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O Level Centre Number/ Index Number	Class	Name
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新加坡海星中学

MARIS STELLA HIGH SCHOOL  
PRELIMINARY EXAMINATION TWO  
SECONDARY FOUR

**BIOLOGY**

5158/01

Paper 1

*Additional Materials:*  
OTAS

29 August 2017  
1 hours 45 minutes

**INSTRUCTIONS TO CANDIDATES**

Write in soft pencil.

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

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 answer in **soft pencil** on the separate Answer Sheet.

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

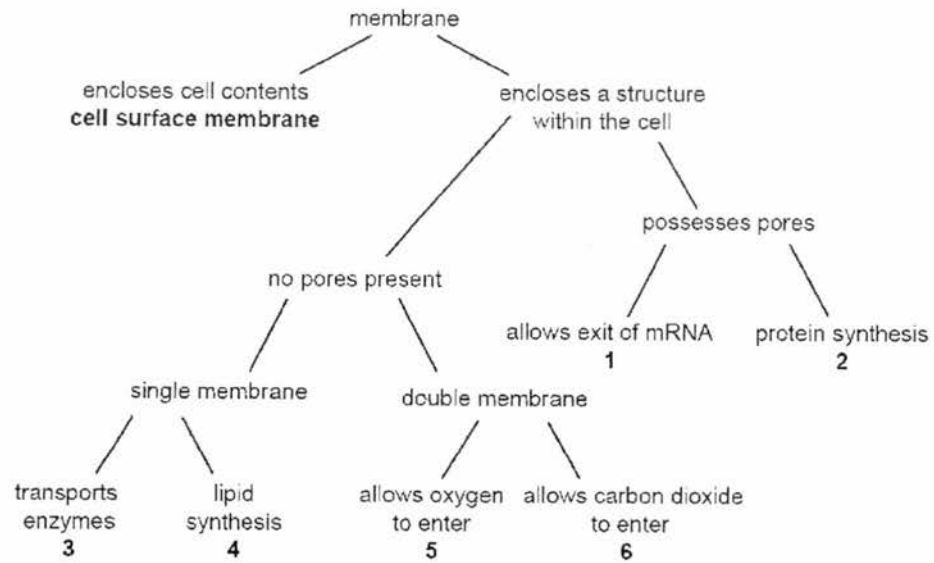
Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this question paper.

The number of marks is given in brackets [ ] at the end of each question or part question. The total number of marks for this paper is 40.

At the end of the examination, hand in the following separately:

- (1) Optical Test Answer Sheet (OTAS)
- (2) Question Paper

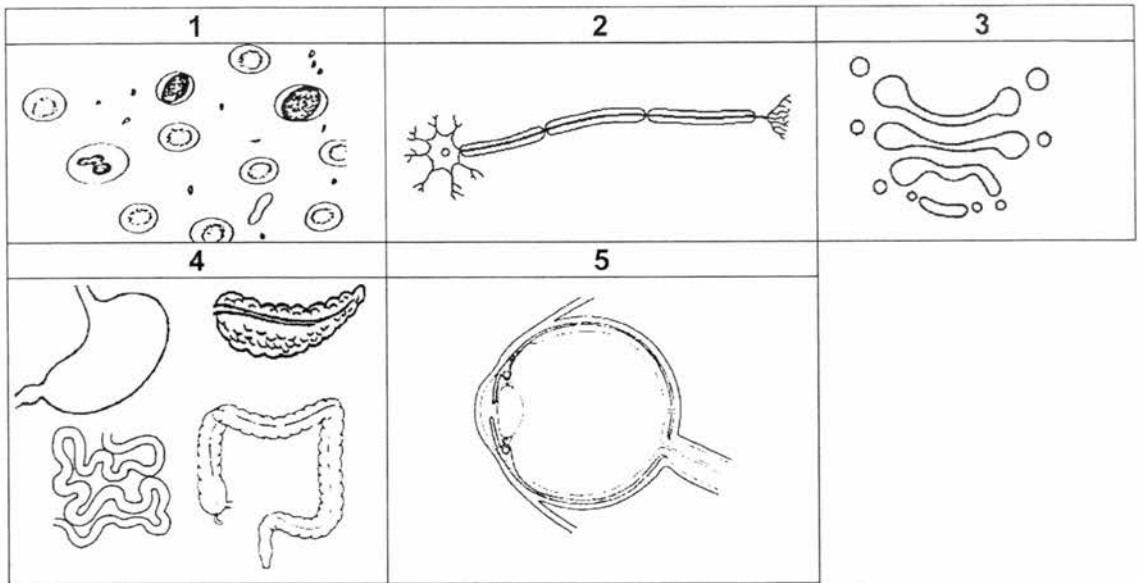
- 1 Membranes within and at the surface of cells have different roles.



