Name _____ Reg. No _____ Class _____

4EX

BIOLOGY

6093/01

Paper 1 Multiple Choice [40 Marks]

PRELIMINARY EXAMINATION

September 2019

1 hour

Additional Materials:
Approved calculator
OTAS

Instruction to Candidates

Do not start reading the questions until you are told to do so.

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, class, and index number on the OTAS provided.

Information for Candidates

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 OTAS.

Read the instructions on the OTAS 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.

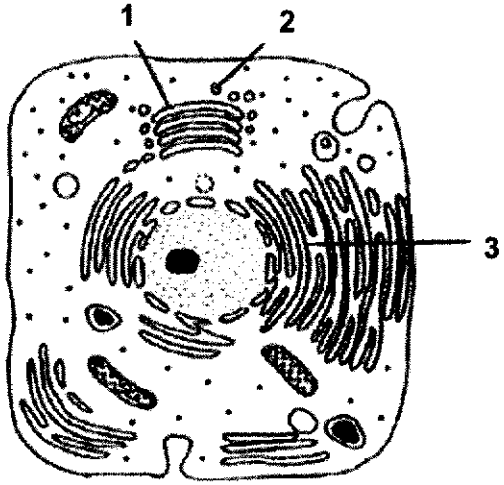
This question paper consists of **20** printed pages.

Setter: Mr Timothy Ng

Vetter: Mrs Marie Huang

[Turn Over

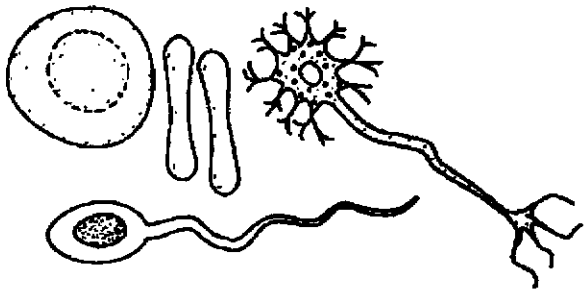
1 The diagram shows the magnified structure of an animal cell under an electron microscope.



What are the functions of the labelled structures?

	synthesizing protein from amino acids	exporting proteins out of the cell	modify, store and package proteins
A	1	2	3
B	1	3	2
C	3	1	2
D	3	2	1

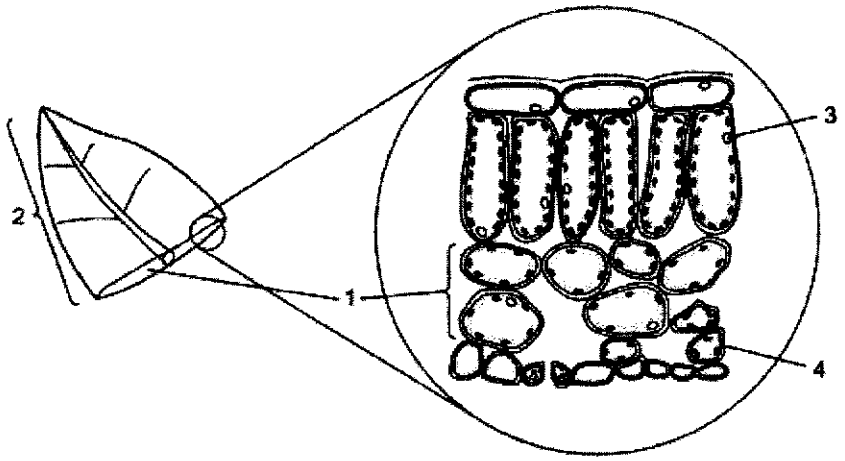
2 The diagrams below show several different types of human cells.



Which of the following statements is correct?

A All the cells can move.
B All the cells can undergo cell division.
C All the cells have a nucleus.
D All the cells have a plasma membrane.

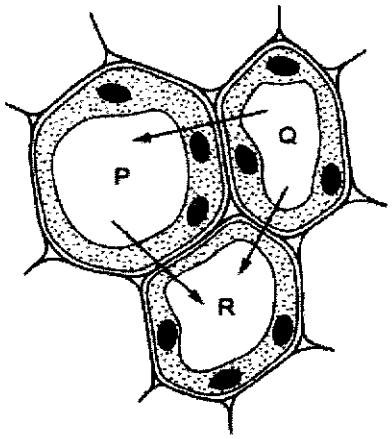
3 The diagram shows the structure of a leaf.



Which letter identifies a cell, a tissue and an organ?

	Cell	Tissue	Organ
A	3	2	4
B	1	4	3
C	4	1	2
D	2	3	1

4 The diagram shows three plant cells labelled P, Q and R. The arrow shows the movement of water by osmosis.



What is the correct order of water potential in the cells, from the highest to the lowest?

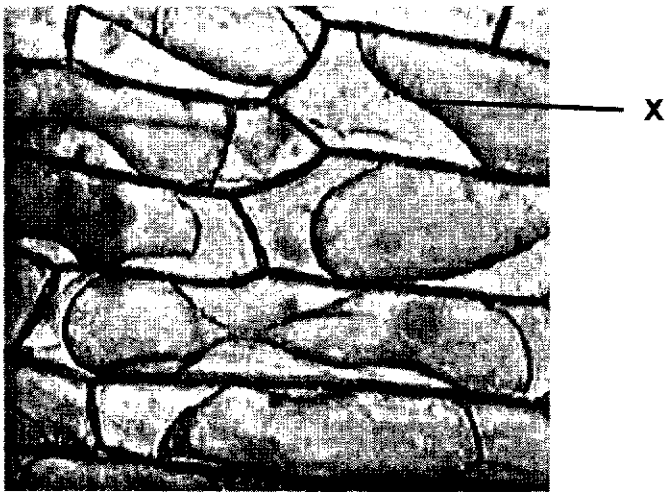
	Highest	Middle	Lowest
A	P	Q	R
B	P	R	Q
C	Q	P	R
D	R	P	Q

[Turn Over

5 Which of the following correctly states a difference between diffusion and osmosis?

	Diffusion	Osmosis
A	against a concentration gradient	along a concentration gradient
B	does not require energy	requires energy
C	requires a partially-permeable membrane	does not require a partially-permeable membrane
D	involves all particles	involves mainly water molecules

6 The light micrograph below shows the appearance of some onion cells after they had been placed in a concentrated salt solution for some time.



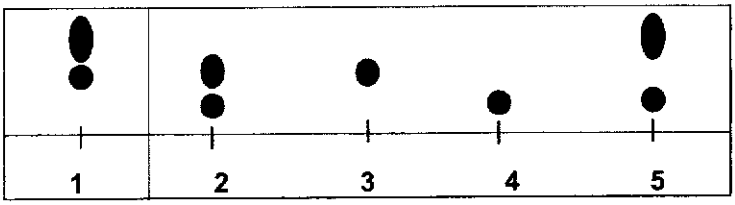
Identify X and the condition of the cells above.

	X	Condition of cells
A	cell membrane	crenated
B	cell membrane	plasmolysed
C	cell wall	crenated
D	cell wall	plasmolysed

7 Which of the following correctly states the digestion of sucrose?

	nutrient	enzyme	products of digestion
A	sucrose	amylase	glucose only
B	sucrose	lactase	glucose and galactose
C	sucrose	lipase	fatty acids and glycerol
D	sucrose	sucrase	glucose and fructose

8 Five disaccharides were each hydrolysed with dilute acid and the purified products were separated by chromatography. The results are shown in the diagram below.



Spot 1 in the diagram represents the products obtained from the hydrolysis of sucrose.

Which of the following represents the results obtained from the hydrolysis of lactose and maltose?

	lactose	maltose
A	2	3
B	2	4
C	5	2
D	5	3

9 A student tested his fluid lunch in the following ways and got the results as shown.

Treatment	Results
Added 1 ml of alcohol followed by water 1 ml of water to a sample of the fluid lunch.	A white emulsion was formed.
Added 1 ml of Biuret solution to a sample of the fluid lunch.	The Biuret solution turned violet.
Added 2 ml of Benedict's solution to a sample of the fluid lunch and placed it in a boiling water bath for 3 minutes.	The Benedict's solution turned into a brick-red precipitate.
Added 3 drops of iodine solution to a sample of the fluid lunch.	The iodine solution remained brown.

The food substances present in the lunch could contain some of the following nutrients:

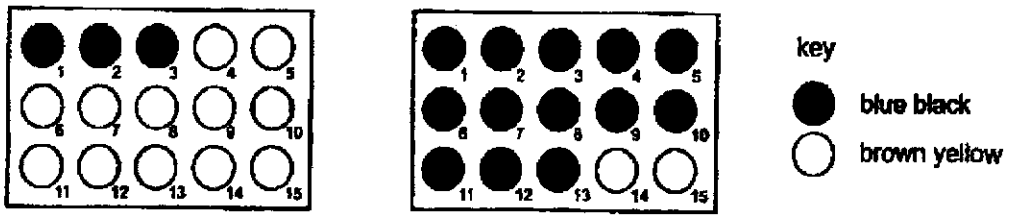
1. fat
2. protein
3. reducing sugar
4. starch

From the results of the tests, which of the nutrients were present in his lunch?

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

[Turn Over

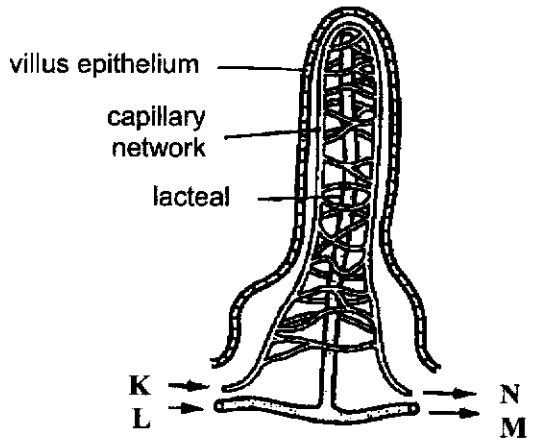
10 An experiment was carried out to investigate the digestion of starch using amylase at two different temperatures. A sample was removed from each mixture at 15 seconds intervals and placed into a spotting tile well containing two drops of iodine solution. The results are shown in the diagram.



Which of the following shows the correct temperatures and times for the complete digestion of starch?

