Preliminary Examination 2016

CANDIDATE NAME		( )
CLASS		

BIOLOGY **5158/01**

Paper 1 Multiple Choice **19 September, 2016**

Secondary 4 Express **1 hr**

Set by: **Ms Rozianna / Mr Desmond Chong**

Vetted by: **Mr Goh Tze Mian**

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

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

1 In order to complete the sentence below, what is the correct process and cell structure?

Cells with a high rate of .....1..... will have many .....2.....

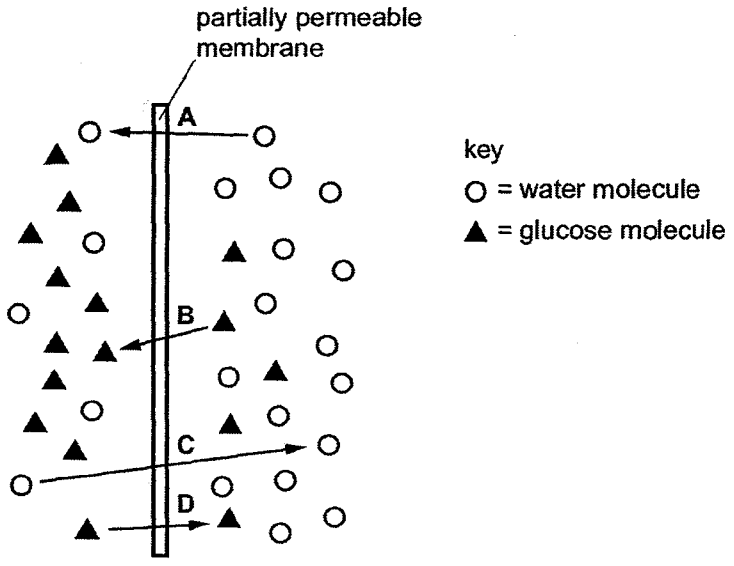
	1	2
A	DNA replication	Golgi apparatus
B	enzyme secretion	ribosomes
C	lipid secretion	nucleus
D	photosynthesis	vacuoles

2 What are the levels of organisation of the retina and of the eye?

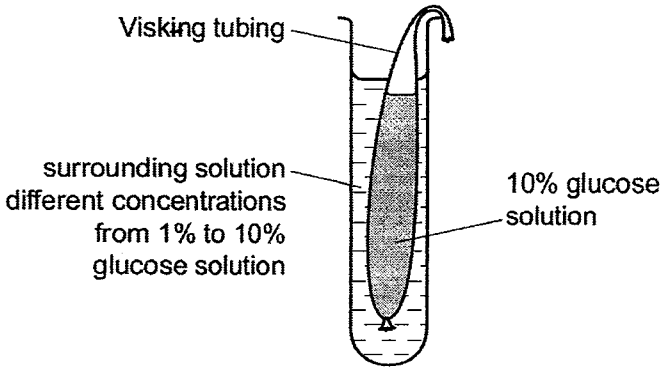
	retina	eye
A	cell	organ
B	cell	organ system
C	tissue	organ
D	tissue	organ system

3 The diagram represents the passage of water molecules and glucose molecules across a partially permeable cell surface membrane.

Which arrow indicates osmosis?



4 The diagram shows apparatus set up to investigate the effect of changing the concentration of glucose in the surrounding solution on the movement of molecules through a selectively permeable membrane (Visking tubing) in 15 minutes.



As the concentration of glucose solution in the surrounding solution increases, which statements are correct?

1 Rate of osmosis increases.
2 Glucose molecules reach equilibrium faster.
3 There is less change in the volume of surrounding solution.
4 Rate of diffusion of glucose molecules increases.

A 1, 2, 3 and 4 **B** 1, 2 and 4

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

5 Four tubes containing 10 cm^3 of 1% starch solution were treated in different ways and then mixed with saliva. After 30 minutes, 1 cm^3 of iodine in potassium iodide solution was added to each tube.

In which tubes were the contents yellow-brown?

	tube incubated at 35 °C	tube incubated at 75 °C	tube incubated at pH 2.5	tube incubated at pH 6.9
A	✓		✓	
B	✓			✓
C		✓		✓
D		✓	✓	

key
✓ represents yellow – brown colour

6 Two solutions, 1 and 2, one containing starch and sucrose, and the other containing glucose and protein, were tested with a variety of reagents to confirm their identity.

The table shows conclusions from the results recorded for the various tests.

Which row identifies the two solutions?

	add iodine solution		boil with Benedict's solution		boil with Benedict's solution after acid hydrolysis		add Biuret solution	
	1	2	1	2	1	2	1	2
A	+	-	+	-	-	+	-	+
B	-	+	+	-	+	-	-	+
C	+	-	-	+	+	-	-	+
D	-	+	+	-	+	+	+	-

Key

+ = biological molecule present

- = biological molecule absent

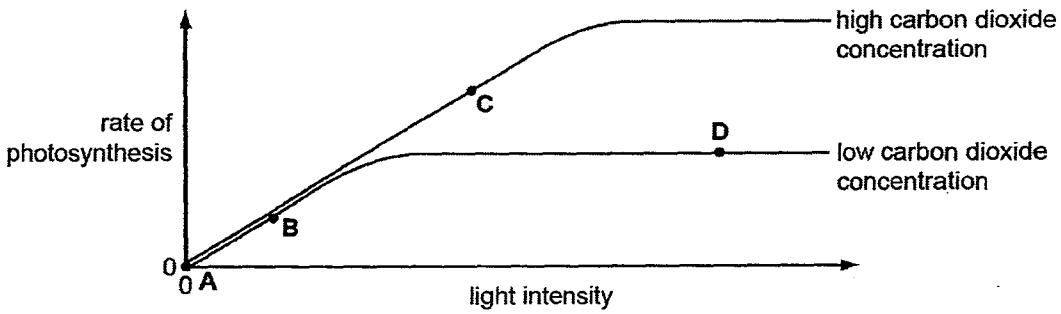
7 Which of the statements describe some roles of enzymes?

1 catalyse the hydrolysis of large molecules
2 increase the number of collisions between molecules
3 lower the activation energy required to start a reaction
4 supply the activation energy required to start a reaction

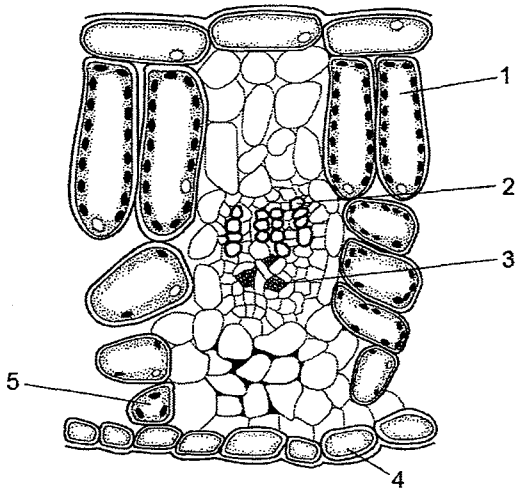
A 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 3 and 4

8 The graph shows the rate of photosynthesis in a pea plant at different light intensities.

At which point is carbon dioxide concentration a limiting factor?



9 The diagram shows a section through a leaf.



Which cells have the functions matched correctly?

	photosynthesis	transport
A	1 and 5	2 and 3
B	1 and 3	2 and 4
C	3 and 4	2 and 5
D	4 and 5	3 and 4

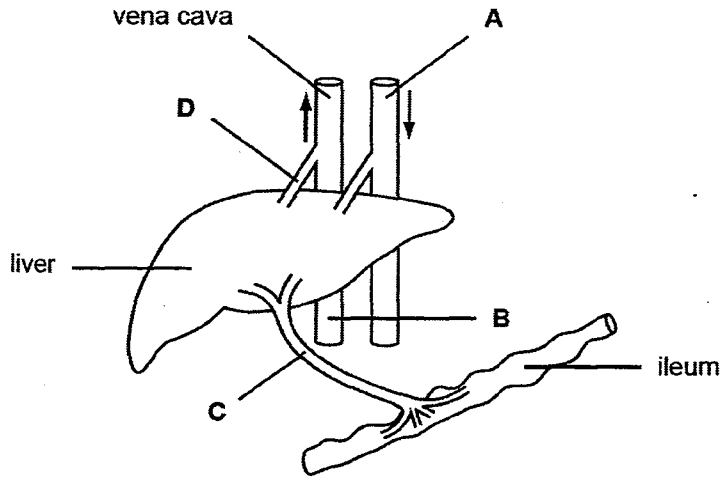
10 When a person eats some egg white, protein and water enter the stomach.

Which substances are found leaving the stomach and the small intestine towards the large intestine?

	leaving the stomach	leaving the small intestine
A	amino acids and water	amino acids and water
B	fatty acids, glycerol and water	fatty acids, glycerol and water
C	protein and water	amino acids and water
D	protein, amino acids and water	water

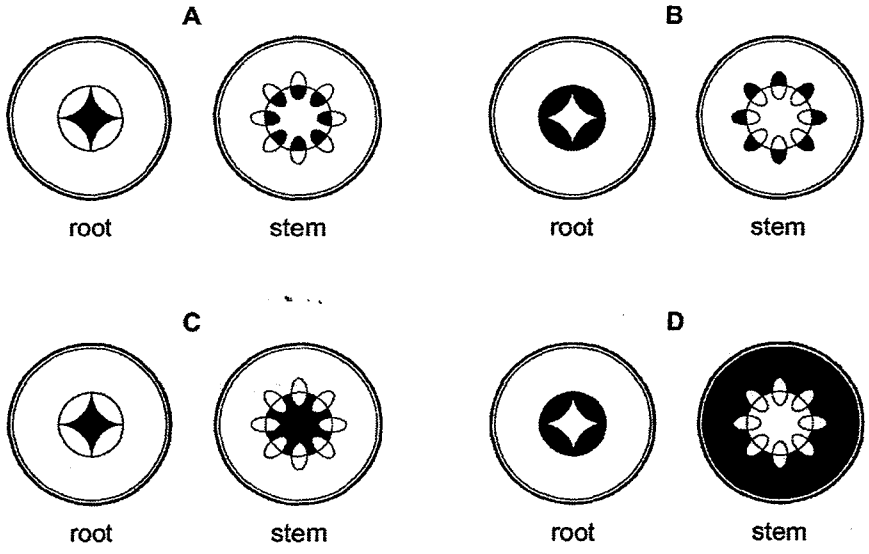
11 The diagram shows the blood supply of the liver.