Which of the outcomes shown below correctly identifies the organelles that possess the membrane and function concerned?

	1	2	3	4	5	6
<b>A</b>	chloroplast	vesicle	smooth ER	rough ER	nucleolus	mitochondrion
<b>B</b>	nucleolus	rough ER	vesicle	smooth ER	nucleus	mitochondrion
<b>C</b>	nucleus	rough ER	vesicle	smooth ER	mitochondrion	chloroplast
<b>D</b>	nucleus	smooth ER	mitochondrion	rough ER	vesicle	chloroplast

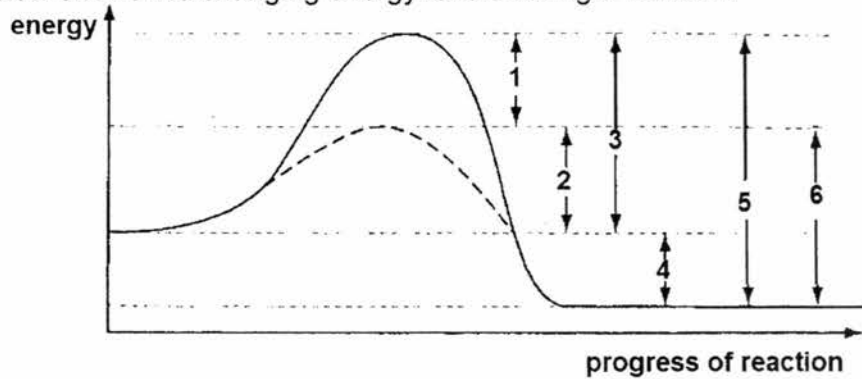
2 The following diagrams show some body components in the body. (The diagrams are not drawn to scale.)



Which of the following correctly identifies these body components?

	organelle	cell	tissue	organ	organ system
A	3	2	1	5	4
B	2	1	3	5	4
C	2	3	1	4	5
D	3	1	4	2	5

3 The graph below shows the changing energy levels during a reaction.

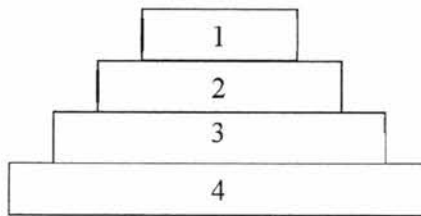


What is the activation energy of the reaction with and without the enzyme?

	activation energy of the reaction	
	with enzyme	without enzyme
A	3	2
B	2	3
C	6	5
D	1	4

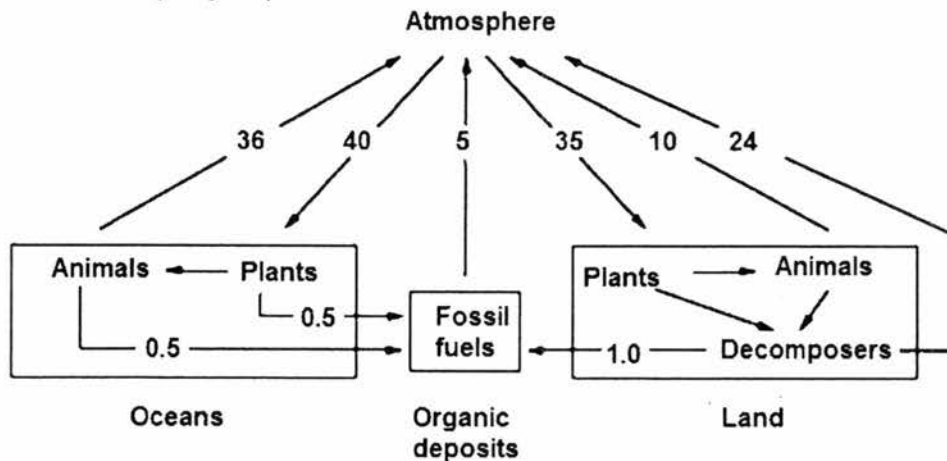
- 4 A substance T found in bananas causes them to turn brown when exposed to air. How would you determine that substance T is an enzyme?
- A Deprive the banana of oxygen and see if it turns brown.  
 B Test whether unpeeled bananas turn brown.  
 C Boil the banana and see if it turns brown when exposed to air.  
 D Test whether the banana turns brown in an atmosphere of pure carbon dioxide.