	Time for digestion of starch / s	
	10°C	30°C
A	0.45	19.50
B	19.50	0.45
C	45.00	195.00
D	195.00	45.00

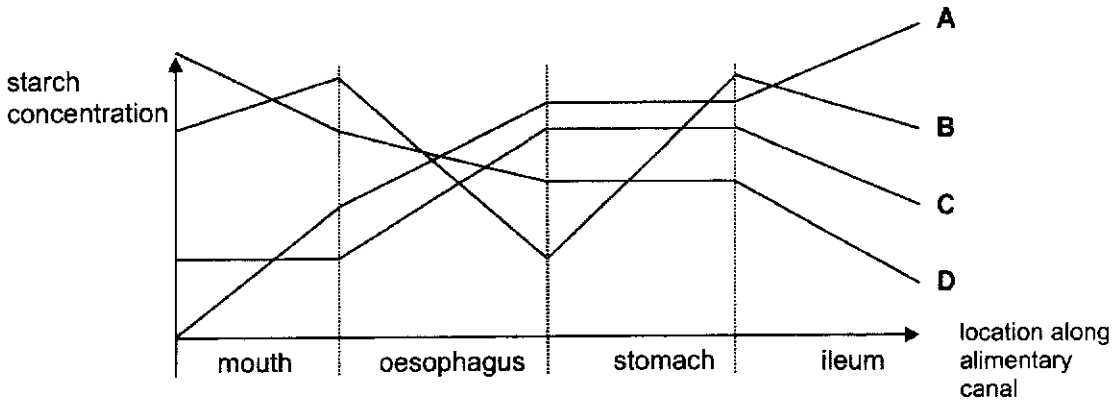
11 The diagram shows the structure of a villus found in the small intestine. The arrows show the direction of flow of the fluids from the products of digestion absorbed by the villus.



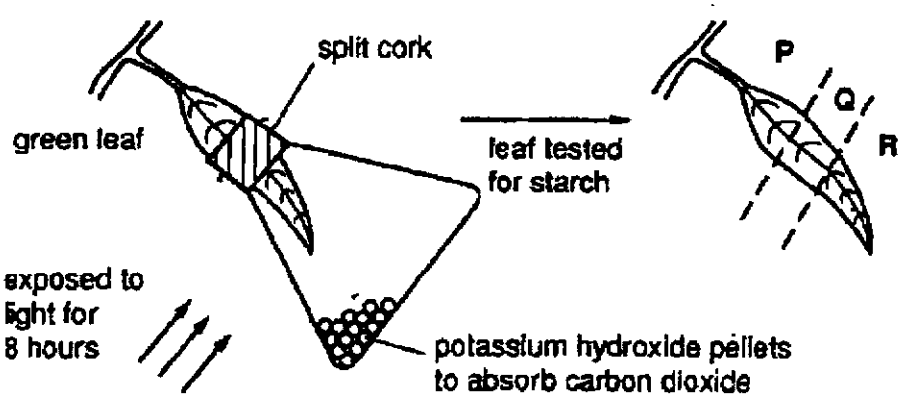
After a meal, where will you find the highest concentrations of amino acids and glucose?

	amino acids	glucose
A	K	N
B	L	M
C	M	M
D	N	N

12 Which of the graphs below represent starch digestion along the alimentary canal?



13 The diagram shows an experiment which was carried out to investigate photosynthesis.

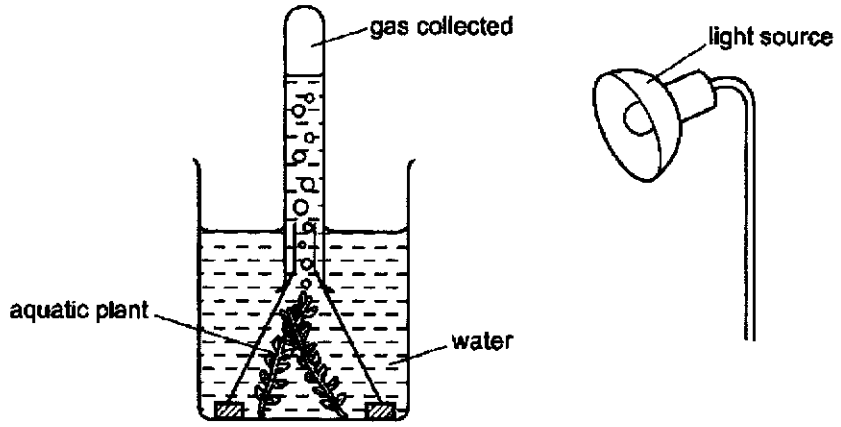


What were the colours of regions Q, and R, after the leaf had been tested for starch using iodine solution?

	Q	R
A	blue-black	brown
B	brown	brown
C	blue-black	blue-black
D	brown	blue-black

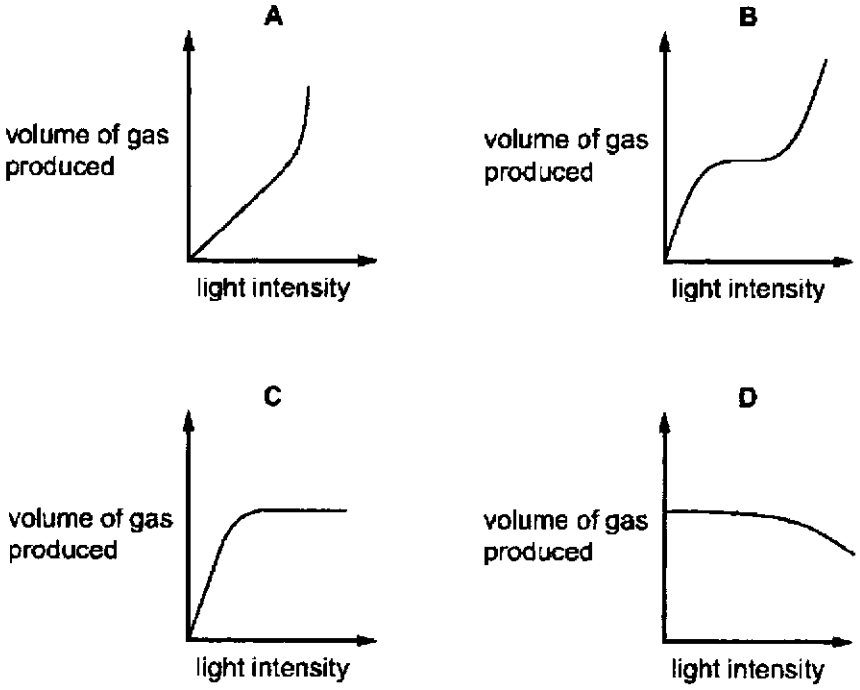
[Turn Over

14 An experiment is set up as shown. The volume of gas collected is measured after 30 minutes.

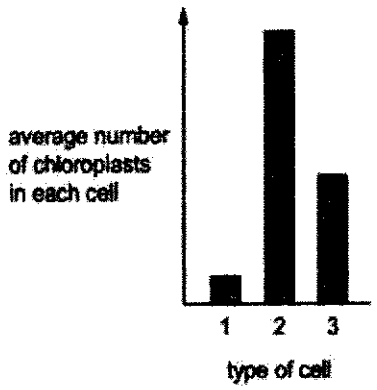


The experiment is repeated several times. Each time the light intensity is increased.

Which graph shows the results?



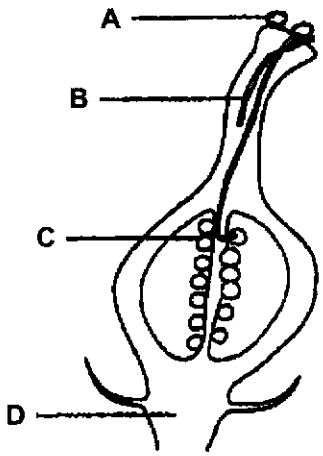
15 The chart shows the average number of chloroplasts in each of three different types of leaf cell.



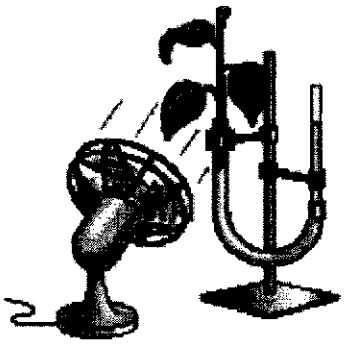
What are the three types of leaf cell?

	1	2	3
A	guard cell	palisade mesophyll cell	spongy mesophyll cell
B	palisade mesophyll cell	spongy mesophyll cell	guard cell
C	spongy mesophyll cell	guard cell	palisade mesophyll cell
D	spongy mesophyll cell	palisade mesophyll cell	guard cell

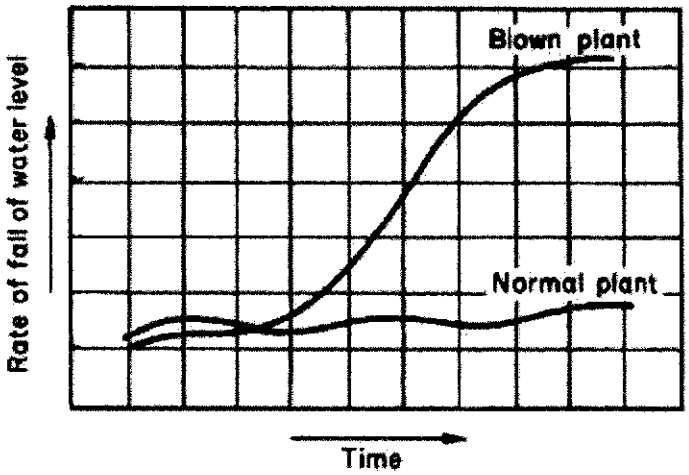
16 In cell tissue culture, cells are taken from the parent plant and grown in a cell culture. From which part of the plant would cell samples be taken so that the new plants would be genetically identical to the parent plant?



17 An experiment was conducted to investigate the effect of wind on the rate of transpiration in plants. One plant had a fan directed at it throughout the experiment.



The graphs below show the rate of fall of the water levels in two plants.

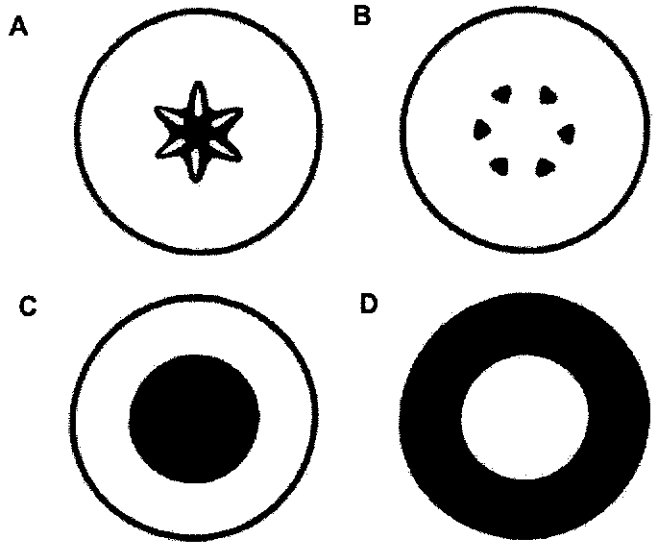


Which statement is the best explanation of the difference between the two graphs?

