <u>decreases</u> as pH increases from 7.0 to 9.0. At high pH of 9.0, the <u>activity of catalase is very low</u>. (<i>Extra: Enzymes are denatured at pH higher or lower than the optimum pH</i>) <i>*describe the three sections of the graph – 1 mark</i> <i>correctly relate each section to the rate of enzyme activity – 1 mark</i> <i>linking rate of activity to volume of oxygen evolved – 1 mark</i></p>	1 1 1
(b)(i)	Protease <u>will break down proteins</u> ; into <u>smaller soluble molecules</u> that can be easily washed off	1 1
(b)(ii)	60	1
(b)(iii)	The optimal temperature of this enzyme is 60 °C whereas <u>human enzymes have an optimal temperature of 37 °C</u> . <i>*must make a comparison</i>	1 [total: 10]

END