East Spring Secondary School
Towards Excellence and Success

Name: _____ ( )

Class:

2nd Semester Examinations 2016
Secondary 3 Express

BIOLOGY Paper

5158

Thursday
13 Oct 2016

2 hr 15 m
0745 - 1000

Additional materials:
OTAS

INSTRUCTIONS TO CANDIDATES

1. Write your name, class and register number in the spaces provided on the cover page.
2. **Section A [25 marks)**
   Answer **all** questions in this section on the **OTAS** provided. For each question there are four possible answers **A, B, C, D.**
   Section B [45 marks]
   Answer all questions.
   Write your answers on the spaces provided in the question paper.
   Section C [30 marks]
   Answer any **all** questions.
   Write your answers in the spaces provided on the Question Paper. Write an **E** (for Either) or an **O** (for Or) next to the number **8** in the grid beside to indicate which question you have answered.
3. Calculators are allowed.

For Examiner's Use	
Section A	
Section B	
6	
7	
8	
Total	/100

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

This question paper consists of **25** printed pages including the cover page.

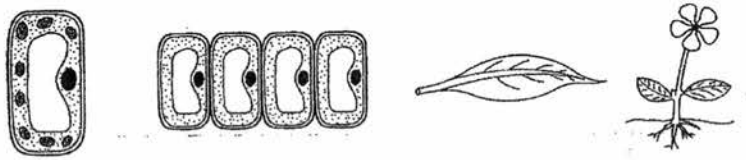
Section A (25 marks)
Answer **all** questions on the **OTAS** provided

1. Which row shows the most likely number of chloroplasts in three types of cell in a leaf?

	guard cells	palisade mesophyll	epidermis
A	0	17	6
B	6	0	17
C	6	17	0
D	17	6	6

2. Which diagram shows one organ only?

A B C D



3. On a dry, sunny day, how does water vapour move through the stomata of a leaf?

   A out of the leaf by diffusion
   B out of the leaf by osmosis
   C into the leaf by diffusion
   D into the leaf by osmosis

4. Which of the following is a description of transpiration?

   A movement of water through the cells of the leaf
   B movement of water from the roots to the leaves
   C exchange of gases between the leaf and the atmosphere
   D loss of water vapour from the leaves and stems of a plant

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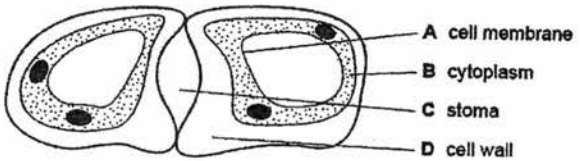
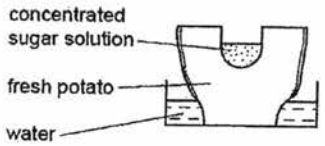
5. The diagram shows a student's drawing of guard cells.

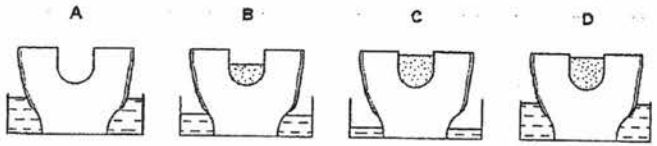
Which label is **not** correct?



6. The diagram shows an experiment using a potato.



Which shows the results of the experiment after 24 hours?



7. Two enzyme-controlled reactions are shown below.

amino acids $\xrightarrow{\text{enzyme 1}}$ proteins

proteins $\xrightarrow{\text{enzyme 2}}$ amino acids

From these reactions, what deduction can be made about enzymes?

A Enzyme can build up large molecules.
B Enzymes can only break down large molecules.
C Enzyme 1 has been changed to enzyme 2
D Enzyme 2 slows down the production of amino acids.

8. The roots of plants take up nitrates from the soil.

What are the nitrates used to make?

A glucose
B protein
C fat
D starch

9. Polyphenol oxidase which is found in bananas turns food molecules in the banana cells into dark coloured products which make the banana go brown or black when oxygen is present.

Which of the following would determine if polyphenol oxidase is an enzyme or not?

A To check if an unpeeled banana goes black.
B To check if the banana goes black in the absence of carbon dioxide
C To deprive the banana of oxygen and see if it goes black.
D To boil the banana and see if it goes black.

10. The liver of an animal is removed surgically and measurements of the dog's blood amino acid and urea concentration are made. Which one of the following would you expect to happen during the next 24 hours?

A An increase in both the amino acid and urea concentration.
B An increase in the amino acid concentration and a decrease in urea concentration.
C A decrease in both the amino acid and urea concentration.
D A decrease in the amino acid concentration and an increase in urea concentration.

11. Which of the following vessels contains blood with the lowest concentration of oxygen?

A Pulmonary artery
B Aorta
C Renal artery
D Hepatic artery

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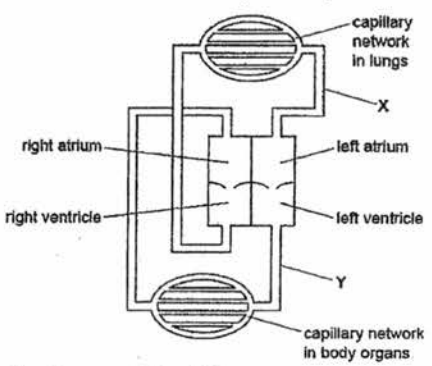
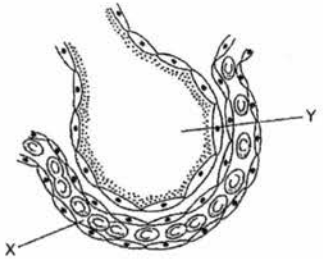
12. The diagram shows the circulatory system of a mammal.