A The fan caused an increase in the rate of translocation, resulting in increased water uptake.
B The fan caused more evaporation of water from the cylinder and the leaves.
C The plant has a greater transpiration rate due to the increased air movement.
D The plant took up less water as the fan cooled the temperature.

18 A plant was exposed to radioactive carbon for a period of time. Six hours later, the cross-section of the stem tissue shown below was cut from the plant and dried in an oven. it was pressed against photographic plates that became black when exposed to radioactivity.

Which of the following shows the appearance of the photographic plate taken at the end of the experiment?



19 The test results of blood group testing of three people, John, Jacob and Jennifer are shown below.

Blood of person	**John**	**Jacob**	**Jennifer**
Serum from blood of group A	clumps	clumps	no clumping
Serum from blood of group B	no clumping	clumps	no clumping

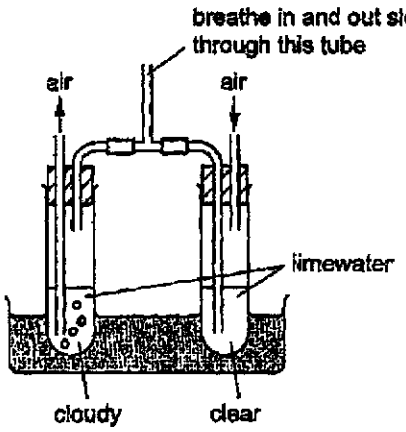
Which of the following correctly identifies their blood groups?

	John	**Jacob**	**Jennifer**
A	A	B	AB
B	AB	A	B
C	B	AB	O
D	O	AB	A

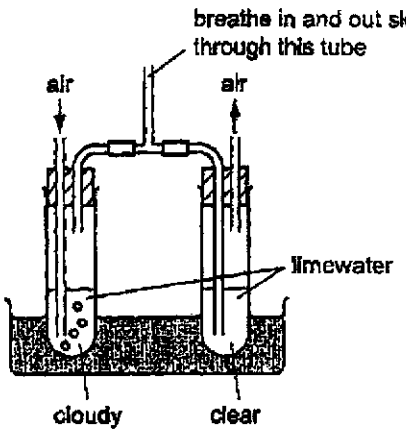
[Turn Over

20 Carbon dioxide turns limewater cloudy. Which one of the following demonstrates that expired air contains much more carbon dioxide?

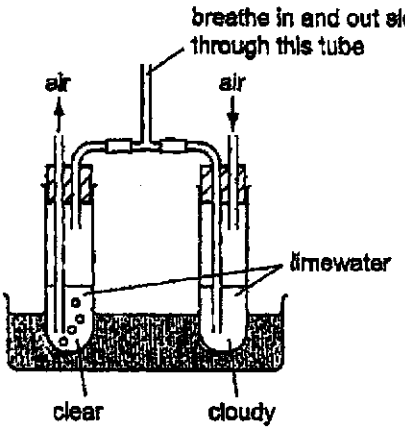
A



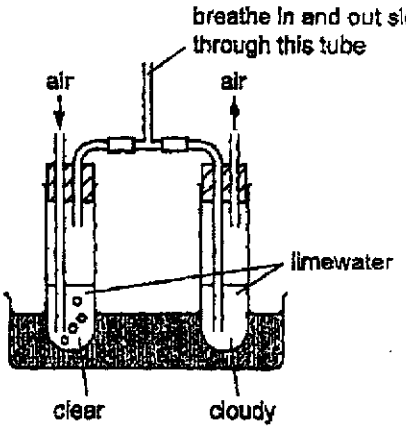
B



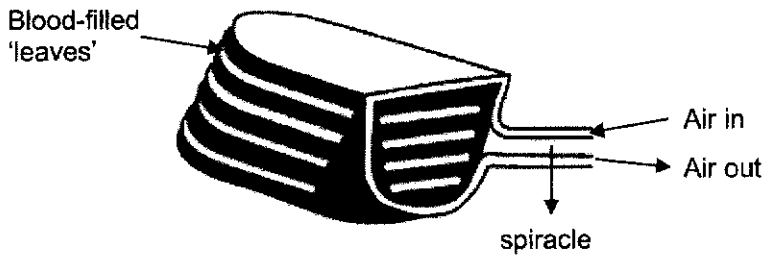
C



D



21 Scorpions have breathing organs called 'book lungs'. These consist of blood-rich tissues arranged like the leaves of a book. Air enters the 'book lungs' through a small opening called a spiracle. Gases can be exchanged between the air and the blood.



Which of the following will speed up gas exchange between the blood in the 'leaves' and the air around them?

A Increasing the flow of blood through the 'leaves'.
B Lowering the blood temperature.
C Reducing the number of 'leaves'.
D Reducing the size of the spiracle.

22 The following table gives the events involved in the secretion and action of anti-diuretic hormone (ADH).

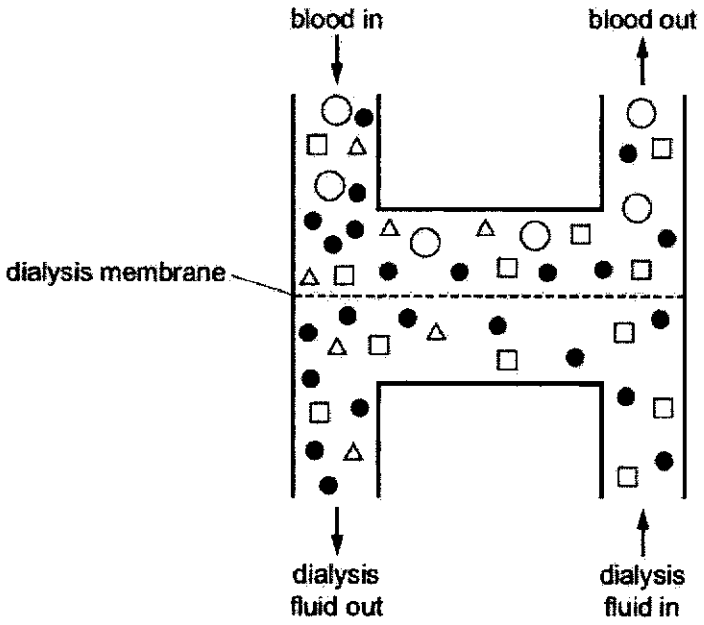
Which row shows the correct chain of events?

Key
+ = Increased
- = Decreased

	Water level in blood relative to normal	Amount of ADH produced relative to normal	Amount of water reabsorbed by kidneys
A	+	+	-
B	+	-	+
C	-	+	+
D	-	-	-

[Turn Over

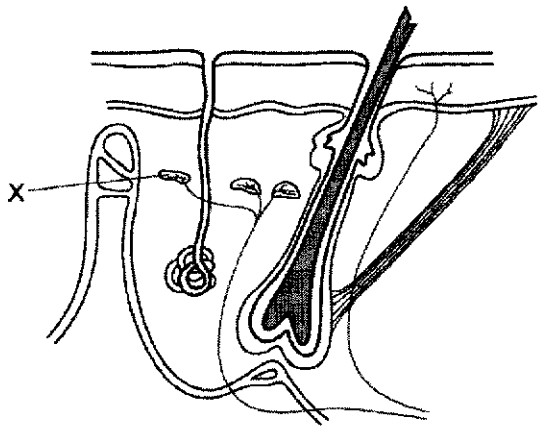
23 The diagram shows how a kidney dialysis machine works. Each shape represents a molecule found in blood or dialysis fluid.



Which shape represents urea?

A ○
B ●
C □
D △

24 The diagram shows some of the structures seen in a section through human skin.



What is the function of structure X?

A to cause capillaries to constrict
B to detect changes in temperature
C to receive impulses from the central nervous system
D to stimulate sweat glands to release sweat

25 Four processes that take place in the human body are listed.

1. absorption of amino acids through the villi
2. maintenance of a constant body temperature
3. production of lactic acid in muscles
4. regulation of blood glucose concentration

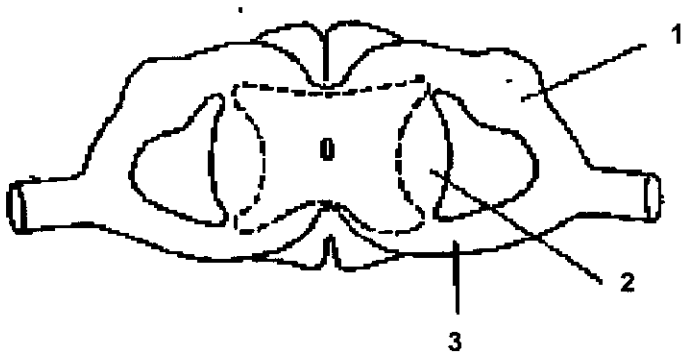
Which two processes are directly controlled by negative feedback?

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

26 How is the concentration of blood glucose regulated?

	Blood glucose concentration	**Pancreas stimulated to secrete**	**Liver converts**
A	fall	glucagon	glycogen to glucose
B	fall	insulin	glucose to glycogen
C	rise	glucagon	glucose to glycogen
D	rise	insulin	glycogen to glucose

27 Part of the spinal cord of a person was damaged. A pin prick was applied to the base of the person's foot. It was observed that the person felt the pain but was unable to jerk his foot away from the pin.



If the diagram represents the spinal cord of the person, which area(s) is/are likely to be damaged?

