West Spring Secondary School

PRELIMINARY EXAMINATION 2018

Biology **6093/02**

SECONDARY 4 EXPRESS

Name _____ ( ) **Date** 13 Sep 2018

Class _____ **Duration** 1 h 45 min

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on the cover page.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A (50 Marks)
Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.
Show **all** relevant working.

Section B (30 Marks)
Answer all the questions.
Write your answers in the spaces provided on the Question Paper.

Electronic calculators may be used

Information for Candidates
You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.
The number of marks is given in [ ] at the end of each question or part question.

FOR EXAMINER'S USE	
Section A	/50
Section B	/30
Total	/80

This document consists of **18** printed pages including the cover page.

Setter(s) Mdm Ho Soo Yin **[Turn over]**

Section A

Answer **all** questions.

Write your answer in the spaces provided.

1 Fig. 1.1 shows a food web in an ecosystem.

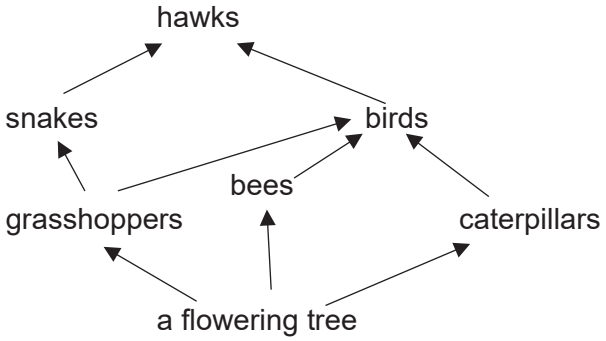

Fig. 1.1

(a) Draw a pyramid of numbers for a food chain involving caterpillars.

[1]

(b) It is known that consumers at the highest trophic level receive the highest amount of insecticides. Based on the pyramid of numbers you have drawn in **(a)**, explain why this is so.

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(c) Explain the observations of the following populations when snakes are removed from this food web.

(i) The grasshopper population increases initially but decreases afterwards.

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(ii) The caterpillar population was constant for a while but decreases afterwards.

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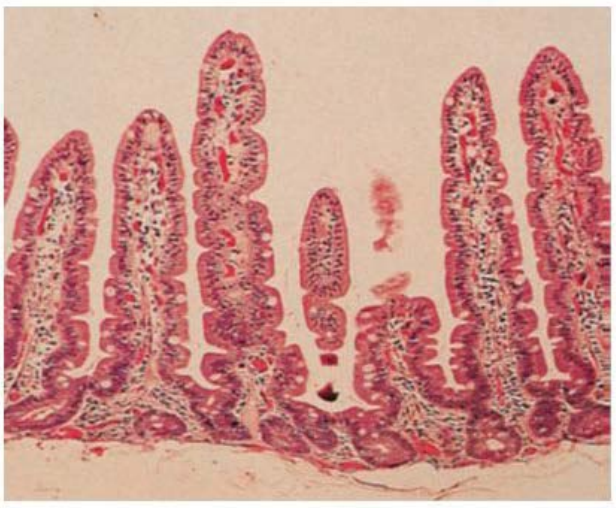
[Total: 9]

2 A surgeon carried out a biopsy on a child who was not gaining the weight expected for his age. A small sample of tissue was removed from inside the child's small intestine.

Fig. 2.1 shows the appearance of the villi in a normal healthy child and that of the child patient's small intestine of the same age. Both diagrams are to the same scale.



healthy child

child patient

Fig. 2.1

(a) With reference to Fig. 2.1, state one difference between the villi of the healthy child and that of the patient.

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.....[1]

(b) Describe and explain three **other** features of a healthy small intestine that help to maximise the absorption of digested food.

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(c) The child was diagnosed as suffering from coeliac disease. This is a condition in which an individual lacks a particular enzyme needed to digest gluten. Gluten is a protein found in wheat. A dietician was asked to advise the family on a suitable diet for the child. The child's parents found it hard to understand why the child could digest proteins present in meat but was unable to digest gluten. How might the dietician have explained to them, using his knowledge of enzymes?

