Anglo-Chinese School (Independent)
PRELIMINARY EXAMINATION
YEAR FOUR EXPRESS

BIOLOGY

6093/01

Paper 1 Multiple Choice

15 August 2024, Thursday

Additional Materials: Multiple Choice Answer Sheet

1 hour

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid/tape.
Write your name and index number on the Answer Sheet in the spaces provided.

There are **forty** questions on this paper. 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 **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

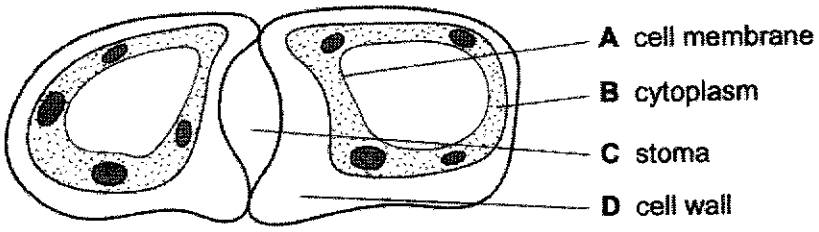
Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

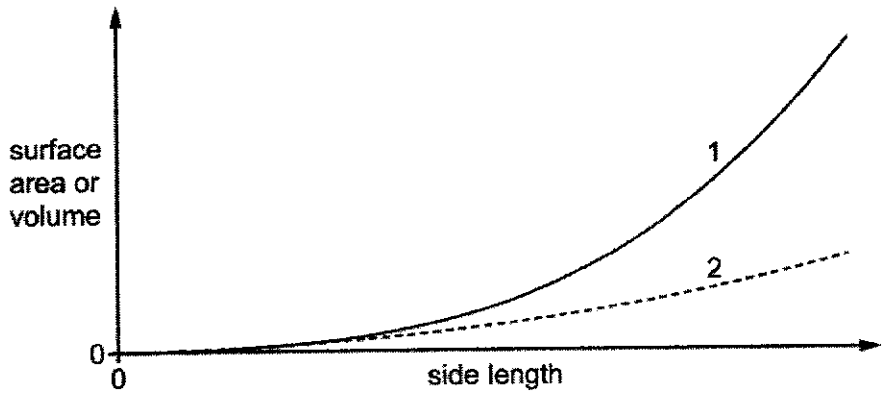
This document consists of **18** printed pages, including this cover page.

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

Which labelling line is **incorrect**?



2 The graph shows the effect of increasing the side length of agar cubes on the surface area and the volume of the cubes.



Which correctly identifies lines 1, 2 and the effect of increasing side length on the surface area to volume ratio of the cubes?

	line 1	line 2	surface area to volume ratio
A	surface area	volume	decreases
B	surface area	volume	increases
C	volume	surface area	decreases
D	volume	surface area	increases

3 The table shows the relative concentrations of two mineral ions in a root cell and in the water in the soil around the plant root.

	concentration of magnesium ions / arbitrary units	concentration of nitrate ions / arbitrary units
water around root	23	19
inside root cell	2475	1306

What is needed for the plant root to increase the concentration of the mineral ions in its cells?

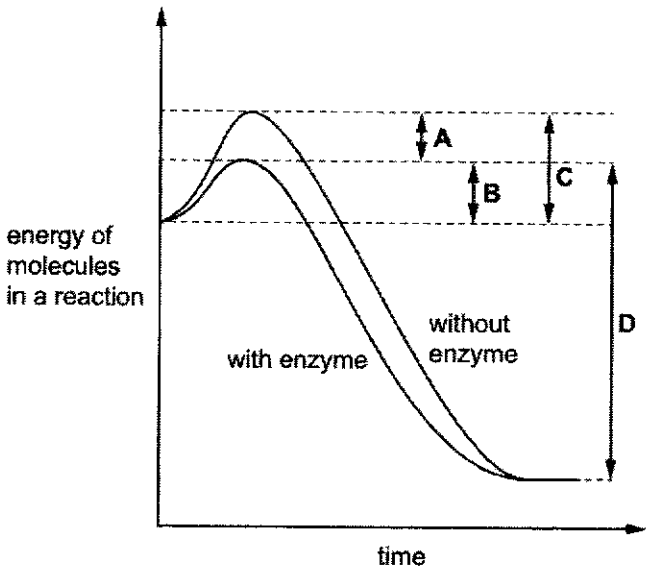
A energy for active transport

B energy for osmosis

C water for active transport

D water for osmosis

4 Which region on the graph shows the activation energy of an enzyme-catalysed reaction?



5 Which statement about chemical digestion in the human alimentary canal is correct?

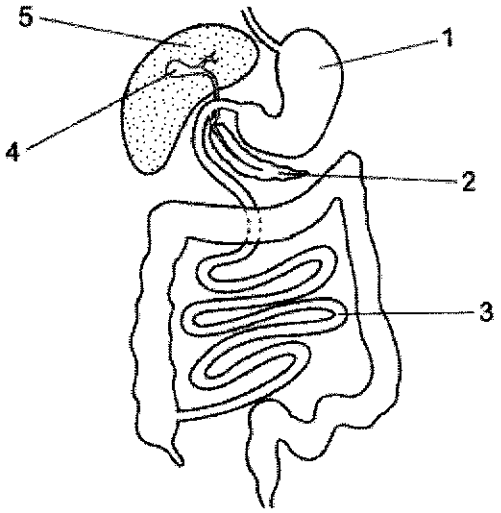
A Digestion of carbohydrates is completed in the colon.

B Enzymes are secreted to break down cellulose in the duodenum.

C Protein digestion is completed in the ileum.

D The stomach secretes enzymes to break down starch.

6 The diagram shows part of the human alimentary canal and associated organs.

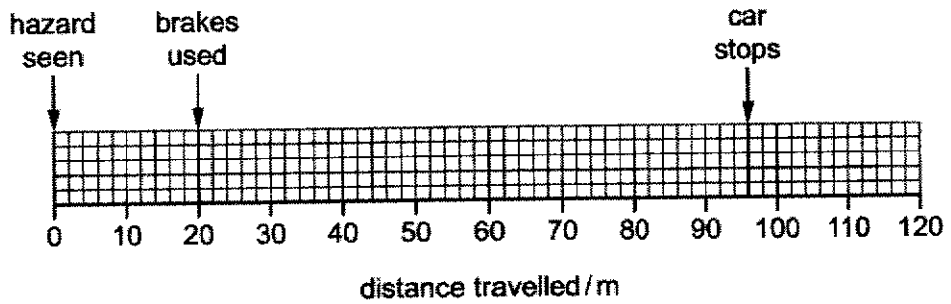


Which row describes the functions of parts shown in the diagram?

	Structure	Function	Structure	Function
A	1	Digestion of protein	3	Absorption of products from digestion
B	2	Emulsifying of fats	3	Absorption of amino acids and glucose
C	4	Production of bile	5	Making digestive enzymes
D	4	Storing digestive enzymes	2	Making digestive enzymes

7 The chart gives information about a car being driven at 110 km/h by someone who has **not** consumed alcohol.

It shows how far the car travels from the time the driver sees a hazard and reacts by using the brakes and how far the car will then travel before finally stopping.

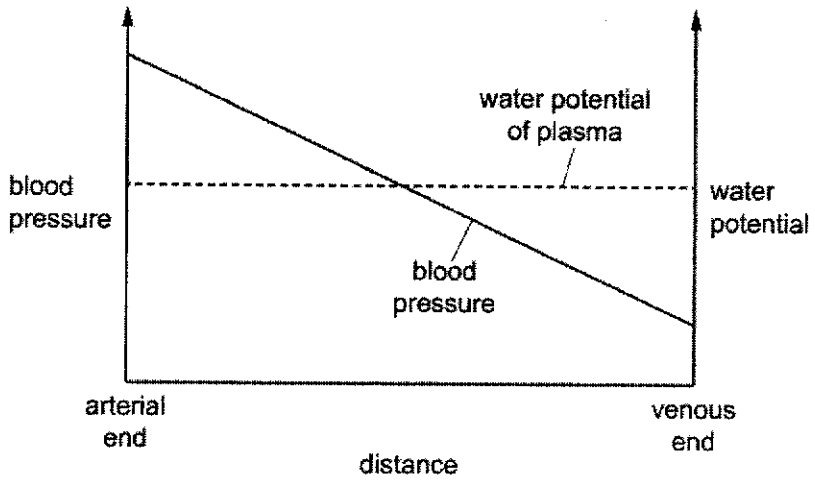


If the same driver consumes alcohol before driving, the distance travelled before reacting to the hazard increases by 20%.

What would then be the total distance travelled by the car before stopping?

A 96 m **B** 100 m **C** 111.2 m **D** 115.2 m

8 The graph shows the changes in blood pressure and water potential across a blood capillary from the arterial end of the capillary to the venous end of the capillary.



What could result in an accumulation of excess tissue fluid?