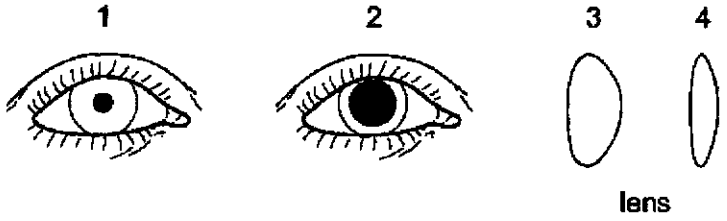
A 1 only
B 3 only
C 1 and 2
D 2 and 3

[Turn Over

28 Which of the following actions is **not** a reflex action?

A choking and coughing when food get stuck in your throat
B closing your eyelids as dust particles from smoke hit your face
C crying when you feel sad
D pulling your hand away after touching a candle flame

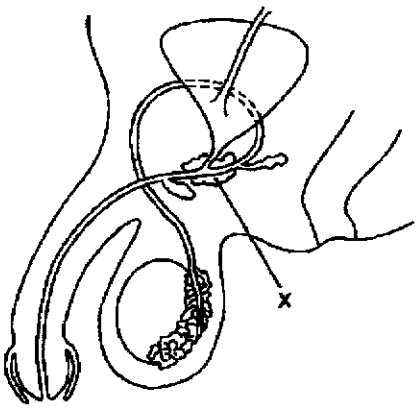
29 The diagrams show the eye viewed from the front and its lens in cross-section.



Which diagrams show the appearance of the pupil and the shape of the lens when looking up at the sky at night?

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

30 The diagram shows part of the male reproductive system.



What will be the effect of removing gland X?

A prevention of the storage of sperm before fertilisation
B reduction of the nutrients in the seminal fluid
C slowing down of the production of sperm
D stoppage of the secretion of a male hormone

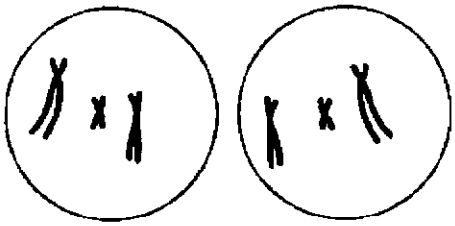
31 Which of the following occurs in mitosis but **not** in meiosis?

A crossing over between homologous chromosomes
B homologous chromosomes are sorted to different nuclei
C independent assortment of chromosomes at metaphase
D nuclear envelope reforming around a diploid number of chromosomes at telophase

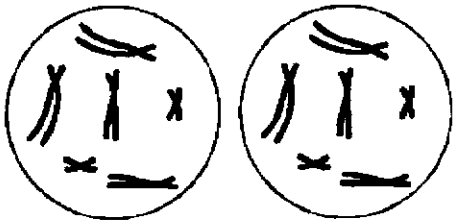
32 The diagram shows the chromosomes in a cell.

Which diagram shows the product of **one** division of the cell by mitosis?

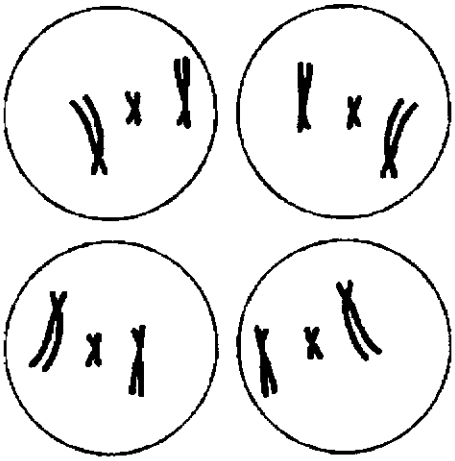
A



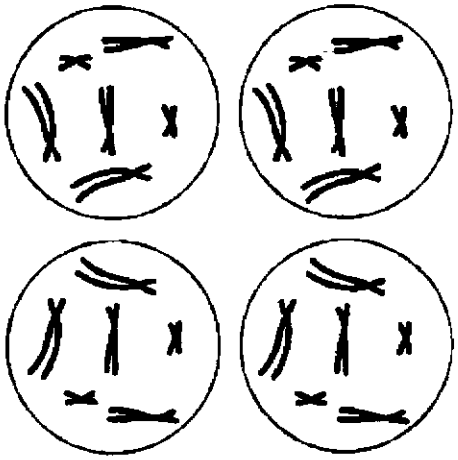
B



C



D



33 In some species of dragonflies, the females have two X chromosomes while the males have one X chromosomes and no Y chromosomes. If the normal diploid number in a dragonfly is 16, what would be the number of chromosomes in the body cells of the male and female dragonflies?

	Male dragonfly	Female dragonfly
A	7	8
B	8	16
C	15	16
D	16	16

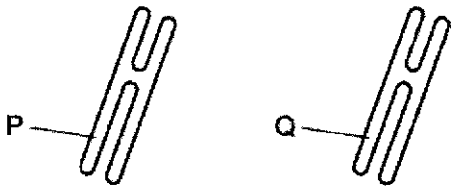
34 The following table shows the base composition of the chromosome in a particular insect.

Base composition/%			
Adenine	**P**	**Q**	**R**
31.6	18.0	18.4	32.0

Which of the following correctly identifies the unknown bases?

	P	Q	R
A	cytosine	guanine	thymine
B	guanine	cytosine	uracil
C	guanine	uracil	cytosine
D	thymine	guanine	cytosine

35 The diagram shows a pair of chromosomes from the same cell.

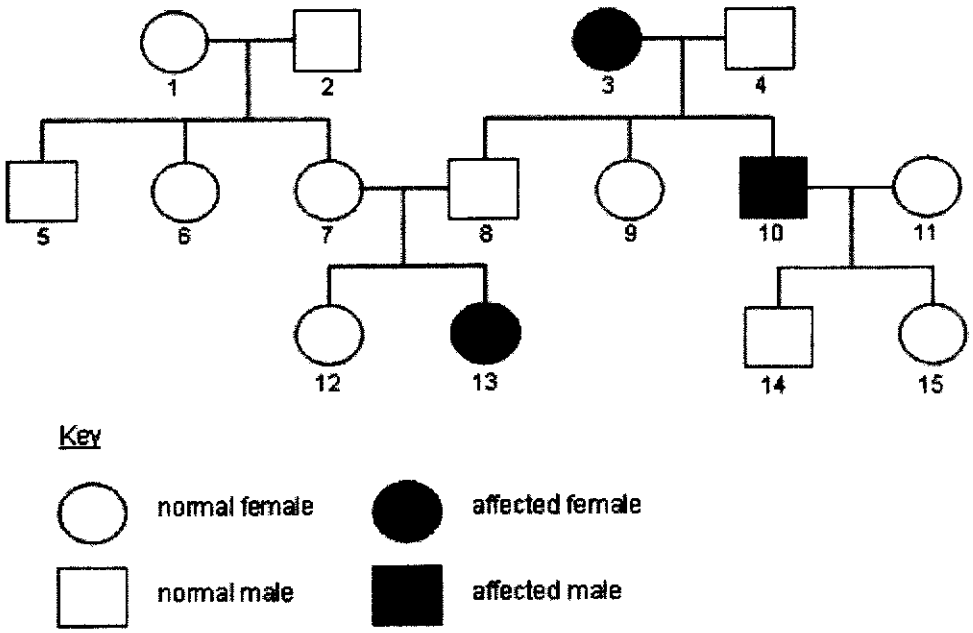


A gene is found at the point labelled P.

In a heterozygous individual, what will be found at the equivalent position labelled Q?

A a different allele of a different gene
B a different allele of the same gene
C a different gene of the same allele
D the same gene of the same allele

36 The family tree shows the inheritance of a condition caused by the recessive allele **g**.



What is/are the possible genotypes for individual 11?

A Gg
B GG
C GG and Gg
D GG, Gg and gg

37 In a species of plant, the allele for yellow flowers is dominant to the allele for white flowers.

Which offspring is it possible to produce from a cross between two plants heterozygous for flower colour?

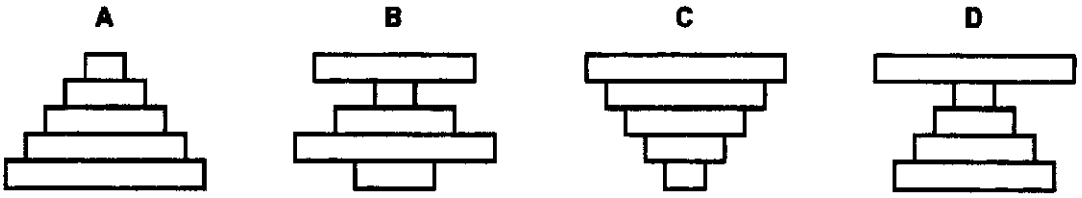
A heterozygous yellow and heterozygous white
B heterozygous yellow only
C heterozygous yellow, homozygous yellow and homozygous white
D homozygous yellow only

[Turn Over

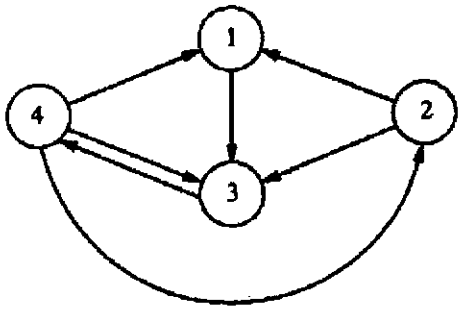
38 A food chain is shown.

wheat → insects → small birds → owls → lice

What is the pyramid of numbers for this food chain?



39 In the diagram below, arrows represent the movement of carbon compounds in the carbon cycle. The circles represent carbon compounds in animals, decomposers, plants and the atmosphere.



Which of the following options correctly identifies the four circles?

	1	2	3	4
A	atmosphere	plants	decomposers	animals
B	animals	atmosphere	Plants	decomposers
C	decomposers	animals	atmosphere	plants
D	plants	decomposers	animals	atmosphere

40 Which change would lead to an increase in biodiversity in an area?

A building a large number of blocks of family dwellings in a city
B increasing the number of cows in a pedigree herd
C replacing a forest with a large palm oil plantation
D stopping fishing in an area of sea for several years

End of Paper

Name	Reg. No	Class

MAYFLOWER SECONDARY SCHOOL

4EX

BIOLOGY	**6093/02**
Paper 2 Theory [80 Marks]	
	PRELIMINARY EXAMINATION
Additional Materials: Approved calculator	September 2019 1 hour 45 minutes

Instruction to Candidates

Do not start reading the questions until you are told to do so.

Write your name, class, and index number on all the work you hand in.

Write in dark blue or black pen.

You may use a soft pencil for any diagrams, graphs or rough working.

Do not use paper clips, highlighters, glue or correction fluid.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the Question Paper.

Section B

Answer **all** questions. The last question is in the form of either/or.

Write your answers in the spaces provided on the Question Paper.

Electronic calculators may be used.

You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.

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

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

FOR EXAMINER'S USE		
Paper		**Marks**
Paper 1 (MCQ)		/ 40
Paper 2		
A		/ 50
B	**6**	/ 10
	7	/ 10
	8	/ 10
Total		**/ 120**

This question paper consists of **18** printed pages.

