West Spring Secondary School
MID-YEAR EXAMINATION 2019

BIOLOGY **6093**

SECONDARY 3 Express

Name _____ ( ) **Date** 09 May 2019

Class _____ **Duration** 1 hr 45 min

Additional Materials: NIL

READ THESE INSTRUCTIONS FIRST

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

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.

Section A
There are **fifteen** questions in this section. Answer **all** questions.
For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the one you consider correct and record your choice in the **boxes** provided on Page **7**.

Section B
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section C
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

At the end of the examination, fasten all your work securely together.

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

FOR EXAMINER'S USE	
Section A	/15
Section B	/45
Section C	/20
Total	/80

This document consists of **20** printed pages including the cover page.

Setter(s) Ms Zhou Siyang **[Turn over**

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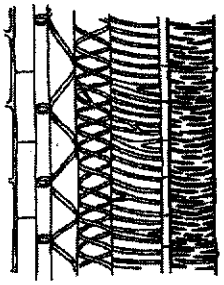
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Section A

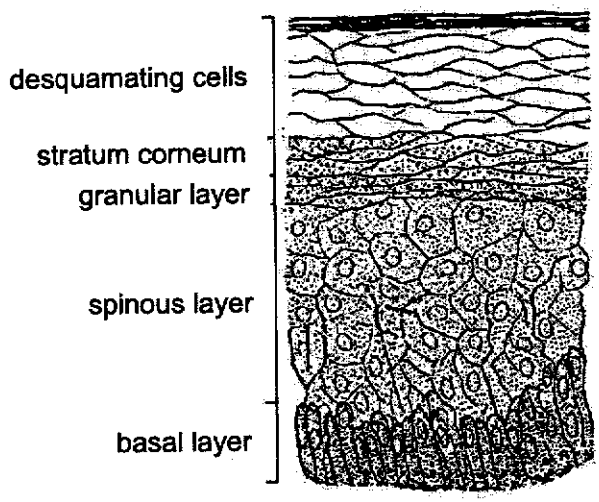
Answer **all** questions from this section in the boxes provided on Page **7**.

1 Which of the following correctly describes the plant structure shown?



	cell wall	nucleus	cytoplasm	lignin	chloroplasts
A	absent	absent	absent	present	absent
B	present	absent	absent	absent	absent
C	present	absent	absent	present	absent
D	present	present	present	present	present

2 The diagram shows the layers that are present in the epidermis of human skin.



Which term describes the epidermis of human skin?

A complex tissue
B organ
C organ system
D simple tissue

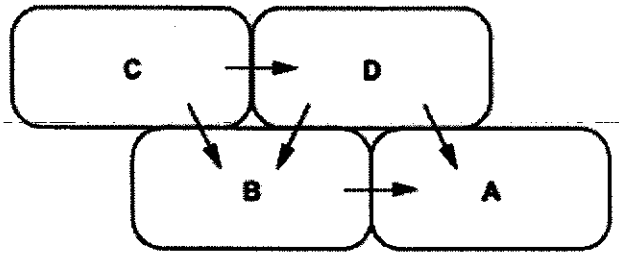
3 An *Amoeba* had its nucleus removed with the help of a fine glass tube. It was not damaged and for a few days, it continued to feed and move. However, it did not reproduce. Another *Amoeba*, which was intact with nucleus, reproduced twice in the same number of days. What can you conclude from this experiment, about the role of the nucleus?

A The nucleus contains DNA.
B The nucleus controls the normal activity of the cell.
C The nucleus is necessary for cell division.
D The nucleus is necessary for life.

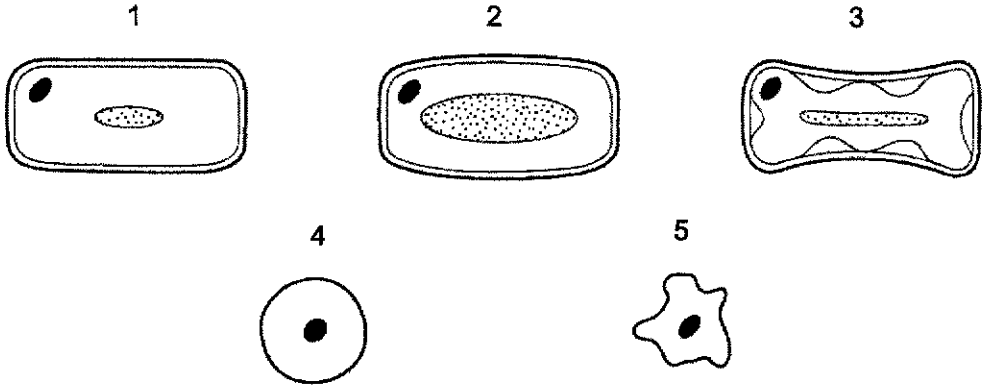
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4 The diagram shows the net movement of water by osmosis between four adjacent cells.

Which cell has the highest water potential?



5 Some plant and animal cells were placed in different concentration of salt solutions and the results are shown.



In which solution was/ were the cell(s) placed in?

	concentrated salt solution	dilute salt solution
A	1 and 2	3 and 5
B	1 and 4	3
C	2 and 4	1 and 3
D	3 and 5	2 and 4

6 Freshly-picked corn tastes sweet because of the high sugar content in the kernels. Enzyme in the corn converts the sugar to starch within one day of picking. The freshly-picked corn is usually immersed in boiling water for a few minutes and cooled to preserve its sweetness.

Which of the following best explains why the boiled corn kernels remain sweet?