A an increase in concentration of large proteins in the blood plasma

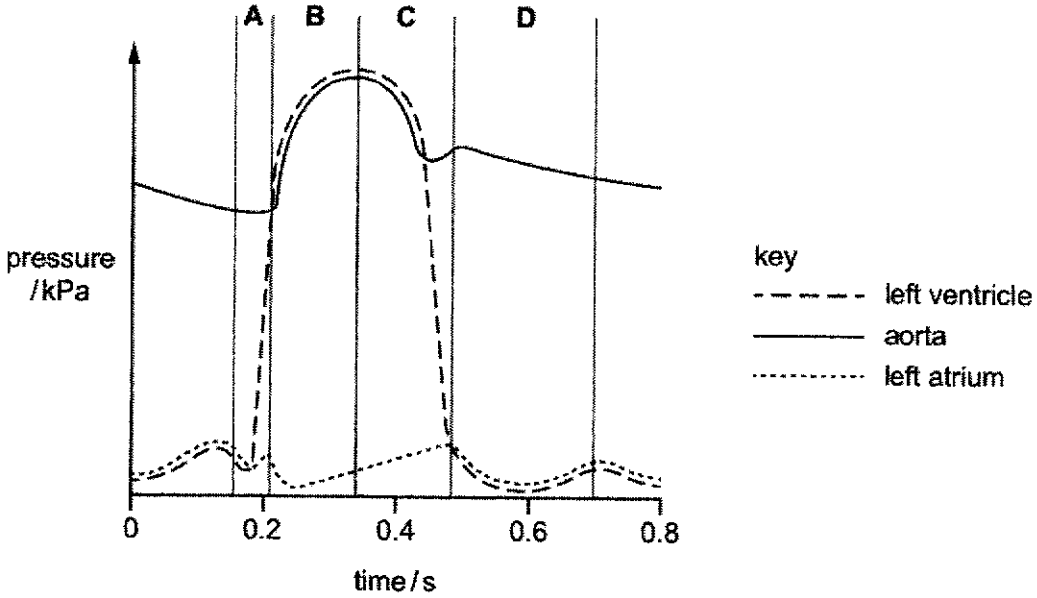
B an increase in blood pressure

C a decrease in the concentration of small proteins in tissue fluid

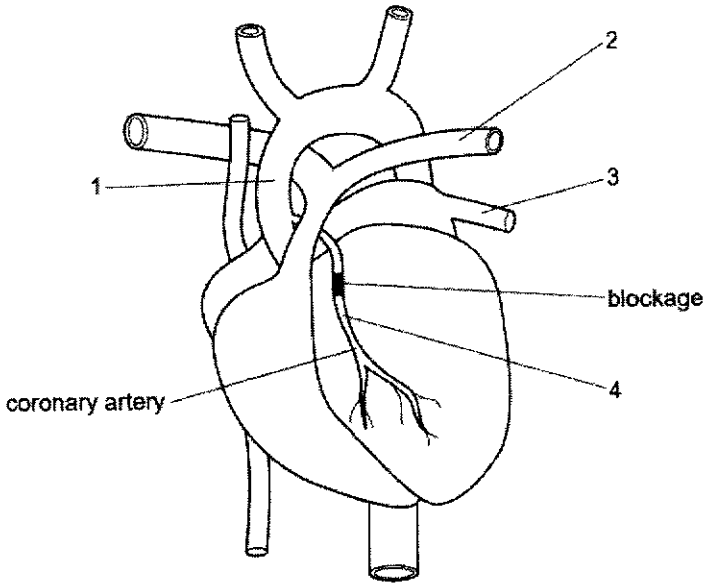
D a decrease in blood pressure

9 The diagram shows the pressure changes in various structures of the left side of the heart during the cardiac cycle.

At the end of which period is the ventricle full of blood?



10 The diagram shows an external view of the heart of a patient with a blockage of the coronary artery. This could be treated by inserting a tube to bypass the blockage.



Which two vessels would be joined by this tube?

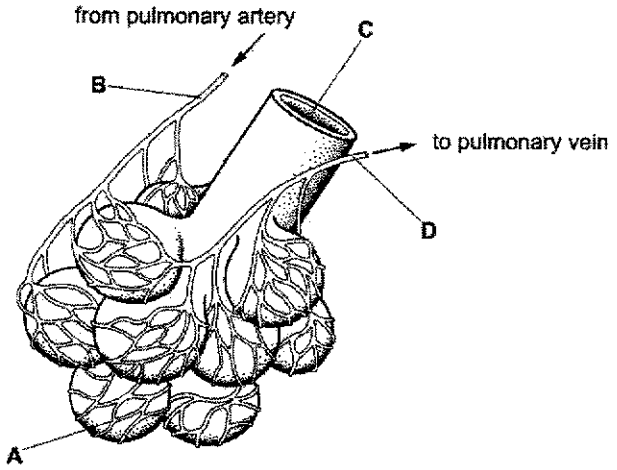
A 1 and 2 **B** 1 and 4 **C** 2 and 4 **D** 3 and 4

11 Which row correctly identifies the effects of carbon monoxide, nicotine and tar?

	effect		
	raises blood pressure	causes gene mutation	reduces oxygenation of blood
A	carbon monoxide	nicotine	tar
B	nicotine	nicotine	carbon monoxide
C	nicotine	tar	carbon monoxide
D	tar	carbon monoxide	nicotine

12 The diagram shows some of the structures in a human lung.

Where is the carbon dioxide concentration highest?



13 Lactic acid builds up in the muscles during vigorous exercise.

During recovery, how is this lactic acid removed?

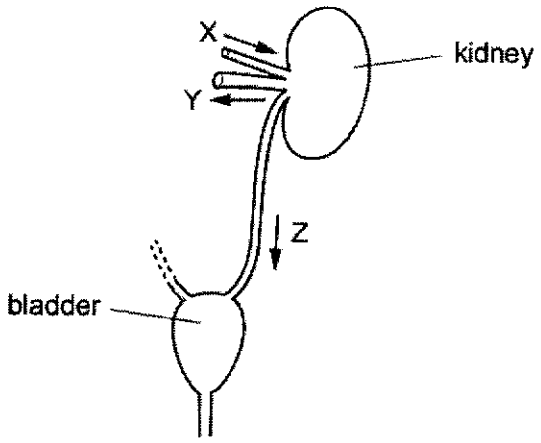
A aerobic respiration of lactic acid in the liver

B anaerobic respiration of lactic acid in the muscles

C excretion of lactic acid by the lungs

D removal of lactic acid by the alimentary canal

14 The diagram shows structures in a human which form and store urine.
Liquids pass through tubes X, Y and Z in the directions shown by the arrows.



Which statement about the volume of liquid passing through Y in one day is correct?

A It is greater than that passing through X.

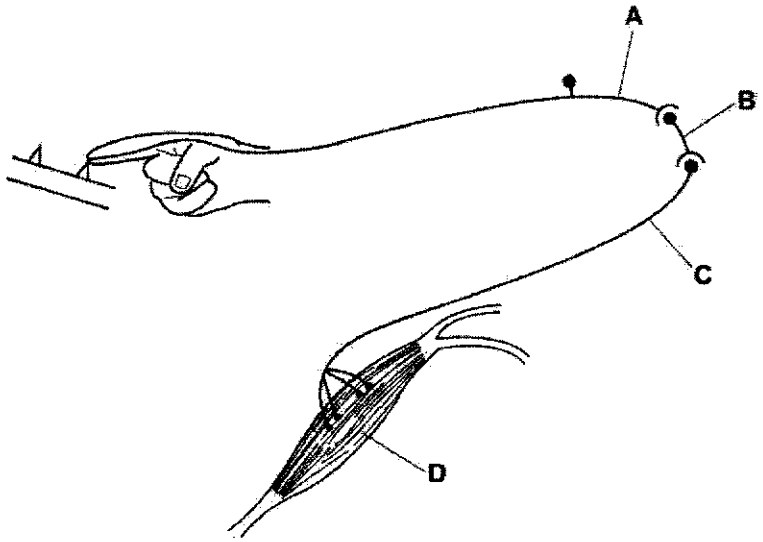
B It is less than that passing through Z.

C It is much less than that passing through X but slightly greater than that passing through Z.

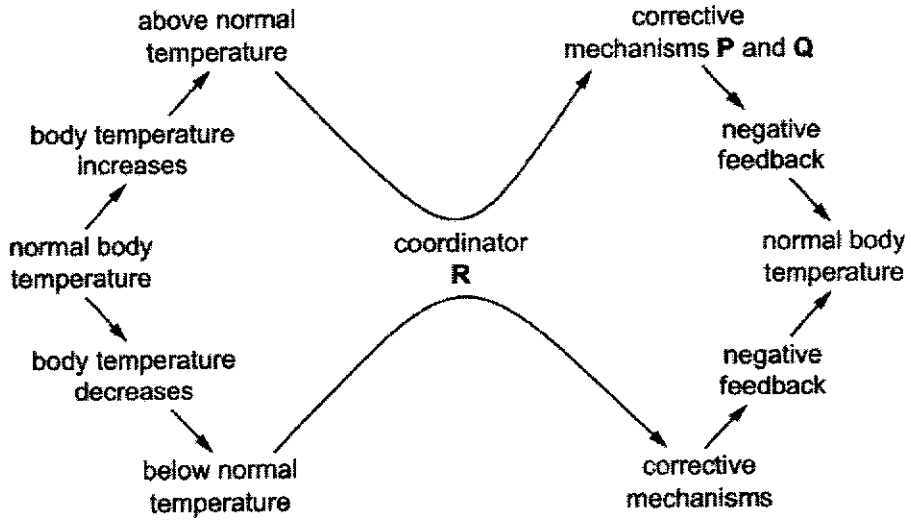
D It is slightly less than that passing through X but much greater than that passing through Z.

15 The diagram shows a reflex arc in the human nervous system. The person's finger has just made contact with a sharp object.

Which part is the motor neurone?