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.....[3]

[Total: 7]

3 Fig. 3.1 shows the structure of a male flower of a maize plant.

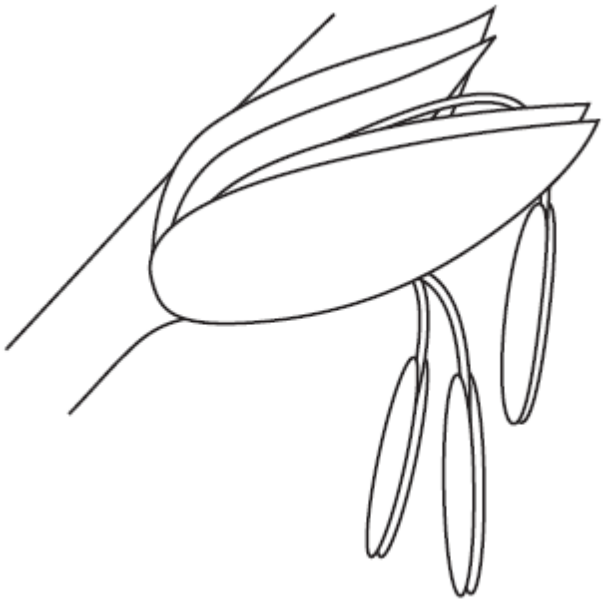

Fig. 3.1

(a) With reference to Fig. 3.1, explain how two features of this flower adapt it for wind pollination.

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.....[2]

(b) The corn borer is an insect pest of maize. The larvae feed on the leaves of the maize plants. The adults can fly but do not feed on maize plants.

Much of the maize that is grown in the USA has been genetically modified to produce Bt toxin, which is lethal to insects that feed on the leaves. However, many populations of the corn borer have now evolved resistance to the Bt toxin.

Explain how this resistance could have evolved.

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(c) The recessive allele, r, of the gene in corn borers confers resistance to Bt toxin. Larvae that are homozygous for the normal, dominant allele R, or that are heterozygous, are killed when they on Bt maize.

State the genotype of the corn borers that successfully turn from larvae into adults in the fields where Bt maize is grown.

.....[1]

(d) In order to reduce the number of corn borers resistance Bt toxin, farmers in the USA are required to grow up to 50% of their maize as non-Bt varieties. The non-Bt maize is grown in separate areas close to the fields of Bt maize. This is called the High Dose Refuge (HDR) strategy.

Almost all corn borer larvae feeding on this non-Bt maize have the genotypes RR or Rr. The HDR strategy assumes that, when these become adults, they will interbreed with the adults developing in the Bt maize fields.

Explain how the HDR strategy could reduce the proportion of corn borers that are resistance to the Bt toxin.

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.....[2]

[Total: 8]

4 Fig. 4.1 shows a kidney nephron and its blood supply.

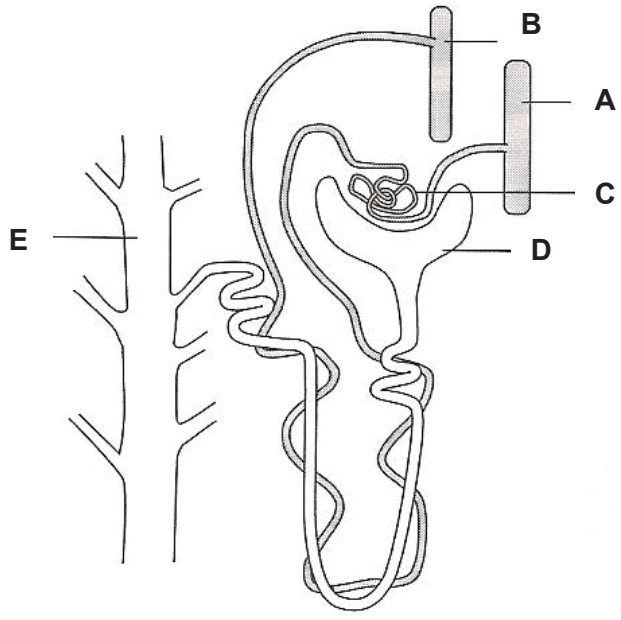

Fig. 4.1

(a) Name the parts labelled **A** and **C**.