Which blood vessel would have the highest concentration of glucose after 24 hours without food?

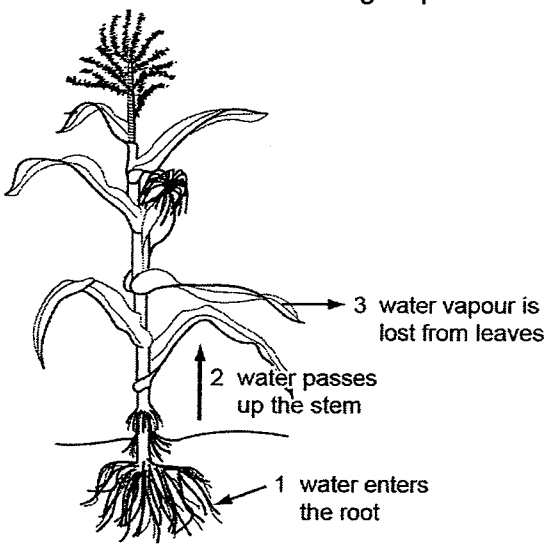


12 A plant was placed in water containing black dye. After 24 hours the plant was removed and sections were taken from the root and the stem.

Which diagram shows the results?



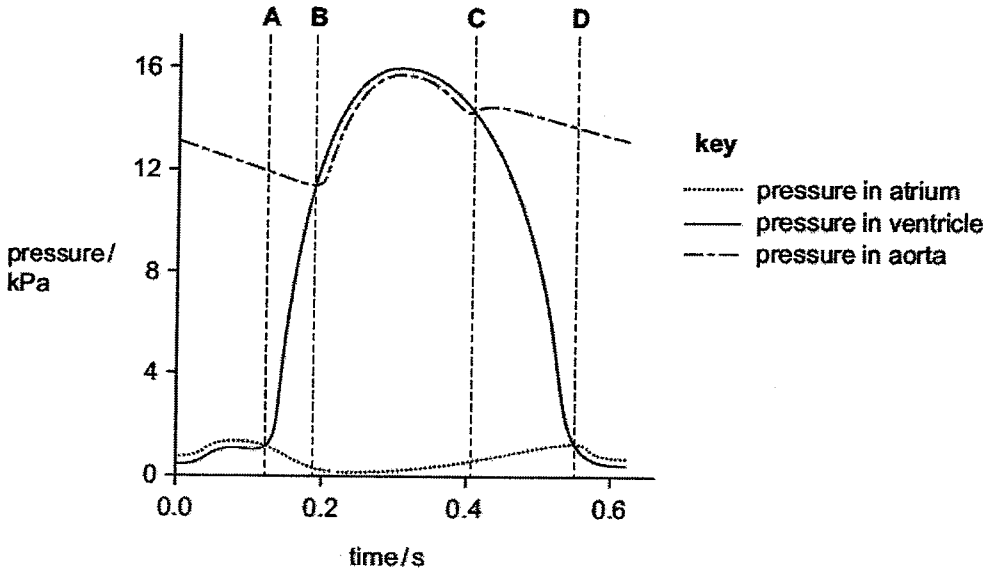
13 The diagram represents the movement of water through a plant.



Which row identifies the correct processes involved during the stages of water movement?

	cohesion and adhesion	transpiration	osmosis
A	1	2	3
B	1	3	2
C	2	1	3
D	2	3	1

14 The graph shows pressure changes in the left side of the heart, during a single heart beat. At which point does the semi-lunar valve open?

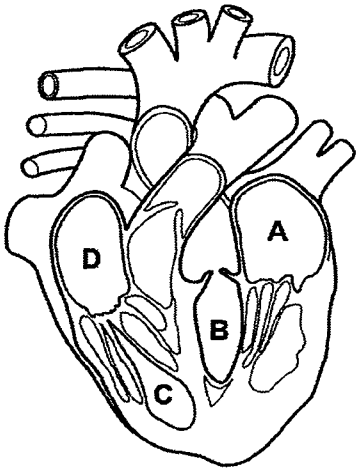


15 Cerebral angiography is a procedure that uses a special dye (contrast material) and x-rays to see how blood flows through the brain.

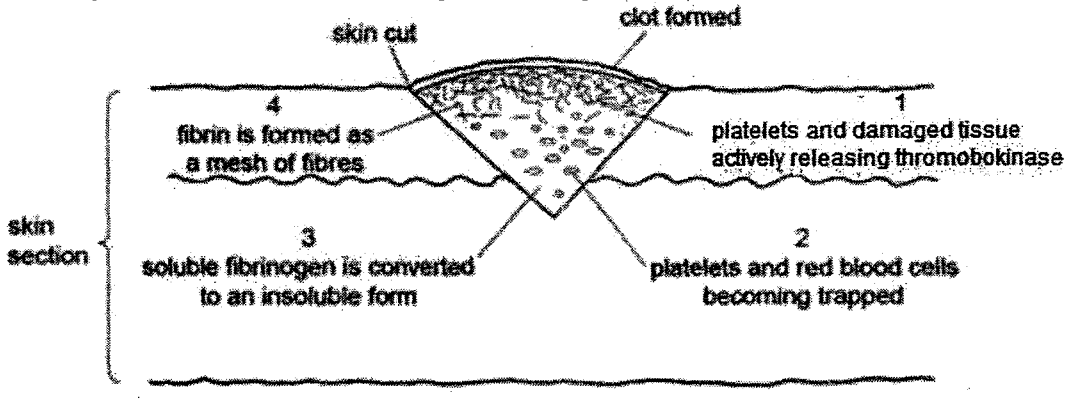
A thin, hollow tube called a catheter is placed through an artery. The catheter is carefully moved up through the main blood vessels in the belly area and chest into an artery in the neck. X-rays help the doctor guide the catheter to the correct position.

Once the catheter is in place, the dye is sent through the catheter. X-ray images are taken to see how the dye moves through the artery and blood vessels of the brain

Which heart chamber would be the first to receive blood with this dye in it?



16 The diagram shows processes during the healing of a skin wound.

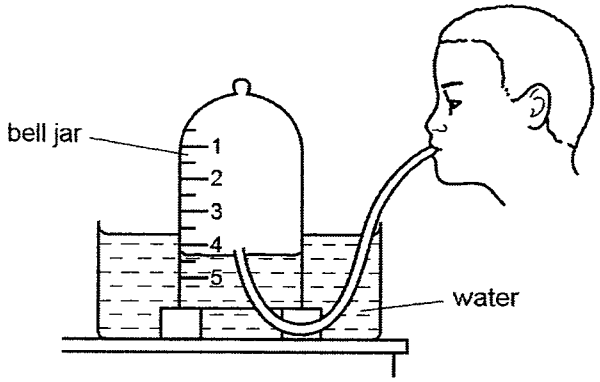


In which order do these processes take place in forming the clot?

A 1 → 2→ 3→ 4 **B** 1 → 3 → 4 → 2

C 3 → 2→ 1→ 4 **D** 3 → 4 → 1 → 2

17 The bell jar was filled with water at the start of an experiment.



The student breathed in as deeply as possible, then blew out as much air as possible to produce the result shown in the above diagram.

What was being measured in this experiment?

A residual volume **B** tidal volume

C total lung capacity **D** vital capacity

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

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

19 Which substances can be removed from the blood by dialysis machines?

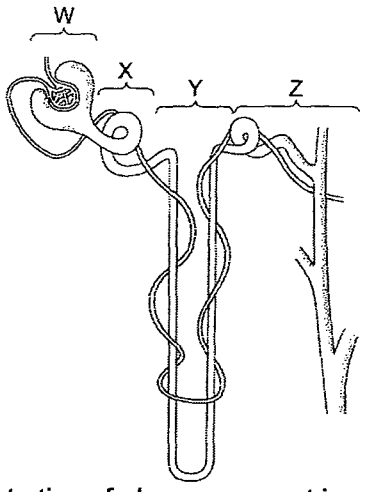
A glucose, glycogen and proteins

B glucose, proteins and urea

C glycogen, urea and some salts

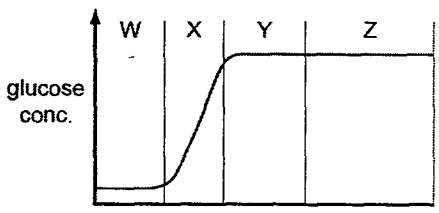
D urea and some salts

20 The diagram shows a nephron and associated blood vessels.

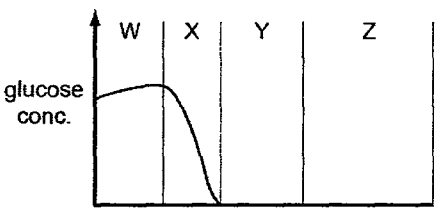


Which graph shows the concentration of glucose present in each part of the kidney tubule?

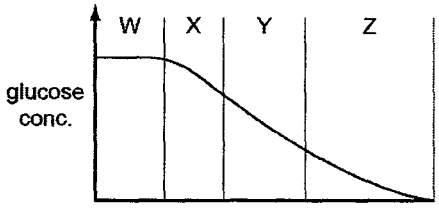
A



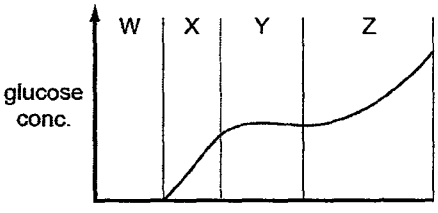
B



C



D

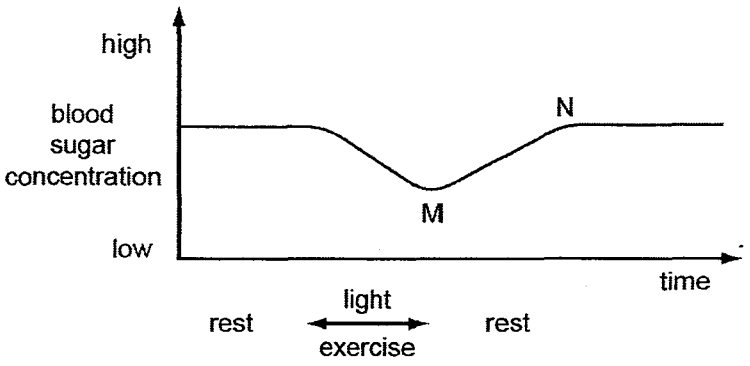


21 A person is digging on a hot day without drinking.

What effect will this have on the release of ADH (antidiuretic hormone) and the reabsorption of water in the body?

	release of ADH	reabsorption of water
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

22 The graph shows the changes in blood sugar concentration during periods of rest and exercise.



Which secretion causes the change in blood sugar concentration between the time M and **N**?