16 The diagram shows the homeostatic control of body temperature.



What are corrective mechanisms P and Q and coordinator R?

	corrective mechanisms		coordinator **R**
	P	**Q**	
A	sweating	more blood flows close to the skin surface	brain
B	sweating	more blood flows close to the skin surface	skin
C	shivering	less blood flows close to the skin surface	brain
D	shivering	less blood flows close to the skin surface	skin

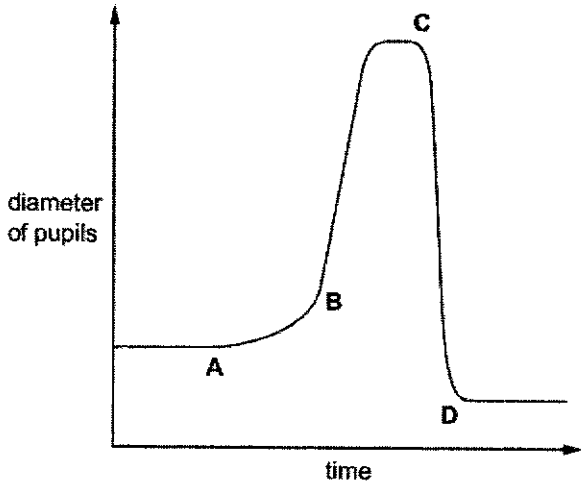
17 A student was asked to compare a typical spinal reflex action with a voluntary action. He has made one mistake in his comparison.

Which row shows the **incorrect** statement?

	reflex action	voluntary action
A	rapid response to a stimulus	response may be slow
B	initiated by the response of a receptor to a stimulus	initiated from the brain by conscious thought
C	the nervous impulse takes the longest pathway	the nervous impulse takes the shortest pathway
D	effectors are muscles or glands	effectors are muscles only

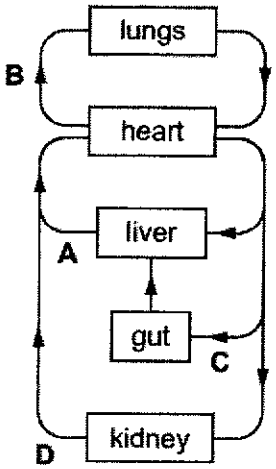
18 The graph shows changes in the diameter of a person's pupils while outdoors on a sunny day.

At which time did the person take off their sunglasses?



19 The diagram shows part of the human circulatory system.

In which vessel do the break-down products of hormones first appear?



20 A patient shows symptoms of unexplained weight loss, severe thirst and frequent need of urination.

A test shows high levels of glucose in the urine.

Which hormone can be used to treat this condition?

A anti-diuretic hormone

B insulin

C progesterone

D testosterone

21 What are characteristics of bacteria?

	contain cytoplasm	have DNA	nuclear membrane present
A	×	✓	×
B	✓	✓	×
C	×	×	✓
D	✓	✓	✓

key
✓ = yes
× = no

22 What could be a possible means by which bacteria gain resistance to antibiotics?

A genetic mutation

B overuse of antibiotics

C natural selection

D patients not finishing a course of antibiotics

23 Which statement is a reason why viruses are unharmed by antibiotics such as penicillin?

A They are very small in size.

B They do not have a cell wall.

C They have genetic material.

D They have a protein coat.

24 Which features apply to both sieve tube elements and xylem vessels?

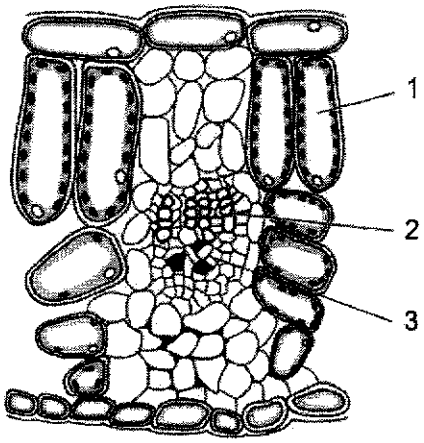
1 no cytoplasm

2 no end walls

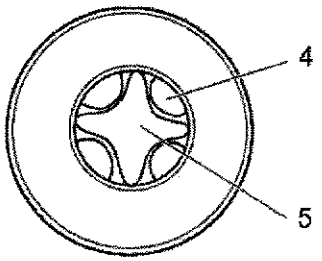
3 no nucleus

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

25 The diagrams show sections of a leaf and a root.



section of a leaf



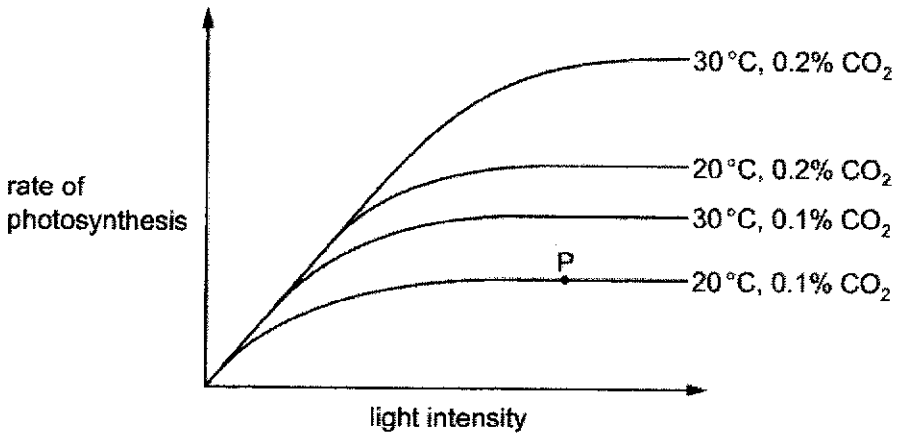
section through a root

not to scale

Which two labelled structures contain sucrose?

A 1 and 5 **B** 2 and 4 **C** 3 and 4 **D** 3 and 5

26 The diagram shows how the rate of photosynthesis varies with light intensity.
The four curves show different conditions of temperature and carbon dioxide concentration.

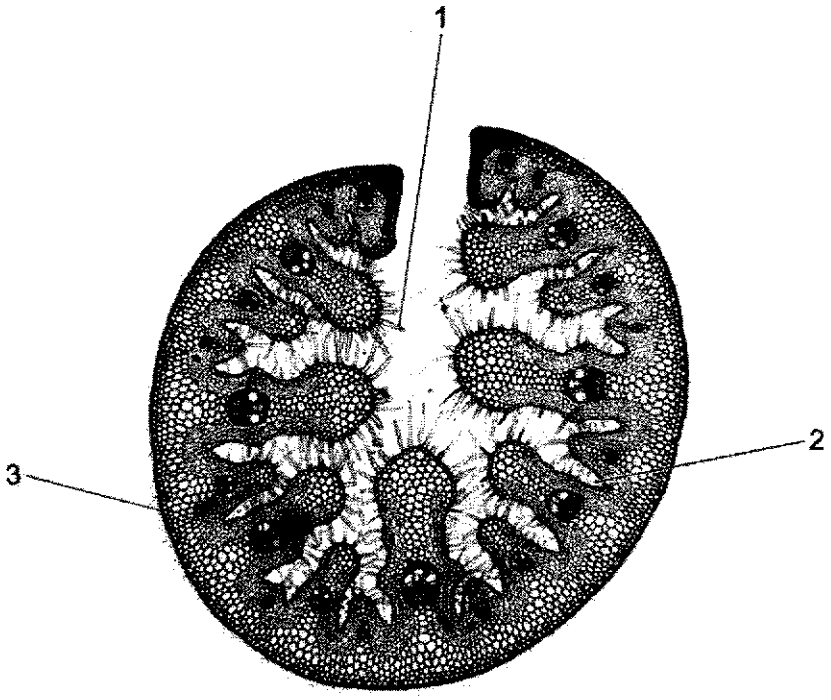


What limits the rate of photosynthesis at point P?

	light intensity	carbon dioxide concentration	temperature
A	✓	✓	×
B	✓	×	×
C	×	✓	✓
D	×	×	✓

key
✓ = yes
× = no

27 The photomicrograph shows the transverse section of a leaf of a species of grass. The grass is specially adapted to grow in a dry habitat.



Which shows the correct functions for structures 1, 2 and 3?

	reduces the water vapour concentration gradient between the inside and outside of the leaf	reduces evaporation from the outer epidermis of the leaf	traps a layer of moist air
A	1, 2 and 3	1 and 3	2 only
B	1 and 2	3 only	1 and 2
C	1 only	2 and 3	1 and 2
D	2 and 3	1 and 2	1 only

28 What is the reason for describing the flow of energy through an ecosystem as non-cyclic?

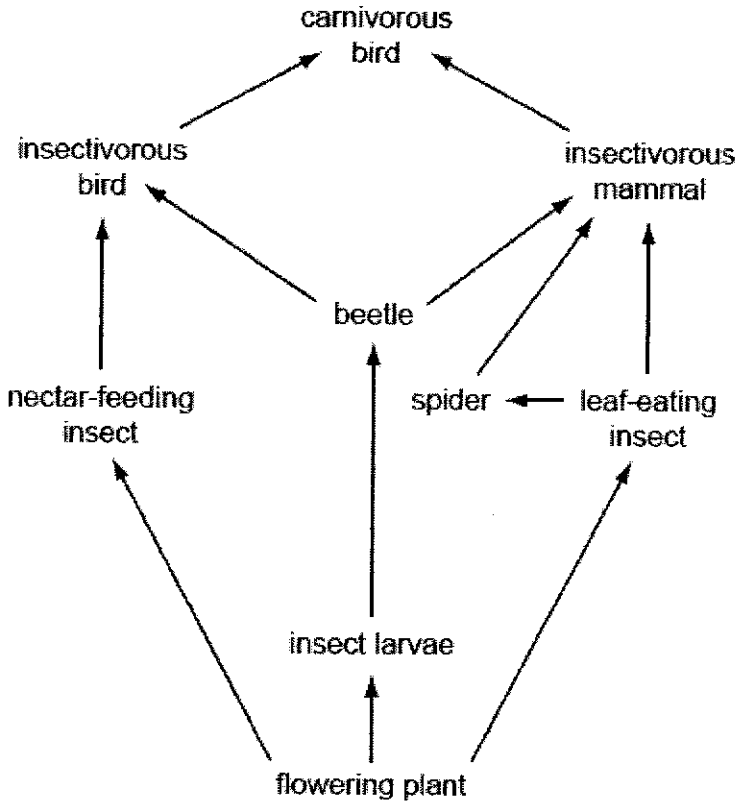
A The energy cannot be returned to its original source.