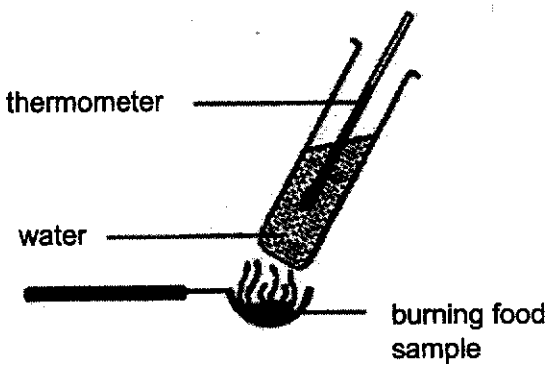
A Boiling activates the enzyme that converts starch into sugar.
B Boiling breaks down the starch molecules into sugar molecules.
C Boiling denatures the enzyme responsible for converting sugar into starch.
D Boiling kills a fungus on the corn that is needed to convert sugar into starch.

7 Which element in the molecule of urea shows that it is formed from amino acids and **not** glucose?

A carbon
B hydrogen
C nitrogen
D oxygen

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8 The diagram illustrates how four equal masses of different food samples were burned.



The temperature of the water was measured before and after each experiment and recorded as shown in the following table.

food sample	water temperature at the start of experiment / °C	water temperature at the end of experiment / °C
W	18	50
X	16	97
Y	19	35
Z	18	80

Which food sample probably contains the most and the least amount of fat?

	most amount of fat	least amount of fat
A	Z	Y
B	Y	Z
C	X	W
D	X	Y

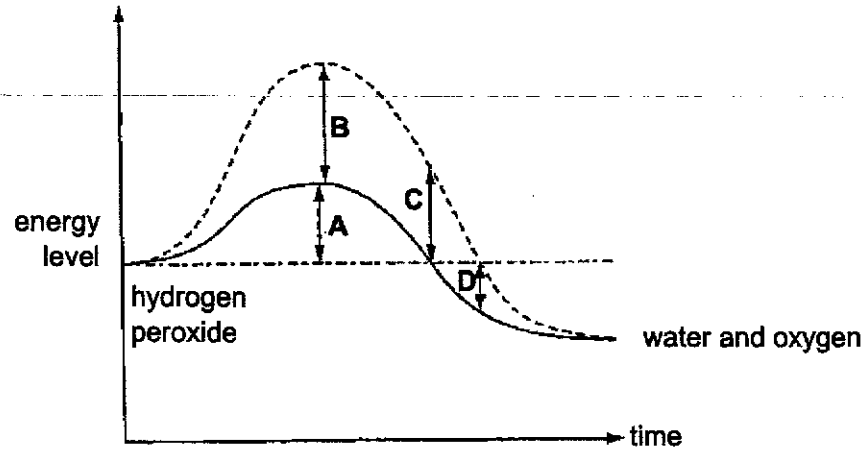
9 A food substance contains sucrose and protein.
What are the results of the food tests conducted on this food substance?

	biuret test	Benedict's test	iodine test
A	violet	blue	yellow
B	violet	red precipitate	yellow
C	blue	blue	blue-black
D	blue	red precipitate	blue-black

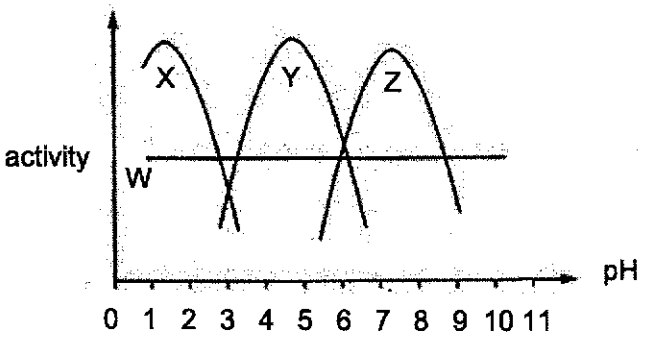
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10 The graph shows the energy level during the breakdown of hydrogen peroxide into water and oxygen, in the presence and absence of catalase enzyme.

What is the difference in activation energy of the reaction when the catalase enzyme is present and when it is absent?



11 The graph shows the effect of pH on the activity of four different types of enzymes.



Which pair of enzymes includes one from the stomach and one that is **not** affected by pH?

A W and X
B W and Y
C Y and X
D Y and Z

12 Four statements about an active site of human trypsin are given.

1. The shape of the active site changes when the temperature falls to 10 °C and does not return to normal when temperature returns to 37 °C.
2. The active site of the enzyme is complementary to the substrate molecule.
3. The specificity of an enzyme depends on the shape of its active site.
4. The shape of the active site changes at pH 2 and returns to normal when the pH increases to pH 8.

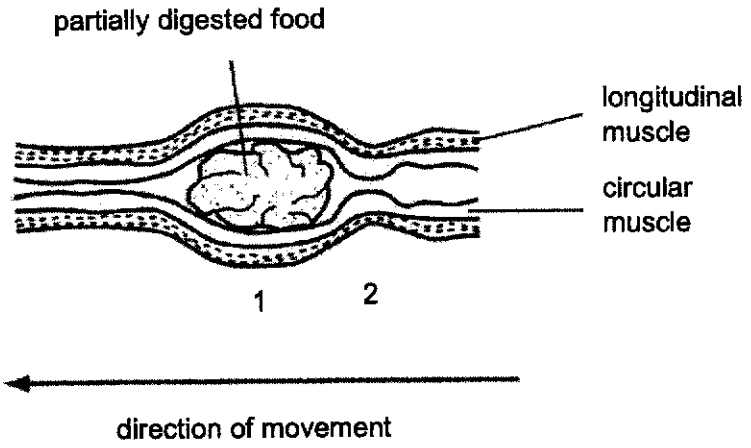
Which statements are correct?