A glucagon from the pancreas

B glucose from the pancreas

C glycogen from the liver

D insulin from the pancreas

23 Marcus was walking alone in the middle of the night when a robber approached him, demanding for money at knifepoint.

Which of the following events are likely to take place in Marcus's body instantly?

1 relaxation of the radial muscle of the iris

2 dilation of arterioles supplying the intestinal tract

3 dilation of arterioles supplying skeletal muscle

4 increased cardiac rate

A 1, 3 and 4 only

B 2, 3 and 4 only

C 1 and 4 only

D 3 and 4 only

24 Which option shows the correct information about endocrine glands?

	gland	hormone produced	target organ	effect
A	adrenal	adrenaline	liver	decreases blood glucose levels
B	ovaries	progesterone	uterus	ovulation occurs
C	pancreas	insulin	liver	conversion of excess glucose to glycogen
D	testes	testosterone	penis	becomes erect to allow sexual intercourse

25 Mydriasis is a condition, which causes the pupil to be excessively dilated. Which of the following would a person with this condition, experience?

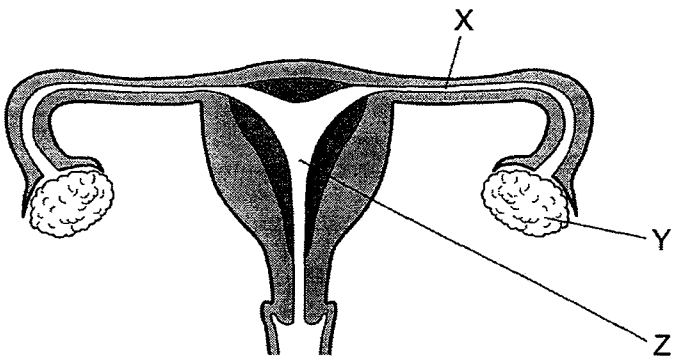
A The image formed on the retina will not be sharp under bright light condition.

B He will not be able to see anything temporarily if he moves from a brightly lit place to a dark place.

C The circular muscles of his iris will be contracted.

D Cones will not be able to function optimally.

26



The diagram shows a section through the female reproductive system.
During pregnancy, where does mitosis occur in the X of the embryo?

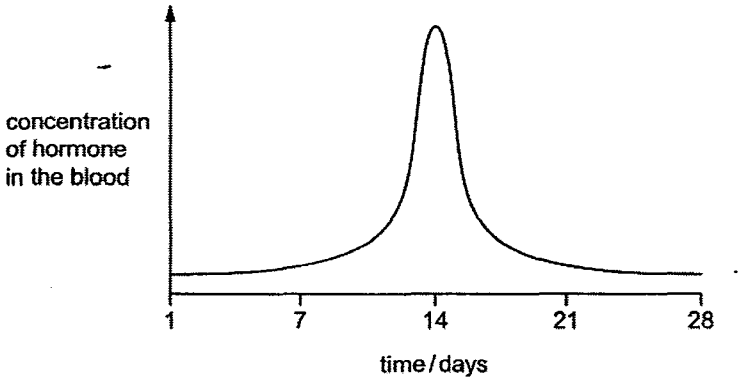
	X	Y	Z
A	✗	✗	✓
B	✓	✓	✗
C	✓	✗	✓
D	✓	✓	✓

key

✓ takes place

✗ does not take place

27 The graph shows the concentration of a hormone in the blood during one menstrual cycle.



Identify the hormone that is studied in the graph.

A oestrogen
B progesterone
C follicle-stimulating hormone
D luteinizing hormone

28 Flowering plants adopt different methods to ensure that their flowers are successfully pollinated.

Some of these methods are listed.

1 Plant 1 has flowers in which the female parts ripen before the male parts.

2 Plant 2 has separate male and female flowers.

3 Plant 3 has separate male and female plants.

4 Plant 4 has flowers in which the male parts ripen before the female parts.

5 Plant 5 has flowers in which the male and female parts ripen at the same time.

Which method(s) make it more likely for cross-pollination to take place?

A 1, 2, 3 and 4 only

B 1 and 4 only

C 2 and 3 only

D 5 only

29 An experiment was set up using four groups of insect-pollinated flowers in a garden. In each group, different parts of the flowers were removed, as shown in the table. Insects were allowed to visit all the flowers freely.

group of flowers	stigma	anthers	petals
A	intact	removed	intact
B	intact	intact	removed
C	removed	intact	removed
D	removed	removed	intact

Which group of flowers produced the most seeds?

30 A diploid cell contains two pairs of homologous chromosomes. Each pair is heterozygous for a pair of alleles Aa and Bb respectively.

After meiosis, how many different combinations of these alleles could be produced in the haploid daughter cells?

A 2 **B** 4

C 8 **D** 16

31 On a particular Indonesian area where the ocean floor is littered with empty coconut shells, a species of octopus has been filmed "walking" on two of its eight tentacles. The remaining six tentacles are wrapped around its body. Scientists believe that, with its tentacles arranged this way, the octopus resembles a rolling coconut. Local predators, including sharks, do not notice the octopus when it behaves in this manner.

What is the likely reason that led to this method of locomotion which lasted over several generations?

A Natural selection took place.

B Artificial selection took place.

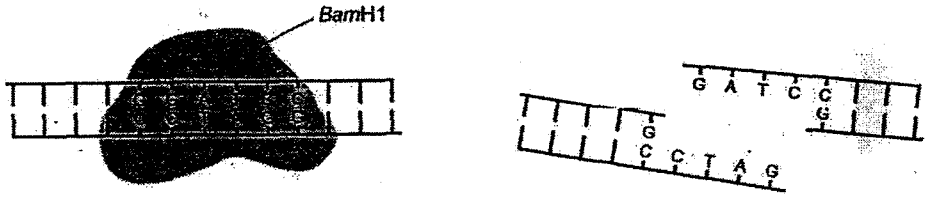
C Competition between the octopuses and their predators.

D Selective breeding of the octopus species.

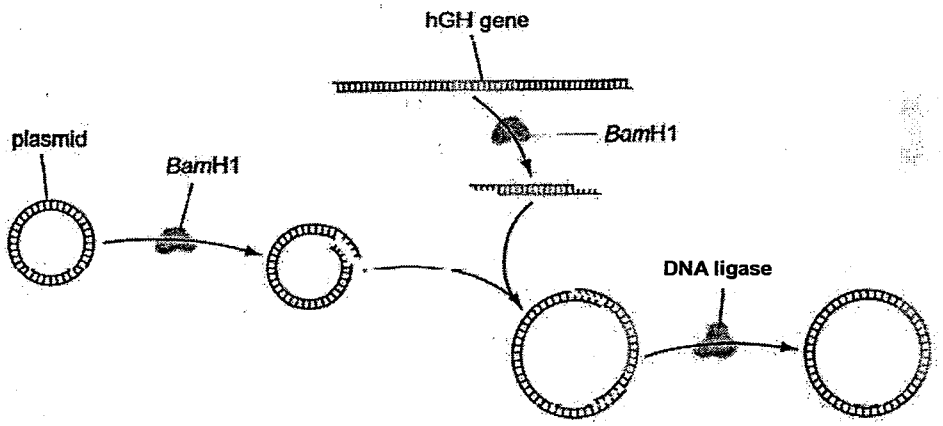
32 A gene containing 600 bases is transcribed and translated to produce a functional protein in the cell. Which of the following correctly represents the numbers of the respective structures?

	number of nucleotides	number of mRNA formed	number of codons on the mRNA	number of polypeptide formed
A	300	1	200	1
B	300	600	600	600
C	600	600	600	600
D	600	1	200	1

33 *Bam*H1 is a restriction enzyme that cuts DNA.



The diagram below shows part of the procedure for producing bacteria that will synthesise human growth hormone, hGH.



At the end of this process, many plasmids do not contain the hGH gene. What could explain this?

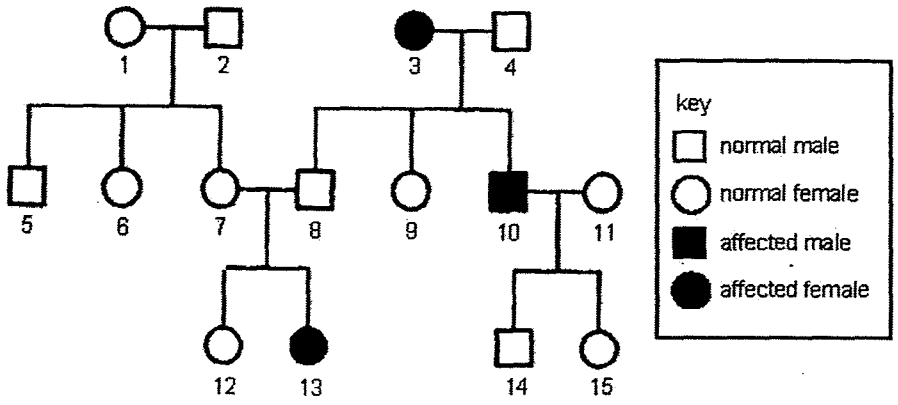
A Different alleles of hGH gene have different sticky ends.

B The sticky ends of some plasmids re-join with each other.

C Some of the plasmids are cut at more than one position.

D Not all of the plasmids cut by *Bam*H1 have sticky ends.