B The energy cannot have its form changed within an organism.

C The energy can only be passed on in its original form.

D The energy can only be transferred to a larger organism.

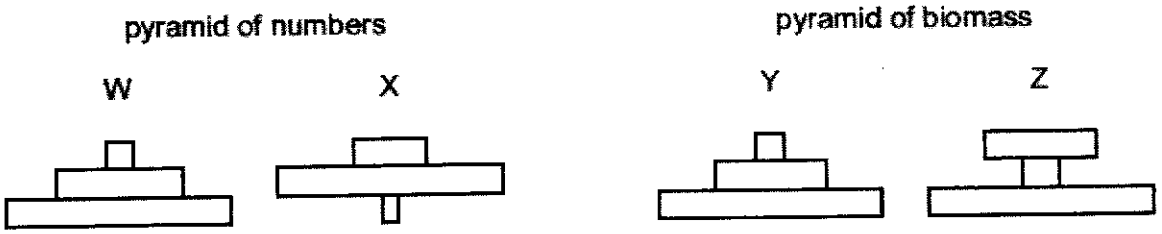
29 The diagram shows part of a food web.



Which one of the following shows the correct trophic level for each organism?

	Primary consumer	Secondary consumer	Tertiary consumer
A	flowering plant	beetle	carnivorous bird
B	flowering plant	insect larvae	insectivorous bird
C	insect larvae	insectivorous mammal	insectivorous mammal
D	nectar feeding insect	spider	beetle

30 A single plant provides food for many herbivores. The herbivores supply food for a few carnivores.



Which pyramid of numbers and which pyramid of biomass show this information?

	Pyramid of numbers	Pyramid of biomass
A	W	Y
B	W	Z
C	X	Y
D	X	Z

31 The following four processes occur during reproduction in a plant.

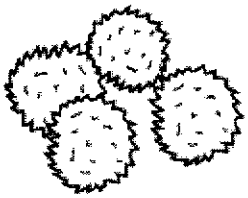
1 The male nucleus fuses with the female nucleus.
2 The male nucleus is released from the pollen tube.
3 The male nucleus travels down the pollen tube.
4 The pollen grain grows a pollen tube.

In which order do these processes occur after pollination?

	First →			Last
A	3	4	1	2
B	3	4	2	1
C	4	3	1	2
D	4	3	2	1

32 The diagrams show pollen grains from three different species of plant as they appear under the microscope. The diagrams are all to the same scale.

1



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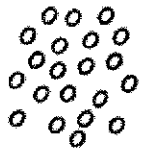

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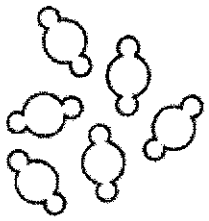


Which pollen grains are involved in insect-pollination?

A 1 only **B** 3 only **C** 1 and 2 only **D** 2 and 3 only

33 What are involved in reproduction in both animals and plants?

A ovary and embryo

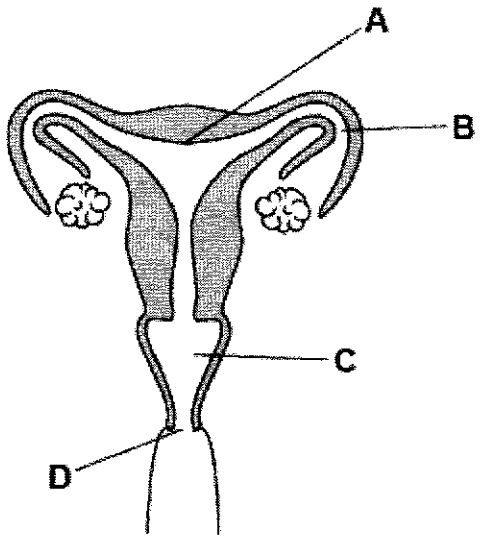
B ovary and testes

C ovule and stigma

D uterus and embryo

34 This diagram shows the reproductive system of a human female.

Where does fertilisation take place?



35 Which one of the following is an example of natural selection?

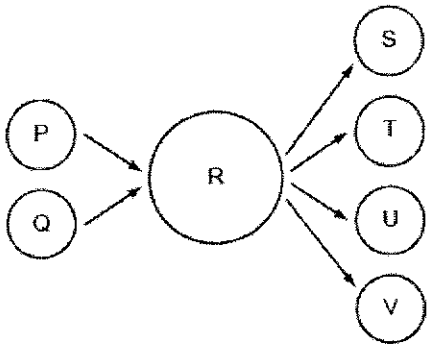
A An albino child born into a family with no family history of albinism.

B Farmer choosing cows that produce the most milk to breed for the next generation.

C Neck of giraffe getting longer over generations as they survive better and reproduce.

D Scientist inserting genes from various source into plants to allow them to survive better.

36 The diagram represents gametes P and Q fusing to give cell R. Cell R then produces gametes S,T, U and V.



Which statement about the numbers of chromosomes in the cells and gametes is correct?

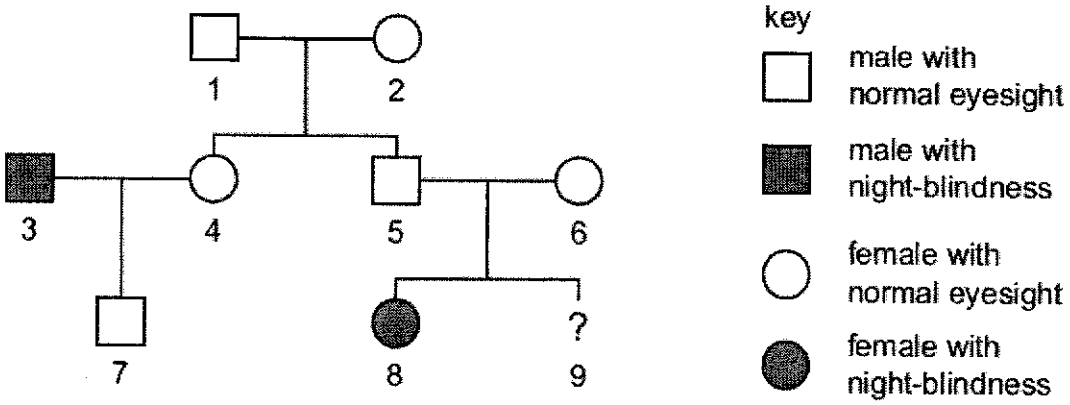
A The numbers of chromosomes in P and Q are different.

B The numbers of chromosomes in P and U are the same.

C The number of chromosomes in R and S are the same.

D The number of chromosomes in T is half the number of chromosomes in Q.

37 The diagram shows a family tree in which hereditary night-blindness occurs.



What is the chance that unborn child, 9, will be a male with night-blindness?

A 1 in 2 **B** 1 in 4 **C** 1 in 8 **D** 3 in 4

38 A woman has blood group O. Her child also has blood group O.

Which blood group can her husband not have?

A A **B** B **C** AB **D** O

39 Elephants are hunted by poachers for their tusks, which are a source of ivory. In 1930, in a National Park, 1% of the elephants were born without any tusks. Lack of tusks was the result of a gene mutation. Currently, in the same area, 15% of the females and 9% of the males do not have tusks.

Which statements can explain this increase in the number of tuskless elephants?

1. Selection against tusked elephants is occurring.
2. Tuskless elephants are less likely to be killed by poachers.
3. Tuskless elephants reproduce and pass the allele to their offspring.

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

40 Which row shows examples of continuous and discontinuous variation in humans?

	continuous variation	discontinuous variation
A	Height	Blood group
B	Blood group	Hair colour
C	Hair colour	Body mass
D	Blood group	Height

End of Paper

2024 YEAR 4 EXPRESS BIOLOGY PRELIMINARY EXAMINATION

PAPER 1 MARK SCHEME

Multiple Choice Questions (40 marks)

1	**A**	11	**C**	21	**B**	31	**D**
2	**C**	12	**B**	22	**A**	32	**A**
3	**A**	13	**A**	23	**B**	33	**A**
4	**B**	14	**D**	24	**D**	34	**B**
5	**C**	15	**C**	25	**C**	35	**C**
6	**A**	16	**A**	26	**C**	36	**B**
7	**B**	17	**C**	27	**B**	37	**C**
8	**B**	18	**C**	28	**A**	38	**C**
9	**A**	19	**A**	29	**C**	39	**D**
10	**B**	20	**B**	30	**C**	40	**A**

Anglo-Chinese School (Independent)
PRELIMINARY EXAMINATION
YEAR FOUR EXPRESS

CANDIDATE NAME									
CENTRE NUMBER						INDEX NUMBER			

BIOLOGY **6093/02**

Paper 2 **12 August 2024, Monday**
1 hour 45 minutes

Candidates answer on the Question Paper
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

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

Section A
Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.