A 1, 2 and 3
B 1 and 4 only
C 2 and 3 only
D 3 and 4 only

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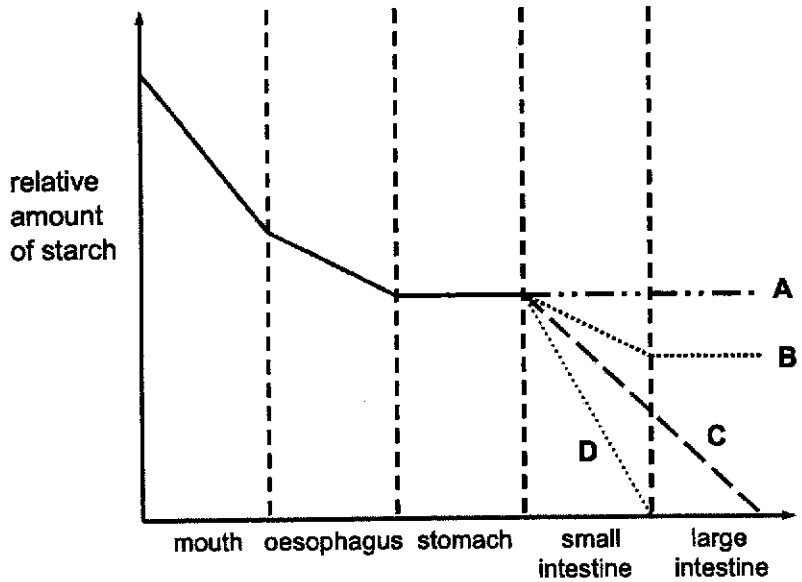
13 The diagram shows a section of the small intestine in which partially digested food is being pushed along.



Which row correctly shows the state of the longitudinal muscles at 1 and 2?

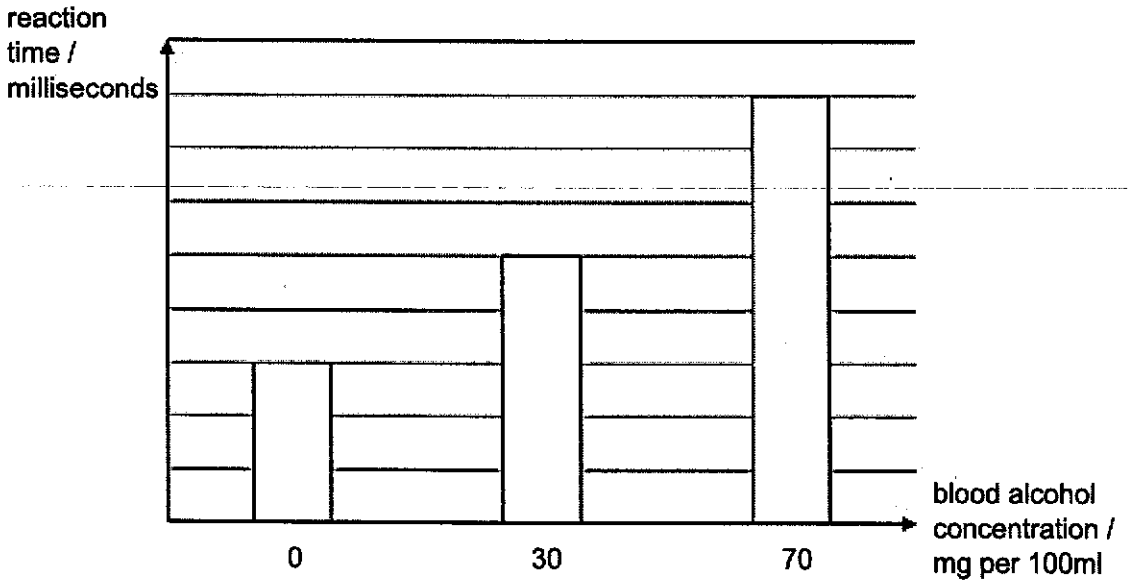
	1	2
A	contracted	contracted
B	contracted	relaxed
C	relaxed	contracted
D	relaxed	relaxed

14 Which line shows the relative amounts of starch in the small and large intestines as food moves along the alimentary canal?



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15 The bar graph shows the effect of varying alcohol consumption on a person's reaction time.



Which one of the following shows the conclusion that can be obtained from the bar graph?

A Increasing alcohol consumption increases the person's reaction time.
B Increasing alcohol consumption speeds up the person's reaction time.
C The higher the alcohol consumption, the greater the blood alcohol concentration.
D The higher the alcohol consumption, the greater the damage done to the liver.

Answer all questions from this section in the boxes below.