What describes the blood in vessels **X** and **Y**?

	X	Y
A	oxygenated	oxygenated
B	oxygenated	deoxygenated
C	deoxygenated	oxygenated
D	deoxygenated	deoxygenated

13. The diagram shows a section through an alveolus and a capillary.



Why does carbon dioxide move from **X** to **Y**?

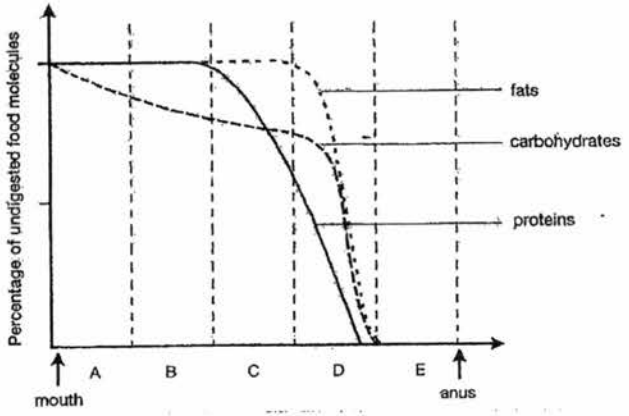
A Diffusion of carbon dioxide can only be out of the blood.

B Air has a lower concentration of carbon dioxide than blood.

C Carbon dioxide is replaced with oxygen.

D Carbon dioxide moves more freely in air than in blood.

14. The diagram below shows the percentage of proteins, carbohydrates and fats digested as they pass through the alimentary canal of Man.



What is part **C** likely to be?

A mouth

B oesophagus

C stomach

D duodenum

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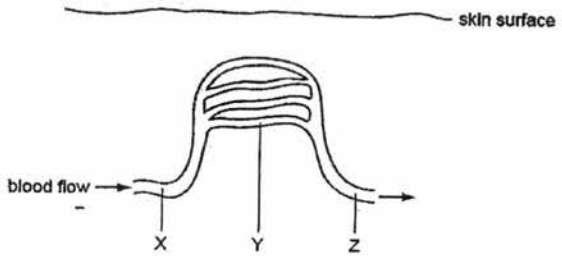
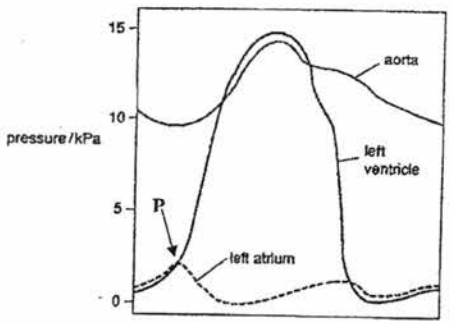
15. The diagram shows some blood vessels near the surface of the skin.



If vasodilation occurs at X, what happens to the blood flow at Y and Z.

	Y	Z
A	increases	increases
B	decreases	decreases
C	increases	stays constant
D	decreases	stays constant

16. The graph below shows the pressure changes that occur in the left side of a mammalian heart during one cardiac cycle.



What happens at point P when the pressure in the left atrium decreases?

A The atrioventricular valves open.
B The atrioventricular valves close.
C The semilunar valves open.
D The semilunar valves close.

17. During a long-distance run on a hot day, Justin produced a large amount of perspiration. As a result, his kidneys changed the rate of urine production. Why is this change important?

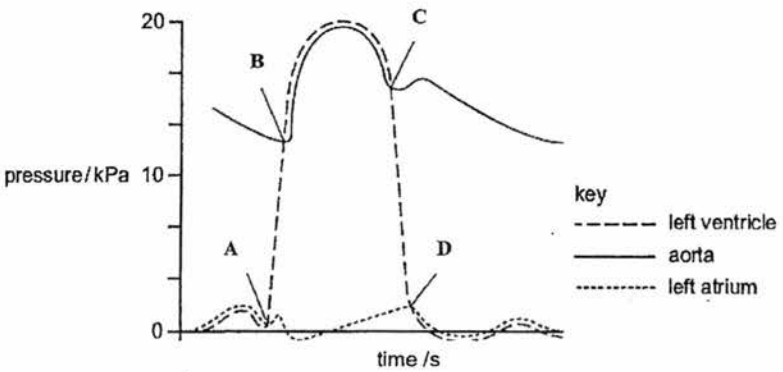
A Increased urine production allows more water to remain in the bloodstream.
B Increased urine production removes waste products formed as a result of running.
C Decreased urine production increases the amount of salt in blood plasma.
D Decreased urine production allows the body to conserve water.

