



TEMASEK SECONDARY SCHOOL  
O Level Preliminary Examination 2014  
Secondary 4 Express

---

**BIOLOGY**

**5158/01**

**Paper 1**

**1 hour**

**Question Booklet**

**Additional Material:      Optical Answer Sheet**

---

**READ THESE INSTRUCTIONS FIRST**

Write your name, index number and class on the Optical Answer Sheet.

You are not required to hand in this booklet.

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 Optical Answer Sheet.

**Read the instructions on the Optical Answer Sheet very carefully.**

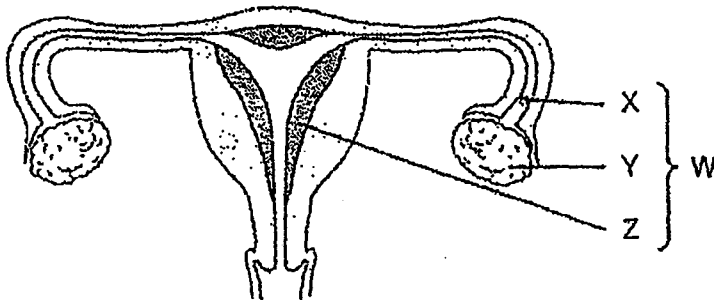
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

Attempt ALL questions in this section.

Choose the most appropriate answer and shade the corresponding letter on the separate answer sheet provided.

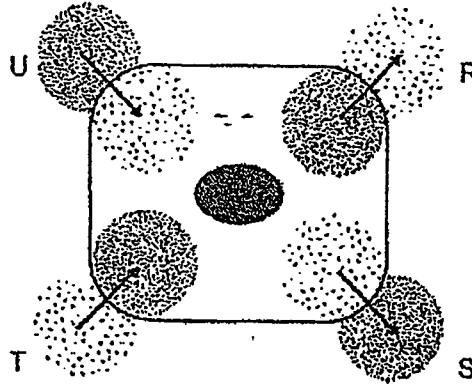
- 1 An actively growing cell is supplied with radioactive amino acids. Which cell component would first show an increase in radioactivity?
- A golgi body  
B rough endoplasmic reticulum  
C nucleus  
D mitochondrion
- 2 A student suggests that plant cells do not require mitochondria since they have chloroplasts. Which of the following statements would you use to convince him otherwise?
- A Having both chloroplasts and mitochondria would maximise the rate of photosynthesis.  
B Having both chloroplasts and mitochondria would maximise the rate of energy production.  
C Mitochondria would be necessary at night when chloroplasts are no longer able to photosynthesise.  
D The chemical energy stored in glucose cannot be efficiently utilised in the cell without the mitochondria.
- 3 The diagram shows the female reproductive system.



Which level of organisation are the structures W, X, Y and Z?

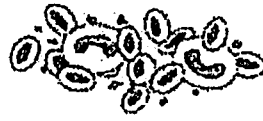
	Cell	Tissue	Organ	Organ system
A	W	X	Z	Y
B	X	Y	Z	W
C	X	Z	Y	W
D	Y	X	W	Z

- 4 The diagram shows four ways in which molecules may move into a cell and out of a cell. The dots show the concentration of molecules.



The cell is respiring aerobically.  
Which process has correctly taken place in the cell?

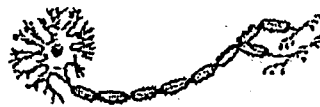
- A R - The movement of carbon dioxide molecules  
B S - The movement of carbon dioxide molecules  
C T - The passive uptake of glucose molecules  
D U - The active uptake of glucose molecules
- 5 Which statement describes the relationship between the human cells illustrated in the diagrams below?



1



2



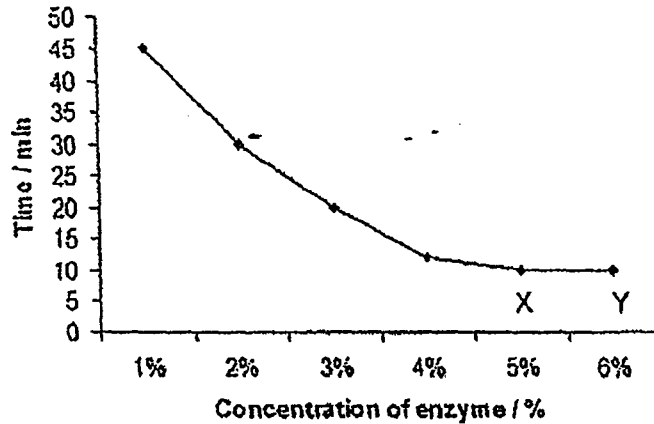
3



4

- A 1 is produced by 4.  
B 2 transports oxygen to 1.  
C 3 is used to repair 2.  
D 3 causes 4 to contract.

- 6 The graph below shows the relationship between concentration of enzyme and time taken for reaction to complete.



Which of the following statements is true between point X and point Y?

- A Enzyme concentration is the limiting factor.  
 B pH of the environment is the limiting factor.  
 C Substrate concentration is the limiting factor.  
 D Temperature of the environment is the limiting factor.
- 7 A student was asked to identify the two food substances in each of these test-tubes. The table shows the results of the student's test.

Test tube	Reagent added to test-tube		
	Biuret solution	Benedict's solution	Iodine solution
X	Purple	Brick red precipitate	Brown
Y	Blue	Blue	Brown
Z	Purple	Blue	Blue-black

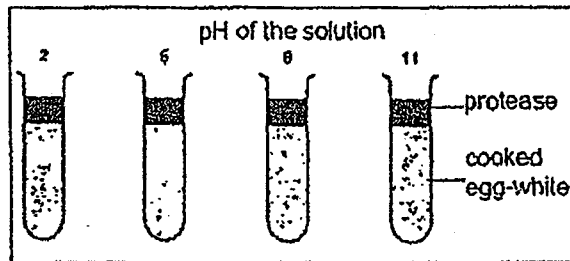
Which of the following is the correct description for the test-tube contents?

- A Egg white and glucose had been placed in tube X.  
 B Starch and sucrose had been placed in tube Y.  
 C Maltose and sucrose had been placed in tube X.  
 D Maltose and starch had been placed in tube Z.

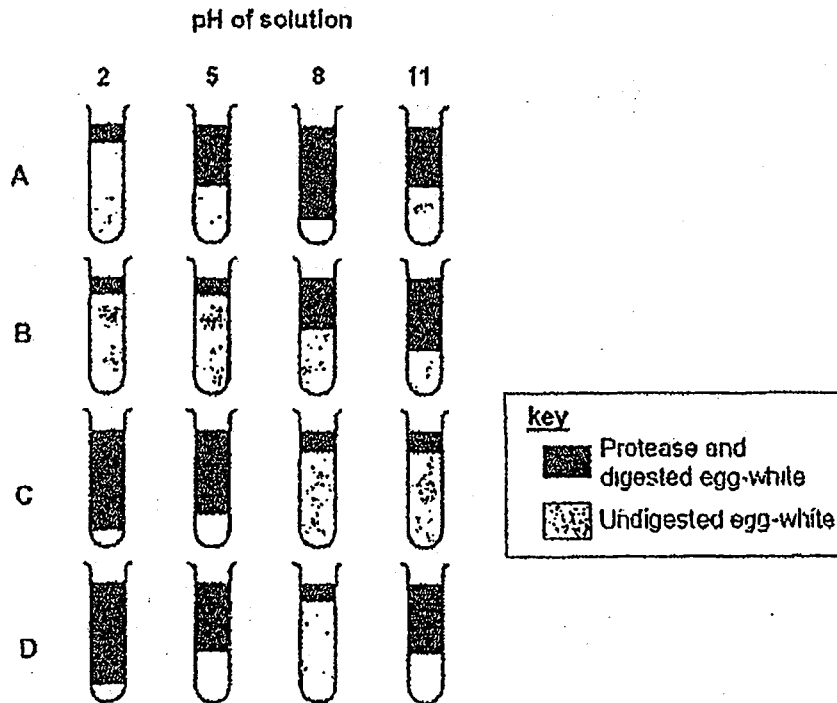
8 Which of the following fluids do not contain enzymes?

- A Blood plasma
- B Secretions from the liver
- C Secretions from the salivary gland
- D Secretions from germinating pollen grains

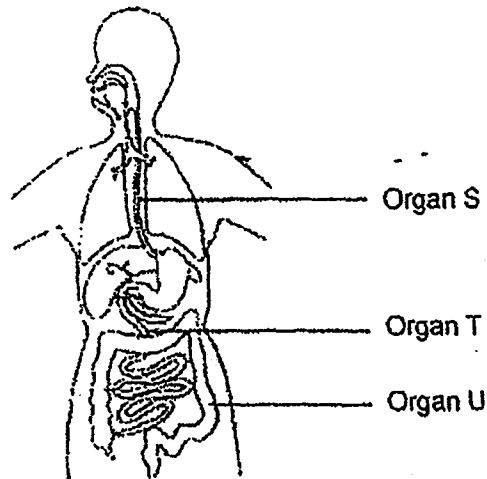
9 Four tubes containing cooked egg white were set up as shown. Protease solutions of different pH are added to each tube.



Which diagram shows the result of the experiment if the protease was pepsin?



10 The diagram below shows parts of the human digestive system.



What does each of the labelled organs (S, T and U) above have in common?

- A All the organs secrete digestive juices.
- B Protein digestion occurs in all three labelled organs.
- C Villi are present along the inner walls of all the organs.
- D All the organs move its content using peristaltic movement.

11 Which of the following statements describe the uses of lipids?

- I It acts as a shock-absorber which protects blood vessels.
- II It forms a heat insulating layer for mammals.
- III It acts as a food reserve because it is miscible with water.
- IV It is an essential component of a cell membrane.