Setter: Mr Timothy Ng

Vetter: Mrs Marie Huang

[Turn Over

Section A

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

1 **Fig. 1** shows the leaves of the same plant during a drought. **Fig. 1.1a** shows the plant before it was watered and **Fig. 1.1b** shows the plant after it was watered daily for one week.

before watering

Fig. 1.1a

after watering

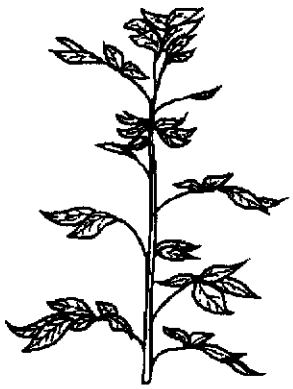


Fig. 1.1b

(a) (i) Define the term *transpiration.*

.....

..... [1]

(ii) Describe and explain two factors that would affect the rate of transpiration of the plant in **Fig. 1.1a** during a drought.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(iii) Suggest how wilting helps the plant to survive during a drought when water is in short supply.

.....

.....

.....

..... [2]

(b) Name one process that takes place in **Fig. 1.1b** only during the day.

..... [1]

(c) **Fig. 1.2** shows the uptake and loss of oxygen by a leaf during a 24-hour period.

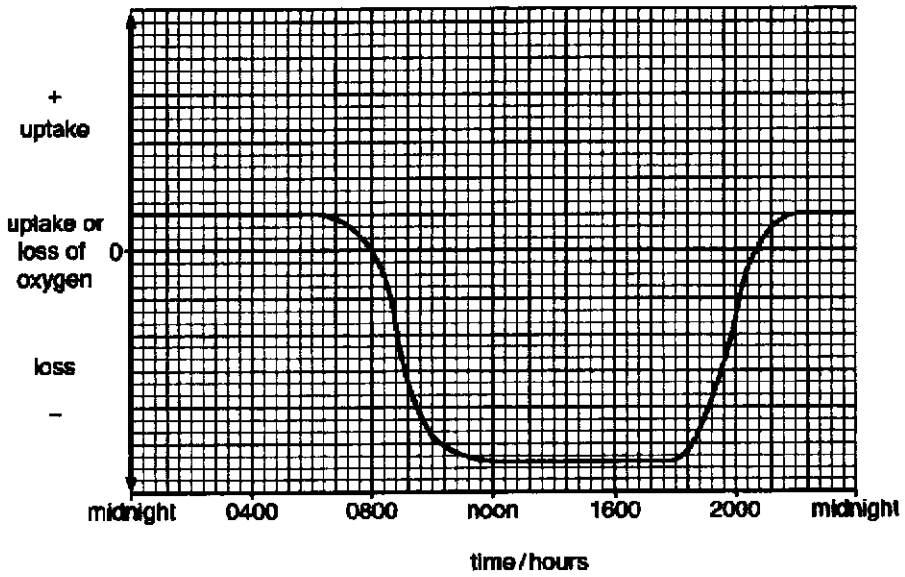


Fig. 1.2

Explain the processes taking place in the leaf between 1800 hours and 2000 hours.

.....

.....

.....

..... [2]

[Total marks = 10]

[Turn Over

2 **Fig. 2.1** below shows the changes in oxygen uptake and pH of the muscles of an athlete during a race.

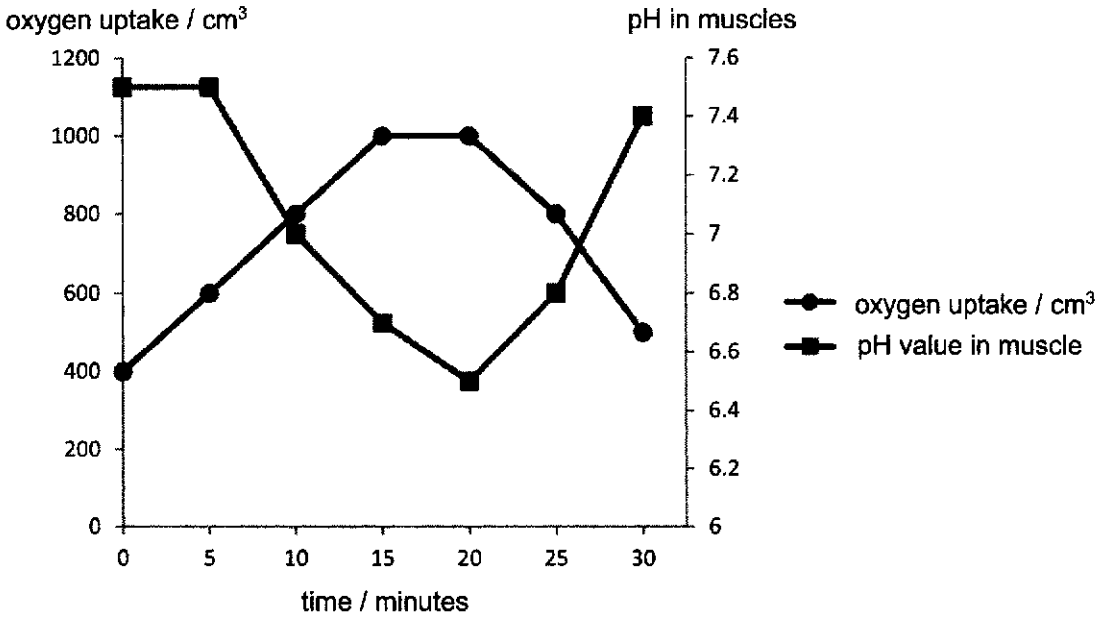


Fig. 2.1

(a) With reference to **Fig. 2.1**,

(i) state the time that the athlete begins to incur an oxygen debt.

.....minutes [1]

(ii) deduce the process that caused the changes in pH in his muscles.

..... [1]

(iii) explain how the oxygen debt results in the changes in pH in his muscles.

.....

.....

.....

.....

.....

..... [3]

(b) The increase in oxygen demand by the athlete was due to an increase in aerobic respiration in his muscles.

State the word equation for aerobic respiration.

..... [1]

(c) **Fig. 2.2** shows a section of an alveolus.

Fig. 2.2

(i) With reference to **Fig. 2.2**, describe **two** ways that the structure of the alveoli is adapted to its function in gaseous exchange.

.....

.....

.....

..... [2]

(ii) Describe the possible harmful effects of smoking cigarettes on the alveoli.

.....

.....

.....

..... [2]

[Total marks = 10]

[Turn Over

3 **Fig. 3.1** below shows a cross section of the heart from a person suffering from a heart defect known as "hole in the heart".

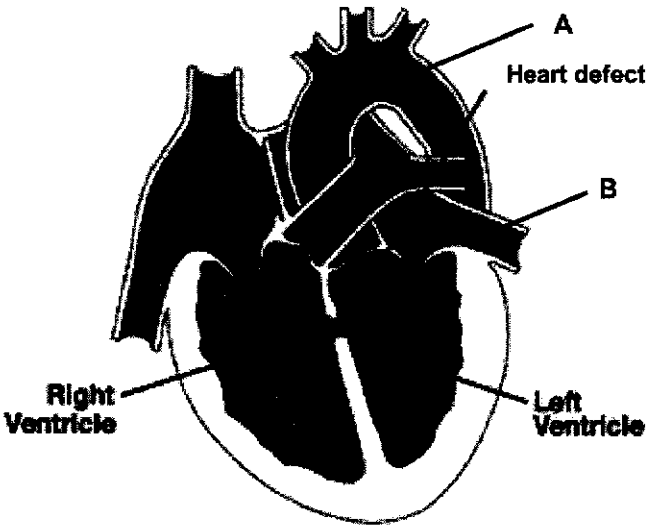


Fig. 3.1

(a) **(i)** Identify the blood vessels labelled **A** and **B** in **Fig. 3.1**.

A: .....

B: ..... [2]

(ii) Describe how the heart works to generate a heartbeat.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(iii) Predict how the heart defect will affect the lifestyle of this person.

.....

.....

.....

..... [2]

(b) **Fig. 3.2** shows pressure changes in the left side of the heart and aorta over time. The total length of a cardiac cycle is 0.8 seconds. Points 1, 2, 3 and 4 indicate when the atrio-ventricular valves and semilunar valves are either open or close.

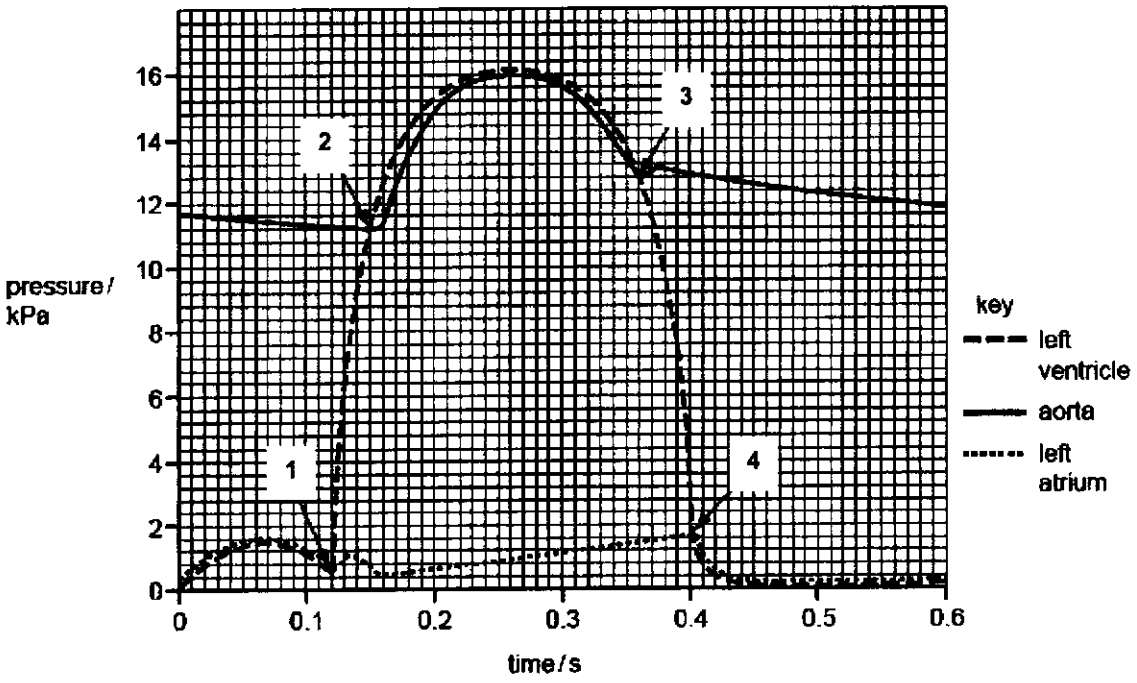


Fig. 3.2

(i) **Circle** on **Fig. 3.2**, the area(s) of the graph where the atrio-ventricular valves and the semi-lunar valves are both closed at the same time during the cardiac cycle shown. [1]

(ii) Calculate how many times the heart described in **Fig 3.2** will beat in **one** minute.