18. In an experiment investigating the transport of food substances in plants, some leaves of a plant were exposed to carbon dioxide containing radioactive isotopes of carbon. After two days of being left in the outdoor garden, samples of tissues were taken from different parts of the plant and tested for radioactivity.

Which plant tissues would test positive for the presence of radioactive substances?

A only the leaves that were exposed to radioactive carbon dioxide
B only the shoots and buds
C roots only
D all parts of the plant

19.



At which point (A, B, C or D) is the 'dub' sound heard?

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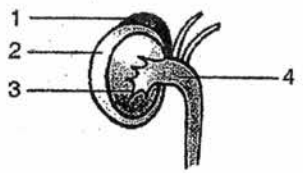
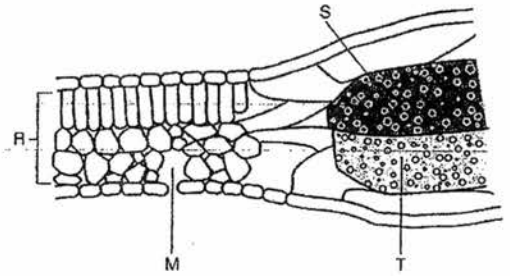
20. The diagram below shows the structure of the mammalian kidney.



Where does ultrafiltration occur?

A 1 **C** 3
B 2 **D** 4

21. The diagram below shows the longitudinal section through the leaf of a green plant.



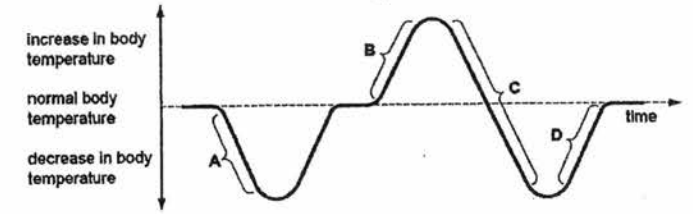
Match the labelled tissues with their correct main function.

	M	R	S	T
A	Gas exchange	Photosynthesis	Food transport	Water transport
B	Photosynthesis	Gas exchange	Food transport	Water transport
C	Gas exchange	Photosynthesis	Water transport	Food transport
D	Photosynthesis	Gas exchange	Water transport	Food transport

56

22. The graph shows the variation in a person's body temperature over a period of time.

Which temperature change is likely to cause most sweating?

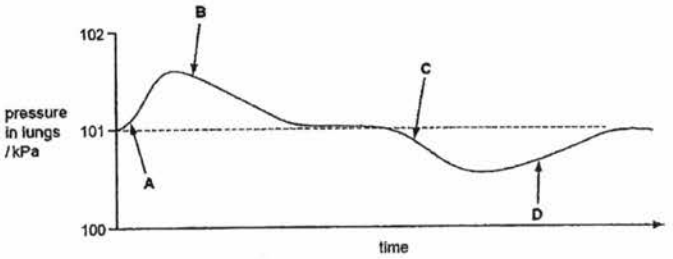


23. Which two substances are transported in the phloem?

A protein and starch
B starch and sucrose
C amino acids and protein
D amino acids and sucrose

24. The diagram shows changes in air pressure inside the lungs during a complete cycle of breathing. Atmospheric pressure is 101 kPa.

Which position on the graph marks the point at which the ribs are beginning to raised?



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25. What substances are dissolved in the liquid which passes along the ureter to the bladder of a healthy person?

	glucose	protein	salts	urea
A	present	present	absent	absent
B	present	absent	present	present
C	absent	absent	absent	present
D	absent	absent	present	present

Turn over for Section B

Section B (45 marks)
Answer **all** questions.
Write your answers in the spaces provided.

For examiner's use

1. When the heart beats, it pumps blood round the body. Fig 1.1 shows the components of blood as seen through a light microscope.

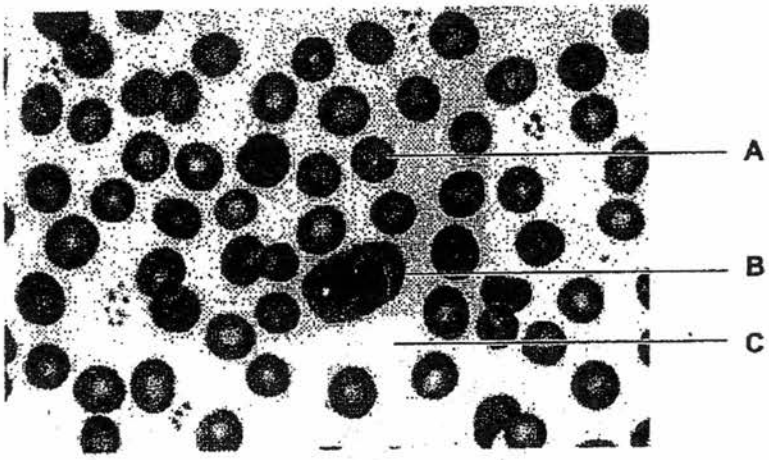

Fig 1.1

a) Name the blood components labelled **A**, **B**, and **C** in Fig 1.1

State one function for each component.

Write your answers in Table 1.1

label	name of blood component	one function of the blood component
A		
B		
C		

Table 1.1

[6]

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b) Fig 1.2 shows a diagram representing part of the human circulatory system. The arrows indicate the direction of blood flow.