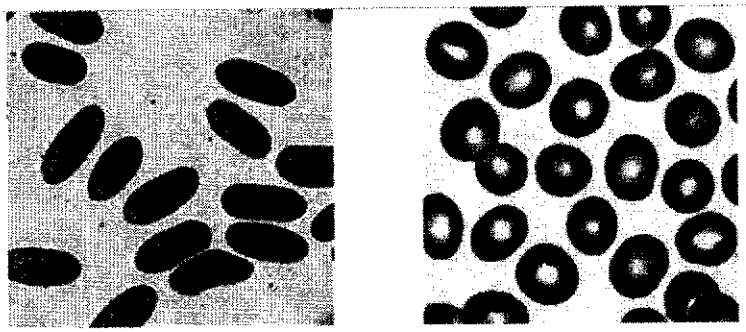
Q1	Q2	Q3	Q4	Q5
Q6	**Q7**	**Q8**	**Q9**	**Q10**
Q11	**Q12**	**Q13**	**Q14**	**Q15**

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Section B

Answer **all** questions from this section in the spaces provided.

1 Fig. 1.1 shows red blood cells from a chicken and human as seen under a light microscope.



chicken red blood cell human red blood cell

Fig. 1.1

(a) (i) Chicken red blood cells contain a structure that is **not** found in human red blood cells.

Label clearly on Fig. 1.1 the position and the name of this structure in chicken red blood cells. [1]

(ii) Explain **two** ways in which human red blood cells are adapted for their function.

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..... [2]

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(b) Human blood also contains white blood cells. One of the functions of white blood cells is to produce proteins called antibodies to fight bacteria.

Fig. 1.2 shows some organelles found in a white blood cell.

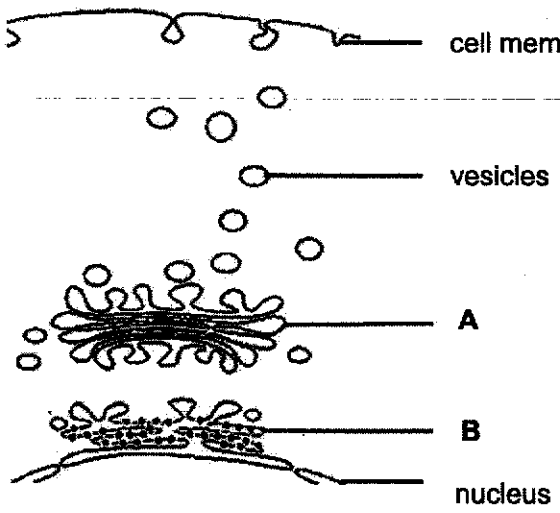


Fig. 1.2

(i) Name organelle **A**.

..... [1]

(ii) Describe **one** difference between the structure of organelles **A** and **B**.

.....

..... [1]

(iii) The white blood cell in Fig. 1.2 was placed in a solution containing a high concentration of radioactive amino acids. After some time, radioactivity was detected inside the cell, around organelle **B**.

Explain this observation.

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..... [3]

[Total: 8]

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2 A study was carried out to investigate the movement of different types of sugar across the intestinal epithelium of sheep. The set up used is shown in Fig. 2.1, where a short segment of epithelial tissue from the small intestine of a sheep was used, and tied at both ends to form a sac. A few similar sacs were used, each filled with a fixed volume of different sugar solutions with the same concentration. The sacs are then immersed in different beakers containing a fixed volume of water.

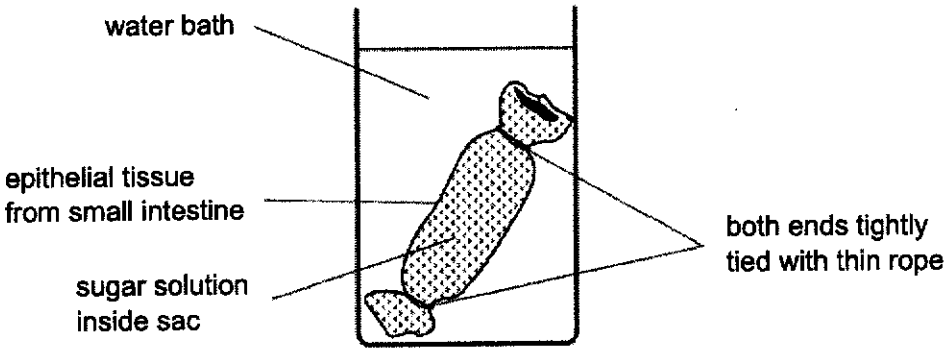


Fig. 2.1

The amount of each type of sugar that entered the water bath after ten minutes was recorded in Table 2.1. In addition, another similar set of experiments was carried out, in which cyanide poison was also added to the test solution, and the results recorded in the same table. Cyanide is a poison that interferes with the cellular respiration in cells.

Table 2.1

sugar	amount of sugar found in water bath/arbitrary units	
	normal intestine	poisoned intestine
glucose	115	33
galactose	100	53
fructose	40	37
xylose	32	31
arabinose	29	29

(a) Define the **two** processes involved in the movement of sugars across the intestinal wall.

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..... [2]

(b) Name the organelle inside the intestinal cells, where the cyanide is most likely to act on.

..... [1]

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(c) Which of the process(es) named in **(a)** is/are disrupted when cyanide was added to the solution? Give a reason for your answer.

.....

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..... [2]

[Total: 5]

3 Fig. 3.1 shows a *Stentor*, a unicellular organism, found in freshwater. When the concentration of salt inside the cell and in the surrounding differs, water might enter the *Stentor* from the surrounding freshwater. The organism then occasionally discharges excess water from its vacuole through pulsations.