34 The family tree shows the inheritance of a genetic disease. This disease is caused by a recessive allele, **b**.



Which females have the **Bb** genotype?

A 1, 6 and 7 only.

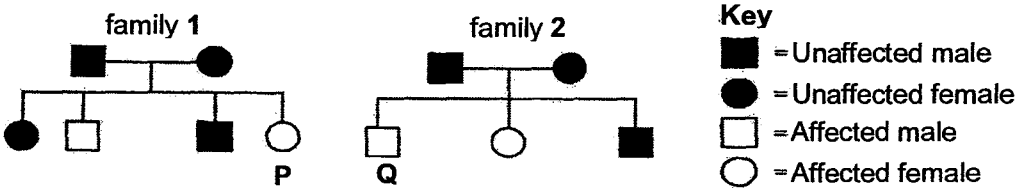
B 1, 7 and 12 only.

C 7, 9 and 15 only.

D 9, 12 and 15 only.

35 Haemophagocytic lymphohistiocytosis is a life-threatening disease causing severe inflammation in the body of the patient where there is an uncontrolled proliferation of white blood cells.

The diagram shows the pattern of inheritance of haemophagocytic lymphohistiocytosis.



If **P** and **Q** married each other, what prediction about their children could be made?

A All their children will be affected by the disease.

B Only their daughters will be affected by the disease.

C 50% of their children will be affected by the disease.

D 75% of their children will be affected by the disease.

36 A species of fish has the strength of its bones controlled by alleles H and h. Fish with HH genotype have very strong bones, fish with Hh genotype have thin, weak bones and fish with hh genotype do not develop into an embryo. Two heterozygous fish mate.

Which proportion of their offspring will be heterozygous?

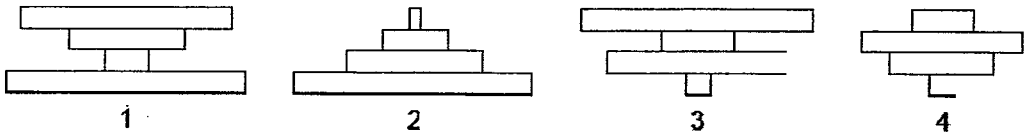
A 25 %

B 50 %

C 67 %

D 75 %

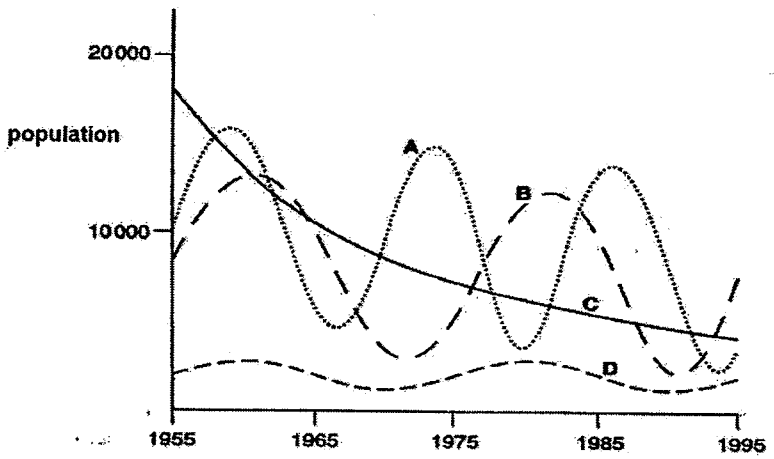
37 A tree has insect larvae burrowing in the leaves. The emerging insects are eaten by birds and the birds have parasitic fleas living amongst their feathers.



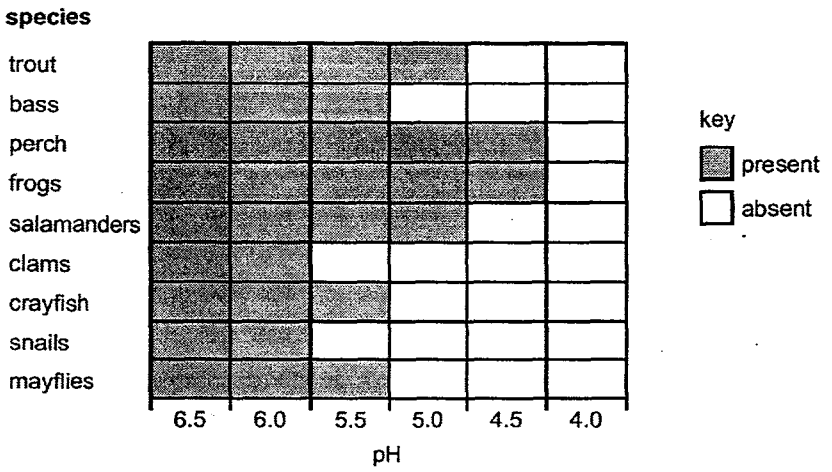
Which represents the correct pyramid of biomass and numbers for this food chain?

	pyramid of biomass	pyramid of numbers
A	2	4
B	1	3
C	2	3
D	1	4

38 The population sizes of four different species of insect, **A**, **B**, **C** and **D** were studied over a period of forty years. Which species is in the greatest danger of extinction?



39 The chart shows different species of animals living in rivers of different pH levels.



What conclusions can be drawn from the chart?

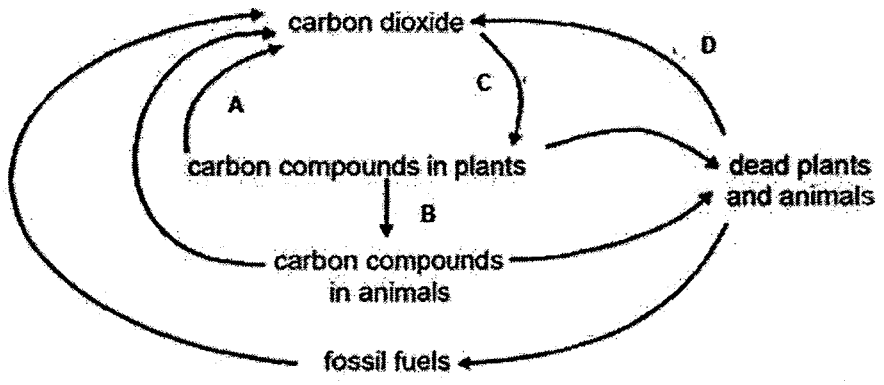
A Most species can live in river water below pH 5.5.

B Snails and clams are most affected by acidic conditions.

C Both frogs and mayflies can live in more acidic conditions than trout.

D Not all species are affected by acidic conditions.

40 The diagram shows part of the carbon cycle.



Which stage (**A**, **B**, **C** or **D**) causes the largest conversion of carbon from one form to another?

End of Paper

Preliminary Examination 2016

CANDIDATE NAME		( )
CLASS		

BIOLOGY **5158/02**

Paper 2 Theory **14 September, 2016**

Secondary 4 Express **1 hr 45 minutes**

Set by: **Ms Rozianna / Mr Desmond Chong**

Vetted by: **Mr Goh Tze Mian**

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class in the spaces at the top of this page and on all separate answer paper used.

Write in dark blue or black pen.

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

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

Answer **all** questions.

Write your answers in the spaces provided on the question paper.
The number of marks is given in brackets [ ] at the end of each question or part question.

All essential working must be shown clearly.

For Examiner's Use	
Section A	
B10	
B11	
B12 E / O	
Total	

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

1 A student investigated the effect of solution E on cucumber.

A thin slice, approximately 2 mm thick, was cut from a cucumber as shown in Fig. 1.1.

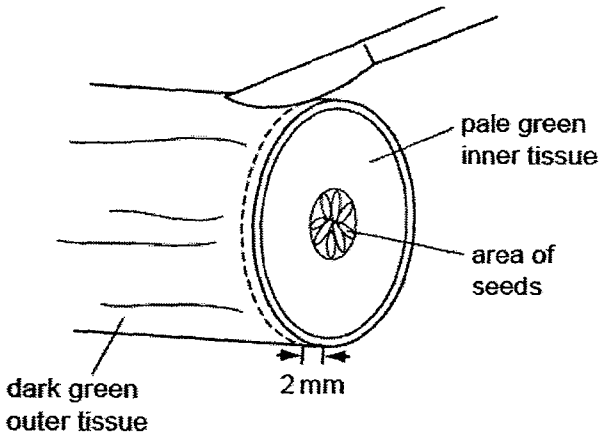


Fig. 1.1

The centre of the slice was removed as shown in Fig. 1.2**A**.
The slice was cut in half as shown in Fig. 1.2**B**.

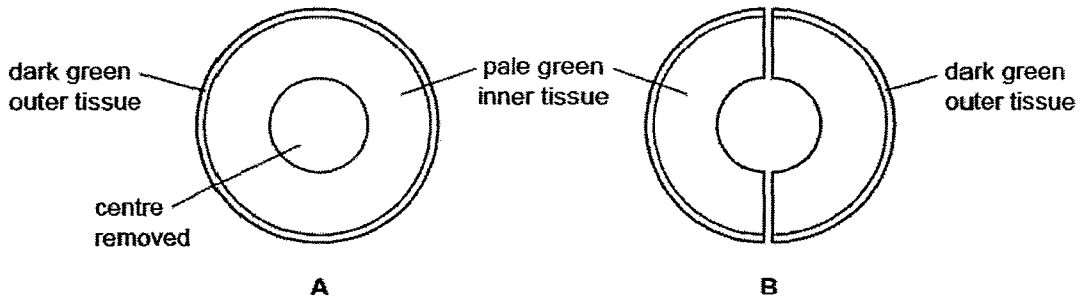


Fig. 1.2

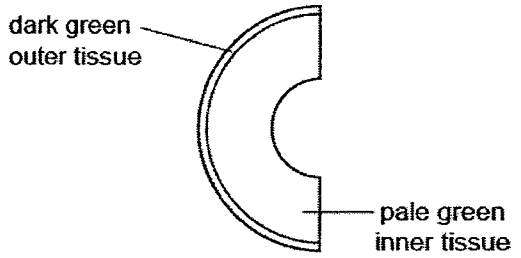
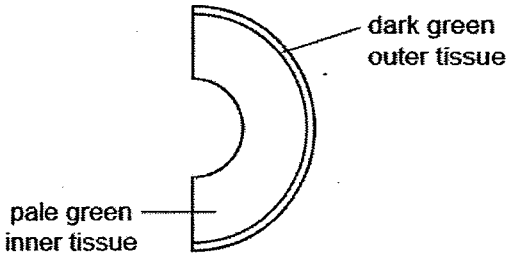
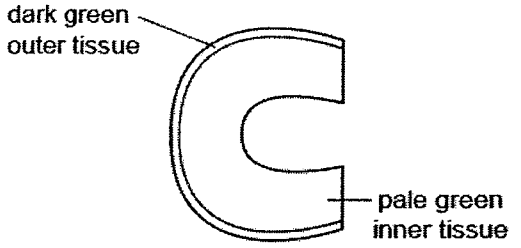
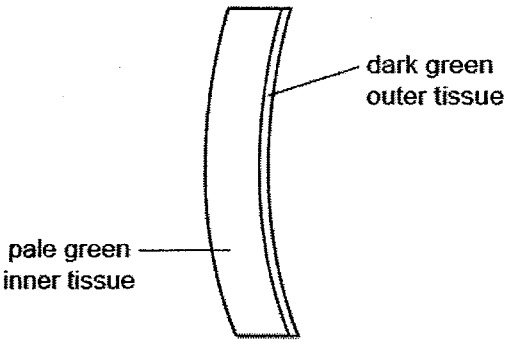
One piece (half slice) of cucumber was placed in solution **E**. A second piece was placed in water.