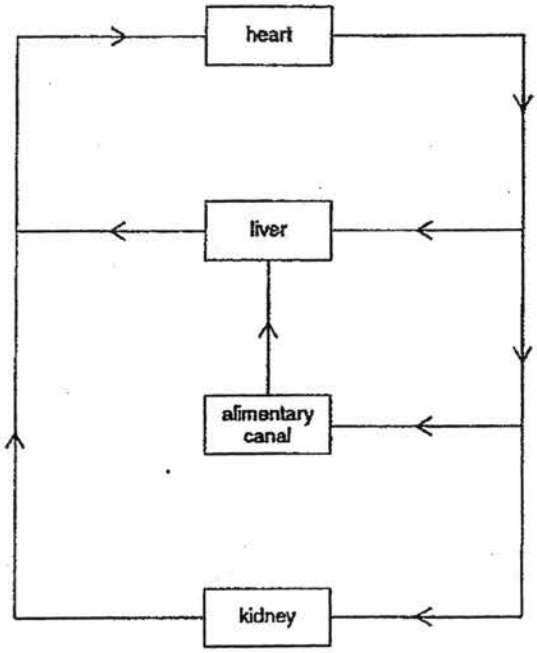

Fig 1.2

On Fig 1.2, label the lines that represent

i) the vena cava;

ii) the hepatic portal vein.

[2]

c) Some students carried out an investigation into the effect of exercise on heart rate. Their results are shown in Table 1.2.

average heart rate at rest / beats per min	average heart rate after exercise / beats per min
72	132

Table 1.2

Explain why exercise caused the average heart rate to increase.

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.....[3]

[Total: 11]

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2 a) (i) Name the process by which plants manufacture carbohydrates from raw materials

..... [1]

Starch is an insoluble carbohydrate stored inside plant cells.

(ii) Explain why starch is a more suitable storage substance than the soluble sugar glucose.

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..... [2]

b) Before a plant can use the stored starch, it must first be broken down by an enzyme. Fig 2.1 shows the *'lock and key'* hypothesis of how enzymes work.

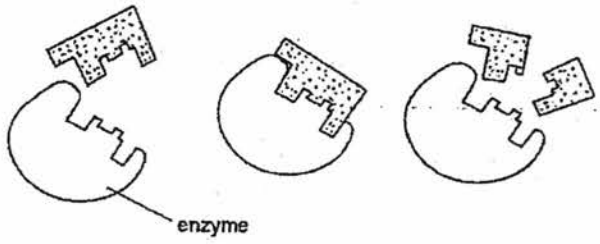

Fig 2.1

Describe the *'lock and key'* hypothesis of enzyme action shown in Fig 2.1.

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..... [3]

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c) In an investigation, two plants were grown in a solution containing mineral ions including nitrate and magnesium. Plant **A** was provided with air containing oxygen and plant **B** was provided with air from which the oxygen has been removed. Fig 2.2 shows the plants after a period of growth in these conditions.

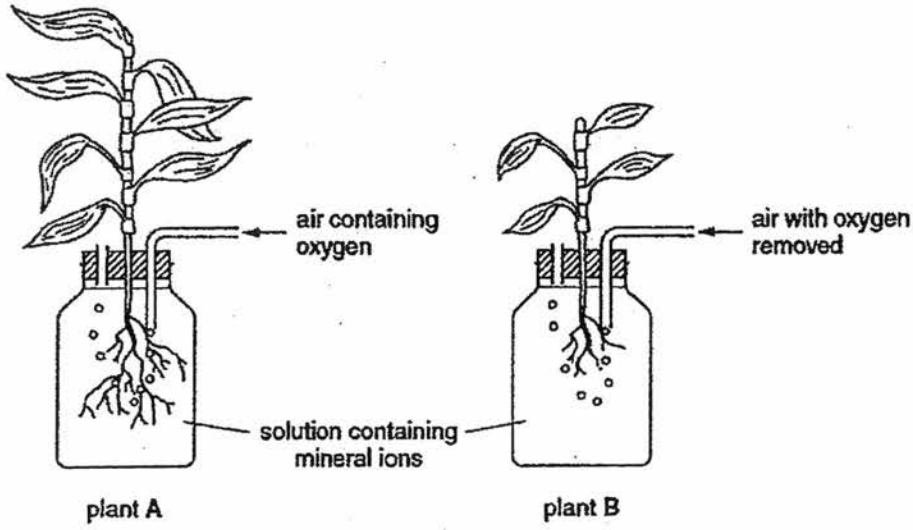

Fig 2.2

Suggest reasons for the increased growth of the plant in the solution supplied with air containing oxygen.

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..... [4]

[Total: 10]

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3 The pie chart in Fig 3.1 gives an indication of the length of time (over a 24-hour period) spent by food in each region of the alimentary canal.