- A I and II only
- B II and III only
- C II and IV only
- D III and IV only

12 Which of the following is correct in the reaction catalyzed by carbonic anhydrase?

	Location	Reactant	Product
A	Plasma	$\text{H}_2\text{CO}_3$	$\text{H}_2\text{O} + \text{CO}_2$
B	Plasma	$\text{H}_2\text{O} + \text{CO}_2$	$\text{H}_2\text{CO}_3$
C	Red blood cell	$\text{H}_2\text{CO}_3$	$\text{H}_2\text{O} + \text{CO}_2$
D	Red blood cell	$\text{H}_2\text{O} + \text{CO}_2$	$\text{H}_2\text{CO}_3$

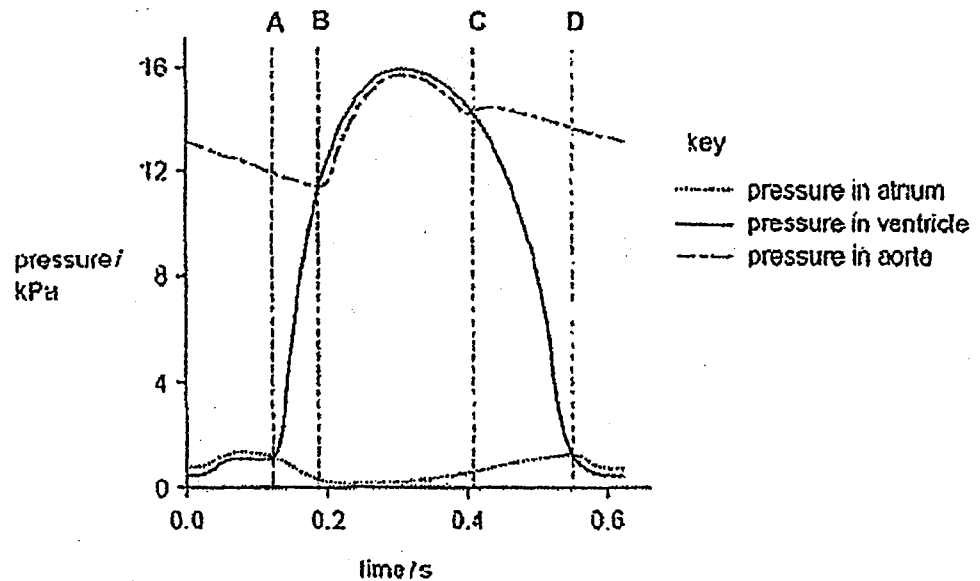
13 Due to an accident, Peter's gall bladder had to be removed. Which of the following is/are expected consequence(s) of this?

- I impaired fat digestion
- II lighter-coloured faeces
- III reduced absorption of amino acids
- IV reduced production of bile

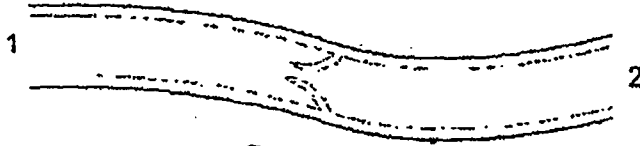
- A I only
- B I and II only
- C I, II and IV only
- D I, II, III and IV

14 The graph shows pressure changes in the left side of the heart, during a single heartbeat.

At which point do the bicuspid valves close?



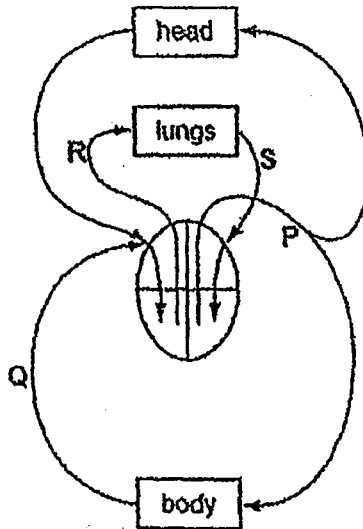
15 The diagram shows a section through part of a blood vessel.



What could be the first organs found in the directions 1 and 2?

	1	2
A	Lung	Heart
B	Heart	Brain
C	Kidney	Heart
D	Intestine	Liver

16 The diagram represents the heart and some major blood vessels.



Which are possible blood pressures (in kPa) for the vessels shown in the diagram?

	P	Q	R	S
A	1	4	2	16
B	4	16	2	1
C	16	2	4	1
D	16	4	1	2

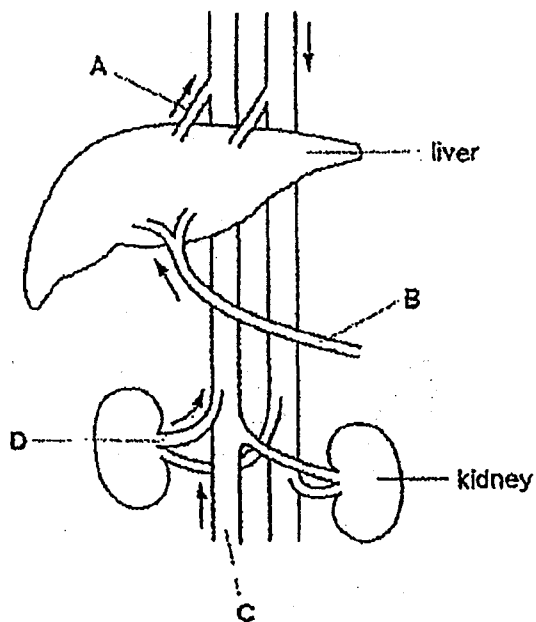


- 17 A person with blood group A needs a blood transfusion. Which option correctly shows the outcome of receiving blood from donors with other blood types?

	AB	B	O
A	+	-	+
B	+ - - -	+	-
C	-	-	+
D	-	+	-

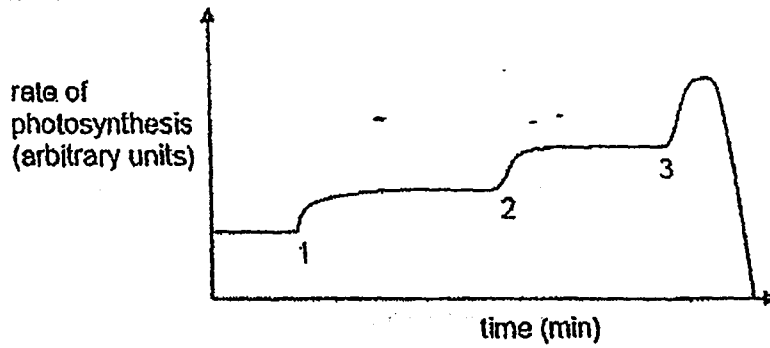
'+' : compatible      '-': agglutination

- 18 The diagram shows the blood supply to various organs.



Which blood vessel carries blood with the highest concentration of urea?

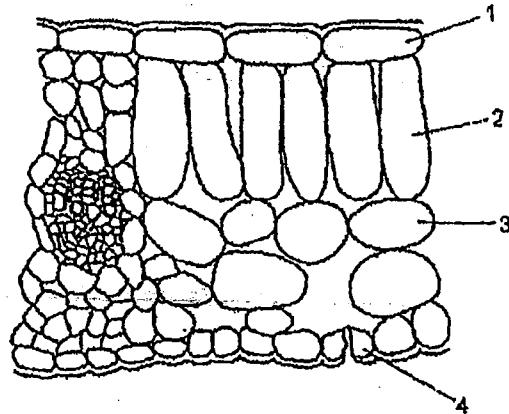
- 19 Temperature, light intensity and carbon dioxide concentration are three limiting factors in photosynthesis. In an experiment, each factor is increased in turn. The results are shown in the graph below.



Which numbered points represent the factors that were increased over a period of time?

	Light intensity	Carbon dioxide	Temperature
A	3	2	1
B	1	2	3
C	1	3	2
D	2	3	1

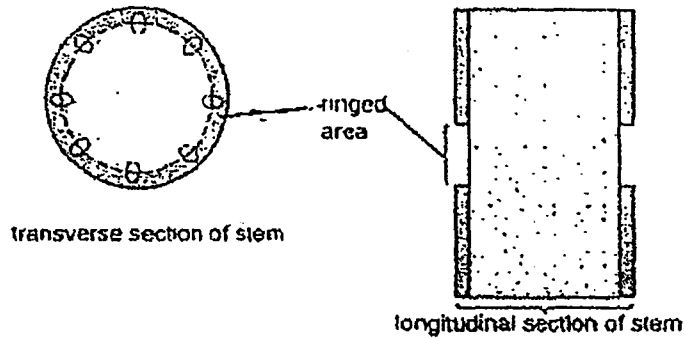
- 20 The diagram shows part of a transverse section of a leaf.



Where does photosynthesis take place?

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

- 21 In an experiment to demonstrate the movement of solutes in a plant, a complete ring of bark was removed from the stem, as shown in the figure below.



After 3 days, which of the following shows the correct concentration of sucrose found in the stem regions immediately above and below the ring?

	Concentration of sucrose in stem above ring / arbitrary units	Concentration of sucrose in stem below ring / arbitrary units
A	0.45	0.00
B	0.00	0.45
C	0.45	0.45
D	0.00	0.00

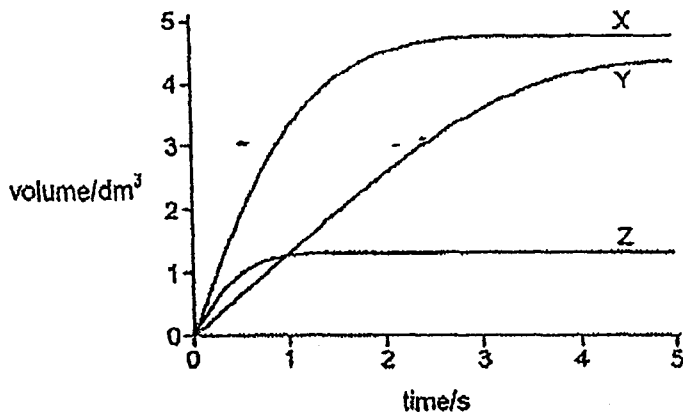
- 22 What would be the result of breathing in the same air that was expired?