After 5 minutes, the shape of the pieces in solution **E** and water had changed.

Total marks:	

Table 1.1 shows the pieces of cucumber before and after being placed in solution **E** and water.

Table 1.1

the shape of the piece of cucumber **before** being placed in solution **E**	the shape of the piece of cucumber **before** being placed in water
	
the shape of the piece of cucumber **after** being placed in solution **E**	the shape of the piece of cucumber **after** being placed in water
	

(a) Complete Table 1.2 to describe the effect of water and solution **E** on both the dark green outer tissue and pale green inner tissue.

Table 1.2

	effect	
	of water	of solution **E**
dark green outer tissue		
pale green inner tissue		

[2]

Total marks:	

(b) In a similar experiment, the change in length and mass of the two layers were studied. It is observed that the pale green inner layer undergoes a greater change in both length and mass as compared to the dark green outer layer.
Suggest an explanation for this observation.

[3]

[Total: 5]

2 There are many people in the world who are not able to digest lactose, a sugar in milk produced by cows, goats and sheep. These people do not make the enzyme lactase, that breaks down lactose in the small intestine.

(a) Describe what is meant by the term, enzyme.

[2]

(b) People who cannot digest lactose sometimes drink a liquid containing the enzyme lactase before they eat food containing milk products. The aim of this treatment is to digest any lactose in the food, but it is not likely to be successful.

Suggest why this treatment is not likely to be successful.

[3]

[Total: 5]

Total marks:	

3 The lymphatic system consists

- thin-walled lymph vessels that drain tissue fluid from many organs of the body
- lymph nodes that contain the cells of the immune system

The fluid in the lymph vessels is moved in a way similar to the movement of blood in veins.

Fig. 3.1 shows part of the lymphatic system.

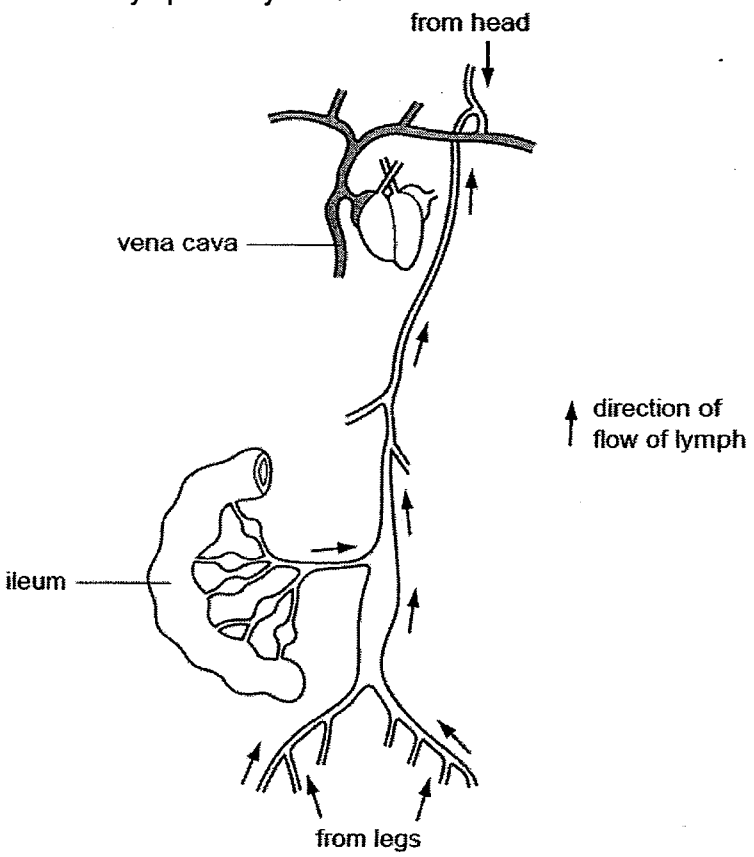


Fig. 3.1

(a) Suggest how lymph moves in the lymph vessels.

_____

_____

_____

_____ [2]

Total marks:	

(b) After a meal rich in fatty foods, the lymph leaving the ileum is full of fat droplets. Explain why there are fat droplets in the lymph leaving the ileum.

_____

_____

_____

_____ [2]

(c) Lymph flows through lymph nodes. Fig. 3.2 shows the action of white blood cells in a lymph node when bacteria are present.

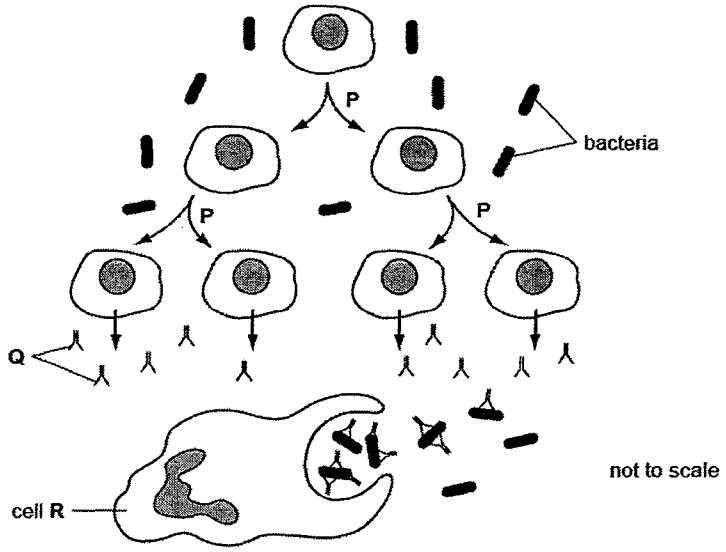


Fig. 3.2

(i) Name the molecules labelled **Q** in Fig. 3.2.

_____ [1]

(ii) Describe how bacteria are destroyed by cell **R**.

_____

_____

_____

_____

_____ [2]

[Total: 7]

Total marks:	

4 Transpiration and translocation are processes responsible for transporting materials around a plant.

(a) Complete Table. 4.1 by stating the materials moved by these processes, their sources and their sinks.

Table 4.1

	materials moved	source of materials in the plant	sink for materials in the plant
transpiration	1..... 2.....	.....	.....
translocation	1..... 2.....	.....	.....

[3]

(b) State a reason why the source and sink for translocation in a plant may change at different stages in the growth of a plant.

.....

.....

..... [1]

[Total: 4]

5 Fig. 5.1 shows a vertical section through a flower of soybean, *Glycine max*, immediately after self-pollination.

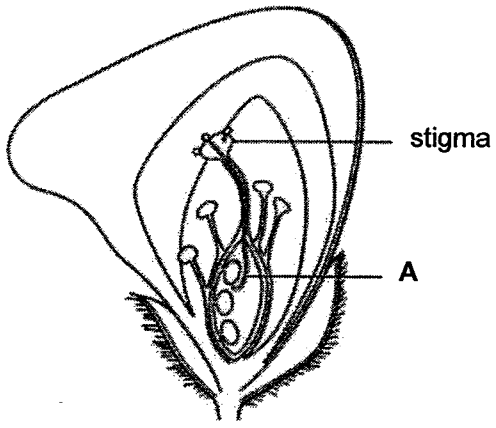


Fig. 5.1

Total marks:	

Figure 5.2 shows part of the section under higher magnification.

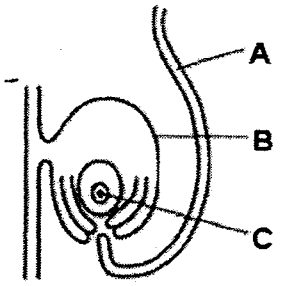


Fig. 5.2

(a) Name the parts **A**, **B** and **C**.

A _____

B _____

C _____ [2]

(b) With reference to Fig. 5.1 and Fig. 5.2, describe how fertilization takes place.

_____

_____

_____

_____

_____

_____

_____ [3]

(c) Describe one advantage and one disadvantage of self-pollination for flowering plants.

_____

_____

_____

_____ [2]

[Total: 7]

Total marks:	

6 Fig. 6.1 shows a cell of a female fruit fly during a stage in mitosis.

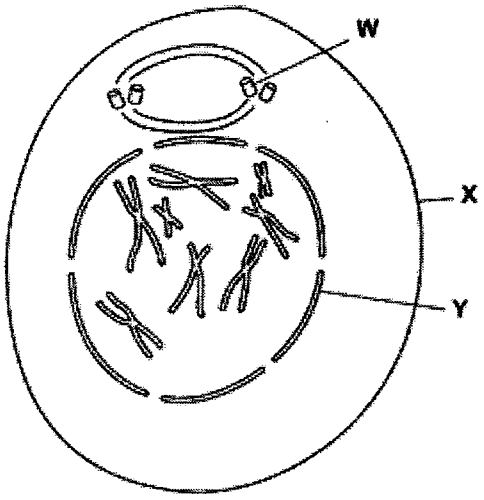


Fig. 6.1

(a) (i) Name the stage of mitosis shown in Fig. 6.1.