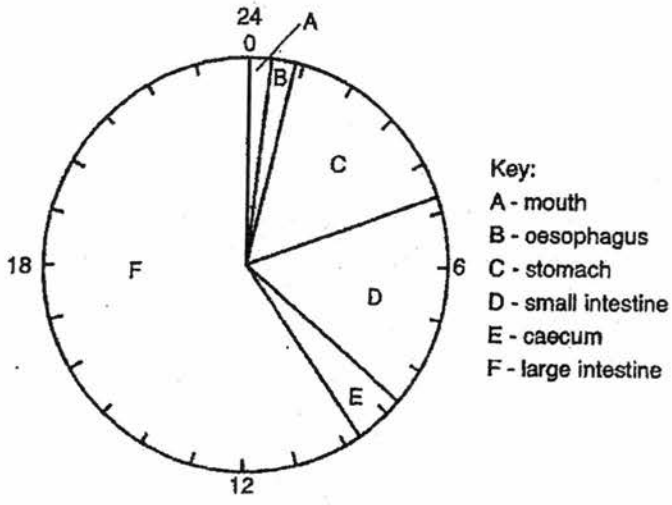

Fig 3.1

a) What changes do food go through during the short period of time in the mouth?

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..... [2]

b) How long does food remain in the stomach?

..... [1]

c) Explain why it is not possible to survive if a person's entire small intestine is removed.

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..... [2]

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d) In which region of the alimentary canal does food spend most time?

..... [1]

e) Suggest a possible explanation for your answer to (d).

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..... [1]

[Total: 7]

4 Fig 4.1 and Fig 4.2 show a section through the skin of a person at two different body temperatures.

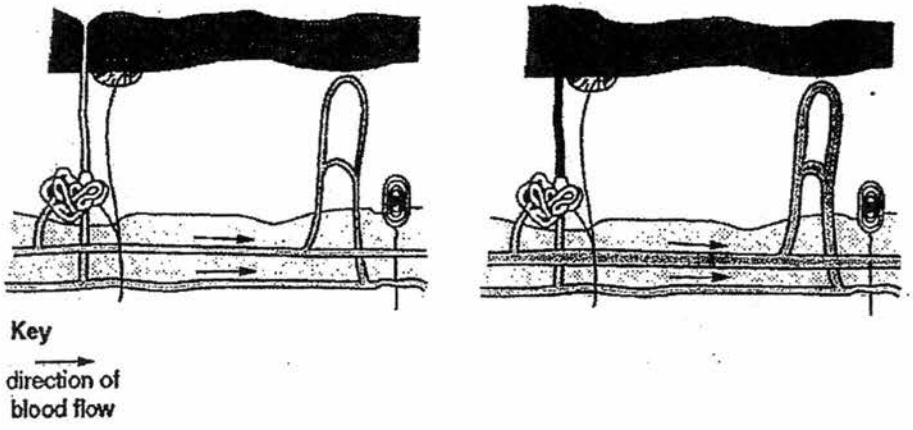

Fig 4.1 Fig 4.2

a) On Fig 4.1, identify and label each of the following.
(i) a sweat gland
(ii) a temperature receptor
[2]

b) (i) State what has happened to the body temperature to cause the changes shown in Fig 4.2 compared with Fig 4.1.

.....[1]

(ii) State **two** reasons for the answer you have given in **(b)(i)**.

1 .....

2 .....[2]

c) (i) On Fig 4.1, label and name the type of blood vessel that constricts when the body temperature falls. [2]

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(ii) Explain the effects caused by constriction of the blood vessels you have named in (c)(i).

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.....[4]

[Total:11]

5. Fig. 5.1 shows the components in a kidney dialysis machine.

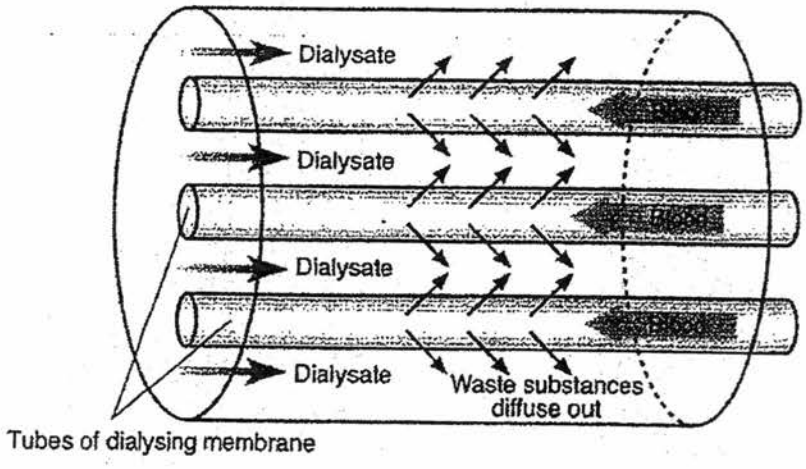

Fig 5.1

a) Explain why the dialysate and the blood must flow in opposite directions to each other.

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.....[2]

b) State two substances that must be present in the dialysate at concentrations similar to that of the patient's blood.

1 .....[1]

2 .....[1]

c) Suggest a suitable temperature for the dialysate entering the machine and give a reason for your answer.

.....

.....[2]

[Total: 6]

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SECTION C (30 Marks)

Answer THREE questions in this section.

Question 8 is in the format of an EITHER / OR question. Only one part should be answered.