Number of heart beats per minute = ... [1]

[Turn Over

(c) **Fig. 3.3** shows the transverse section of two types of blood vessels found in the human circulatory system.

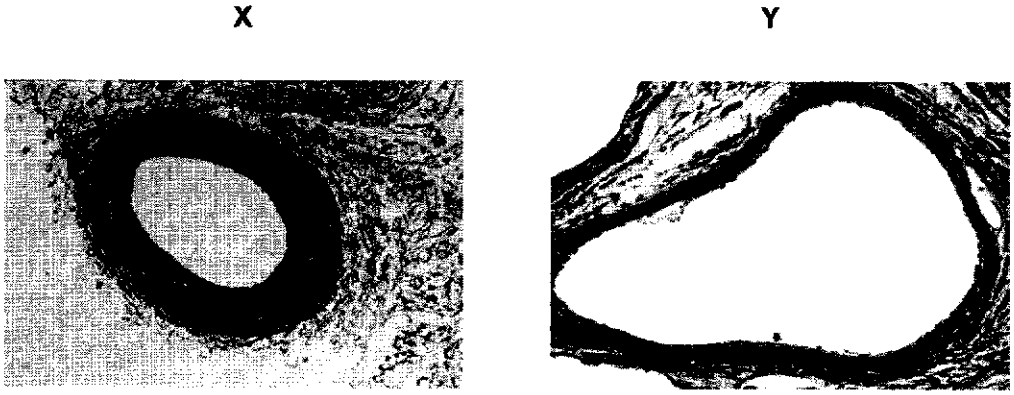


Fig. 3.3

(i) Identify blood vessel **Y**.

..... [1]

(ii) Describe the differences in the structures **X** and **Y** as shown in **Fig. 3.3**.

.....

..... [1]

[Total marks = 12]

4 **Fig. 4** shows the model of how a kidney nephron function.

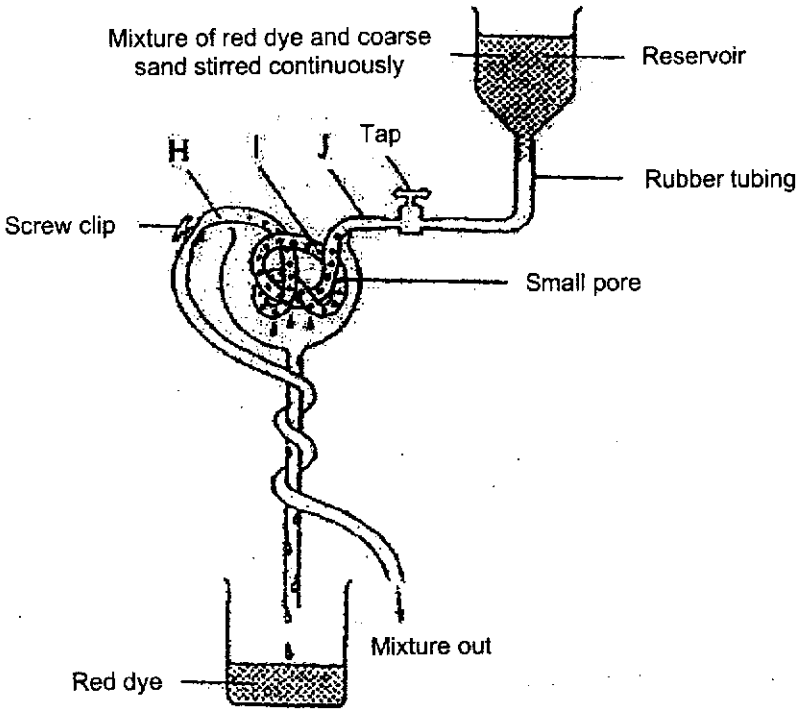


Fig. 4

(a) Identify the labelled structures **H**, **I** and **J**.

H: .....

I: .....

J: ..... [2]

(b) Name one cell type or organic compound in the mammalian body that is represented by the coarse sand in the mixture.

..... [1]

(c) Part **I** is involved in two key processes in the excretion of urea from the body.

(i) Define the term *excretion*.

.....

..... [1]

(ii) State the key process that part **I** is involved in during excretion.

..... [1]

[Turn Over

(d) The reabsorption of water in the kidneys is controlled by a hormone produced by an endocrine gland.

Name this hormone and state its role in the kidneys during excretion.

.....

.....

.....

..... [2]

(e) Describe two differences between the nervous system and the hormonal system.

.....

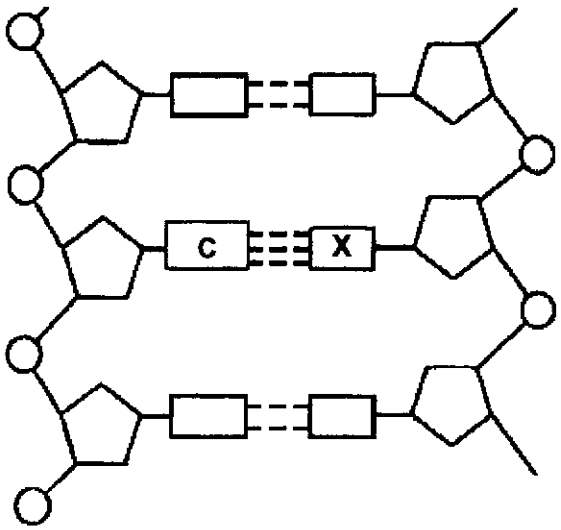
.....

.....

..... [2]

[Total marks = 9]

5 **(a)** **Fig. 5.1** below shows a section of DNA.



Key:
C = Cytosine

Fig. 5.1

(i) On **Fig. 5.1**, **circle** one nucleotide. [1]

(ii) Identify base **X**.

..... [1]

(iii) Outline the relationship between DNA, genes and chromosomes.

.....

.....

.....

..... [2]

(f) A person with diabetes may be treated with insulin produced by genetically modified bacteria.

Outline how such genetically modified bacteria may be produced and used to manufacture human insulin on a commercial scale.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

[Total marks = 9]

- - - - - End of Section A - - - - -

Section B

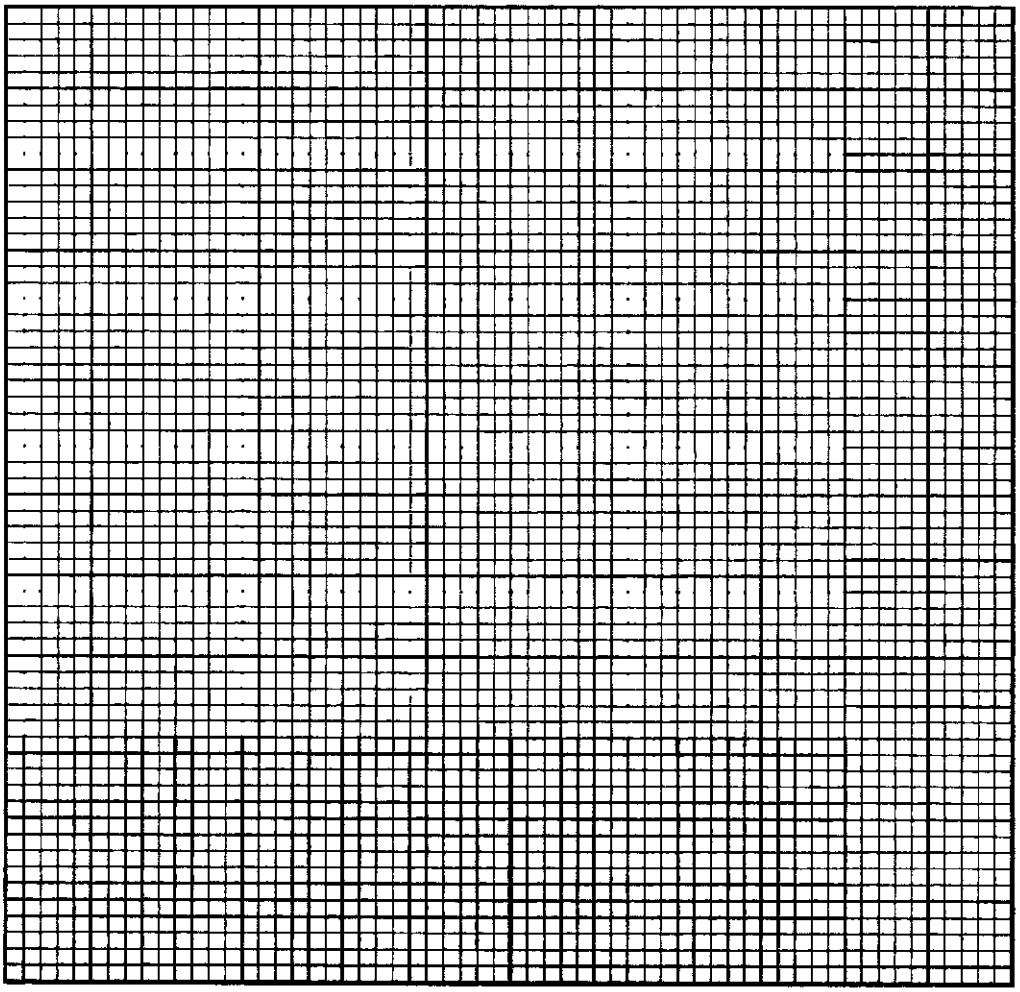
Answer **three** questions.

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

6 The table below shows the distribution in blood group among a population of 1000 people living in a small town in Alaska.

Blood Group	Number of people
A	410
AB	30
B	90
O	470

(a) With reference to the data above, draw a histogram to represent the data. [3]



(b) Identify and explain the type of variation that is shown by the blood group.

.....

.....

..... [2]

(c) Blood group of individuals are inherited from their family members. **Fig. 5.1** shows a family tree.