- 5 The following diagram shows an ecological pyramid.



Which of the following statement is always true?

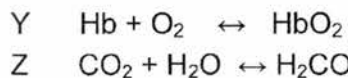
- A Level 1 is occupied by photosynthesising organism.  
 B Energy flow is upwards from level 4 to 1.  
 C Numbers in level 4 exceed those in level 3.  
 D Cumulative toxins become more concentrated from level 1 down to level 4.
- 6 The diagram below shows the relative movement of carbon within the carbon cycle. (Units are  $\text{kg} \times 10^{12}$  carbon per year)



Which component of the carbon cycle is likely to be a carbon sink?

- A atmosphere  
 B land  
 C oceans  
 D organic deposits

- 7 Which of the following best describes the function of the hepatic portal vein?
- A** Transports by-products of respiration from the body to the kidney.  
**B** Transports by-products of respiration from the body to the liver.  
**C** Transports soluble end products of digestion from the ileum to the kidney.  
**D** Transports soluble end products of digestion from the ileum to the liver.
- 8 Due to a viral infection, a person had part of his liver surgically removed. Which of the following is / are the expected consequence(s) of the removal of part of the liver?
- 1: lighter-coloured faeces  
 2: reduced absorption of amino acids  
 3: reduced production of bile  
 4: slower fat digestion
- A** 1 and 4 only  
**B** 3 and 4 only  
**C** 1, 2 and 3 only  
**D** 1, 3 and 4 only
- 9 Both equations, Y and Z, are of reactions that take place within the red blood cells.



Key: Hb = Haemoglobin

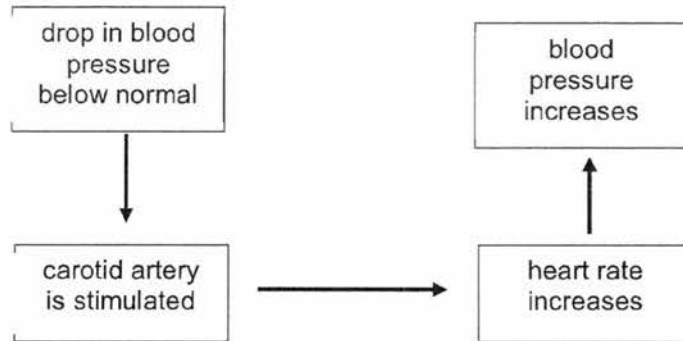
Which of the following gives its location in the body and the factors that determine the speed and direction of the reactions?

	reaction Y			reaction Z		
	concentration of reactants	correct enzyme present	location	concentration of reactants	correct enzyme present	location
<b>A</b>	✓	✓	alveolar cells	✓	×	red blood cells
<b>B</b>	✓	×	plasma	✓	×	alveolar cells
<b>C</b>	✓	×	red blood cells	✓	✓	red blood cells
<b>D</b>	×	✓	red blood cells	×	✓	plasma

key : ✓ = factor involved

× = factor not involved

10 The diagram below shows the regulation of blood pressure in the human body.



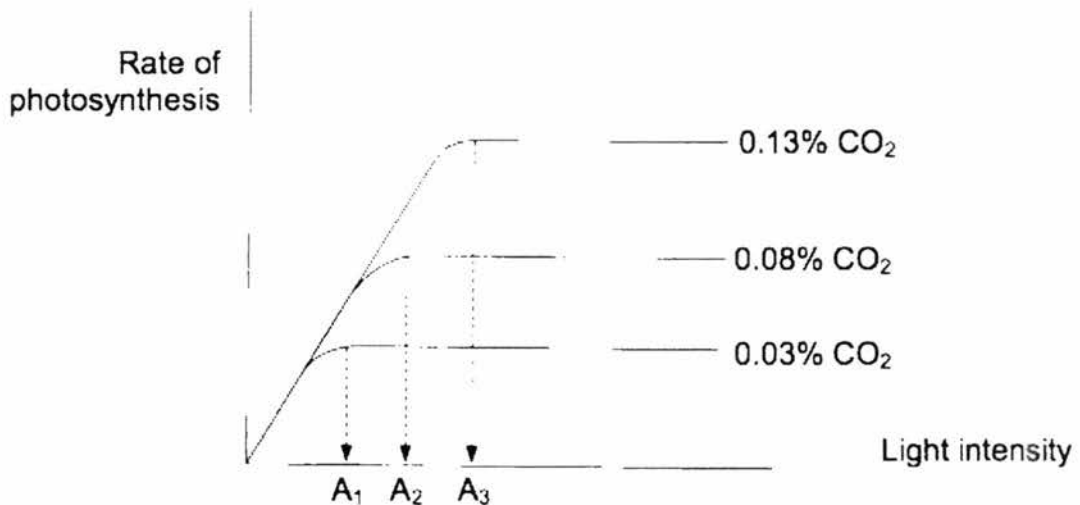
From the diagram, which of the following are the receptor and effector in the regulation of blood pressure?