For examiner's use

6. Some students carried out an investigation to find the effect of the shape of an animal's body on heat loss from the bod. Heat loss was measured as a decrease in temperature in °C. They used two plastic containers, **A** and **B**, to represent two differently shaped bodies of an equal volume. (not drawn to scale)

The containers used are shown in Fig 6.1.

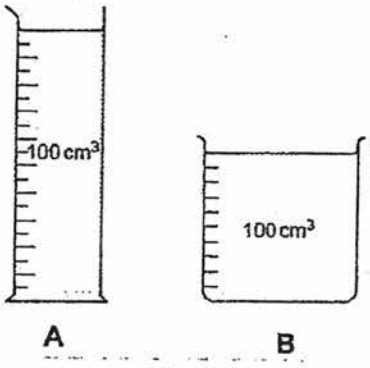

Fig 6.1

The two containers, **A** and **B**, were each filled with 100 cm³ of hot water. A thermometer was used to measure the temperature of the hot water in each container immediately. These temperatures were recorded every two minutes, for a total of eight minutes, as shown in Table 6.1.

Time / min	Temperature/ °C	
	A	**B**
0	65	65
2	55	58
4	50	54
6	46	50
8	40	48

Table 6.1

a) Calculate and record the overall decrease in temperature of the water for each container and record these two values below

Show your working

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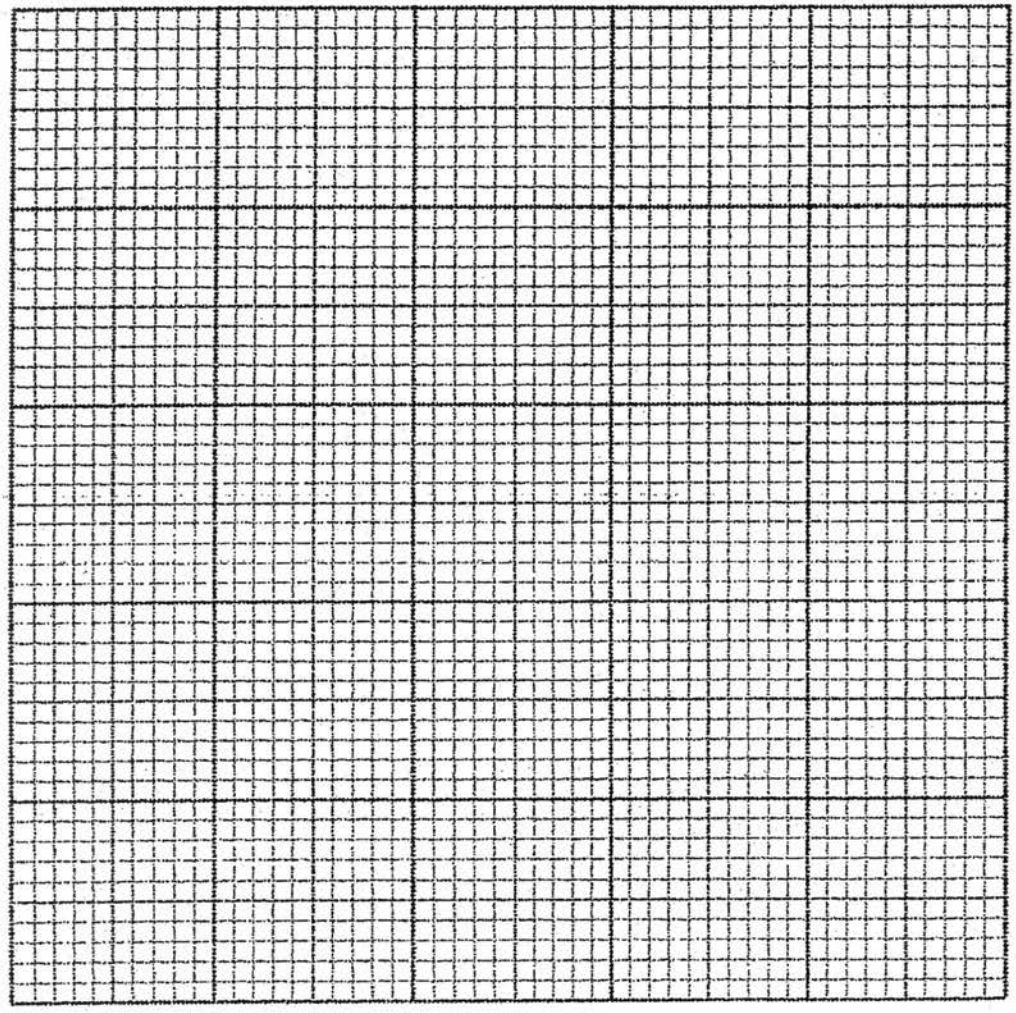
A ..... °C B ..... °C

[1]

b) (i) Construct a graph to show the decrease in temperature of the water with time, in containers **A** and **B**, using the results in Table 6.1. Use the same axes for both sets of data.



[5]

(ii) Describe these results.

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.....[2]

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(iii) The shape of a container does affect heat loss from the container.

Suggest an explanation for this.

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.....[2]

[Total: 10]

7) a) Explain the effect of strenuous physical activity on the pH of the blood.

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.....[3]

b) Describe the part played by the cells lining the trachea.