.....

[1]

(ii) On Fig. 6.1, shade a pair of homologous chromosomes. [1]

(b) (i) Predict the number of chromosomes found in the ovum of the fruit fly.

.....

[1]

(ii) Predict the number of chromosomes found in a cell during prophase I of meiosis.

.....

[1]

(c) Describe the importance of mitosis in living organisms.

.....

.....

.....

.....

[2]

[Total: 6]

Total marks:	

7 Glucose-6-phosphate dehydrogenase deficiency (G6PD) is caused by G6PD gene mutations. Almost all G6PD mutations lead to changes in single building blocks that make up the glucose-6-phosphate dehydrogenase enzyme. The gene associated with this condition is located on the X chromosome.

G6PD is a genetic disorder that occurs most often in males. This condition mainly affects red blood cells. In affected individuals, a defect in glucose-6-phosphate dehydrogenase causes red blood cells to break down prematurely.

(a) The G6PD gene consists 16,197 bases. How many amino acids are present in the glucose-6-phosphate dehydrogenase enzyme?

_____ [1]

(b) A small segment of the G6PD gene has the following sequence, ATTTCCAGCTT.

A single mutation of the above segment of the G6PD gene results in the following sequence, ATTTCTAGCTT.

With reference to G6PD,

(i) define mutation.

_____

_____ [1]

(ii) explain the significance of the order of bases in DNA.

_____

_____

_____ [2]

(c) Suggest why affected males inherit this condition from their mothers and not their fathers.

_____

_____

_____ [2]

[Total: 5]

Total marks:	

8 *Drosophila melanogaster*, the common fruit fly, has been used for genetic experiments. Wing type and colour of eyes are controlled by two genes respectively.

Pure bred parental male and female flies, with the following phenotypes in **Table 8.1**, were mated and produced F1 offspring with the phenotypes in **Table 8.2**.

Table 8.1

parental phenotype	number of males	number of females
normal wings / sepia eyes	4	0
vestigial wings / red eyes	0	5

Table 8.2

F1 phenotype	number of males	number of females
normal wings / red eyes	84	76
normal wings / sepia eyes	0	0
vestigial wings / red eyes	0	0
vestigial wings / sepia eyes	0	0

(a) Distinguish between gene and allele.

[2]

(b) State the dominant type of wings and eye colour.

[1]

Total marks:	

(c) Using a genetic diagram, show the probability of the offspring having red eyes when a female and a male from the F1 are mated.

[3]

[Total: 6]

9 Fig. 9.1 shows a green plant, *Nuphar lutea*, which grows in lakes.

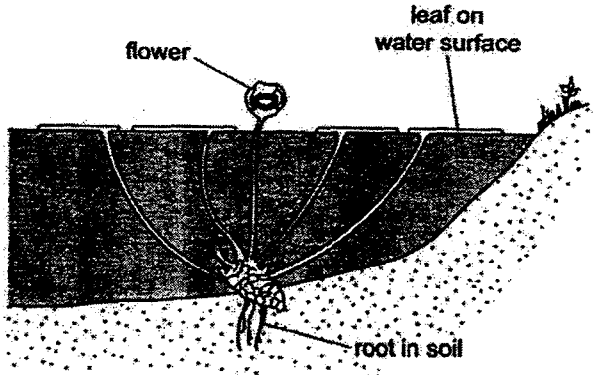


Fig. 9.1

Total marks:	

Fig. 9.2 is a vertical section from one of the leaves to show its internal structure.

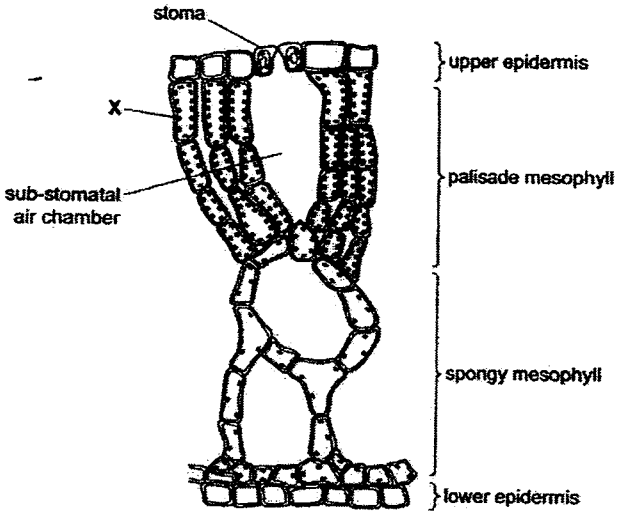


Fig. 9.2

(a) (i) Suggest how the large air spaces help *Nupher lutea* to survive in its habitat.

_____

_____

_____ [2]

(ii) The stomata in *Nupher lutea* are all on the upper leaf surface. Suggest why there are no stomata on the lower surface.

_____

_____ [1]

(b) The air spaces in the leaves of some water plants continue through the leaf stalks and the main stems all the way to the roots. Gases diffuse through these air spaces. The plant absorbs minerals from the soil in the bottom of the lake through the roots. Explain how the arrangement of air spaces helps the plant do this.

_____

_____

_____

_____

_____ [2]

[Total: 5]

Total marks:	

Name: _____ ( ) Class: _____

Section B

Answer all **three** questions.
Question 12 is in theform of an **EITHER / OR** question.
Only one part should be answered.

10 Many plants produce two types of leaves. One type is produced where the leaves develop in full sunlight and are called 'sun leaves'. The other type is produced where the leaves develop in the shade and are called 'shade leaves'.

Fig 10.1 shows the two different types of leaves collected from the same plant.

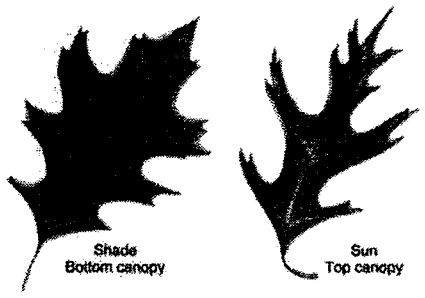
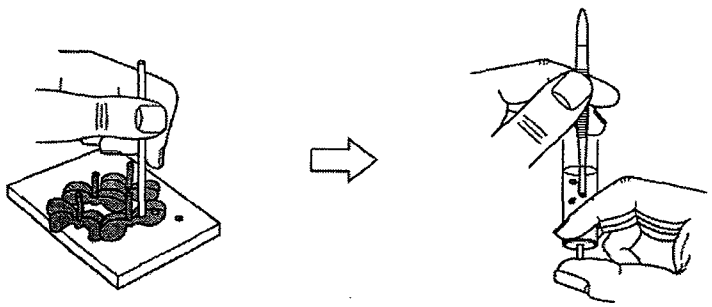


Fig. 10.1

A student investigated photosynthesis in both types of leaves using leaf discs. Fig. 10.2 shows the method used by the student to obtain the leaf discs.



1. leaf discs cut using a plastic straw

2. forceps used to place six leaf discs into 0.2 mol dm^{-3} sodium hydrogen carbonate solution in a syringe barrel

Fig. 10.2

The student then carried out the following actions

3. replaced the plunger into the syringe, turned the syringe upside down and pushed in the plunger to force out all the air.
4. placed a finger over the open end of the syringe and pulled down the plunger to create a vacuum.
5. tapped the side of the syringe to remove air bubbles.
6. repeated actions 3–5 until the leaf discs sank to the bottom of the syringe.

Total marks:	

Fig. 10.3 shows the appearance of the leaf discs in the syringe as they photosynthesise.

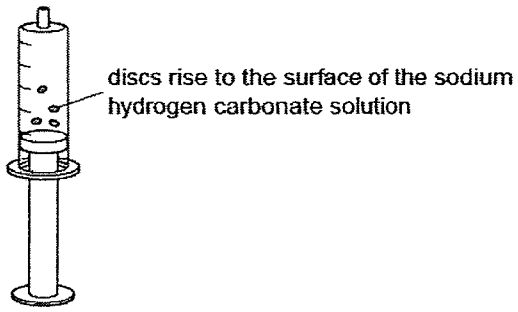


Fig. 10.3

(a) Why do the leaf discs rise as the leaf discs start to photosynthesise?

_____

_____

_____ [1]

(b) Table 10.1 shows the results that the student obtained from the investigation.

Table 10.1

	y- axis	
x- axis	sun leaves	shade leaves
500	0	2
1000	4	6
1500	10	8
2000	16	10
2500	20	10
3000	24	10

Suggest labels for the axes for this graph and how he obtained the data to plot the graph.