	receptor	effector
<b>A</b>	carotid artery	carotid artery
<b>B</b>	carotid artery	heart
<b>C</b>	heart	carotid artery
<b>D</b>	heart	heart

11 At which stage of the blood clotting process is calcium needed?

- A** During the production of thrombokinase.
- B** When fibrinogen is converted to fibrin.
- C** When prothrombin is converted to thrombin.
- D** When the platelets are exposed to an open wound.

For questions 12 and 13, refer to the graph below that shows the effect of varying light intensity on the rate of photosynthesis.



12 Complete the sentence below.

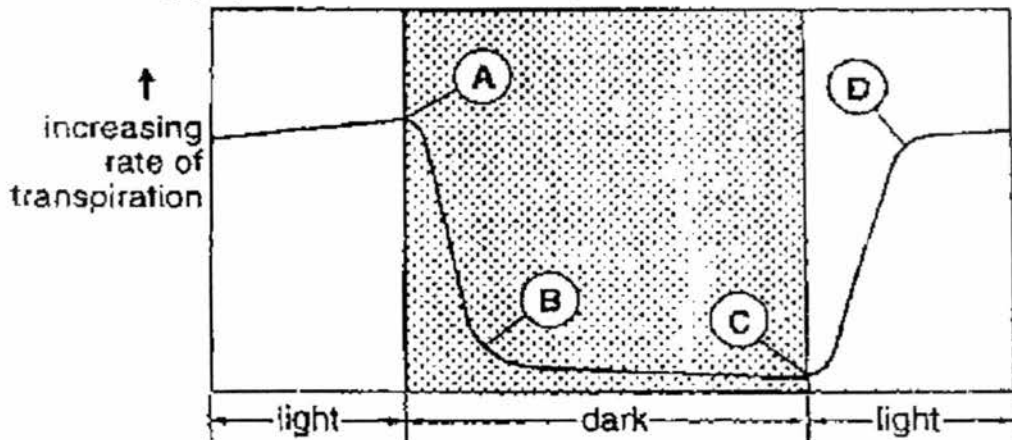
At \_\_\_\_\_ CO<sub>2</sub>, light intensity ceases to be a limiting factor of photosynthesis once it reaches \_\_\_\_\_.

- A 0.03%; A<sub>1</sub>
- B 0.08%; A<sub>1</sub>
- C 0.13%; A<sub>1</sub>
- D 0.13%; A<sub>2</sub>

13 What can be concluded from the three graphs?

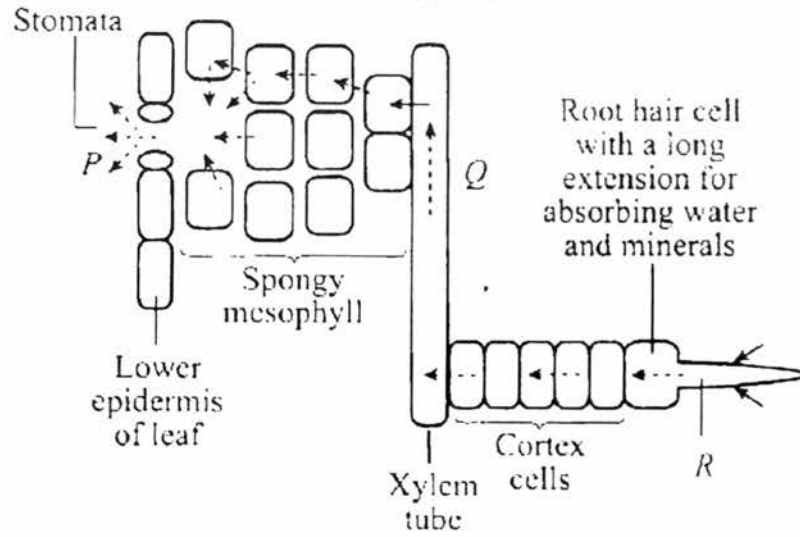
- A The rate of photosynthesis reaches a maximum beyond a certain level of light intensity.
- B The rate of photosynthesis reaches a maximum beyond a certain level of carbon dioxide concentration.
- C Light intensity has no apparent effect on the rate of photosynthesis.
- D The rate of photosynthesis always increases with light intensity.