	Blood pH	Breathing rate
A	Fall	Decrease
B	Fall	Increase
C	Rise	Increase
D	Rise	Decrease

- 23 Nicotine and carbon monoxide are present in tobacco smoke. What are their effects on health?

	Nicotine	Carbon monoxide
A	Causes addiction	Causes atherosclerosis
B	Causes addiction	Causes emphysema
C	Increases blood pressure	Causes addiction
D	Paralyzes cilia	Causes lung cancer

24 The graph shows the volume of air breathed out quickly and with force, following a deep breath, for three different persons X, Y and Z.

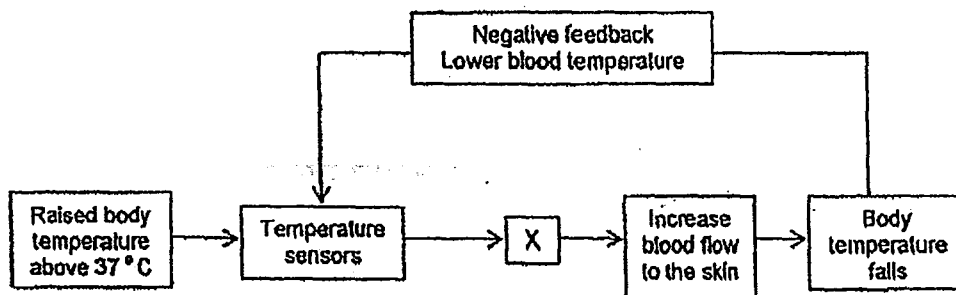


Of the three persons, one is suffering from chronic bronchitis, one is suffering from emphysema and the third person has normal lung function.

Which option correctly matches X, Y and Z to their condition?

	Chronic bronchitis	Emphysema	Normal lung function
A	X	Y	Z
B	X	Z	Y
C	Y	Z	X
D	Z	Y	X

25 The diagram below shows the negative feedback loop to regulate our body temperature.



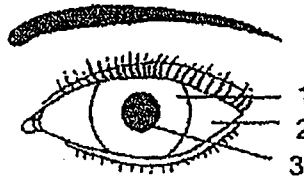
Which of the following structures constrict at point X?

- A Shunt vessels
- B Skin capillaries
- C Arterioles
- D Artery

26 A drug has been found to inhibit the effects of antidiuretic hormone (ADH). What would be the most expected consequence of administering this drug to a healthy person?

- A A smaller volume of urine would be produced.
- B More proteins would be deaminated into urea.
- C The urine produced will be more concentrated.
- D The person will be dehydrated due to excess water loss.

27 The diagram below shows the external view of the human eye.



Which of the following statements regarding the diagram of the human eye is/are correct?

- I Structure 1 is a group of muscles.
- II Structure 2 is a tough white coating around the eyeball.
- III Structure 3 is pigmented.

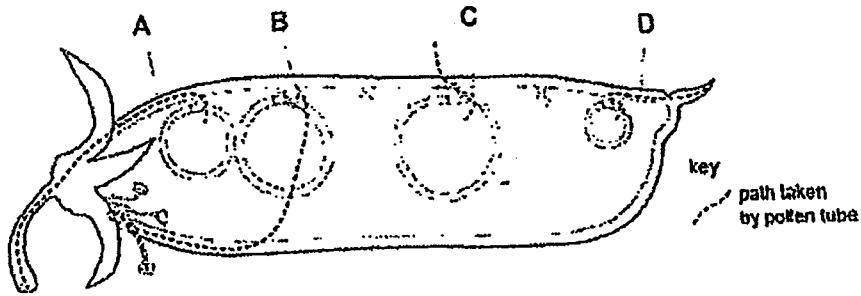
- A I only
- B I and II only
- C II and III only
- D I, II and III

28 The tri-germinal nerve in humans connects the brain with the teeth and with the skin of the face. When the dentist injects a local anaesthetic that targets this nerve, a person cannot feel pain or smile properly.

Which of the following conclusions can be best made?

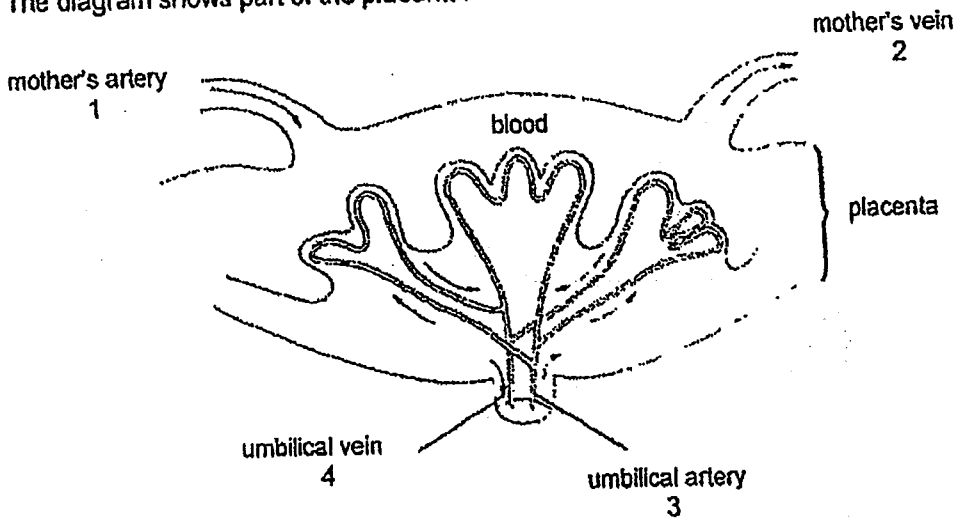
- A The tri-germinal nerve contains only sensory neurones.
- B The tri-germinal nerve contains only motor neurones.
- C The tri-germinal nerve contains both sensory and motor neurones.
- D The tri-germinal nerve contains sensory, relay and motor neurones.

29 The diagram shows a pod from a pea plant.



Which line correctly shows the path that was taken by a pollen tube to an ovule?

30 The diagram shows part of the placenta.



In which numbered parts does the blood contain the most oxygen?

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

- 31 The nurses working at the maternity ward of a hospital suspected that they might have accidentally mixed up three babies at birth. Blood typing of the three couples and the three babies involved were carried out to match each baby to the right family.

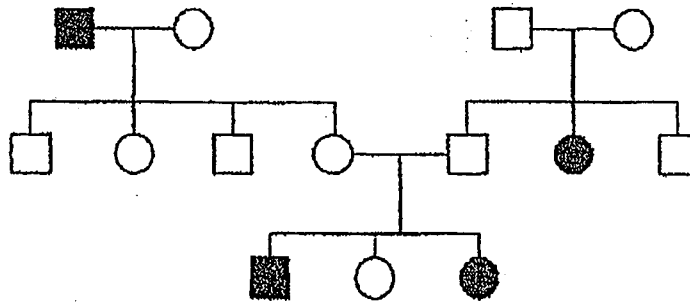
The following results were obtained.

Baby 1: Type B      Baby 2: Type A      Baby 3: Type O

Family	Husband's blood type	Wife's blood type
Ang	O	AB
Tan	A	O
Chan	AB	B

What can be concluded from the above data?

- A Baby 1 belongs to the Ang family.  
 B Baby 2 belongs to the Chan family.  
 C Baby 3 belongs to the Tan family.  
 D The families of all three babies cannot be determined from the above data.
- 32 The diagram below tracks the inheritance of fast twitch muscles (which are useful for sprinting) and slow twitch muscles (which are useful for long distance running) in three generations of horses.



□ male      ○ female

White indicates a horse with fast twitch muscles.  
 Black indicates a horse with slow twitch muscles.

What is the relationship between the two characteristics?

- A The allele for fast twitch muscles is dominant.  
 B The allele for slow twitch muscles is dominant.  
 C The characteristics exhibit co-dominance.  
 D There is insufficient data to draw any conclusion.

- 33 Many people have an inherited condition that determines if they suffer from anaemia. H and h represents the alleles that determine this condition.

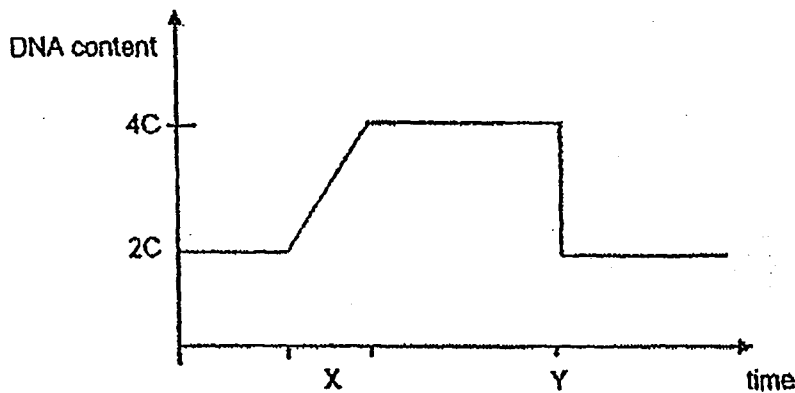
*HH genotype: not anaemic*

*Hh genotype: mildly anaemic*

*hh genotype: severely anaemic, with high mortality rate*

Two heterozygotes got married and planned to have children. What is the probability that a surviving offspring of the next generation is homozygous dominant?

- A 0.00  
 B 0.25  
 C 0.33  
 D 0.50
- 34 The graph shows the changes in the amount of DNA present in the nuclei of the cells during cell division. A diploid cell has a 2C nuclear DNA content.



Which of the following conclusions can be deduced from the graph?