A: .....

C: .....[2]

(b) Table 4.1 shows the composition of samples obtained from **C** and **E**.

Table 4.1

substance	composition in **C** / g/cm^3	composition in **E** / g/cm^3
water	91	9.4
urea	0.02	2.4
glucose	0.1	0.0
protein	7.5	0.0
salts	0.5	1.1
creatinine	0.002	0.13

Some materials from **C** were not found in **E**. Explain what has happened to these materials.

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[Total: 6]

5 Fig. 5.1 shows a section of lung tissue from a smoker.

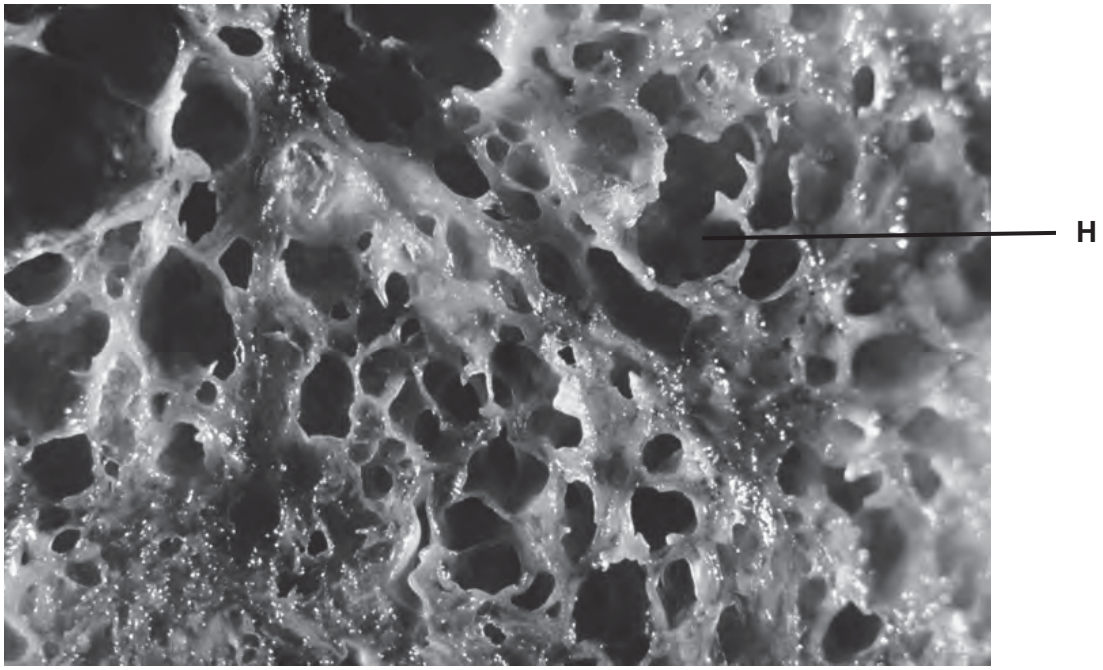

Fig. 5.1

In a smoker, the walls between the gas exchange structures in the lungs can break down, resulting in the damaged features visible in Fig. 5.1. One of these damaged features is labelled **H**.

(a) (i) Name the gas exchange structures which are damaged in Fig. 5.1.

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..... [1]

(ii) Name the smoking-related disease resulting in the damaged feature labelled **H** in Fig. 5.1.

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..... [1]

(b) Smoking-related diseases may increase the risk of respiratory diseases of the gas exchange system. Describe **and** explain how smoking can increase the risk of these diseases.

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(c) From one cigarette, a smoker will inhale between 14 and 20 mg of carbon monoxide.

Describe the effects of carbon monoxide on haemoglobin.

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[Total : 7]

6 Fig. 6.1 shows a graph of the number of people, worldwide, estimated to be newly infected with the human immunodeficiency virus (HIV) in the years 1990 to 2008.