Section B
Answer only **ONE** question in this section.
Write your answers in the spaces provided on the Question Paper.

The use of an approved scientific calculator is expected, where appropriate.

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

For Examiner's Use	
Section A	
Section B	
Total	/ 80

This document consists of **21** printed pages, including this cover page.

[Turn Over

Section A

Answer **all** questions.
Write your answers in the spaces provided.

1 Fig. 1.1 shows blood pressure changes as blood flows through part of the circulatory system, beginning at the right atrium, travelling to the lungs, and ending in the pulmonary vein.

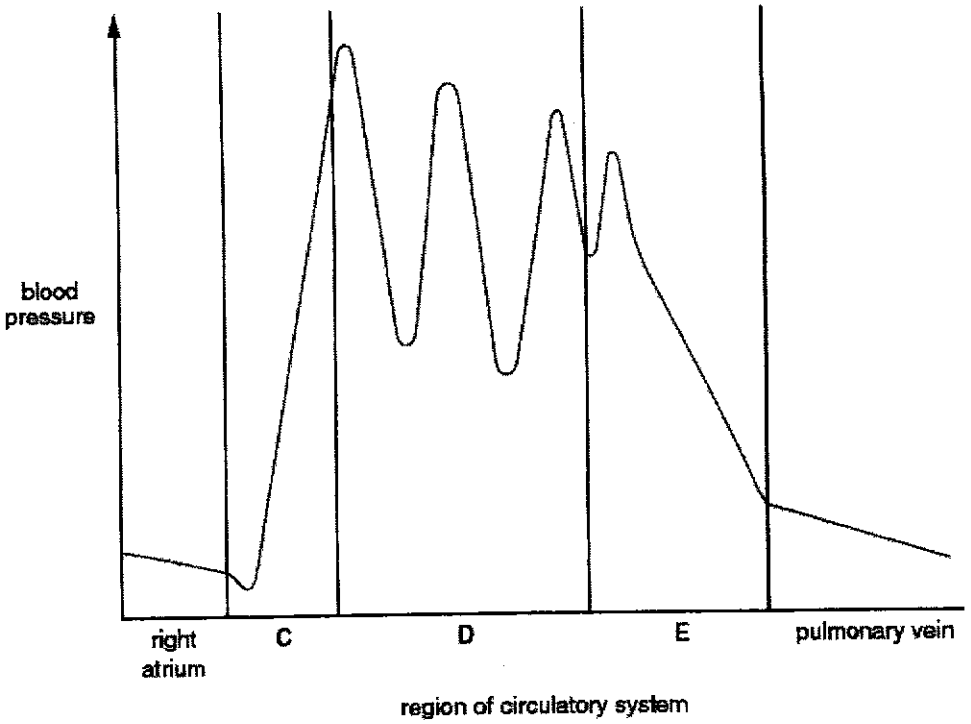


Fig. 1.1

(a) Identify the chamber of the heart represented by **C**.

Chamber **C** .....[1]

(b) Explain the reasons for the regular changes in blood pressure in region **D**.

.....

.....

.....

.....

.....[2]

(c) Important exchange of substances take place in the blood as it passes through region **E**.

(i) Identify organ **E**.

.....[1]

(ii) Identify and describe the exchange of substances that take place.

.....

.....

.....

.....[2]

(ii) State **two** features of organ **E** and explain how they help to improve the efficiency of the rate for exchange of substances.

Feature 1 .....

Explanation .....

.....

.....

Feature 2 .....

Explanation .....

.....

.....[4]

[Total: 10]

2 The yields of corn grown in open fields in India are low compared to the yields of corn grown in the glasshouses in The Netherlands.

In a study, scientists in India grew corn plants in glasshouses and in open fields nearby. The growth of the plants and the yields of the corn were recorded.

The results are shown in Table 2.1

Table 2.1

	location corn plants grown in	
	glasshouse	open field
mean final height of corn plants / cm	84.1	68.0
mean number of leaves per corn plant	132.0	83.0
mean fresh mass of corn plants / g	978.5	485.2
mass of corn per plant / g	2853.0	832.4
mean fresh mass of corn / g	98.0	86.5

(a) The mean fresh mass of corn grown in glasshouses was greater than the mean fresh mass of corn grown in open fields.

Calculate the difference in mean fresh mass as a percentage of the mean fresh mass of corn grown in open fields.

Show your working. Give your final answer to a whole number.

.....% [2]

(b) Suggest how an increase in the height of the plants **and** the number of leaves on each plant affect the yield of corn.

.....

.....

.....

.....

.....

.....[3]

(c) The scientists ensured that the only differences between the two groups of plants were the result of the protection provided by the glasshouses.

Suggest **two** factors that the scientists should have kept constant for the two groups of plants in this investigation.

.....

.....

.....

.....[2]

(d) The growth and final yields of crops grown in open fields are often limited by environmental factors.

Describe how these factors are controlled in a commercial glasshouse to give high yields of crops such as corn.

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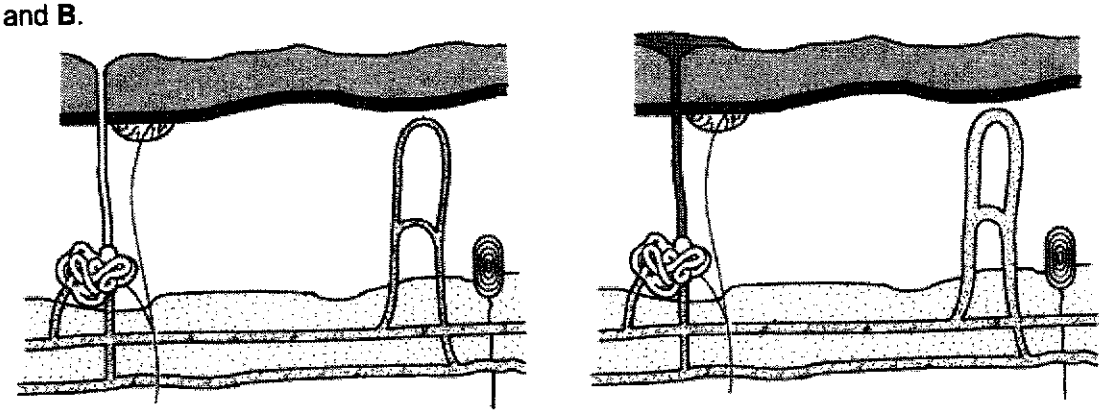
.....[3]

[Total: 10]

3 Fig. 3.1 shows a vertical section through the skin in two different environmental conditions, **A** and **B**.



skin in environmental condition **A**

skin in environmental condition **B**

Fig. 3.1

(a) On Fig. 3.1 under condition **A**, label each of the following:

- A sweat gland
- An arteriole. [2]

(b) Using the information in Fig. 3.1, suggest how environmental condition **B** is different from environmental condition **A**.

.....

.....[1]

(c) With reference to Fig. 3.1, state and explain two differences between the skin in environmental condition **A** and the skin in environmental condition **B**.

1.....

.....

.....

2.....

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.....[4]

(d) (i) State the change in the level of anti-diuretic hormone (ADH) in a person if the person is to stay in environmental condition **B** for a period of time without access to drinking water.

.....

.....[1]

(ii) Explain how the change in ADH level stated in **(d)(i)** affects the urine production of the person.

.....

.....

.....

.....[2]

[Total:10]

4 The dominant allele for the ability to smell the scent of a particular flower is represented by **A**. The recessive allele, which does not allow a person to smell the scent of the flower, is represented by **a**.

(a) (i) Using these letters, indicate each of the following:

the genotype of a woman who is unable to smell the flower: .....[1]

(ii) the possible alleles found in the gametes of a woman who can smell the flower.

..... and ..... [2]

(b) Fig. 4.1 represents some alleles on part of the sex chromosomes of a woman and of a man.

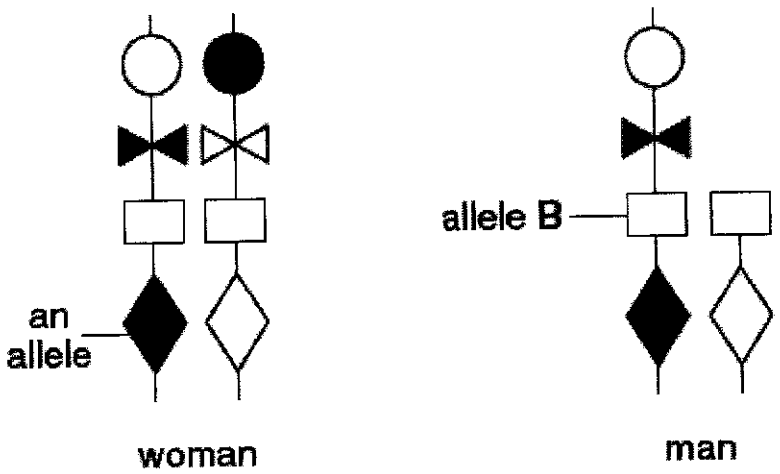

Fig. 4.1

In the space below, draw the possible alleles as they might be carried in sperm cells.

[2]

(c) Fig. 4.2 shows how the alleles on one of the chromosomes might appear in a liver cell in the man's body. Allele **B** shows a mutation.