(ii) *x- axis* _____

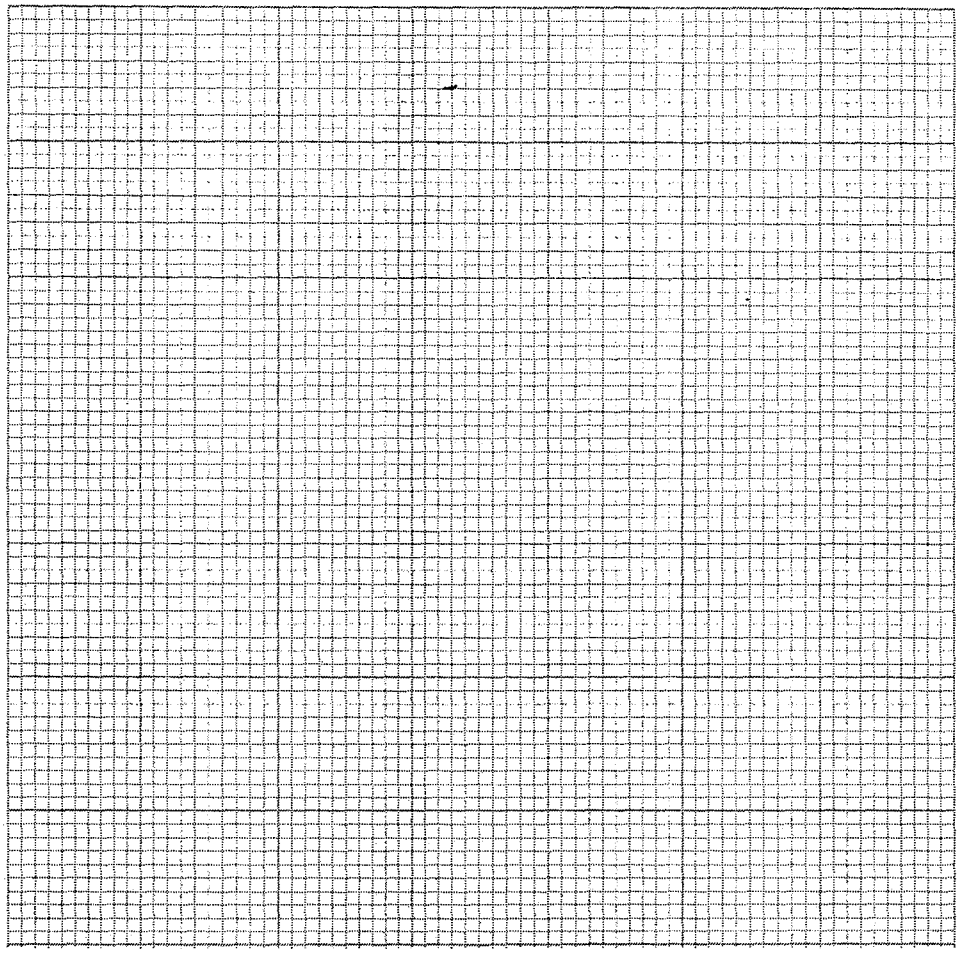
_____

y-axis _____

_____ [2]

Total marks:	

(ii) Plot the data in Table 10.1 on the grid provided below



[4]

(iii) Based on the graph above, state two conclusions that you can deduce about photosynthesis about sun leaves and shade leaves.

1 _____

_____

2 _____

_____ [2]

(c) Suggest an advantage of having both sun leaves and shade leaves for tall trees.

_____

_____ [1]

[Total:10]

Total marks:	

11 Fig. 11. 1 shows a longitudinal section through a kidney.

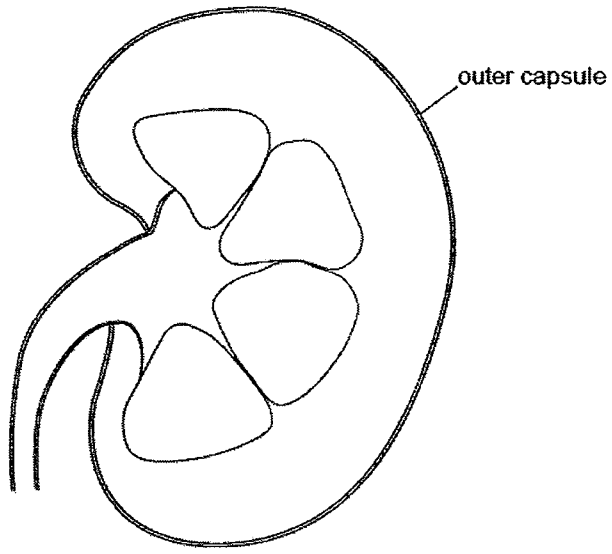


Fig. 11.1

(a) Use label lines and the letters **A**, **B**, **C** and **D** to identify the cortex, medulla, pelvis and ureter on Fig. 11 .1.

A cortex
B medulla
C pelvis
D ureter

[2]

(b) Describe how the function of the kidneys is affected by changes in

(i) diet

[4]

Total marks:	

(ii) atmospheric temperature

[4]

[Total: 10]

12 EITHER

(a) Explain the effect of exercise on body temperature and describe how the body counters this effect.

[6]

Total marks:	

(b) Explain how water potential in the blood is regulated during exercise.

[4]

[Total: 10]

12 OR DDT is an insecticide used to destroy a disease-carrying insect. DDT was banned in 1970s after it was discovered to have a variety of harmful effects on mammals.

The bar chart in Fig. 12.1 shows the accumulation of DDT in the body fat of mammals found in a food chain. The curve shows the percentage of these mammals found to have cancer.

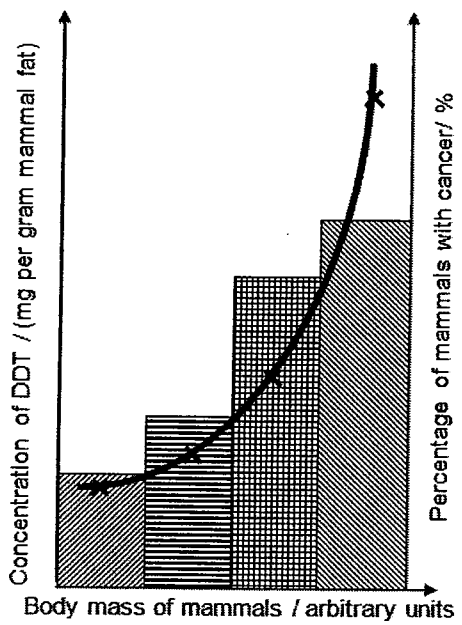


Fig. 12.1

Total marks:	

(a) **(i)** State the relationship between the concentration of DDT and the percentage of mammals with cancer.

[1]

(ii) Describe and explain the relationship between the body mass of mammals concentration of DDT .

[3]

(b) A scientist estimated the total amount of energy flowing through an area of rainforest per year. The results were recorded as shown in Table 12.2.

Table 12.2

energy flow	amount of energy / kJ per m^2 per year
light energy incident on forest trees	4 600 000
energy stored in cells of trees	44 000
energy transferred to primary consumers	2 900
energy transferred to secondary consumers	700

(i) Calculate the percentage of light energy used for photosynthesis by trees.

[2]

Total marks:	

(ii) The energy flow in this food chain is non-cyclical. With reference to Table 12.2, explain the term non-cyclical.

[4]

[Total: 10]

END OF PAPER

The sturdiest pillars of human morality are compassion and a sense of justice.
~Frans de Waal~

Total marks:	

2016 PRELIMINARY EXAMINATION [Answer Key]

4E Biology

PAPER 1 [40 marks]

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

PAPER 2 Section A [50 marks]

<table>
<tr><th>Qn</th><th>Marking Point</th><th>Marks</th></tr>
<tr><td>1</td><td></td><td></td></tr>
<tr><td>Q1a</td><td>
<table>
<tr><td></td><td colspan="2">effect</td></tr>
<tr><td></td><td>of water</td><td>of solution E</td></tr>
<tr><td>dark green outer tissue</td><td>curve straightened / dark green tissue on inside of curve</td><td>curved inwards/ curled up / ~~expanded/ lengthened / stretched /~~</td></tr>
<tr><td>pale green inner tissue</td><td>curve straightened / bent backwards/ outwards / inner pale green tissue on outside of curve</td><td>curled up more / ~~expanded / lengthened / swollen / stretched /~~ shortened / shrank</td></tr>
</table>
</td><td>½ per box</td></tr>
<tr><td>Q1b</td><td>
• Changes due to osmosis →1
• Properties of tissue layer →1 (either permeability or elasticity)
• How property of tissue layer results in difference in observations →1
Pale green tissue more permeable and dark green tissue (presence of cuticle on outer surface) to water.
Allow higher rate of osmosis of water in and out of the tissue,
thus the change in mass in greater due to greater movement of water
Dark green (presence of cuticle) tissue is less elastic/more rigid.
Movement of water into the tissue by osmosis
does not cause as much change in length as compared to the pale inner tissue.
</td><td>1
1
1
1
1
1</td></tr>
<tr><td>2a</td><td>Enzymes functions as a <u>biological catalyst or speeds up chemical reactions</u> in organisms / lowers activation energy for chemical reactions.
that <u>remains chemically unchanged</u> at the end of the reaction</td><td>1
1</td></tr>
</table>

<table>
<tr><td></td><td></td><td></td></tr>
<tr><td>2b</td><td>Lactase works optimally in alkaline conditions
lactase can be denatured in stomach due to acidic conditions / denatured due to pH changes as lactase travels from mouth to small intestine
protease (pepsin) in stomach may digest it;</td><td>1
1

1</td></tr>
<tr><td>3a</td><td>The muscles of the surrounding tissues / skeletal muscles contracts and squeeze the lymph vessels ;
Presence of valves to prevent backflow and ensure one way flow</td><td>1

1</td></tr>
<tr><td>3b</td><td><u>Lymph is full of fat droplets after a fatty meal because</u>
fatty acids combine with bile → soap and glycerol → water soluble, are absorbed in the ileum.
fat are <u>resynthesized</u> / fatty acids and glycerol <u>recombine</u> to become fat and enters the lacteals
lacteals then empties into lymph vessels which are part of lymphatic system ;</td><td>
1
1</td></tr>
<tr><td>3ci</td><td>Antibodies</td><td>1</td></tr>
<tr><td>3cii</td><td>Body recognises foreign matter / pathogens eg bacteria or virus
The antibodies will “mark” and cause bacterial cells to agglutinate
Cell R will engulf and ingest the agglutinated bacteria by phagocytosis
Fusion of ingested bacteria with lysosomes
Lysosome release enzymes to digest contents of bacteria</td><td>
1
1
1
1</td></tr>
<tr><td>4a</td><td>Table 4.1
<table><tr><td></td><td>materials moved</td><td>source of materials in the plant</td><td>sink for materials in the plant</td></tr><tr><td>transpiration</td><td>water
mineral salts/ ions /</td><td>roots / root hairs</td><td>leaves / shoot / stem ; flowers / fruits named</td></tr><tr><td>translocation</td><td>sucrose
amino acids
ions / minerals /
hormones</td><td>leaves / (named) storage organ / seed(s) / cotyledon</td><td>roots / stem / shoot / named growing region / (named) storage organ ; buds / flowers / fruits / tubers</td></tr></table></td><td>½ per box</td></tr>
</table>