	Stage X	Stage Y
A	Uncoiling of DNA	Meiosis
B	Uncoiling of DNA	Mitosis
C	Replication of DNA	Meiosis
D	Replication of DNA	Mitosis



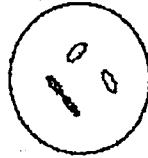
- 35 The nucleus below contains the chromosomes of a sea urchin zygote at the two-cell stage.



Which of the diagram below best represents the nucleus of an embryo at the 64-cell state grown from this cell?



A



B

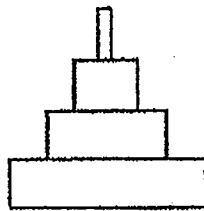


C

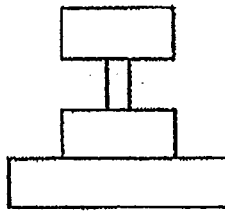


D

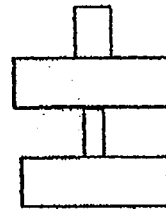
- 36 The diagram shows four ecological pyramids.



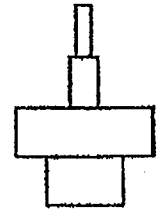
1



2



3



4

In a food chain, grass is eaten by cows. The cows have insects living on their skin. The insects are eaten by birds.

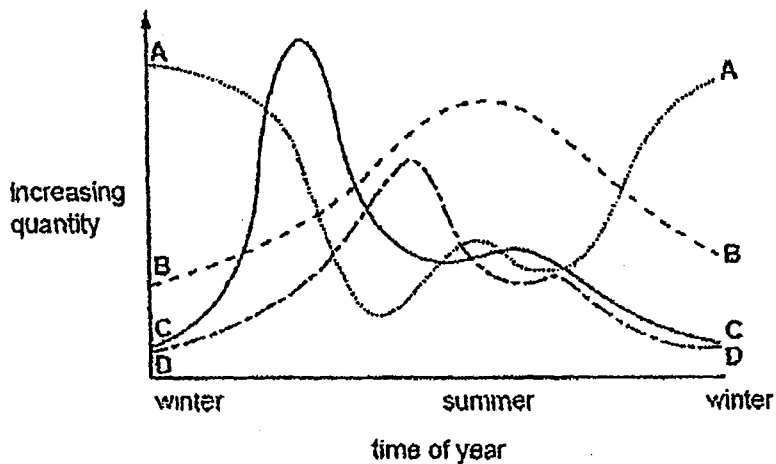
Which is the pyramid of mass and which is the pyramid of numbers in this food chain?

	Pyramid of mass	Pyramid of numbers
A	1	3
B	1	4
C	3	1
D	3	2

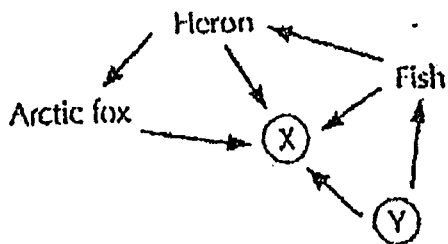
37 The graph shows the annual changes of the following factors in a lake.

- intensity of light per day
- numbers of producers
- numbers of primary consumers
- quantity of nutrients

Which curve represents the numbers of primary consumers?



38 The diagram below shows a food web on an Arctic island.

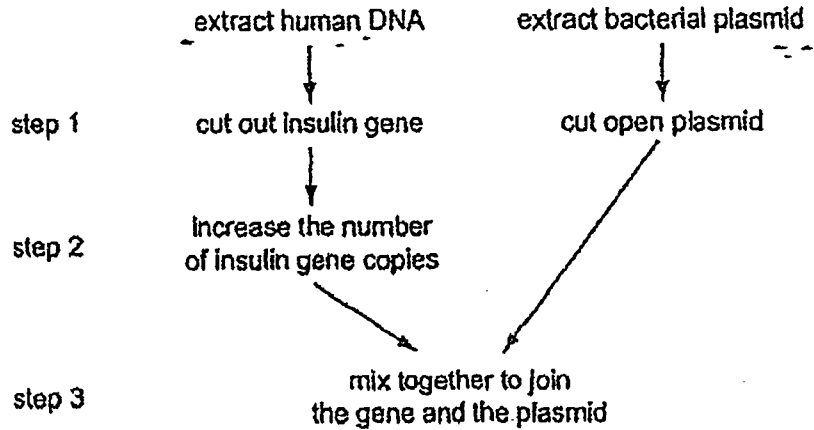


Which of the organisms can X and Y be?

	X	Y
A	Bacteria	Fungi
B	Bacteria	Algae
C	Fungi	Bacteria
D	Man	Bacteria

39 The diagram outlines part of the process to produce recombinant DNA that will synthesize human insulin.

At steps 1, 2 and 3, enzymes have to be used.



Which option correctly identifies the enzyme in each step?

	Step 1	Step 2	Step 3
A	Polymerase	Ligase	Restriction
B	Polymerase	Restriction	Ligase
C	Restriction	Ligase	Polymerase
D	Restriction	Polymerase	Ligase

40 DNA extracted from the nuclei of octopus cells is found to comprise 18% adenine in terms of base composition. What percentage of the bases is guanine?

- A 18
- B 32
- C 36
- D 64

\*\*\*\*\*END OF PAPER\*\*\*\*\*



Name: \_\_\_\_\_ Index Number: \_\_\_\_\_ Class: \_\_\_\_\_



TEMASEK SECONDARY SCHOOL  
O Level Preliminary Examination 2014  
Secondary 4 Express

**BIOLOGY**

**5158/02**

**Paper 2  
(SECTION A)**

**Total time for sections A & B:  
1 hour 45 minutes**

**Question and Answer Booklet**

**Additional Material: Nil**

**READ THESE INSTRUCTIONS FIRST**

**Do not open the booklet until you are told to do so.**

**You are required to submit this booklet at the end of the examination.**

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

**Write in dark blue or black pen.**

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

**Answer all questions in this section.**

**Write your answers in the spaces provided.**

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

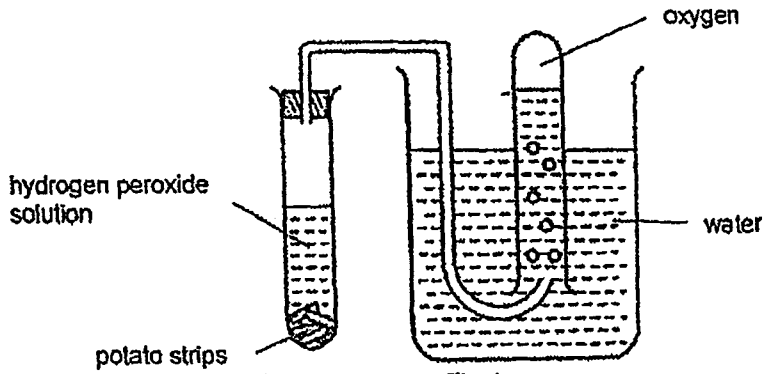
**Submit Sections A and B separately.**

For Examiner's Use	
Section A	/50
Section B	/30
Total	/80

**SECTION A (50 MARKS)**

Answer ALL the questions in this section.

- 1 Fig.1 shows an experimental set-up using potato strips in a hydrogen peroxide solution at room temperature.



Potato cells contain an enzyme that breaks down hydrogen peroxide to release oxygen gas. The number of bubbles released per minute is counted, to measure the rate of enzyme activity in the potato cells.

- (a) The hydrogen peroxide solution was kept in the refrigerator for a day, before it was used in the experiment. Explain why there were no bubbles released initially when the potato strips were added to it. [ 2]

.....

.....

.....

.....

- (b) Cells found in carrot strips too contain enzymes. However, when the carrot strips were used in place of the potato strips as shown in Fig.1, no bubbles of oxygen were released. Explain this observation. [2]

.....

.....

.....

.....

- (c) Suggest and explain a change to the potato strips in this experiment so that the number of bubbles released per minute can be increased. [2]

.....

.....

.....

.....

- 2 Fig.2.1 shows a *Stentor*, a freshwater unicellular animal that attaches itself to stationary objects when it feeds through its feeding funnel. It possesses two contractile vacuoles which fill up with water and empty their contents to the environment to expel excess water in the cell. Each filling and emptying of the contractile vacuole is called a pulsation.

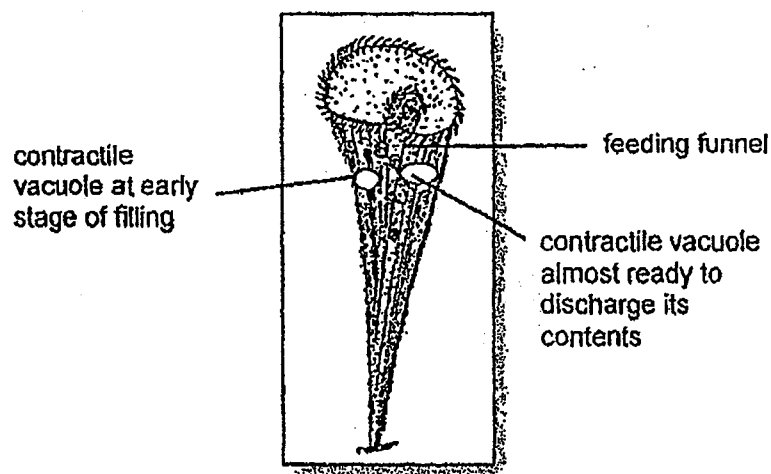


Fig.2.1

In an experiment, a specimen of a *Stentor* was placed in bathing solutions of different salt concentrations and the average time for each pulsation was recorded using a microscope.

Concentration of salt solution (mol/dm <sup>3</sup> )	Average time for one pulsation (s)
0.1	95
0.3	156
0.5	201
0.7	378

Table 2.2

(a) State and explain the process of how water enters the *Stentor*. [3]

.....  
.....  
.....  
.....  
.....