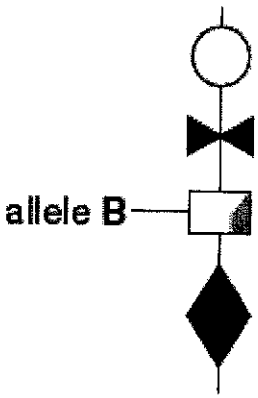

Fig. 4.2

Suggest **two** possible causes of the mutation.

1.....

2.....[2]

(d) Mutated alleles such as that shown in Fig. 4.2 are usually recessive.

Use your knowledge of genetics to explain why society discourages marriages between closely-related people.

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.....[3]

[Total: 10]

5 (a) Define the term, *sexual reproduction*.

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.....[2]

Progesterone is a hormone involved in the control of the menstrual cycle.
Fig. 5.1 shows the level of progesterone in the blood of three women, labelled **X**, **Y** and **Z**, for 30 days.

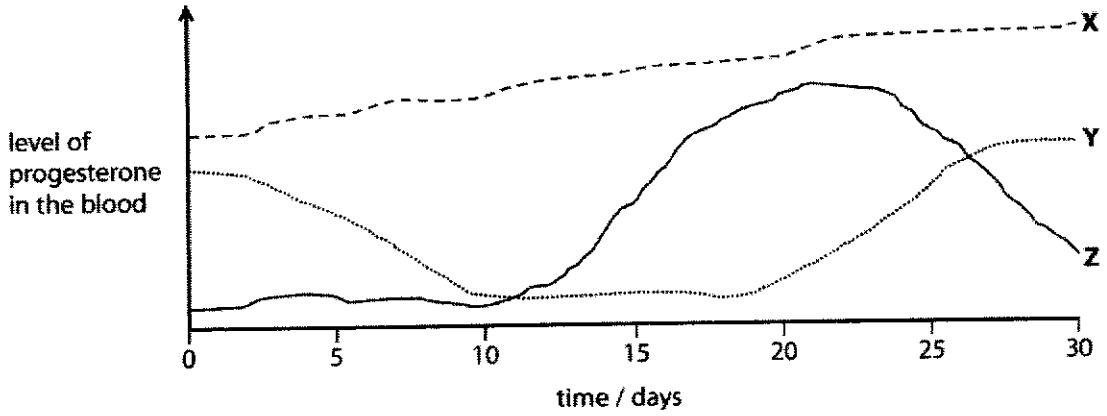


Fig. 5.1

(b) (i) Name the stage of the menstrual cycle that is occurring for person **Y** on day 10.

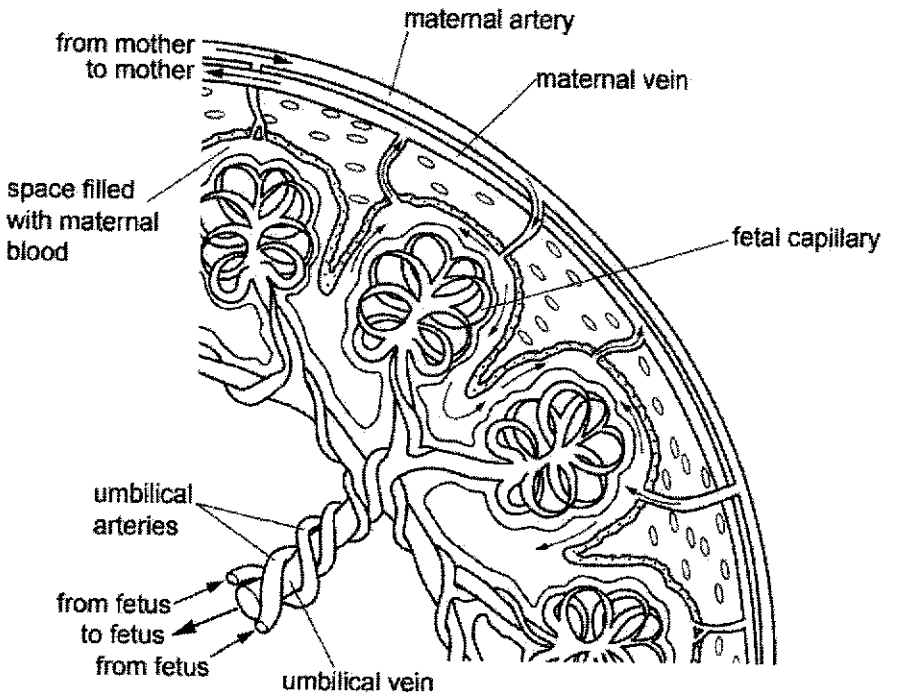
.....[1]

(ii) Suggest a reason for the increasing progesterone level of person **X**.

.....

.....[1]

Fig. 5.2 shows a drawing of a section of a human placenta. The arrows show the direction of blood flow.



not to scale

Fig. 5.2

(c) Using the information in Fig. 5.2, suggest how the placenta is adapted for efficient diffusion.

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.....[3]

(d) The placenta is often described as the 'lung and kidney' of the fetus. Explain why this is a valid description.

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.....[3]

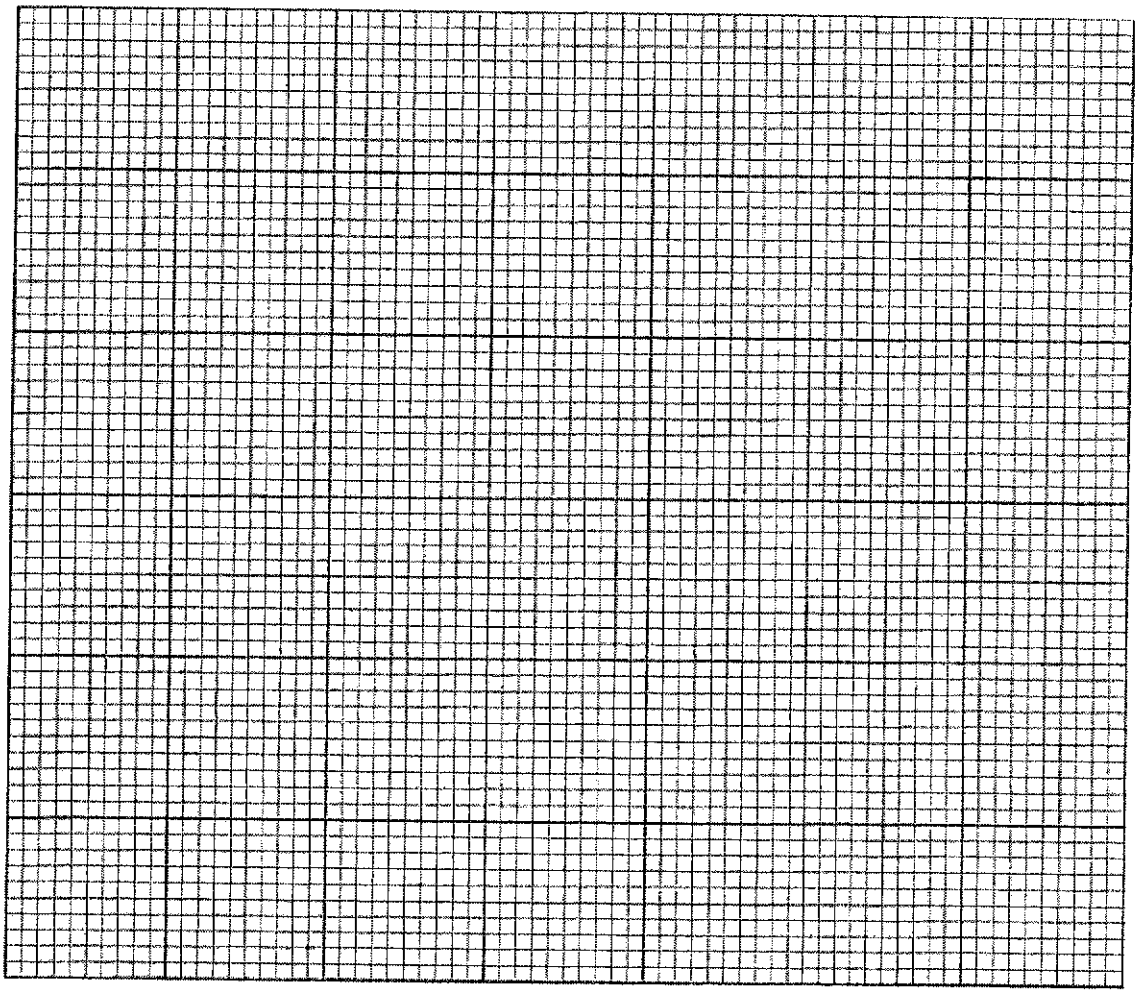
[Total: 10]

6 Table 6.1 shows the results of an investigation to find out how temperature affects the activity of two protease enzymes.

Table 6.1

temperature / °C	enzyme activity / arbitrary units	
	enzyme A	enzyme B
0	0	0
5	10	2
10	24	8
15	60	12
20	98	22
25	80	38
30	66	62
35	52	94
40	40	34
45	30	10
50	20	0
55	10	0
60	0	0

(a) Plot the two graphs on the same axes in the grid provided.



[6]

(b) Using information from Table 6.1, determine which of the two enzymes is obtained from a human. Explain your answer.

.....

.....

.....

.....[2]

(c) Explain the activity shown by enzyme **A** at temperatures above 20 °C.

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.....

.....[2]

[Total: 10]

7 Bacteria may be classified as pathogenic and non-pathogenic.

(a) Describe **two** features of a bacterial cell that are different from an animal cell.

1.....

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2.....

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.....[2]

(b) Non-pathogenic bacteria can be used in the field of genetic engineering.