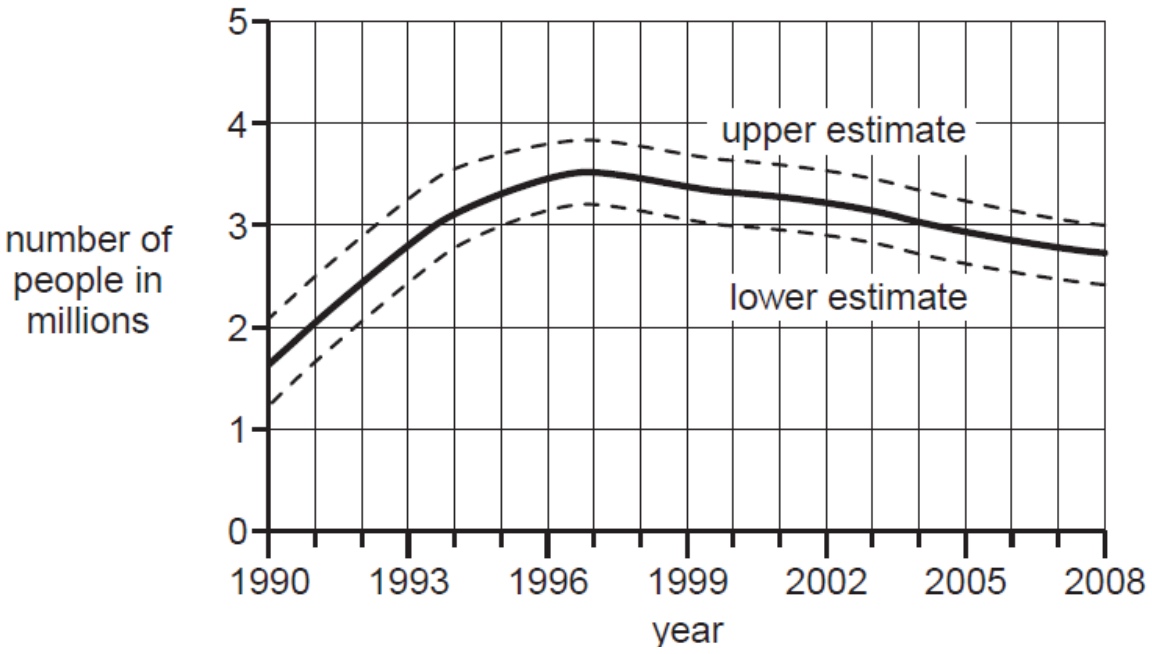

Fig. 6.1

(a) Use the information in Fig. 6.1 to describe the changes in the number of people newly infected with HIV.

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(b) Suggest the possible explanations for the decrease in the number of people newly infected with HIV.

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[Total: 5]