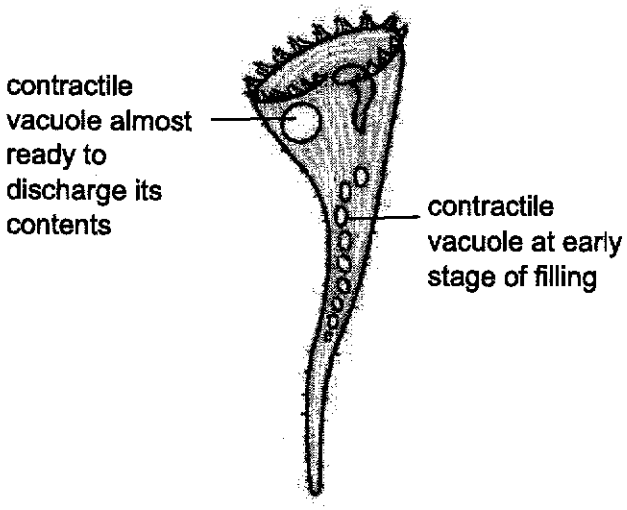


Fig. 3.1

In an experiment, a *Stentor* specimen was placed in solutions of different concentrations. The average time for each pulsation was recorded as shown in Table 3.1.

Table 3.1

concentration of salt solution / mol/ dm^3	average time for one pulsation / s
0.1	95
0.3	156
0.5	201
0.7	378

(a) Describe and explain the process whereby water enters the *Stentor*.

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..... [2]

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(b) Describe and explain the relationship between the concentration of salt solution and the average time for one pulsation.

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..... [3]

(c) Explain the importance of controlling water potential for *Stentor* living in freshwater environment.

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..... [2]

[Total: 7]

4 Fig. 4.1 shows information extracted from a popular canned drink among athletes.

Nutritional information per 100 ml		
Energy value	.....	113 kJ
Protein	.....	0 g
Carbohydrate	.....	6.7 g
Fat	.....	0.56 g

Ingredients:
Carbonated water, sucrose, glucose, citric acid,
Sodium citrate, sodium chloride, potassium phosphate
Natural and permitted flavourings and preservatives.

Fig. 4.1

(a) While promoting the canned drink, the salesman claims that it is a must-buy for athletes as it allows fast release of energy. With reference to the ingredients, suggest the reason behind the salesman's claim.

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..... [3]

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(b) The canned drink is subjected to the ethanol emulsion test. What would be observed?

.....

..... [1]

(c) After a fall, an athlete was told by the doctor to include more of a certain type of nutrients in his diet. Suggest what this nutrient may be and explain the doctor's advice.

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..... [2]

(d) The marathon is a long race of more than 42 kilometers. An enormous amount of energy is required to complete the race. A few days before the race, runners are advised to eat lots of sugary foods, which is a term known as 'carbo-loading'. This is so that runners can use the stored energy during the race day itself.

(i) What form are the sugars stored in the body before the race?

..... [1]

(ii) State **two** parts of the runners' bodies you would expect the sugars to be stored in.

..... [1]

[Total: 8]

5 A student conducted an experiment to test the nature of a solution obtained from the alimentary canal of a human. Four test tubes labelled **C** to **F** were placed in a water bath at 37°C for 15 minutes.

The contents of the test tubes are summarised in Table 5.1. At the end of the experiment, the tubes were shaken and the results were observed. The results are recorded in Table 5.1.

Table 5.1

test tube	egg white solution	liquid from human	dilute HCl	dilute NaOH	observation
C	2 cm^3	-	-	-	cloudy
D	2 cm^3	1 cm^3	5 drops	-	clear
E	2 cm^3	1 cm^3	-	5 drops	cloudy
F	2 cm^3	1 cm^3 (boiled)	5 drops	-	cloudy

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(a) What was present in the liquid that brought about the results of the experiment? Provide evidence from the results that supports your answer.

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..... [3]

(b) Identify the part of the alimentary canal of the human that this liquid was most likely extracted from.

..... [1]

[Total: 4]

6 Fig. 6.1 shows a part of the human digestive system.

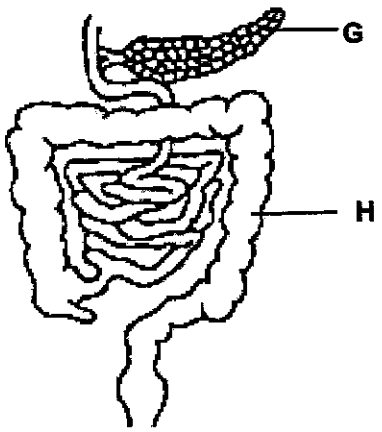


Fig. 6.1

A study was conducted to investigate the significance of structures **G** and **H** of the digestive system. Two groups of mice were surgically treated as shown in Table 6.1.

Table 6.1

group	surgical treatment
G	structure **G** was removed
H	structure **H** was removed

The two groups of mice were fed with the same type and amount of food over a one-week period and the observed effects of the surgical treatments were recorded.

Provide an explanation for each of the observations below.

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(a) Mice from Group **G** experience diarrhoea.

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..... [2]

(b) The average weight of mice from Group **H** decreased from 25 g to 17 g.

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..... [3]

[Total: 5]

7 Fig. 7.1 shows a villus of the small intestine.

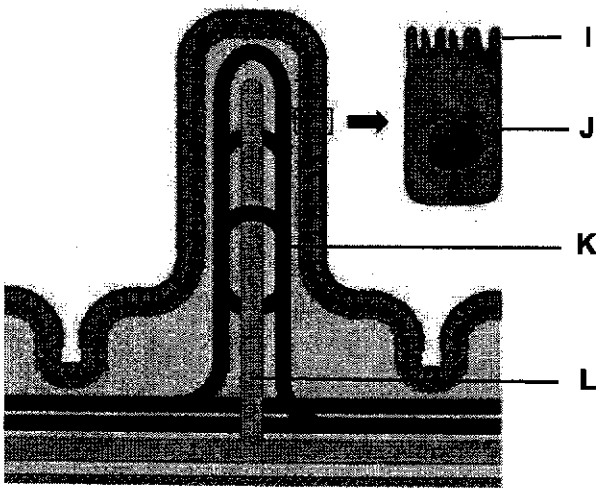


Fig. 7.1

(a) Label structures **I**, **J**, **K** and **L**.