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..... [3]

c) Explain what may happen to the cells lining the trachea in a smoker, and how this may affect the person's health.

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..... [4]

[Total: 10]

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Question 8 is in the form of an **Either/Or** question. Only one part should be answered.

8E Aphids are insects that feed by piercing the phloem of soft, young shoots. Aphids then use their sharp, hollow mouthparts for sucking up their nutrients from the plant.

a) Explain why phloem is more suitable for this purpose than any other plant tissue.

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..... [3]

b) Suggest and explain the effect on the plant shoot if a large number of aphids are feeding at the same time over a period of several weeks.

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..... [7]

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[Total:10]

8O a) Decribe the structure and function of a chloroplast.

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..... [4]

b) Describe and explain how
(i) temperature and
(ii) light intensity
affect the rate of photosynthesis.

i).....

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ii).....

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..... [6]

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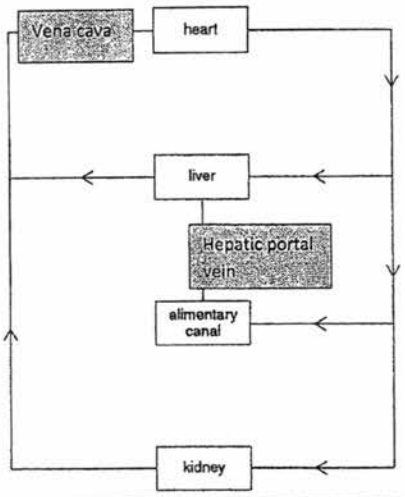
b		2	
c	more muscle contraction / muscle activity (in exercise); more energy required ; more respiration (occurs) ; more oxygen / oxygenated blood / glucose / sugar needed (by muscle cells) ; more carbon dioxide / heat produced ; (and so) more blood pumped round body / blood pumped round body faster;	max 3	"more" (AW such as "increased") must be mentioned at least once in the account – if not, max = 2
2ai	photosynthesis;	1	
ii	starch stays inside cell (not easily transported)/ glucose can move R glucose used up; does not lower water potential inside cell; prevents water gain by cells; correct ref. osmosis / diffusion	2	
b	correct ref. active site; / Enzyme action depends on the presence of active sites substrate perfect fit / complementary shape / specific to active site / Enzyme is the lock; substrate is the key Form the enzyme-substrate complex	3	

3E Biology 2016 2SE Mark Scheme

Section A

1	C		11	A		21	C
2	C		12	A		22	B
3	A		13	B		23	D
4	D		14	C		24	C
5	A		15	A		25	D
6	C		16	B			
7	A		17	D			
8	B		18	D			
9	D		19	C			
10	B		20	B			

Section B

Question	Expected Answer			Mark	Additional Guidance
1a	label	name of blood component	one function of the blood component	6	function must match component, but if component is incorrectly named, and the function given for it is a correct one, allow 1 mark
	A	red (blood) cell	transports oxygen / O_2; R – carries / contains oxygen		
	B	white (blood) cell R – phagocytes / lymphocytes (component of blood)	antibody formation / phagocytosis / kills bacteria or pathogens / AW;		
	C	plasma	transport of blood cells / soluble nutrients (digested food / hormones / urea / carbon dioxide / plasma proteins / heat;		

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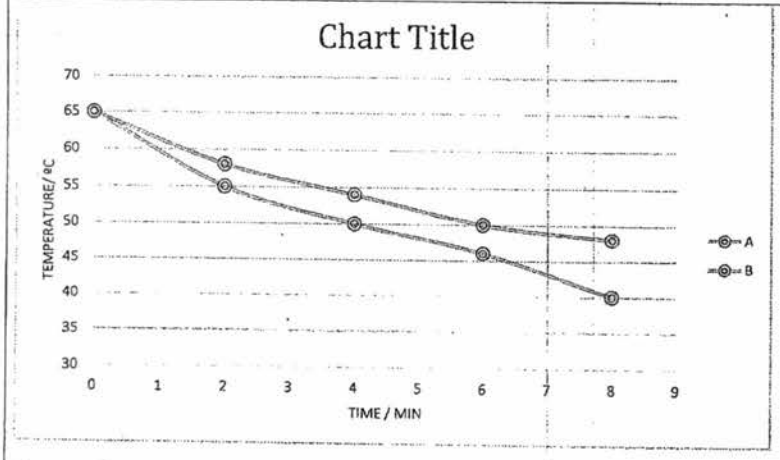
	less sweat produced; ref to latent heat of vaporisation;		vessels supplying blood to it
5a	To ensure that there is always a constant/maintained gradient in the concentration of the substances in the blood and the dialysate So that diffusion is efficient / rapid	2	R – content/concentration gradient alone
b	Mineral salts / amino acids / fatty acids & glycerol / glucose	2	1 each; max 2 R – food/nutrients/undigested form
c	Body temperature; (36.5 – 37.5°C) to ensure that the proteins and enzymes in the blood are maintained at optimal temperatures	2	
Section C			
6a	A: 65-40 = 25 B: 65-48 = 17	1	
bi	 time on x axis, temperature on y axis + full labels ;	5	x-axis: t/min, y-axis: temp/°C tolerance ± ½ small square