7 Fig. 7.1 shows the stages in the process of genetic engineering to produce the hormone insulin.

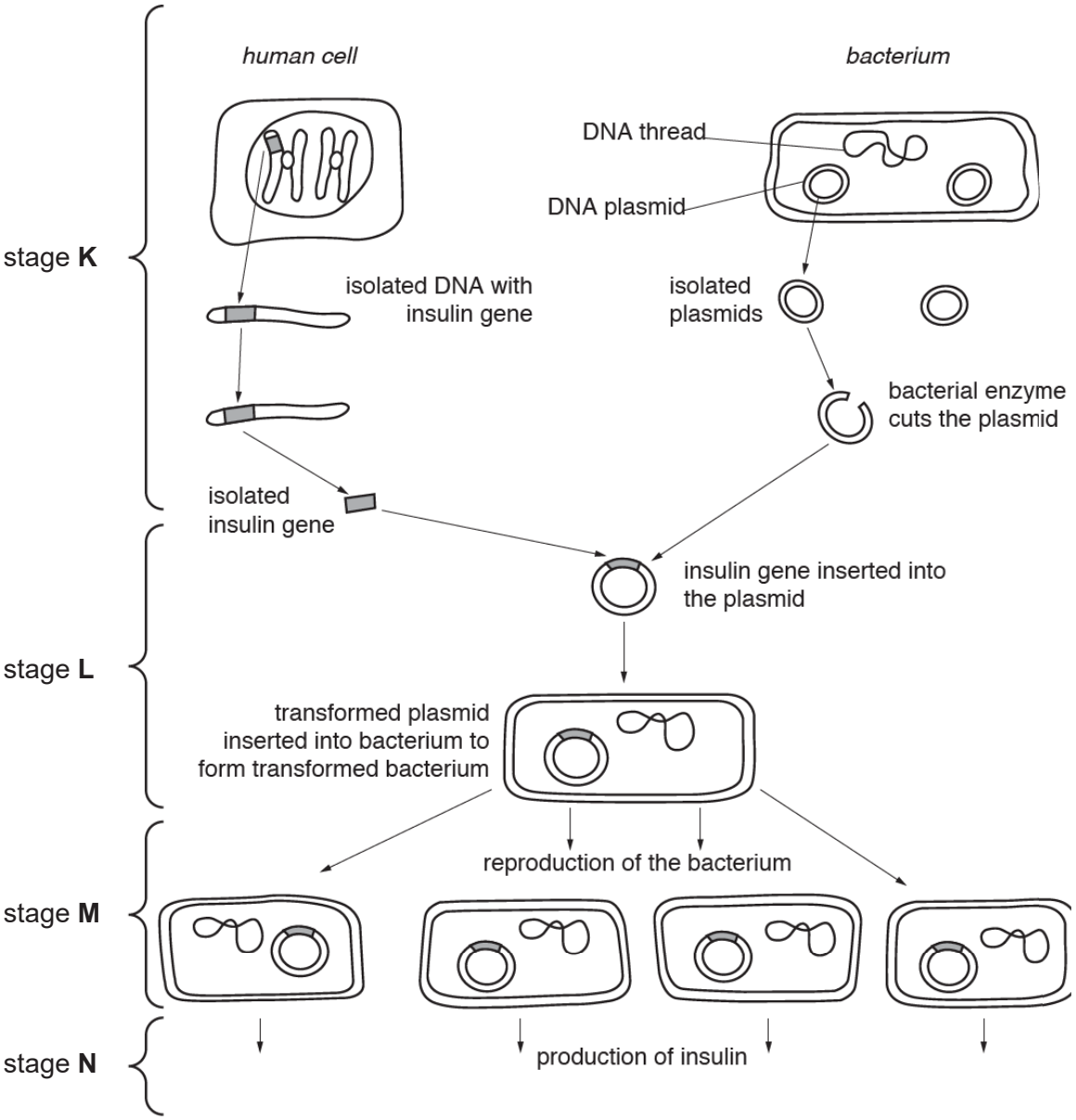

Fig. 7.1

(a) State the type of reproduction that takes place in stage **M** of Fig. 7.1. Use your knowledge of the process of cell division to explain why it is important that this type of reproduction occurs.

type of reproduction .....

explanation.....

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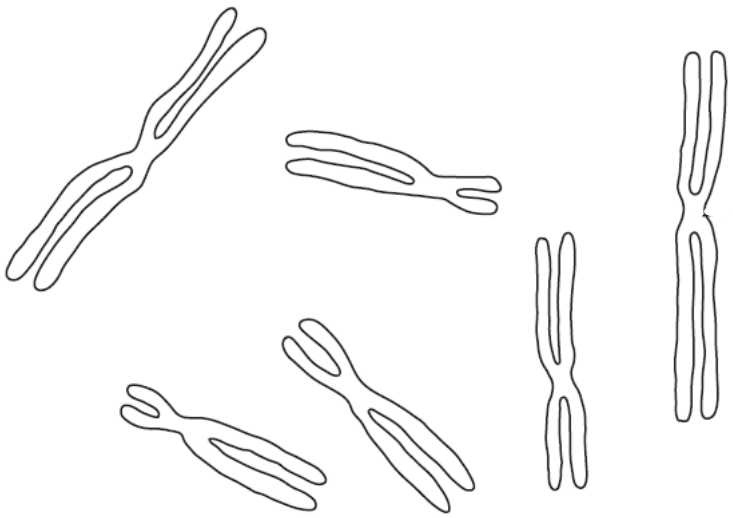
.....[3]

(b) Name the condition in humans that is treated using insulin produced by the bacteria in stage **N** of Fig. 7.1.