I: .....

J: .....

K: .....

L: ..... [2]

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(b) List **three** features of the villus and explain how these features allows it to better carry out its function.

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..... [3]

(c) Some people are born with celiac disease, a disease in which the villi of the small intestines are destroyed. Describe **two** possible symptoms you might observe in a child with celiac disease and explain your answer.

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..... [3]

[Total: 8]

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Section C

Answer **all** questions from this section in the spaces provided.

8 The time needed to digest starch by salivary amylase at different temperatures was investigated. Both the starch (in suspension) and the salivary amylase solution were allowed to reach the required temperature before being mixed in equal quantities.

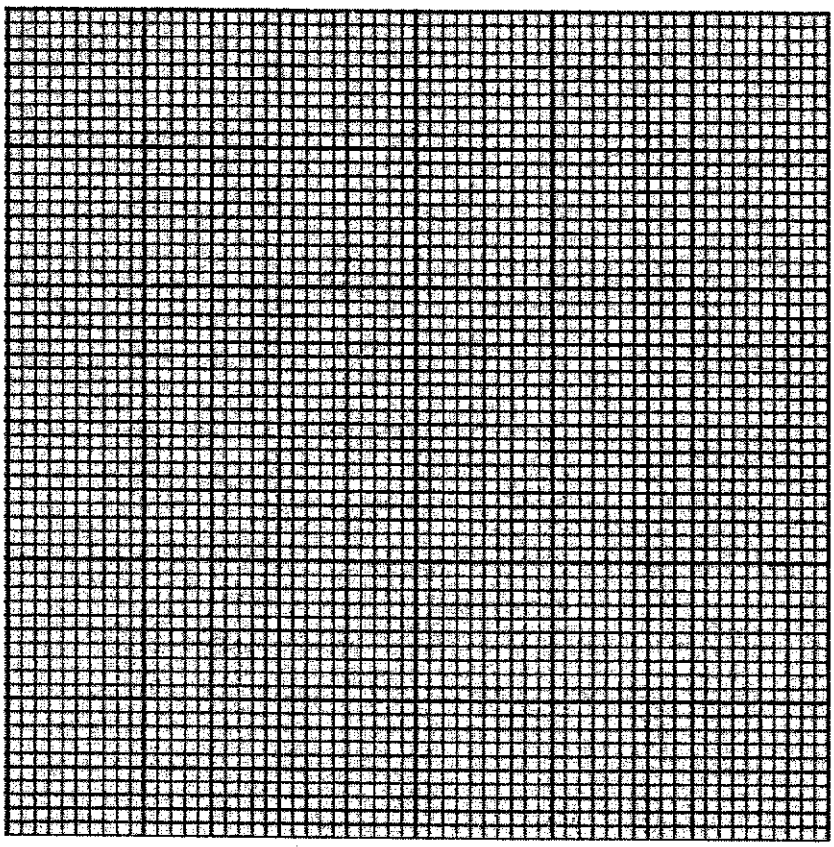
Samples of the mixture were removed at intervals of one minute and tested for starch.

The results of the experiment are shown in Table 8.1.

Table 8.1

temperature /°C	time to digest starch/minutes
15	25
20	15
25	8
30	5
35	3
40	7
45	26

(a) Draw a graph of these data on the grid.



[4]

(b) From the graph, at what temperature would starch be digested most rapidly?

..... [1]

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(c) Explain the effect of temperature on amylase activity on starch.

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..... [5]

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9 **(a)** Salmon is widely recommended by dieticians and doctors as it is a healthy source of protein and omega-3 fatty acids.

Describe and explain what happens to a piece of salmon from the point it is consumed to just before it enters the small intestine.

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..... [3]

(b) Gallstones are hard, crystal-like particles found in the gallbladder. They are formed when bilirubin, a yellowish pigment, and calcium salts in the bile solidify.

State and explain how a person's diet and lifestyle are affected in the event of gallstones **partially** blocking the bile duct.

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..... [3]

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(c) Fig. 9.1 shows the liver and blood vessels connected to it.

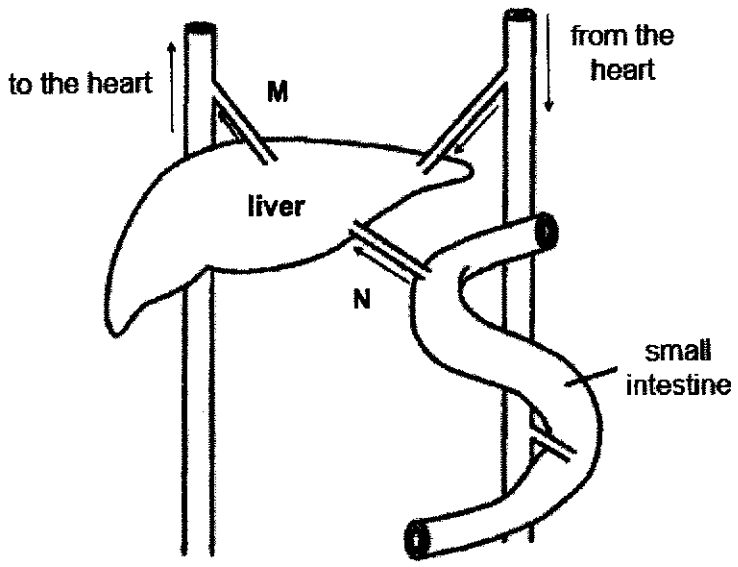


Fig. 9.1

Explain why the level of glucose in blood vessel **N** can vary throughout the day while that in **M** remains relatively stable. Identify blood vessel **M** and **N** in your answer.