	reactions take place to convert substrates to product/ product molecule products leave + active site / enzyme re-useable / unchanged;		
c	respiration can occur (presence of oxygen) provides energy for root (cells / hairs) to increased uptake of ions; by active transport; ref. energy requirement of active transport; - Result in (any two of the following that leads to better plant growth) (increased) chlorophyll production + magnesium; (increased) photosynthesis (since more chlorophyll); (increased) amino acid / protein production + nitrates;	4	
3a	Mechanical digestion / mastication where food is broken down into smaller pieces by the chewing action of the teeth; Chemical digestion where starch in food is broken down into maltose by salivary amylase/ ptyalin	2	
b	3.8-4 hrs	1	
c	Complete digestion of carbohydrates, proteins and fats is completed in the small intestine / duodenum; Absorption of digested food takes place in the ileum; OR If small intestine is removed, the person will be deprived of nutrients as they cannot be digested and hence absorbed, hence he cannot survive	2	
d	Large intestine	1	
e	Absorption of water and mineral salts take place in the large intestine; Undigested matter accumulates in the rectum before it is passed out as faeces	1	R – undigested food stays in the large intestine
4ai	label line must touch the sweat gland;	1	Label on (i) = gland
ii	label line must touch some part of receptor under Malpighian layer;	1	(ii) = temp receptor
bi	(temperature / it) increases / rises;	1	R cooler / decreases OWTTE
ii	In either order: sweat; wider blood vessels / capillaries / more blood;	2	R veins
ci	arteriole; the upper horizontal blood vessel labelled;	2	A Artery
ii	less blood (flows) to capillaries (R capillaries constrict) blood carries heat / less heat carried; less heat lost by skin / radiation/conduction or convection; less blood (flows) to sweat glands)	4	A less heat lost by blood Capillaries cannot constrict or dilate – it is the blood

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	contains sucrose / sugar / carbohydrate; contains amino acids; in solution / water; easily absorbed/ not lignified / is softer **AW**; **R** starch / glucose / mineral ions **Ig** nutrients		
b	1. impaired growth **AW** / death; 2. amino acids used to make protein; 3. less / no new cytoplasm/ protoplasm; 4. less sucrose or carbohydrate; less glucose; 5. for use in respiration; 6. energy used; for any named purpose; 7. may introduce viruses / disease; damage to plant **AW**; **Ig** wilting	max 7	
8Oa	• structure/organelle in plant/leaf cells or named plant cell; • contains chlorophyll • a green chemical/pigment/molecule in chloroplast • traps/harnesses/absorbs/converts light • contains enzymes for photosynthesis Chloroplast organelles found in plants Chlorophyll is present in chloroplast is a green pigment that absorbs light energy and convert it to chemical energy contains enzyme for photosynthesis	4 Any 4	
bi	(temperature) • photosynthesis is enzyme-controlled and enzymes are affected by temperature • rate increases with increased temperature • beyond a certain point / optimum temperature, increase of temperature causes decrease of rate/ rate highest at optimum and decrease thereafter • enzymes work faster with increased temperature but high temperature denatures enzymes	3 Any 3	controlled by limiting factors stated in either (i) or (ii)
ii	(light intensity) • more energy/light absorbed by chlorophyll • higher the light intensity the faster the rate • up to a point, beyond that point, further increase in light intensity does not increase the rate any faster / rate remains constant	3 Any 3	

	only one linear scale on each axis, both using at least half the grid ; all points clearly plotted ; two continuous lines between the points / two smooth curves / two lines of best fit; key or label to distinguish between the two sets of data		
ii	drop in temperature in both containers / AW ; / AW / comparative statement (e.g. both decrease similar amounts) / temperature falls most quickly (in both) in the first 2 minutes / ref. to early rate; in A the drop is greater With reference to data; A decrease by 25°C compared to B decrease 17°C over 8 mins	2	
iii	larger surface area (SA) loses more heat ; by named heat loss ;	2	A ref. surface area : volume ratio A radiation / evaporation /convection / conduction
7a	pH decreases; increased rate of aerobic respiration; more carbon dioxide (into blood plasma); forms (carbonic) acid; anaerobic respiration occurs (during strenuous exercise); lactic acid produced;	3	
b	gland cells produce mucus; to trap dust; and bacteria / pathogens (R germs); cilia; to move mucus + up AW; moisten air / warm air; before it enters the lungs	3	
c	cilia paralysed / destroyed / killed AW; by tar/ irritants airways blocked with mucus / mucus builds up / excess mucus produced (A mucus not removed); narrower airways breathing difficulty / breathlessness;(smoker's) cough; pathogens not removed / enter lungs / bacteria proliferate;tendency to infection / disease or named caused by pathogen; (lung / tracheal cancer / emphysema; / bronchitis) ref. to the effect of decreased oxygen uptake;	4	must be made with reference to trachea
	OR (Chronic bronchitis) epithelium lining of trachea becomes inflamed, leads to excessive mucus production Cilia becomes paralyzed and mucus cannot be removed/ builds up, narrowing airway; leading to breathlessness or coughing this can lead to emphysema – persistent coughing; alveoli walls to break leading to decreased oxygen intake		
8Ea	within reach/nearer to surface	3	

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