(b) (i) Describe the trend obtained from the results in Table 2.2. [1]

.....  
.....

(ii) Explain the trend that you have described in b(i) above. [3]

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....

(c) Explain the significance of controlling the water level for *Stentor* living in a freshwater environment. [2]

.....  
.....  
.....  
.....



3 Fig.3.1 shows how blood pressure changes as blood travels through one circuit of the circulatory system.

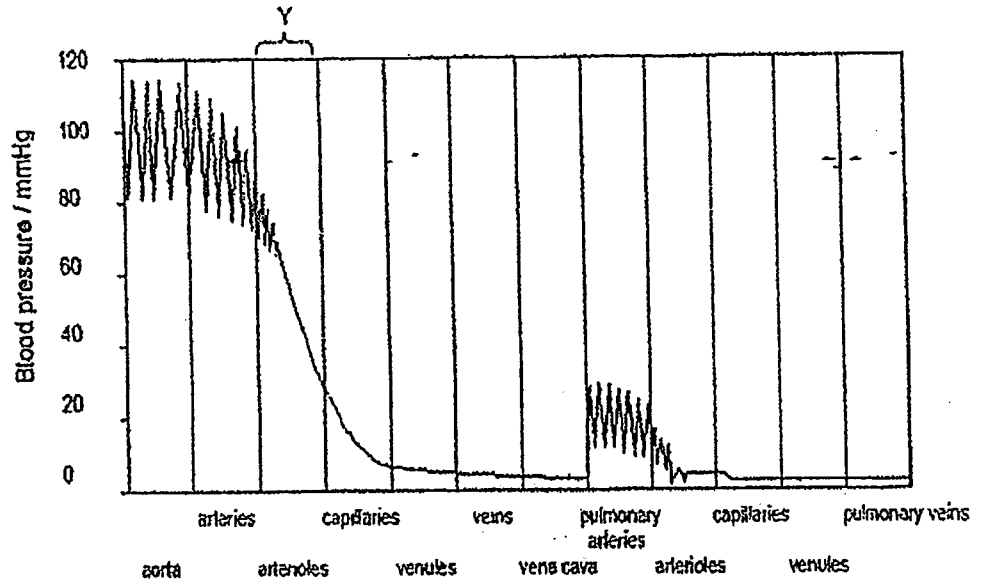


Fig.3.1

(a) Explain why the blood pressure decreases so rapidly in region Y. [2]

.....

.....

.....

.....

.....

.....

(b) In the space below, draw a labelled diagram to show the cross-sectional view of a blood capillary. [1]

- (c) Give two reasons to explain how a return flow of blood to the heart is possible when the pressure in the veins is so low. [2]

.....

.....

.....

.....

.....

- (d) Fig.3.2 shows a blocked artery being treated with the use of a stent (small tube of stainless steel mesh). A balloon with the stent is inserted into the artery and inflated. The balloon is then removed and the stent remains inside the artery.

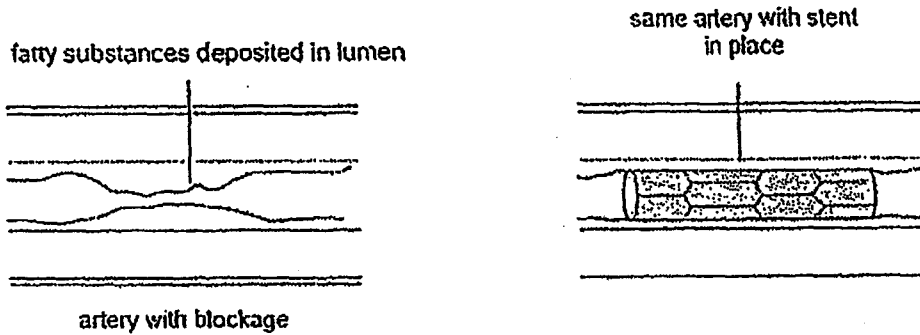


Fig.3.2

- (i) Suggest why the artery wall is able to 'bounce back' when the balloon is used to inflate the artery is removed. [1]

.....

.....

- (ii) Explain why the ability of the artery wall to bounce back is important in a normal, healthy artery. [2]

.....

.....

.....

.....

- 4 Gastric bypass surgery makes the stomach smaller and causes the food to bypass part of the small intestines. In this surgery, a small part of the stomach is used to create a stomach pouch which is then connected to the middle part of the small intestines (jejunum) as shown in Fig. 4 below.

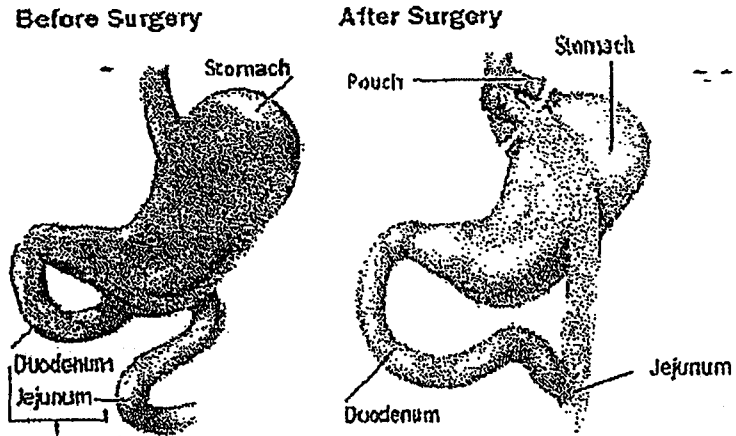


Fig.4

- (a) Describe the role played by the stomach in digestion. [4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (b) Using Fig.4, state the difference in the route taken by the food after surgery. [1]

.....

.....

- (c) Gastric bypass can be performed on people who are obese and wants to lose weight. Explain how it will help the person lose weight. [3]

.....

.....

.....

.....

.....

.....

.....

- (d) Suggest why this may not be the best way to lose weight. [1]

.....

.....

- 5 Fig.5.1 shows two flowers belonging to the same plant species. Bees are known to assist in the reproductive processes of the flowers in this species.

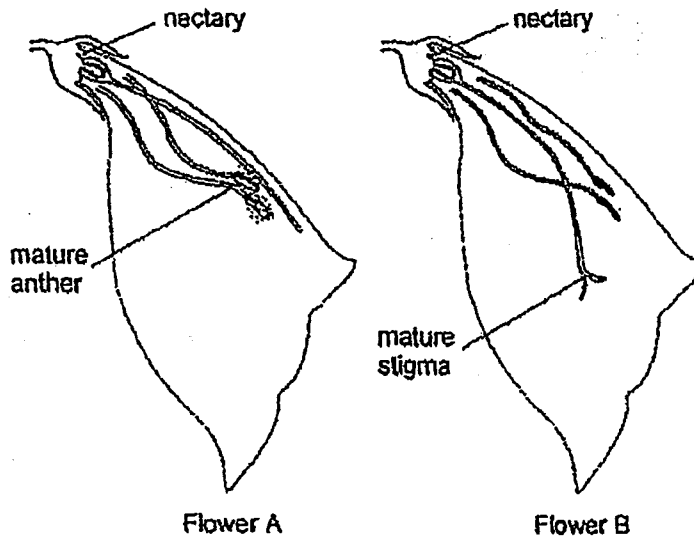


Fig.5.1

- (a) With reference to only the male and female parts of the flower given in Fig.5.1, suggest how cross pollination by the bee is guaranteed in this species. [2]

.....

.....

.....

.....

- (b) Complete the table below on the movement of the male gamete in the female reproductive system of this plant species and that of humans. [4]

	Given plant species	Human
Structure(s) through which male gamete passes to reach female gamete.		
Adaptation for movement of male gamete.		

- (c) Table 5.2 shows a recording of the lengths of 5000 fully grown standard petals of this species growing in a certain area.

Standard petal length, $x$ / mm	Frequency
$5 \leq x < 10$	2
$10 \leq x < 15$	0
$15 \leq x < 20$	0
$20 \leq x < 25$	0
$25 \leq x < 30$	1775
$30 \leq x < 35$	975
$35 \leq x < 40$	0
$40 \leq x < 45$	0
$45 \leq x < 50$	1075
$50 \leq x < 55$	1173
$55 \leq x < 60$	0

Table 5.2

(i) State the kind of variation seen in standard petal length in this species [1]

.....

(ii) Account for the frequency recorded for standard petal length of  $5 \leq x < 10$ . [1]

.....

.....

6 Fig.6.1 shows an activity involving the DNA molecule.

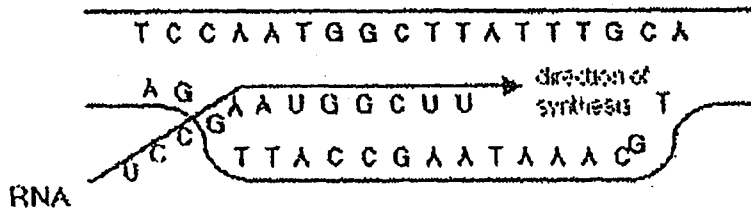


Fig.6.1

(a) In the cell, activities involving nucleotide chains could be replication, translation or transcription.

(i) Which of the following activities is depicted in Fig.6.1? [1]

.....

(ii) Explain which two features in Fig.6.1 give support to your answer. [2]

.....

.....

.....

.....

.....

(b) Table 6.2 shows the RNA bases needed to code for particular amino acids.

Amino acid	mRNA code
Arginine	UCC
Glycine	CCA
Tryptophan	ACC
Serine	AGC

Table 6.2

Write in the DNA sequence needed to produce the following sequence:

serine – tryptophan – glycine – glycine – glycine – arginine - serine [1]

.....

(c) Glutamic acid can be coded for by either CTC or CTT.  
Valine can be coded for by either CAA or CAT.