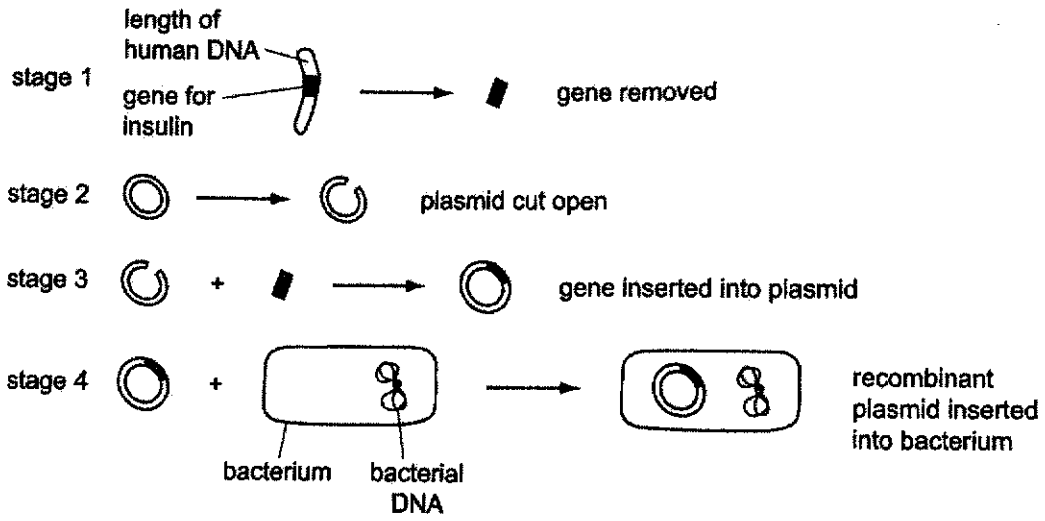

Fig. 7.1

With reference to Fig. 7.1, describe how bacteria can be genetically engineered to produce human insulin.

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.....[4]

(c) Pathogenic bacteria species like *Streptococcus pneumoniae* cause pneumococcal diseases in humans which may lead to death.

Vaccines and antibiotics are used in different ways to reduce the number of deaths from pneumococcal disease.

Explain the different ways in which vaccines and antibiotics are used.

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.....[4]

[Total: 10]

Section B

Answer only **ONE** question from this section.
Write your answers in the spaces provided.

8 Fig. 8.1 shows the Institut Pierre Simon Laplace model, which is a prediction of how carbon emissions may be distributed in the environment from 1920 to 2100.

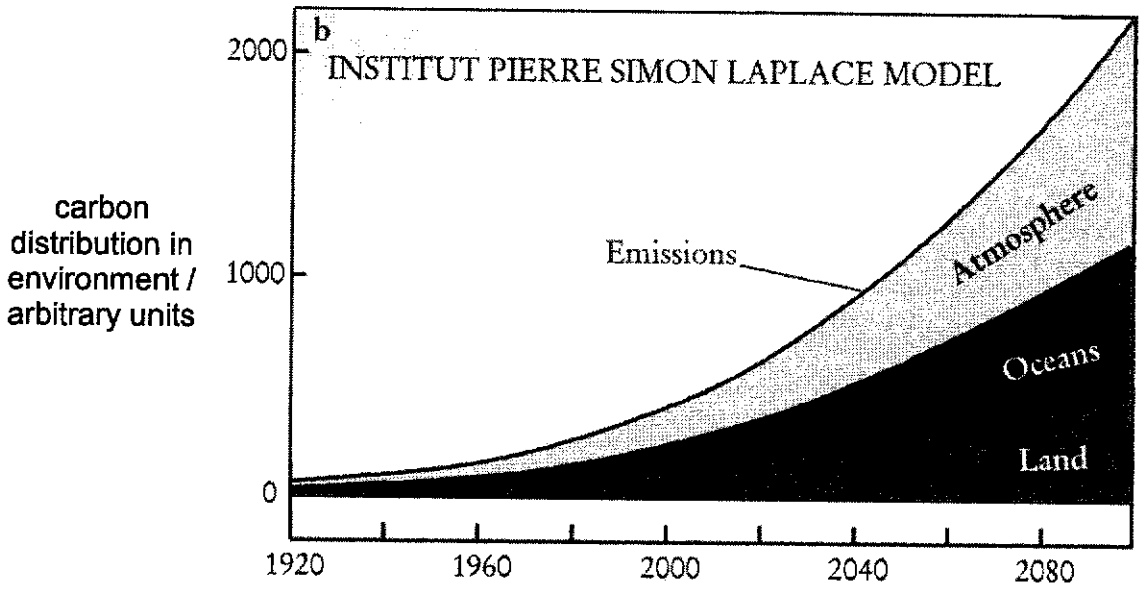

Fig. 8.1
[adapted from Physics Today 55, 8, 30 (2002)]

(a) Describe **two** human activities that cause an increase in carbon emissions observed in Fig. 8.1.

1.....

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2.....

.....[2]

(b) With reference to Fig. 8.1, explain why the carbon distribution in both oceans and land increases as carbon emissions increases.

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.....[5]

(c) Describe **three** human actions that can reduce the effects of global warming.

1.....

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2.....

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3.....

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.....[3]

[Total: 10]

9 (a) Fig. 9.1 shows two locations, **X** and **Y**, on the Earth.

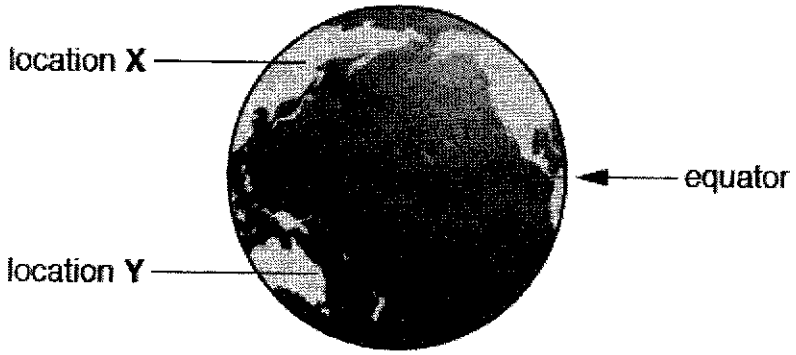


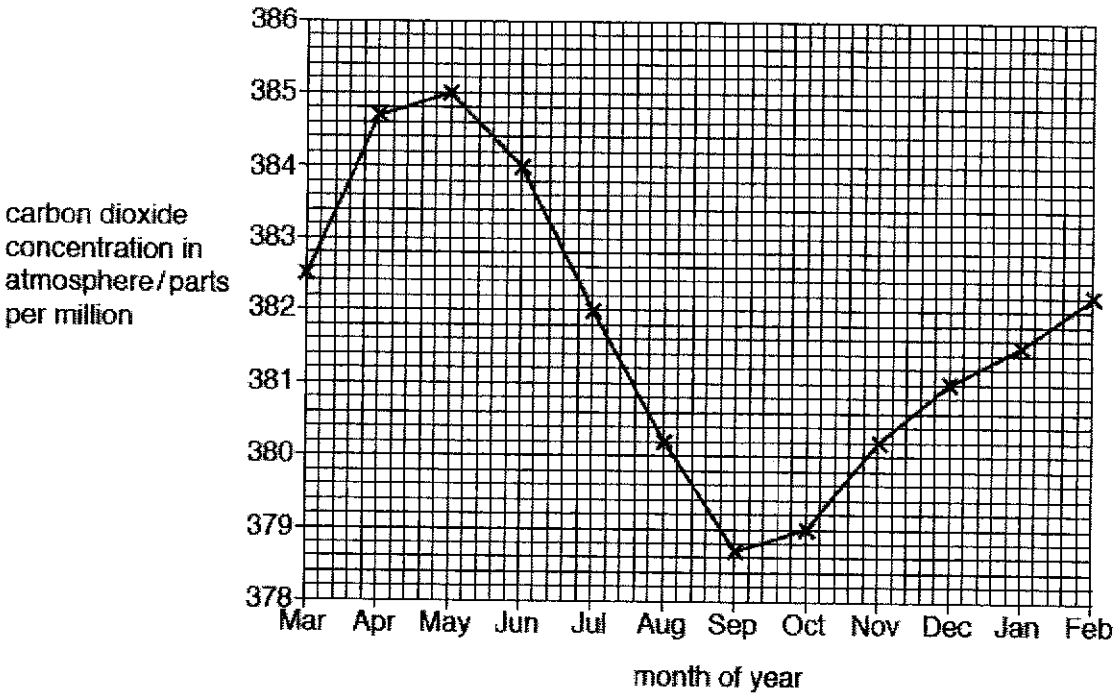
Fig. 9.1

Table 9.1 shows the length of daylight at each location during a year.

Table 9.1

	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
length of daylight at location X	medium			long			medium			short		
length of daylight at location Y	medium			short			medium			long		

Graph 9.1 shows the changes in carbon dioxide concentration in the atmosphere measured during one year at location **X**.



Graph 9.1

(i) With reference to Graph 9.1, suggest an explanation for the pattern of changes in the concentration of carbon dioxide in the atmosphere at location **X**.

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.....[3]

(ii) Sketch a line on Graph 9.1 to suggest the change in carbon dioxide concentration in the atmosphere during the year at location **Y**. [2]

(b) Fig. 9.2 shows two possible uses of the same area of land to produce food.