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..... [4]

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Section A

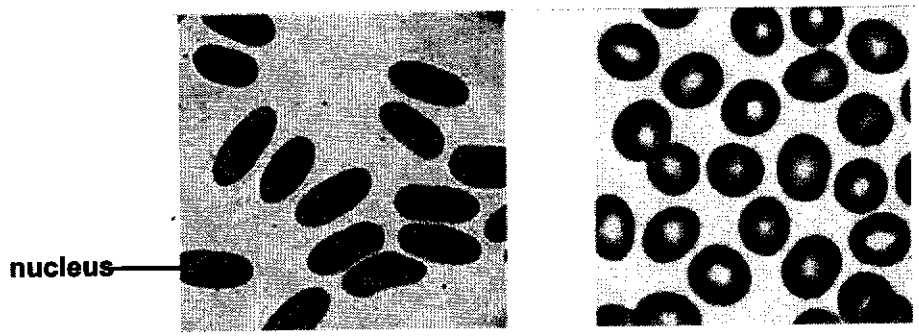
Answer all questions from this section in the boxes below.

Q1	Q2	Q3	Q4	Q5
C	A	C	C	D
Q6	Q7	Q8	Q9	Q10
C	C	D	A	B
Q11	Q12	Q13	Q14	Q15
A	C	B	D	A

Section B

Answer **all** questions from this section in the spaces provided.

1



chicken red blood cell human red blood cell

Fig. 1.1

(a) **(i)** Label clearly on Fig. 1.1 the position of this structure in chicken red blood cells. [1]

(ii) Any 2
Contains <u>haemoglobin to carry oxygen</u> from lung to all parts of the body. [1]
<u>No nucleus</u> to carry <u>more haemoglobin</u> hence <u>more oxygen</u> [1]
Circular and <u>biconcave</u> shape to <u>increase the surface area to volume ratio</u> to allow <u>faster diffusion</u> of oxygen. [1]
<u>Elastic</u> to <u>squeeze</u> through to narrow capillaries. [1]

(b)

(i) Golgi apparatus/ golgi body

(ii) Organelle B has <u>ribosomes</u> attached but organelle A does not/
Organelle B is continuous with the nuclear envelope but organelle A is not.

(iii) The concentration of radioactive amino acids outside the cell was higher than the concentration of amino acids inside the cell. [1]
Amino acids enter the cell by diffusion. [1].
Amino acids are used by ribosomes on organelle B/ rough endoplasmic reticulum to synthesise proteins [1]

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2

(a) Diffusion is the net movement of sugar from a region of higher concentration to a region of lower concentration. [1]
Active transport is the process in which energy is used to move the sugar across a membrane, against its concentration gradient (OR from a region of lower concentration to one of higher concentration). [1]

(b) Mitochondria [1]

(c) Active transport [1]
Cyanide added prevented cellular respiration. Energy cannot be released for active transport. [1]

3

(a) There is a lower water potential inside the Stentor cells [1]. Water enters the cells by osmosis [1] across the partially permeable membrane.

(b) The higher the concentration of salt solution, the longer/slower it takes for one pulsation. [1]
The higher the concentration of the salt solution, the lower the tendency of water to enter the cell/ the lower the concentration gradient. [1]
As a result, it takes a longer time for the vacuole to fill up and thus the time taken for each discharge is longer. [1]

(c) It is important to keep the water potential under control as water would enter the organism if water potential difference is too high. [1]
This would cause the cell to expand and eventually burst. [1]

4

(a) There are glucose/sucrose [1] in the drink. There is no need to digest glucose/glucose can be absorbed immediately into bloodstream/sucrose is easier to digest [1].
Glucose is used in cellular respiration, to release energy [1]

(b) A cloudy white emulsion is formed [1]

(c) Protein [1] Proteins are needed for the synthesis of new protoplasm for growth and repair of worn-out cells. [1]

(d)
(i) glycogen [1]

(ii) Liver and muscles [1]

5

(a) Pepsin, an enzyme [1]
The liquid cannot work in test tube F shows it had been denatured in high temperature [1]
The liquid works best in acidic condition in test tube B to digest egg white/protein but cannot work in alkaline condition in test tube E. [1]

(b) Stomach [1]

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6

(a) Pancreas is removed [1]. Pancreas produce enzymes such as pancreatic amylase, pancreatic lipase and trypsin to digest food. With pancreas removed, starch, protein and some fats cannot be digested [1].

(b) Large intestine is removed [1]. It is responsible to absorb remaining [1] water and mineral salts [1].