In sickle cell haemoglobin, glutamic acid is replaced by valine. If this is the result of a change in single base, what was the original DNA code for glutamic acid? [1]

.....

7 It is thought that Darwin's finches evolved from one type of ancestral finch. Fig.7 shows examples of different species of Darwin's finches.

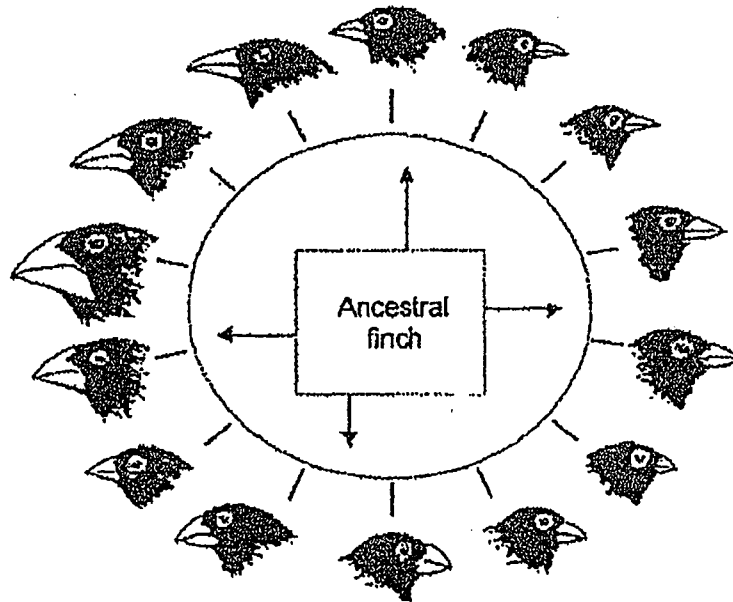


Fig.7

- (a) (i) What two observations can be made from the diagram about the structure of the finches' beaks? [2]

.....  
.....  
.....

- (ii) Name one environmental factor which has led to this variation. [1]

.....

- (b) The existence of Darwin's finches is under threat in the Galapagos Islands due to human activity.

- (i) Give an example of a human activity that could be affecting the finches [1]

.....  
.....

- (ii) What could be the effect of this human activity on finch biodiversity? [1]

.....  
.....



Name: \_\_\_\_\_ Index Number: \_\_\_\_\_ Class: \_\_\_\_\_



TEMASEK SECONDARY SCHOOL  
O Level Preliminary Examination 2014  
Secondary 4 Express

**BIOLOGY**

**5158/02**

**Paper 2  
(SECTION B)**

**Total time for sections A & B:  
1 hour 45 minutes**

**Question and Answer Booklet**

**Additional Material: Nil**

**READ THESE INSTRUCTIONS FIRST**

Do not open the booklet until you are told to do so.

You are required to submit this booklet at the end of the examination.

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

Write in dark blue or black pen.

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

Answer all the questions in this section.

Write your answers in the spaces provided

Write an E (for Either) or an O (Or) next to the number 10 in the grid below to indicate which question you have answered.

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

For Examiner's Use	
8	
9	
10	
<b>Total</b>	<b>/30</b>

**Submit Sections A and B separately.**

## SECTION B (30 MARKS)

Answer THREE questions in this section.

Question 10 is in the format of an EITHER / OR question. Only one part should be answered.

8 Fig.8.1 shows a small, deep-rooted bush growing in a warm, dry climate.

Branches B and C have a similar number of leaves, but the leaves of branch B are enclosed in a transparent polythene bag that empties into a container.

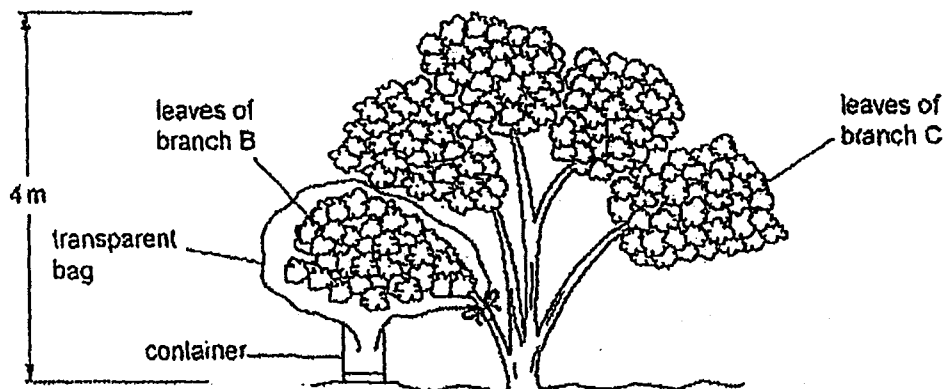


Fig.8.1

Fig.8.2 is a graph showing the total volume of water lost by the leaves of branch B from 0600 h to 1800 h.

Table 8.3 shows the total volume of water lost by the leaves of branch C during the same day.

Table 8.3

Time of day / h	0600	0800	1000	1200	1400	1600	1800
Total volume of water lost / cm <sup>3</sup>	2.2	2.6	4.2	7.0	9.6	11.9	12.2

(a) (i) Plot the graph for branch C on Fig.8.2 below.

[2]

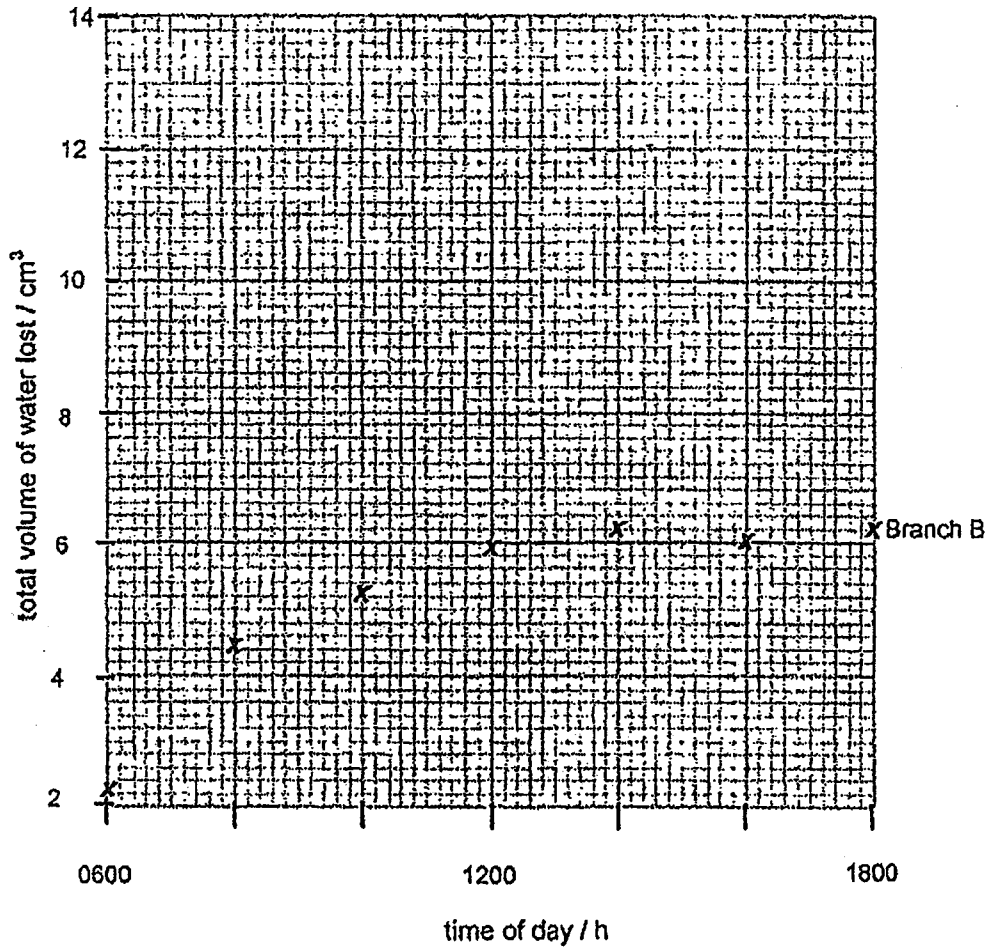


Fig.8.2

(ii) State two environmental factors responsible for the water loss during the day by branch C. [2]

.....

.....

(iii) Describe and explain the differences in the graph for the volume of water lost from leaves of branch B and branch C during the same day. [4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(b) If branch B was enclosed in a black polythene bag, sketch a graph on Fig.8.2 to show the total volume of water that would be lost for the same period. [1]

(c) Suggest why, even for certain plants that are poisonous to humans, the container in Fig.8.1 can supply travellers with safe drinking water. [3]

.....

.....

.....

.....



.....

.....

.....

[Total: 12 marks]

- 9 In a breeding experiment, a scientist investigates the body patterns of a particular species of moth. The life span of the moth is about three months. Three groups of moths K, L and M with different genotypes are crossed in an experiment and the results are shown in the table below.

Cross between:	Phenotype observed	
	 Striped	 Full bodied
L and L	268	84
K and M	417	0

- (a) Explain the advantage of using moths as a model to study inheritance. [1]

.....

.....

- (b) Use the letter ' F ' to represent the dominant allele and ' f ' for the recessive allele.

- (i) Suggest which phenotype is dominant and explain your answer. [2]

.....

.....

.....

.....