.....[1]

(c) Fig. 7.2 shows the chromosomes in a skin cell of a small deer found in North America at prophase of mitosis.



(i) State the diploid chromosome number of the deer.

.....[1]

(ii) On Fig. 7.2, shade a pair of homologous chromosomes. [1]

(iii) During the formation of eggs in the ovary of the female deer, the chromosome number changes. State what happens to the chromosome number and explain why this change is necessary.

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.....[2]

[Total: 8]

Section B

Answer **three** questions.

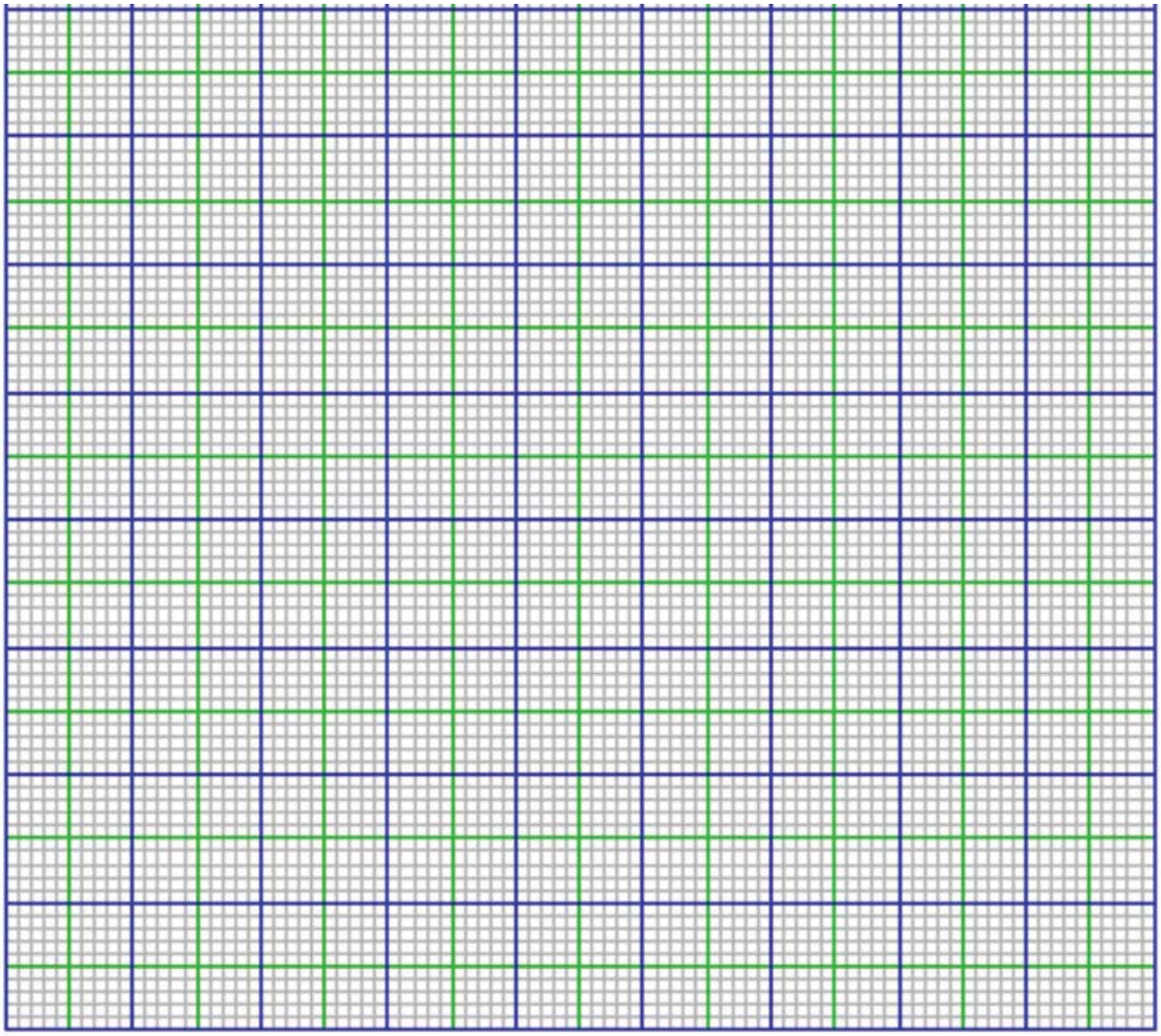
Question **10** is in the form of an **Either/Or** question. Only one part should be answered.