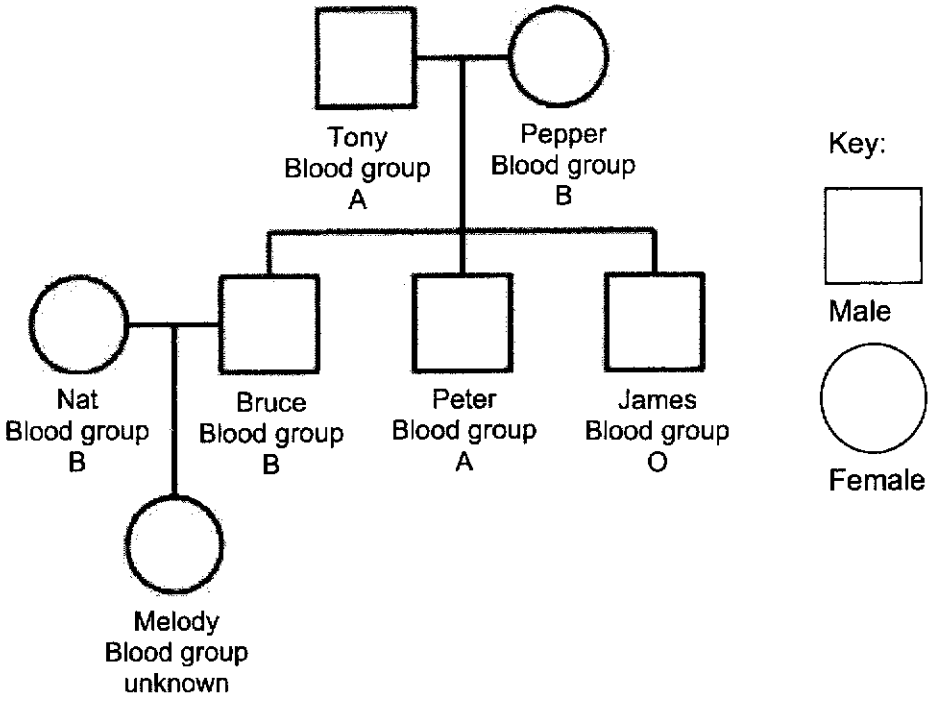


Fig. 5.1

(i) Using a genetic diagram, determine the probability that Tony and Pepper can have a child with blood group AB.

Probability = ... [4]

[Turn Over

(ii) Deduce using **Fig. 5.1** the possible blood group(s) that Melody could have.

..... [1]

[Total marks = 10]

7 The diagram below shows a food web of a community of organisms.

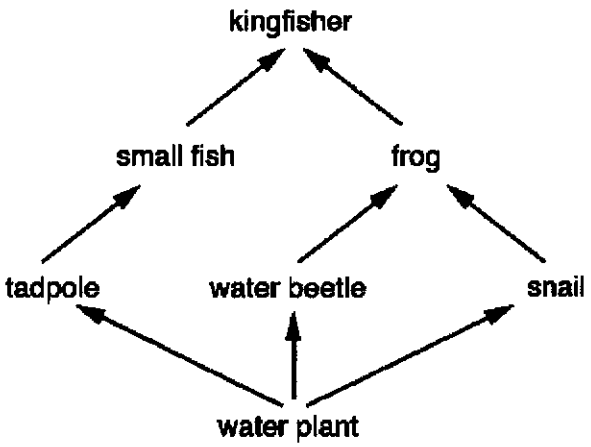


Fig. 7

(a) Referring to the food web in **Fig. 7**,

(i) Draw a pyramid of biomass for a food chain that consists of at least **four** trophic levels.

[2]

(ii) complete the table by writing the correct number of organisms for each statement about the food web. The first number has been written for you.

statement	number
the number of producers	1
the number of consumers	
the number of food chains	

[1]

(b) The oceans and forests help in the cycling of carbon in our ecosystem. Define the term carbon sink and describe the importance of the oceans as a carbon sink.

.....

.....

.....

.....

.....

..... [3]

(c) Scientists observing the kingfishers did a blood test on them and discovered high levels of the pesticide, DDT accumulating in their bodies. They noticed that the kingfishers frequently preyed along the rivers near a farming community.

Explain how the excessive use of DDT by the farmers affects the survival of the kingfishers.

.....

.....

.....

.....

.....

.....

.....

..... [4]

[Total marks = 10]

8 Either

(a) Distinguish between asexual reproduction and sexual reproduction in flowering plants.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(b) **Fig. 8.1** below shows the flower of a plant.

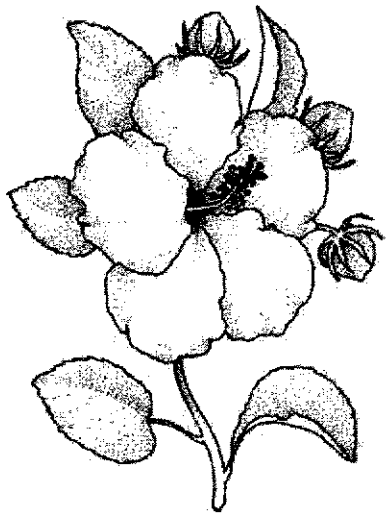


Fig. 8.1

Describe and explain two adaptations observed in **Fig. 8.1** that facilitate pollination of this flower.

.....

.....

.....

..... [2]

(c) Describe the processes that takes place in a flower from **Fig. 8** after it is successfully pollinated.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

[Total marks = 10]

8 Or

(a) Describe the levels of hormone oestrogen and progesterone and its effect in the menstrual cycle.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

[Turn Over

(b) **Fig. 8.2** shows a section of a mother's uterus.

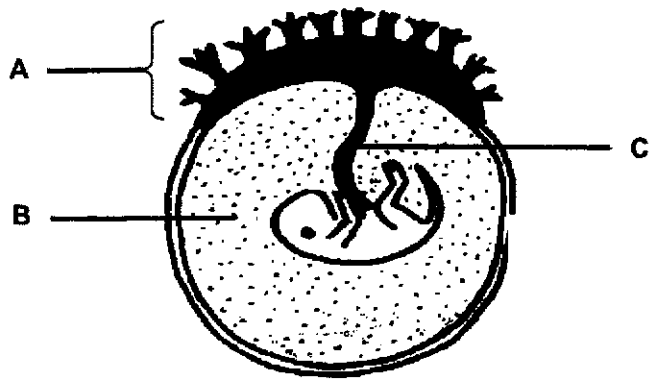


Fig. 8.2

With reference to structures **A**, **B** and **C**, describe how they help to support the growth and development of the foetus during pregnancy.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

[Total marks = 10]

- - - - - End of Section B - - - - -
- - - - - End of Paper - - - - -

Answer Key (Prelim 2019 – 6093/01)

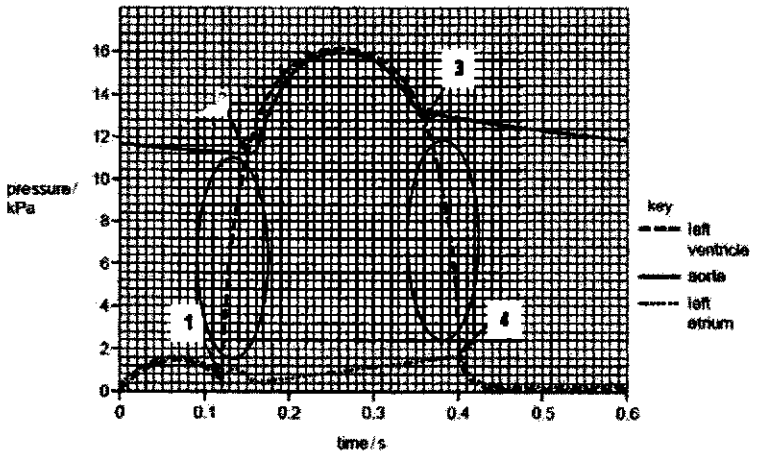
Paper 1: 40 MCQs [40 marks]

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

Answer Key (Prelim 2019 – 6093/02)

Paper 2 Section A: Answer all questions [50 marks]

1	(a)(i)	Transpiration is the loss of water vapour from the aerial parts of the plants through the stomata of the leaves.	[1m]
	(a)(ii)	• Temperature As the temperature during the drought is very high, there will be an increase in the rate of evaporation of water from the surfaces of the leaf. This increases the rate of transpiration. • Humidity As the humidity is very low, the water vapour concentration gradient between the surrounding air and the intercellular air space (in the leaf) is very high. Water vapour diffuses out of the leaf increasing the rate of transpiration. (light intensity and wind speed not accepted)	[2m] [2m]
	(a)(iii)	• Wilting will cause the leaves to droop/fold up, reducing the surface area exposed to sunlight. • Stomata size reduced • This helps the plant to reduce transpiration as the guard cells turn flaccid.	[2m]
	(b)	Photosynthesis	[1m]
	(c)	• From 1800 to 2000 hours, the uptake of oxygen is increasing as the rate of respiration in the plant is now higher • than the rate of photosynthesis as the light intensity of the surrounding decreases to zero at night.	[2m] **Total: 10**
2	(a)(i)	5 minutes	[1m]
	(a)(ii)	Anaerobic respiration	[1m]
	(a)(iii)	• Aerobic respiration is not able to meet the energy demands of the athlete. Muscles will respire aerobically and anaerobically to get more energy creating an oxygen debt. • Anaerobic respiration releases a lactic acid as a by-product. • The lactic acid produced caused the pH to decrease from 7.6 to 6.2 from 5 min to 20 min.	[3m]
	(b)	glucose + oxygen → carbon dioxide + water + large amounts of energy	[1m]
	(c)(i)	• The oxygen enters the alveoli where it dissolves into the thin film of moisture lining the inner walls of the alveoli increasing the speed of diffusion. • The walls of the alveoli are one-cell thick which allows for rapid diffusion of dissolved oxygen into the red blood cells.	[2m]