7

(a) Any 2 for 1m
I: Microvilli
J: Epithelial cell (A: cell membrane)
K: Blood capillary
L: Lacteal

(b) Any 3
Has microvilli to increase the surface area to volume ratio for faster/more efficient absorption. [1]
Numerous blood capillaries to carry away absorbed substances to maintain steep concentration gradient for faster diffusion [1]
Epithelium layer one cell thick for shorter diffusion distance/faster diffusion [1]
Epithelium cells have abundant mitochondria to provide energy for active transport of substances [1]

(c) (any 2 correct symptoms and 1 correct reason)
Malnutrition/Stunted growth/Weight loss/fall sick easily/weak + Unable to absorb digested nutrients needed for growth/synthesis of protoplasm;
Diarrhoea + unable to absorb water;
Anemia + unable to absorb iron;
Fatigue + unable to absorb glucose needed for respiration

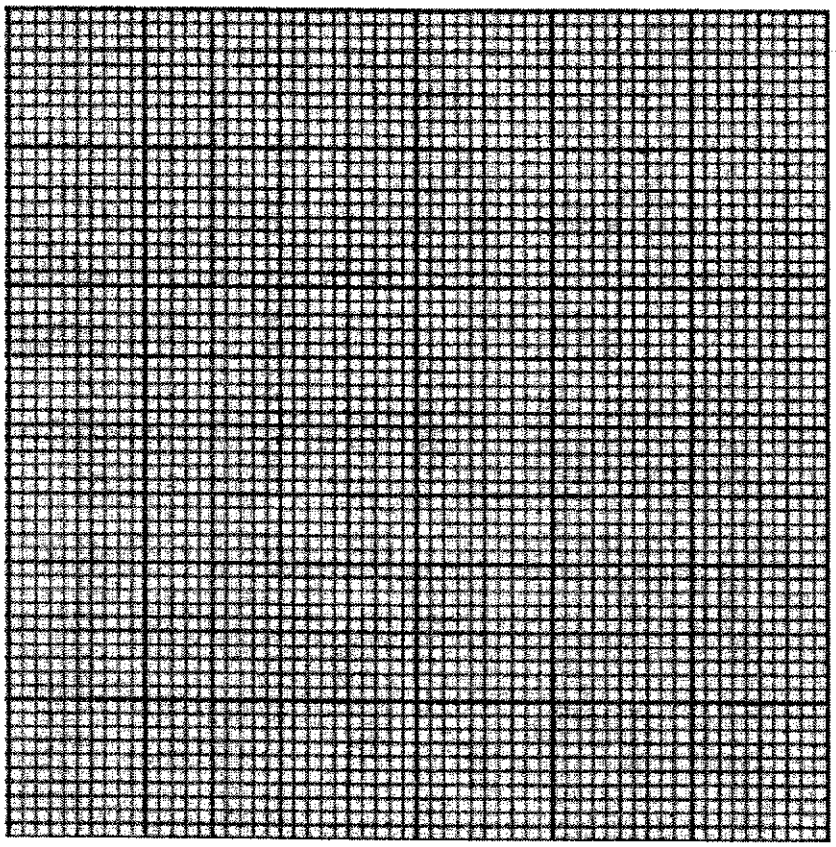
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Section C

Answer **all** questions from this section in the spaces provided.

8

(a) Scale [1]; Axis [1]; Points [1] Best fit line [1]



(b) 35°C [1]

(c) Any 5 points

Enzymes are inactive [1] at low temperatures as they possess low kinetic energy. Thus the amylase and starch molecules will not collide frequently and low production of enzyme-substrate complexes (only need to mention once)[1].

As temperature increases, enzyme activity increase [1] as the amylase and starch molecules will have increased kinetic energy, causing more frequent collision and greater production of enzyme-substrate complexes.

The optimum temperature of the enzyme activity is highest [1] is when kinetic energy the rate of collision and the production of the enzyme-substrate complexes are the highest.

Beyond the optimum temperature, the amylase molecules will denature, this will cause a decrease in rate of activity [1] and the active sites lose its original shape and can no longer fit [1] the substrate molecule.

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9 (a) Any 3 points

In the mouth, the teeth chews and breaks down the salmon into small pieces to increase the surface area for enzymes to act on more efficiently. [1]
Salivary glands secrete saliva that contains mucus to soften the food. [1]
The tongue rolls the food into boli before it is swallowed down the oesophagus. [1]
In the oesophagus, peristalsis pushes the food down towards the stomach. [1]
In the stomach, peristalsis continues to mix and churn food that becomes liquefied chyme. [1]
Pepsin that digests proteins into polypeptides. [1]

(b) Any 3 points

The person should consume a low fat diet / more frequent bowel movements / long term medication to emulsify fat/the person will have diarrhea. [1]
Gallstones blocking the bile duct would reduce the amount of bile released into the small intestine. [1]
Bile emulsifies fats into smaller globules to increase the surface area to volume ratio [1]
for lipase to digest fats into fatty acids and glycerol. [1]
Hence, fat digestion would be less efficient with less fats emulsified, digested and absorbed into the bloodstream. [1]

(c) First point and any other 3 points

N is hepatic portal vein while M is hepatic vein [1]
After a meal, glucose is absorbed in the small intestine and carried via the hepatic portal vein (N) to the liver, hence blood glucose levels rise. [1]
During periods of starvation, no glucose is absorbed in the small intestine and the levels of glucose in the hepatic portal vein (N) decreases. [1]
However, blood glucose levels remain constant in the hepatic vein (M) due to the action of insulin and glucagon. [1]
When blood glucose levels rise after a meal, insulin released by the pancreas stimulates the liver to convert excess glucose into glycogen to be stored in the liver. [1]
When blood glucose levels drop after periods of starvation, glucagon released by the pancreas stimulates the liver to convert glycogen back to glucose. [1]
Hence, blood glucose concentration is kept relatively constant when glucose enters the blood via hepatic portal vein.

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