8 Table 8.1 shows the rate of photosynthesis of two different plants over a range of light intensities.

Table 8.1

light intensity / lux	rate of photosynthesis / mg carbohydrate produced per unit area per min	
	plant **R**	plant **S**
5	2	3
10	5	10
20	9	29
30	19	46
40	23	49
50	32	54
60	42	58
70	55	60
80	72	60
90	72	60

(a) Plot the data for all the light intensities in the range of 5 to 90 lux on the grid.



[3]

(b) State, with a reason, which plant would grow best in shady conditions.

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(c) Explain why, at light intensity above 80 lux, the rate of photosynthesis in both plants might increase if they were:

(i) supplied with higher concentrations of carbon dioxide;

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(ii) exposed to 40 °C.

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(d) Suggest why the rate of photosynthesis may fall when a plant wilts.

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[Total: 11]

9 Fig. 9.1 shows a longitudinal section of the heart of man.

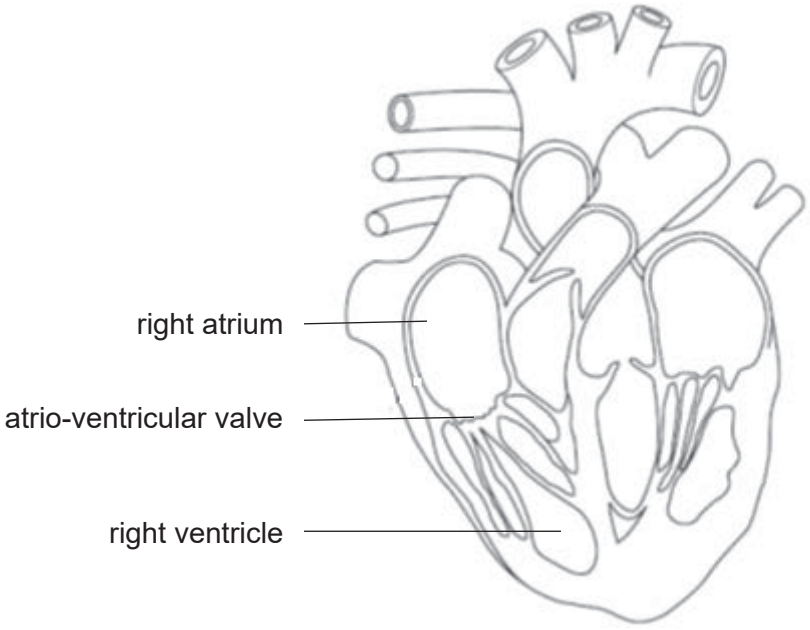

Fig. 9.1

(a) Explain the difference in the thickness of the left ventricle and the right ventricle.

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(b) Explain how the structures labelled in Fig. 9.1 ensure that blood flows in the correct direction.

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(c) Outline the effects of atherosclerosis in coronary arteries and the resulting effects on the heart itself.

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[Total: 9]

10 either

(a) Describe and explain the events that occur after the body temperature falls, which will allow the body temperature to return to its normal level.

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(b) Explain what is meant by control by 'negative feedback'.

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[Total: 10]

10 or

Carbon flows through the ecosystem in the carbon cycle whereas energy flows in a non-cyclical manner.

(a) Explain how carbon, in the form of organic matter in the producer, flows through the ecosystem.

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(b) Explain why energy has to be constantly supplied to the ecosystem.

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[Total: 10]

~ END OF PAPER ~