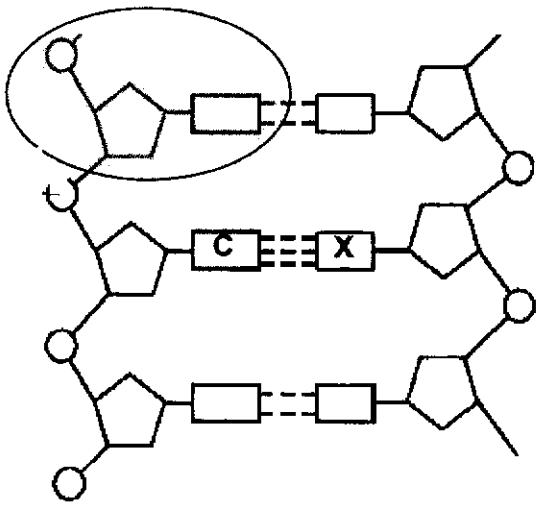
	(c)(ii)	• Tar will paralyse the cilia causing a build-up of mucus which may result in bronchitis / frequent coughing. • The frequent coughing may cause emphysema where the walls of the alveoli are damaged reducing the surface area for gaseous exchange.	[2m] **Total: 10**
3	(a)(i)	A – Aorta B – Pulmonary vein	[2m]
	(a)(ii)	Deoxygenated and oxygenated returns to the right and left atrium from the body and lungs respectively. • During atrial systole, the higher pressure in the atriums compared to the ventricles causes the atrio-ventricular valves to open forcing blood into the ventricles. • During ventricular systole, the higher pressure in the ventricles compared to the atrium and arteries causes the semi-lunar valves to open and the atrio-ventricular valves to close creating the "lub" sound. • As the blood is pumped to the lungs and rest of the body, the higher pressure of the aorta and pulmonary artery will cause the semi-lunar valves to close to prevent backflow of blood. This will create the softer "dub" sound. (1m awarded for stating when the "lub" and "dub" sound is produced)	[1m] [1m] [1m] [1m]
	(a)(iii)	• The hole in the median septum will cause the oxygenated blood in the left side of the heart to mix with the deoxygenated blood in the right side of the heart. • This will result in less oxygen transported in the blood around the body. Hence, he will be unable to participate in any strenuous activities.	[2m]
	(b)(i)	 2 correct circles required for full marks	[1m]
	(b)(ii)	60 / 0.8 = 75	[1m]
	(c)(i)	Vein	[1m]

<table>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>(c)(ii)</td><td>Y has thinner less muscular and elastic walls compared to X.</td><td>[1m]

Total: 12</td></tr>
<tr><td>4</td><td>(a)</td><td>H – Efferent arteriole
I – Glomerulus
J – Afferent arteriole

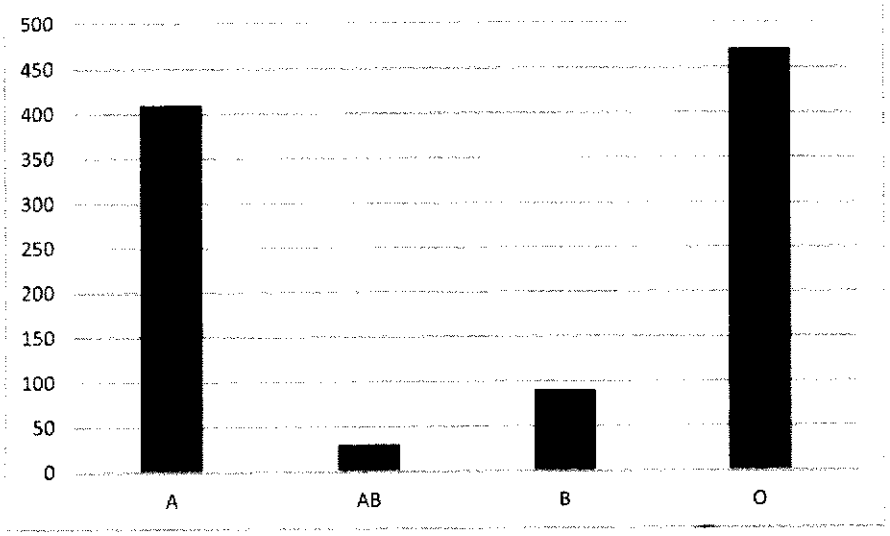
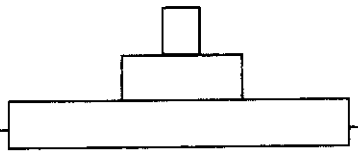
1m for 1 correct
2m for all correct</td><td>[2m]</td></tr>
<tr><td></td><td>(b)</td><td>Red blood cell / Plasma proteins</td><td>[1m]</td></tr>
<tr><td></td><td>(c)(i)</td><td>Excretion is the process by which metabolic waste products and toxic waste materials are removed from the body.</td><td>[1m]</td></tr>
<tr><td></td><td>(c)(ii)</td><td>Ultrafiltration</td><td>[1m]</td></tr>
<tr><td></td><td>(d)</td><td>• Anti-diuretic hormone.
• It controls the permeability of the proximal convoluted tubule and the collecting duct to water for reabsorption.</td><td>[2m]</td></tr>
<tr><td></td><td>(e)</td><td><table><tr><td>Involve nerve impulses (electrical signals)</td><td>Involve hormones (chemical substances)</td></tr><tr><td>Impulse are transmitted by neurones</td><td>Hormones are transported by the blood</td></tr><tr><td>Quick response</td><td>Slow Response</td></tr><tr><td>Reponses are short-lived</td><td>Reponses may be short-lived or long-lived</td></tr><tr><td>May be voluntary or involuntary</td><td>Always involuntary</td></tr><tr><td>Tend o affect one target organ</td><td>Tend to affect more than one target organ</td></tr></table>
Any 2 suitable comparison</td><td>[2m]

Total: 9</td></tr>
</table>

5	(a)(i)		[1m]
	(a)(ii)	Guanine	[1m]
	(a)(iii)	• A gene is made up of a specific sequence of nucleotides that code for a particular polypeptide. • A chromosome contains many genes / DNA organises into many chromosomes within the nucleus / Each molecule of DNA is a chromosome.	[2m]
	(b)	• Use a restriction enzyme to cut out the insulin gene from a human chromosome. Sticky ends will be produced. • Using the same restriction enzyme, cut the plasmid from a bacterium • to produce complementary sticky ends. • Combine the insulin gene with the plasmid using DNA ligase to produce a recombinant plasmid. • Use heat or electric shock to insert the recombinant plasmid into *E.coli* bacteria and culture the bacteria for commercial production of insulin.	[5m] **Total: 9**

Paper 2 Section B: Answer all questions [30 marks]

6	(a)(i)	Number of people	[3m]

		 - Clean, clear bars drawn/point plotted correctly - Correct axis labels - Appropriate scale	
	(b)	- Discontinuous variation - There are a few clear-cut phenotypes / genes do not show additive effect.	[2m]
	(a)	B or O	[1m]
	(b)	Allele of blood group A = I^A Allele of blood group B = I^B Allele of blood group O = I^O Parental phenotype – blood group A : blood group B Parental genotype - I^AI^O : I^BI^O Gametes - I^A I^O : I^B I^O (with circles) Crossing over F1 genotype - I^AI^B / I^AI^O / I^BI^O / I^OI^O F1 phenotype - AB / A / B/ O Ratio - 1 : 1 : 1 : 1 Probability = 0.25 or 1/4	[1m] [1m] [1m] [1m]
	(a)	B or O	[1m] **Total: 10**
7	**(a)(i)**		[2m]

		 1m for correct pyramid shape 1m for correct trophic levels with labels • water plant > tadpole > small fish > kingfisher • water plant > water beetle > frog > kingfisher • water plant > water beetle > snail > kingfisher (any 1)	
	(a)(ii)	<table><tr><th>statement</th><th>number</th></tr><tr><td>the number of producers</td><td>1</td></tr><tr><td>the number of consumers</td><td>6</td></tr><tr><td>the number of food chains</td><td>3</td></tr></table> All correct for 1m	[1m]
	(b)	• A carbon sink is an area that stores carbon compounds for an indefinite period of time. It stores more carbon than it releases. • Carbon dioxide that dissolves in the oceans are absorbed by phytoplankton during photosynthesis. • Some of the carbon compounds found in oceans is buried under the seabed as fossil fuels.	[3m]
	(c)	• Excess DDT used by farmers might have washed into nearby river. DDT is non-biodegradable and not easily excreted by the cells in the body. • The microscopic algae absorb the DDT which accumulates in their bodies. • As we move up the trophic levels, bio-accumulation occurs as DDT concentration increases in the bodies of the animals • Bio-amplification occurs as the concentration of DDT in top-level predators may reach lethal levels.	[4m] **Total: 10**
8	**Either** **(a)**	• Asexual reproduction does not involve the fusion of gametes while the fusion of gametes occurs in sexual reproduction. • Only one parent is need in asexual reproduction compared to one or two parents in sexual reproduction. • Offspring are genetically identical in asexual reproduction while they are genetically different in sexual reproduction. • Asexual reproduction is a quicker method of reproduction compared to sexual reproduction. • Asexual reproduction produces a larger number of offspring than sexual reproduction. (any 4)	[4m]
	(b)	• Large petals to attract insects to land • Small, compact stigma that do not protrude out of the flower.	[2m]

		➢ Insects will help transfer pollen grains onto the stigma as they enter the flower to collect nectar.	
	(c)	• The mature stigma secretes a sugary fluid that stimulates germination of the pollen grain. • A pollen tube grows out of the pollen grain transporting the male gametes down the style. • The pollen tube secretes enzymes to digest the tissues of the stigma and style as it grows towards the ovule. • The pollen tube enters the ovule through the micropyle, releasing the male gametes to fuse with the female gametes for fertilisation.	[4m] **Total: 10**
8	**Or** **(a)**	• During the menstrual flow stage (day 1 to day 5), the levels of oestrogen and progesterone are very low. Menstruation occurs. • During the follicle stage (day 6 to day 13), the follicle cells begins to produce oestrogen which causes the repair and growth of the uterine lining. • During the corpus luteum stage (day 16 to day 28), the corpus luteum will secrete progesterone and some oestrogen. The progesterone maintains and further thickens the uterine lining, building up more blood capillaries. • If no fertilisation occurs, the corpus luteum breaks down and the levels of oestrogen and progesterone decreases causing menstruation to occur again. • If fertilisation occurs, the corpus luteum will not degenerate and continue to produce both hormones until the placenta is fully developed and takes over.	[1m] [1m] [1m] [1m] [1m]
	(b)	Placenta (A) • Separates the maternal blood from the foetal blood to protect it from the high blood pressure. • Prevents the mixing of the mother's blood and the foetus's blood as they may agglutinate if the blood groups are not compatible. • The maternal blood allows protective antibodies to diffuse from the mother's blood to the foetus's blood protecting it from certain diseases. • The placenta produces progesterone which maintains the uterine	[5m] **Total: 10**

		lining in a healthy state during pregnancy. (any 2) Amniotic Fluid (B) • Helps to protect the foetus from physical injury / shock absorber. Umbilical cord (C) • Umbilical arteries transport deoxygenated blood and metabolic wastes from the foetus to the placenta. • Umbilical veins transport oxygenated blood and nutrients from the placenta to the foetus.	