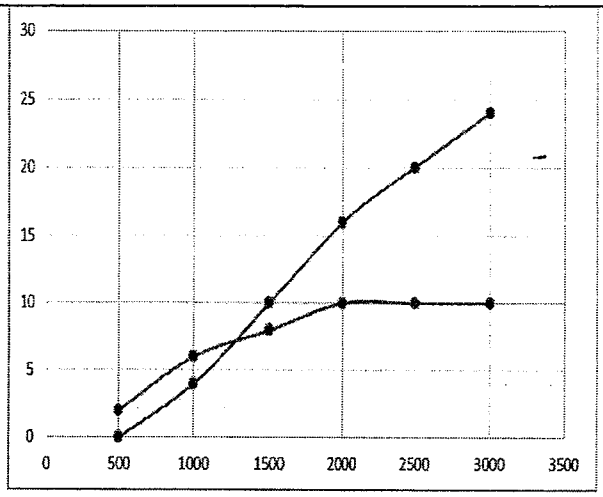
4b	answer needs to make clear which structures are source and sink 1 mark to describe change in source 1 mark to describe change in sink <u>Germination</u> Intitially during source is seed / cotyledon ; As the leaves grow and starts to photosynthesise it becomes the source; In early plant growth, root is the sink; At later later stages during reproduction, flowers / fruits / seeds / tubers /become sinks) Or 1 organ alternative between sink and source (max 1) During daytime, rate of photosynthesis is high and the life is the source. However, at night or prolong period of low sunlight (winter) Leaves may slow down and stop photosynthesizing and become the sink	 1 1 1
5(a)	A pollen tube B ovule C ovum / egg cell / female gamete	2 m for all 3 correct 1 m for 1 mistake
5(b)	Germination of pollen grain that lands on stigma Growth of pollen tube from stigma towards the ovary / Vegetative nucleus releases enzymes to digest style and allow pollen tube to penetrate ovule via <u>micropyle</u> <u>Male gamete fuses with female gamete to form diploid zygote</u>	1 1 1
5(c)	Advantage Higher rate of successful pollination and thus fertilization Less wastage of pollen grains Not reliant on external pollinating agents such as insects, wind Beneficial traits passed down Only one parent is required Disadvantage Less genetic variation in offspring's genotype Accumulation of undesirable / harmful traits due to recessive alleles causing it to be more susceptible to diseases and harsh environmental conditions	 1 1 1 1 1 1 A + 1 D Max 2
6(a)i	prophase;	1
6(a)ii	shade a pair of homologous chromosomes (same length and centromere position);	1
6(b)i	4 chromosomes;	1
6(b)ii	8 chromosomes;	1
6(c)	Mitosis occurs during growth and development of a multicellular organism; Mitosis occurs during the replacement of worn-out parts of the body; Mitosis is the basis of asexual reproduction, which results in a colony of identical individuals, i.e. clones;	1 1 1 Max 2
7(a)	5399 amino acids	1
7(b)i	Mutation is the sudden / random <u>change in structure of gene</u> / sequence of nucleotide of G6PD gene **Reject change in chromosome number**	1
7(b)ii	In G6PD, the base <u>cytosine has been changed to thymine</u> OR base in <u>mRNA is also changed from guanine to adenine</u> The synthesised enzyme (protein) has a different / altered function/shape/type / the enzyme is synthesised in reduced quantity	1 1
7(c)	Males have the <u>sex chromosomes, X and Y</u> The <u>mother</u> can pass down the mutated gene on <u>X chromosome</u> whereas the	1

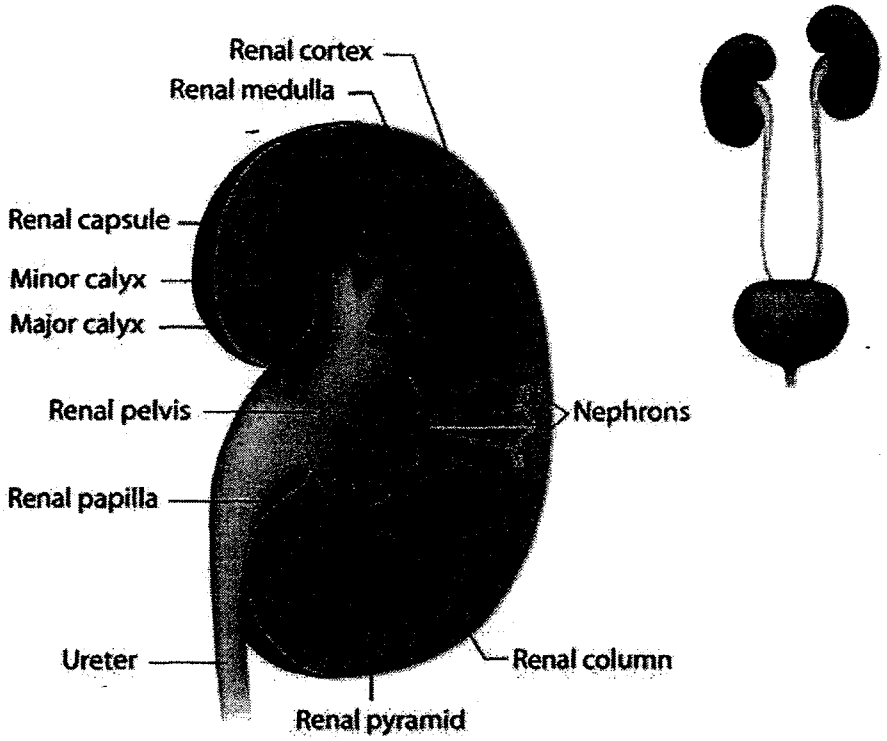
	father passes down the Y chromosome only	
8(a)	a gene is a segment of DNA consisting of a sequence of nucleotides which codes for a specific polypeptide an allele is a different form of the same gene – resulting in different types of phenotypes	1 1
8(b)	Normal wings Red eyes	½ ½
8(c)	Both parental genotype heterozygous – represented with correct allele symbols Format of diagram (parental phenotype → parental genotype → gametes → F1 genotype → F1 phenotype) F1 phenotypic ratio 75% or ¾ have red eyes Poor presentation (no legend, no arrows, incomplete statements. Incorrect representation of generation) – **minus 1 mark**	1 1 1
9(a)i	enabling leaf to float / providing buoyancy leading to efficient diffusion / exchange (of gases/oxygen/carbon dioxide) or better access to light	1 1
9(a)ii	stomata in contact with water; carbon dioxide diffuses faster through air than through water stomata in contact with water; less efficient gaseous exchange from lower surface	1 1
9(b)	roots have access to oxygen for aerobic respiration ; to provide energy / ATP ; needed for active uptake of, minerals / nutrients / salts / ions Accept 'active uptake uses energy'; Reject 'make / create energy'	1 1

PAPER 2 Section B [30 marks]

<table>
<tr><th>Qn</th><th>Marking Point</th><th>Marks</th></tr>
<tr><td>10a</td><td>During photosynthesis, oxygen is produced.
Oxygen is trapped within the intracellular air spaces/ sub-stomata air spaces.
Increase bouyancy/decrease density of leaf
Leaf starts to float</td><td>1</td></tr>
<tr><td>(b)i</td><td>x-axis
<table><tr><td>Light intensity
Strength of bulb ½</td><td>Using a light sensor and datalogger ½
Using lamps with known power ratings ½</td></tr></table>
y-axis
<table><tr><td>Time ½</td><td>Time taken for all 6 to leaf discs to rise ½</td></tr></table></td><td>1

1</td></tr>
</table>

(b) (ii)	 Plots – 1 (minus ½ for each wrong plot) Scale - 1 Labels for both graph - 1 Best fit – point to point line/curve – ½ for each graph	4
b iii	1. Sun leaves has a lower rate of photosynthesis at low light intensity as compare to shade leaves 2. The maximum rate of photosynthesis is lower for shade leaves 3. Photosynthesis begins at a lower light intensity as compare to the sun leaves	1 1 Max:2
c	Plant can photosynthesis for longer periods (early morning and late evening for low light intensity and afternoon(When light intensity is high) Sun leaves at top canopy allow photosynthesis at high light intensity and the shade leaves at bottom canopy can phtosynthesis simultaneously because the sunleave will absorb some of the sunlight to reduce light intensity	1 1 Max: 1
11a	Each correct label ½ mark	2

		
11bi	more protein (or reverse argument) ; more deamination in liver / or described (ora) ; more urea (ora) to be lose in the urine; more salts in diet, causes more salt to be lose in the urine(ora) ; more water consumed more has to be removed (ora) to maintain blood concentration **Reject changes to glucose intake → healthy kidney is able to reabsorb all glucose**	1 1 1 1 1 Max 4
11b ii	Increase in temperature causes Increase amount of sweating to regulare internal body temperature; This causes the concentration of plama to rise and more ADH is released More water reabsorbed less is lost in the urine Sweating causes more salts in to be loss ; adjustment of salts in urine to be loss to be lower, to maintain blood concentration ;	 1 1 1 1 1 Max :4

E 12(a)	increase in aerobic respiration generates more heat which increases body temperature to above set point. detected by thermoreceptors in hypothalamus. Skin arterioles dilate and shunt vessels constrict. More blood is transported to the capillaries at the skin surface to increase heat loss through conduction, convection and radiation. Sweat glands become more active which increase secretion of sweat. This increases heat loss through latent heat of vaporisation from evaporation of water from sweat. Rate of metabolic processes decrease.	1 1 1 1 1 1 1 Max 6
E 12(b)	Higher rate of water loss during exercise due to increased sweating. Low water potential is detected by hypothalamus More ADH is released by pituitary gland Increase in the permeability of the cells at the collecting duct / increased reabsorption of water	1 1 1 1
O 12(a)i	As the concentration of DDT increases, the percentage of mammals with cancer increases	1
O 12(a)ii	as the body mass increases, the concentration of DDT increases; Bioaccumulation of insecticide (ref to unable to excrete DDT/consume many contaminated organisms); as one organism feeds on the previous organism (and in large amounts)in the food chain;	1 1 1
O 12(b)i	44000/4600000 x 100% = 0.96% (1%) Minus ½ mark for no units	1 1
O 12(b)ii	lost as heat in primary consumers during respiration; used for work/movement by primary consumers; lost as waste (defaecation/excretion) from primary consumers; lost as uneaten parts This energy does not return to the same system or organism and cannot be recycled/used again by producers or consumers Thus, energy in the form of light energy from the sun, has to be constantly supplied to the ecosystem	Any 2 1 m each 1 1