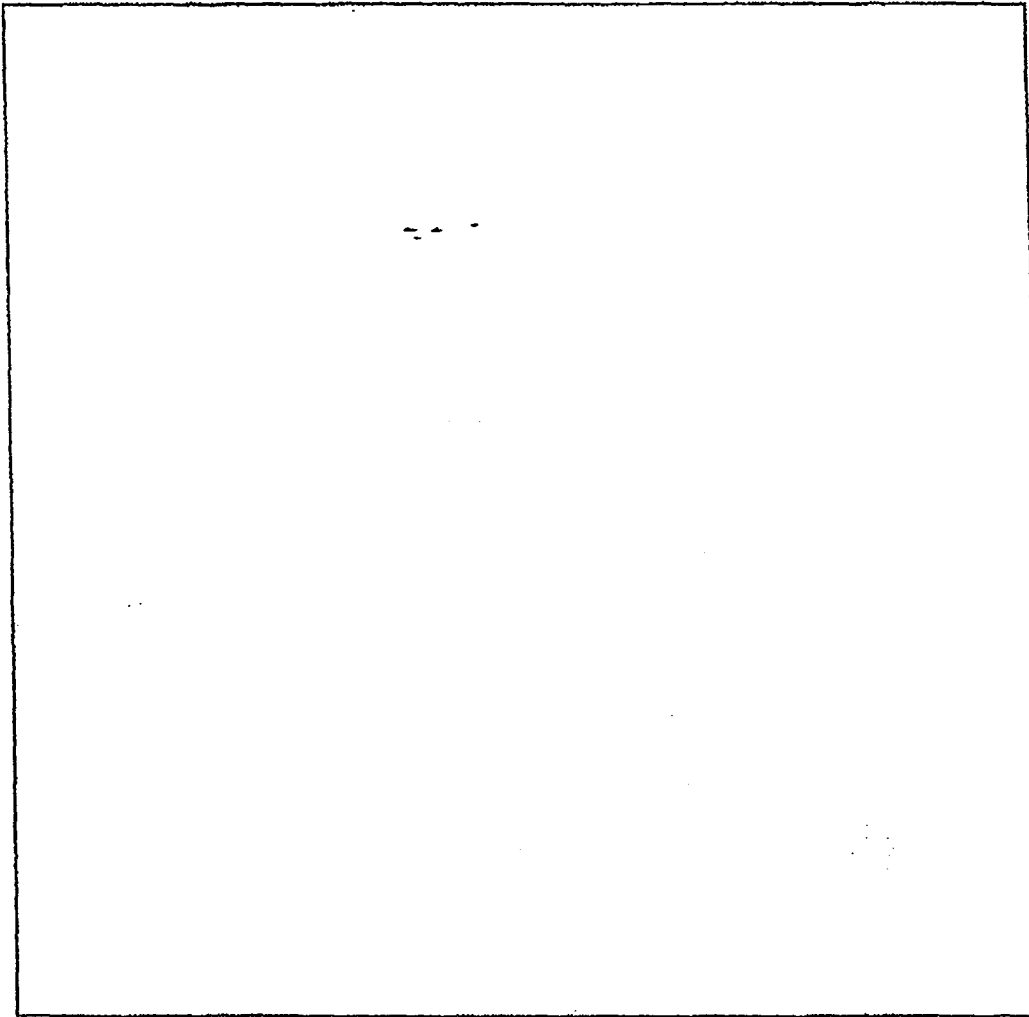
.....

- (ii) State the possible genotype of moth K, L and M. [2]

.....

.....

- (c) Use a genetic diagram to illustrate a possible cross between two groups of moths that will result in a phenotypic ratio of 1:1 in the offsprings. [3]



[Total: 8 marks]







(b) Explain, using a named example, how mutations may lead to genetic diseases.

[4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

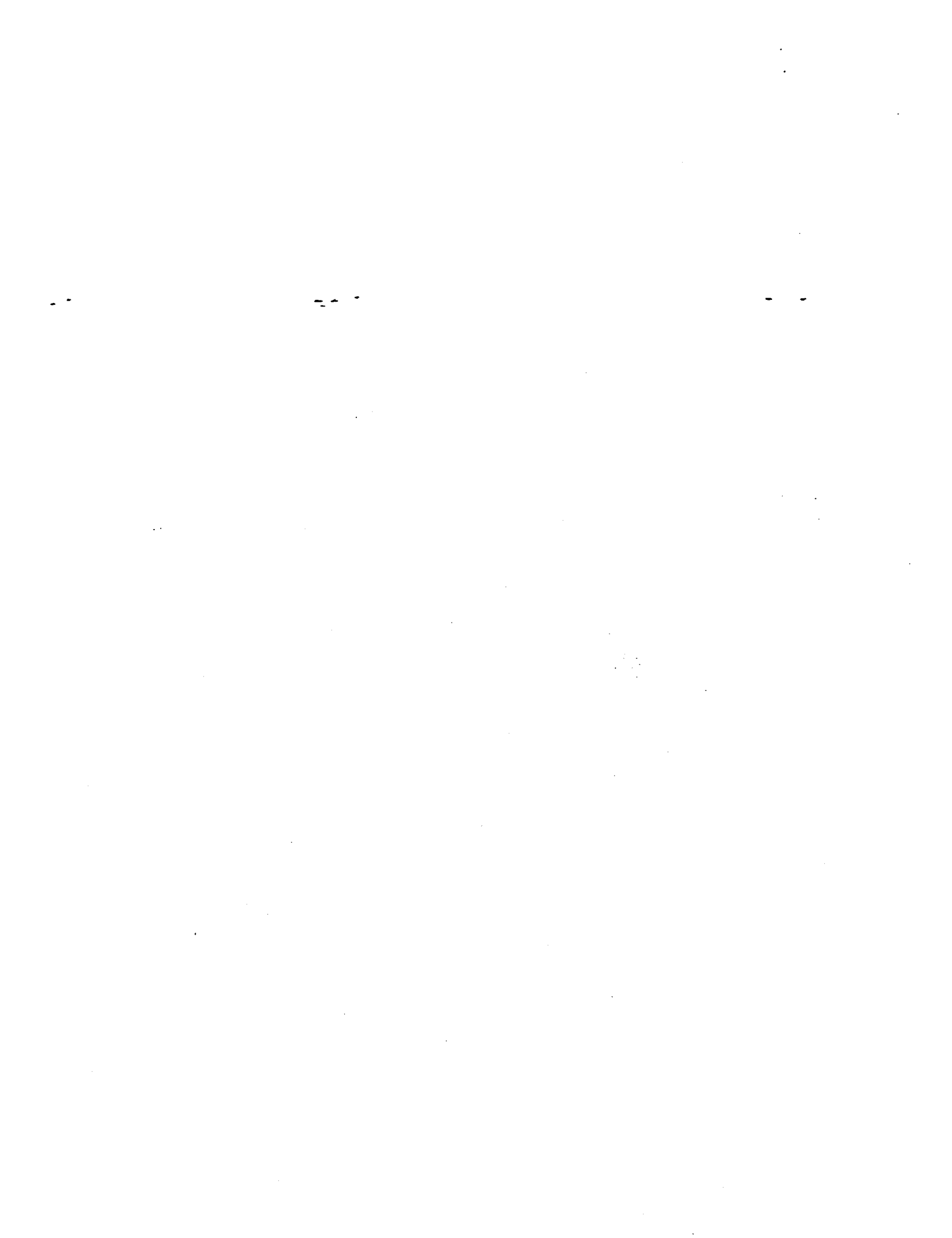
.....

.....

.....

[Total: 10 marks]

\*\*\*\*\*END OF PAPER\*\*\*\*\*



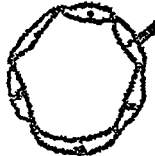
TEMASEK SECONDARY SCHOOL  
Preliminary Examinations 2014  
Secondary 4 Express Biology

Paper 1 Answers

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

## Paper 2 Section A (50 marks)

Qn		Marks
1(a)	At low temperature, the enzymes are less active due to lower level of kinetic energy so the rate of breaking down hydrogen peroxide is low due to decreased rate of effective collisions between enzymes and substrates	1 1 [2m]
(b)	The active sites of enzymes in carrot cells are not complementary to the shape of the binding site on hydrogen peroxide / substrate molecule to form the ES complex, so hydrogen peroxide cannot be broken down into oxygen	1 1 [2m]
(c)	Cut the potato strips into smaller pieces. This will increase the surface area to volume ratio for enzymes to break down the hydrogen peroxide.	1 1 [2m]
2(a)	As surrounding freshwater / dilute salt solution has a higher water potential than the cell cytoplasm, water will pass through the partially permeable cell membrane into the cell by osmosis	1 1 1 [3m]
(b)(i)	As water potential of surrounding salt solution decreases, time taken for pulsation increases. OR Time taken for pulsation increases as salt concentration increases	1m
(ii)	Rate of osmosis / water entering cell decreases as the water potential gradient between the cell and the surrounding salt solution decreases; it takes longer for the two vacuoles to fill up sufficiently with water before the excess water is expelled; therefore time taken for pulsation increases.	1 1 1 [3m]
(c)	Higher water potential of the freshwater can result in too much water entering the cell; Pressure exerted against cell wall membrane can result in lysing and death of the cell.	1 1 [2m]
3(a)	Arteries are dividing into many smaller arterioles; Blood flow slows down as blood enters the numerous smaller arterioles, pressure is greatly reduced / with a larger total cross-sectional area, pressure is greatly reduced	1 1 [2m]

3(b)		1m
(c)	<p>Prevention of backflow by semi-lunar valves in the veins;          Contraction and relaxation of skeletal muscles help push blood along the vein;          Relaxing heart muscles cause pressure in heart to become lower than in veins, allowing blood to flow into atria          (any 2)</p>	1 each  [2m]
(d)(i)	Presence of stretchable elastic tissue in walls of artery	1m
(ii)	<p>Walls of artery can stretch and recoil;          Helps to push blood along to maintain continuous blood flow          / help to withstand high pressure of blood in the arteries</p>	1 1 [2m]
4(a)	<p>Churning action of stomach mixes food particles with gastric juice;          breaks down food into smaller pieces to increase surface area of food for faster enzyme action ;          protease (pepsin) starts digestion of proteins to polypeptides;          rennin coagulates soluble milk protein into insoluble casein for further digestion by pepsin          / gastric juice contains hydrochloric acid which activates enzymes/provides suitable medium for action of enzymes</p>	1 1 1 1 [4m]
(b)	After surgery, food passes from the stomach pouch directly into the jejunum, bypassing the rest of the stomach and the duodenum	1m
(c)	<p>Only a small stomach pouch is created, resulting in less food ingested, and the person is likely to feel full quickly;          Less digestion taking place, as most of stomach is removed, and food does not pass into duodenum;          Resulting in less absorption of digested food / body uses up food reserves (glycogen and fats), hence loss in weight</p>	1 1 1 [3m]
(d)	<p>Can result in malnutrition as less protein/fats/carbohydrate/nutrients is digested and absorbed;          / Surgical complications can set in</p>	1m