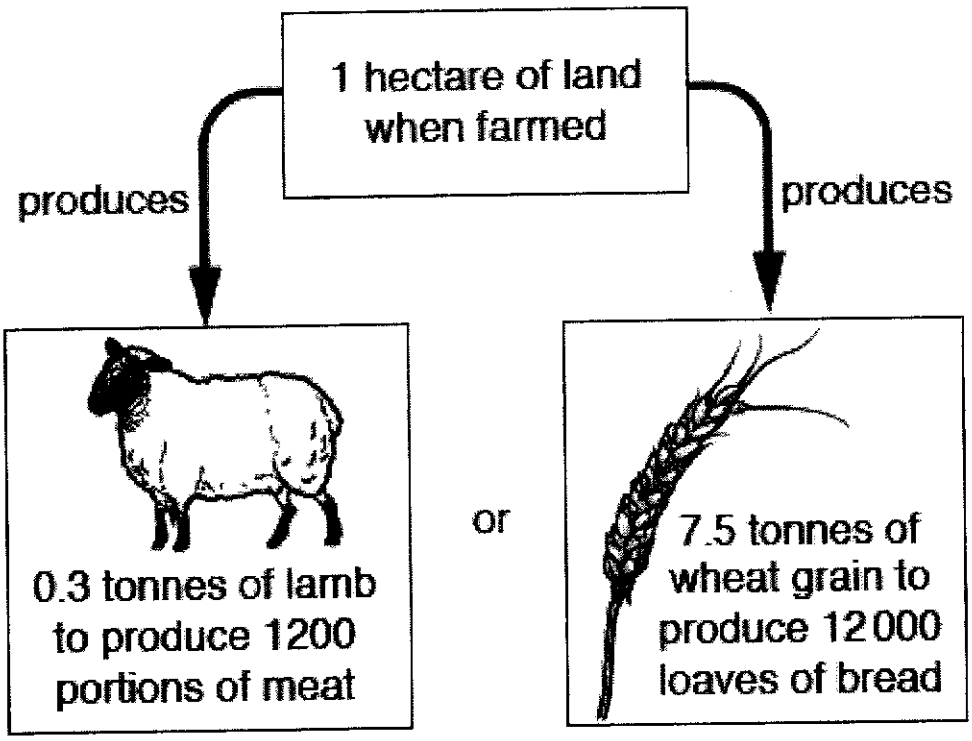

Fig. 9.2

With reference to Fig. 9.2, and your own knowledge, explain why it is possible to feed a greater number of people if the area of land is used to farm crops rather than to farm animals.

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.....[5]

[Total: 10]

--- End of Paper ---

2024 YEAR 4 EXPRESS BIOLOGY PRELIMINARY EXAMINATION

PAPER 2 MARK SCHEME

Section A

1a) right ventricle;

1b) increases when heart / ventricle + contracts/systole;
decreases when heart / ventricle + relaxes/diastole;

1ci) lung;

1cii) Oxygen diffuse from the air spaces in the alveoli/lung to the blood capillaries;
Carbon dioxide diffuse from the blood into the air spaces in the alveoli/lung;

1d) clusters of alveoli -> increase SA:V
single cell epithelium/ thin wall -> reduce distance travelled
constant blood flow -> maintain concentration gradient (any 2 pairs)
Reject: Moist surface-> allow gases to dissolve (does not increase efficiency)

2a) Percentage difference in mean fresh mass = (98.0-86.5/86.5)x100%=13(whole number)

2b) **Increase in height →**
more sunlight can be absorbed;
allow more room for corn to form/grow;
Increased number of leaves →
increases the surface area exposed to sunlight;
increases the amount of gaseous exchange;
increases amount of chloroplast/chlorophyll; (any 3)

leading to increases the yield of corn;

2c) Reject: Light intensity/Temperature/Carbon dioxide concentration/humidity (all these factors will change in the glass house)
Accept: amount of water, type of corn seeds, space between corn plant, type of soil, nutrients/fertilizer level, number of plants for experiment

2d) Light intensity: lights can be installed to provide light to the plants under low light conditions (e.g. at night, early morning);

Temperature: heater may be installed to provide sufficient heat for enzymes to function close to their optimum temperature for photosynthesis;

Carbon dioxide: Any valid method to increase carbon dioxide levels. E.g. burning of candles, rearing of pets / livestock in glasshouse;

3a) correct label on the diagram

3b) hotter/warmer/higher temperature;

3c) Sweat glands more active/more sweat secreted;
More latent heat (of vapourisation) removed from body due to evaporation of water in the sweat;

Skin arteriole dilated;
more blood reaches the skin arterioles, resulting in more heat lost through the surface of the skin via through convection, radiation and conduction;

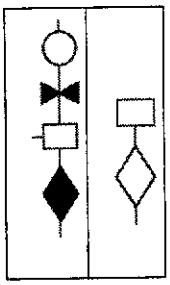
3di) ADH increased

3dii) Walls of the collecting duct more permeable to water, more water selectively reabsorbed via osmosis from the lumen of the collecting duct back into blood;
Lesser volume and more concentrated urine produced;

4ai) aa;

4aii) A and a OR A and a.
Reject a and a, AA, Aa

4b)



*Correct shading required

4c) *State one type of*
chemical, e.g. tar;
radiation, e.g. ultraviolet radiation

4d) closely related people possess similar genotype
Higher chance of homozygous genotype
Recessive condition will be expressed

5a) the process involving the fusion of nuclei of male and female gametes to form a zygote; and the production of genetically dissimilar/ different/ non-identical offspring;

5bi) menstruation

5bii) pregnancy

5c) large surface area to volume ratio for exchange of substances;
thin walls/ membranes leading to shorter diffusion distance;
richly supplied with blood capillaries / highly vascularised to maintain a steep concentration gradient;

5d) Functions like 'lungs':
- Allow oxygen to diffuse from maternal blood into fetal blood;
- Helps to remove carbon dioxide which diffuse from the fetal blood into the maternal blood;

Functions like 'kidneys'
- helps to remove removes excretory products such as urea which diffuses from the fetal blood into the maternal blood for removal;

6a) S: Scale of both graphs are more than >50% of the size of the grids
L1: Best-fit line for enzyme A
L2: Best-fit line for enzyme B
A: Axes labelled with units correctly for x and y axes + graphs are labelled A and B.
P1: Points plotted correctly for enzyme A.
P2: Points plotted correctly for enzyme B.

6b) Enzyme B is obtained from a human;
as its optimum temperature is close to that of human blood temperature of 37 °C;

6c) Enzyme molecules begin to denature;
Active sites unfold/ deformed / lost their shapes and are no longer complementary to the shape of the substrate molecules, leading to lower frequency of effective collisions and less enzyme-substrate complexes formed.

7a) Any 2:

bacterial cell	**animal cell**
cell wall present	cell wall absent
nucleus / nuclear envelope absent	nucleus / nuclear envelope present
membrane bound organelle absent e.g. RER, SER, Golgi body, vacuole	membrane bound organelle present e.g. RER, SER, Golgi body, vacuole

Reject: animal cells have no flagellum (sperm cells exist).

(b) Insulin gene is isolated by cutting with restriction enzyme to produce sticky ends and plasmid is cut with the same restriction enzymes;
To generate complementary sticky ends;
DNA ligase is used to repair the sugar-phosphate backbone / seal the recombinant plasmid
Transformation via heat shock or electric shock / Bacterial ribosomes synthesise insulin protein;
Reject: bacteria cells produce insulin (as this is repeating the question), recombinant plasmid is inserted into bacterial cell (this is repeating the words in the Fig.)

7c)

Vaccines	**Antibiotics**
used to prevent infectious diseases	used to treat **bacterial** diseases
effective against bacterial and viral diseases	effective only against bacterial diseases
stimulates white blood cells to produce antibodies	chemical that disrupts bacterial cell structure (cell wall, cell membrane, ribosomes, enzymes) to kill cell

Section B

8a) Burning/combustion of fossil fuels;
Deforestation/ cutting down trees in forests;
other valid answer but **process** must be clearly stated

8b) The oceans function as a carbon sink (or) The land contains forests, which can function as a carbon sink.

A carbon sink is an area that functions as a reservoir that accumulates and stores more carbon (compounds) than it releases.

The waters of the oceans can function as a solvent and dissolve carbon dioxide.

Large amounts of phytoplankton (producers) in the ocean can carry out photosynthesis (or) Trees in forests can carry out photosynthesis, which is a process that removes carbon dioxide from the atmosphere to form glucose.

The oceans and seas consist of coral reefs / bodies of marine organisms can store carbon compounds. The calcium carbonate skeleton of corals can help store carbon thus removing it from the environment. (or) The bodies of trees can store carbon compounds.

The dead bodies of aquatic organisms can sink to the bottom of the sea and become fossilised, where they are converted into fossil fuels. Fossil fuels found at the bottom of oceans and seas also store (sequester) carbon from the environment. / The dead bodies of trees can be buried and converted into fossil fuels (charcoal). [max: 5]

8c) Cycle, walk, take public transport (instead of driving);
Use fans instead of aircon;
Eat more fruits and vegetables (instead of meat);
other valid answer [max:3]

9ai) relate long daylight (June – Sep) to decreasing concentrations of carbon dioxide;
Rate of photosynthesis higher than respiration, more carbon dioxide used up
Data cited from graph;

9aii) peak between Jun – Aug
Trough between Dec – Feb
Smooth line for entire graph otherwise max: 1

9b) more food produced ;
comparative data manipulation ;
fewer levels in food chain AW ;
correct reference to herbivore / carnivore + human ;
correct reference to primary / secondary + consumer ;
less energy lost / more efficient ;
example of energy not lost (e.g. through movement); [max: 5]