5(a)	Anther of all flowers on plant A will mature first, releasing pollen grains, before stigma of all flowers on plant B can mature; Pollen grains of flowers on one plant can only be accepted by mature stigmas of flowers on another plant	1  1  [2m]									
(b)	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th data-bbox="217 422 442 457"></th> <th data-bbox="442 422 762 457">Given plant species</th> <th data-bbox="762 422 1091 457">Human</th> </tr> </thead> <tbody> <tr> <td data-bbox="217 457 442 665">Structure(s) through which male gamete moves to reach female gamete.</td> <td data-bbox="442 457 762 665">           Stigma → style            ↓            ovary            ↓            ovule         </td> <td data-bbox="762 457 1091 665">           Vagina → Uterus            ↓            oviduct         </td> </tr> <tr> <td data-bbox="217 665 442 903">Adaptation for movement of male gamete.</td> <td data-bbox="442 665 762 903">Pollen tube transports male nuclei down the style, enzyme action allows growth of pollen tube to reach ovule</td> <td data-bbox="762 665 1091 903">Sperm has numerous mitochondria to provide energy for moving the flagellum so that sperm can move towards ovum</td> </tr> </tbody> </table>		Given plant species	Human	Structure(s) through which male gamete moves to reach female gamete.	Stigma → style ↓ ovary ↓ ovule	Vagina → Uterus ↓ oviduct	Adaptation for movement of male gamete.	Pollen tube transports male nuclei down the style, enzyme action allows growth of pollen tube to reach ovule	Sperm has numerous mitochondria to provide energy for moving the flagellum so that sperm can move towards ovum	1 for each box          [4m]
	Given plant species	Human									
Structure(s) through which male gamete moves to reach female gamete.	Stigma → style ↓ ovary ↓ ovule	Vagina → Uterus ↓ oviduct									
Adaptation for movement of male gamete.	Pollen tube transports male nuclei down the style, enzyme action allows growth of pollen tube to reach ovule	Sperm has numerous mitochondria to provide energy for moving the flagellum so that sperm can move towards ovum									
(c)	Discontinuous variation	1m									
(d)	Mutation took place, resulting in very short petals	1m									
6(a)(i)	Transcription	1m									
(ii)	When double helix separates, one of the DNA strand act as a template for making mRNA; A will pair with U on RNA, G will pair with C, T with A (message on DNA strand is copied onto the mRNA)	1  1  [2m]									
(b)	TCG TGG GGT GGT GGT AGG TCG	1m									
(c)	CTT	1m									

7(a)(i)	Beaks differ in thickness / sharpness / width / length / curvature (any 2)	1 each [2m]
(ii)	Type of food available / type of diet	1m
(b)(i)	Deforestation, resulting in destruction of their roosting places/availability of food; / environmental pollution eg of air (burning of garbage generated by humans), water (major oil spill), thus affecting their survival / introduction of other animals by humans, eg. wasps, which results in competition for food source (caterpillars) with finches, upset the equilibrium of the ecosystem (any one)	1m
(ii)	Decreases the biodiversity of finches / extinction of some varieties	1m

SECTION B (30 MARKS)		
8(a)(i)	All points correct; Smooth curve;	1 1 [2m]
	<p>total volume of water lost / cm<sup>3</sup></p> <p>0800 1200 1800</p> <p>(a)(i) Branch C</p> <p>Branch B</p> <p>(b) Branch A</p>	
(ii)	Humidity of surrounding air / Wind speed / Light intensity / Availability of soil water / Temperature of surroundings (any 2)	2m
(iii)	The volume of water lost from branch B is greater than C up to about 1100h; after which much less water (less than 50%) was lost from branch B compared to C; air trapped in the transparent bag warms up quickly; heat speeds up the rate of evaporation of water from the leaf in branch B; hence more water lost from branch B; As humidity increases in the bag, rate of transpiration decreases as less water vapour can diffuse out of the leaves into the humid surroundings; hence less water lost.	1 1 1 1 [4m]



(b)	Lower than B, higher than C up to 1000h , then level off	1m
(c)	Water and dissolved mineral salts is absorbed from the soil (not manufactured by plant) ; and carried up to the leaves via xylem tissue; Metabolites/substances made by plant transported via phloem tissue; it is only water that evaporates during transpiration ; poisonous substances remain in cells.	1 1 1 [3m]
9(a)	Short reproductive cycle, able to reproduce faster; / Female moth able to lay many eggs at one time, able to produce a larger sample size of offsprings; / distinct phenotypes, able to easily differentiate between the different phenotypes (any 1)	1m
(b)(i)	Striped moth; In the cross between K and M, all offsprings displayed striped body. This suggests that the parents are pure bred and the offsprings are all heterozygous and display only the dominant phenotype  / In the cross between L and L, the offsprings displayed striped to full bodied phenotype in the ratio of 3:1. This indicates that the parents are heterozygous and that striped phenotype is dominant as both homozygous recessive and heterozygous individuals can express the trait.	$\frac{1}{2}$ $\frac{1}{2}$ 1 [2m]
(ii)	Both K and M: FF or ff L: Ff (any 1 mistake, minus 1 mark)	[2m]
9(c)	<p>Parent L x M/K</p> <p>Parental genotype Ff ff</p> <p>Gametes F f f f</p> <p>F1 genotype Ff Ff ff ff</p> <p>F1 phenotype Striped Striped Full Full</p> <p>F1 phenotypic ratio 1 Striped : 1 Full</p>	<p>3m</p> <p>Correct parental genotype : 1m</p> <p>Headings: 1m</p> <p>Correct diagram and ratio : 1m</p> <p>Any 1 mistake: minus <math>\frac{1}{2}</math> m</p>

10 Either		
(a)	<p>In plants: Oxygen from atmosphere diffuses through the stomata into the intercellular spaces among spongy mesophyll cells in the leaf; Oxygen then dissolves in the moisture on the walls of the cells and diffuses into the cells; It diffuses from cell to cell to reach those tissues which are not directly connected to the air.</p> <p>In humans: Oxygen is breathed in through the nose, travels via respiratory passage (trachea, bronchus) into the lungs; Oxygen dissolves in the moisture lining the alveolar wall before diffusing into the blood in blood capillaries; gas then combines with haemoglobin in red blood cells to form oxyhaemoglobin, which is carried by blood to oxygen-poor tissues in other parts of the body, where oxygen is liberated and then diffuses through the walls of blood capillaries into the cells.</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>[8m]</p>
(b)	<p>Both the flattened expanded surface of leaves and the thousands of alveoli in the lungs of mammals provide a large surface area for increased diffusion of gases; Thin lamina of leaf and one cell thick alveolar wall of mammal allows gases to diffuse through easily.</p>	<p>1</p> <p>1</p> <p>[2m]</p>
10 OR		
(a)	<p>With the introduction of the new variety, Advantages</p> <ul style="list-style-type: none"> <li>• farmers are able to obtain higher yield since the it has been genetically modified with a gene to boost photosynthesis / rate of photosynthesis is increased</li> <li>• Soya beans will be unaffected by herbicides used to kill the weeds, hence they can continue to grow well;</li> <li>• In addition, soya beans will be able to thrive better in the field since there will be lesser competition for nutrients and water as weeds can be removed easily with herbicides.</li> </ul>	<p>1</p> <p>1</p> <p>1</p>

	<p>Disadvantages</p> <ul style="list-style-type: none"> <li>• With the introduction of gene that can resist herbicides, weeds that cross-breed with soya bean plants may inherit the gene and develop immunity to herbicides as well.</li> <li>• Formation of <u>superweeds</u>, weeds that are not easily removed in future by the same herbicide. This will create even greater competition for nutrients and space for growth with the soya bean crops.</li> <li>• Population of insects that feeds on weeds and help in pollination will be reduced since there will be drastic drop in weed population in the field / useful insects will be killed, links in food web are broken which will upset the ecological balance</li> </ul>	<p>1 1 1 [6m]</p>
(b)	<p>Sickle cell anaemia.</p> <ul style="list-style-type: none"> <li>• Mutation results in change in structure of gene controlling haemoglobin production</li> <li>• Mutated gene produces haemoglobin S, which causes red blood cells to become sickle-shaped</li> <li>• The shape interferes with the oxygen-carrying property of red blood cells and condition can be fatal</li> </ul> <p>OR</p> <p>Down's syndrome</p> <ul style="list-style-type: none"> <li>• Nondisjunction during ovum formation results in one ovum having an extra chromosome in the 21<sup>st</sup> pair</li> <li>• Fertilization between a normal sperm and a mutated ovum results in the zygote having one extra chromosome in the 21<sup>st</sup> pair;</li> <li>• Affected child has characteristic facial features and exhibits mental and physical difficulties</li> </ul> <p>OR</p> <p>Albinism</p> <ul style="list-style-type: none"> <li>• Mutation in the gene controlling production of pigment (melanin)</li> <li>• Results in absence of pigment in the skin, hair and eyes of animals</li> <li>• Individual has reddish white skin, white hair, iris appears red, very sensitive to light</li> </ul>	<p>1 1 1 1 [4m]</p>