14 The following graph shows the rate of transpiration from the leaves of a plant.



At which point (A, B, C, or D) do the stomata begin to open?

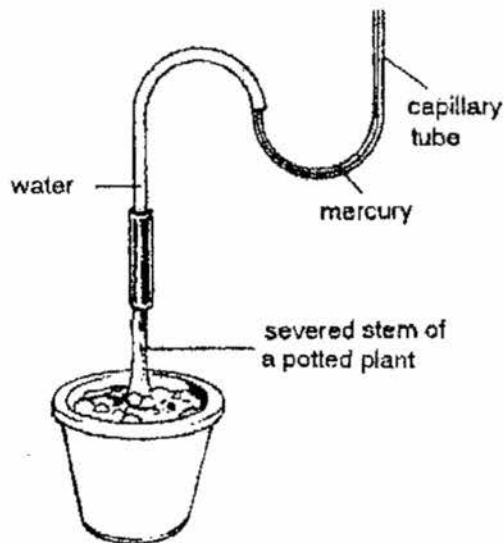
15 The diagram shows the transport of water through a plant.



What causes the movement of water at P, Q and R?

	P	Q	R
<b>A</b>	diffusion	transpiration pull	osmosis
<b>B</b>	transpiration pull	capillary action	osmosis
<b>C</b>	osmosis	capillary action	active transport
<b>D</b>	diffusion	transpiration pull	root pressure

Questions 16 and 17 refer to the following experiment in which a potted plant was cut off just above the soil level and was attached to a capillary tube as shown below.



16 After a while, the mercury level began to rise up in the vertical arm of the capillary tube. What is the best explanation for this?

- A The mercury was being drawn up the tube.
- B The mercury was being pushed down the tube.
- C The roots were taking up water from the soil and were exerting a transpiration pull.
- D The roots were taking up water from the soil and were forcing it upwards.

17 The magnitude of the root pressure is determined by the following factors except the

- A rate of transpiration available.
- B amount of soil water.
- C size of the root system.
- D health of the root system.

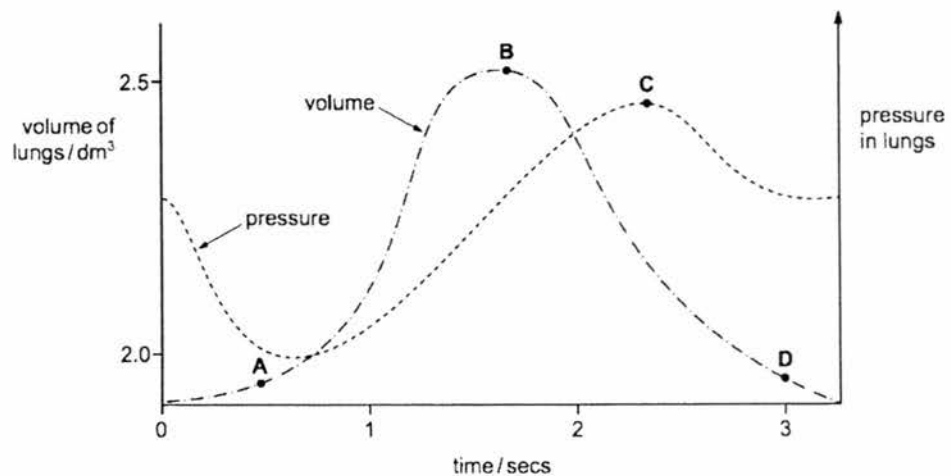
18 The following are some of the processes involved in breathing in a mammal.

- 1: air is forced into lungs
- 2: volume of thorax decreases
- 3: external intercostal muscles contract
- 4: diaphragm flattens
- 5: air pressure of thorax decreases

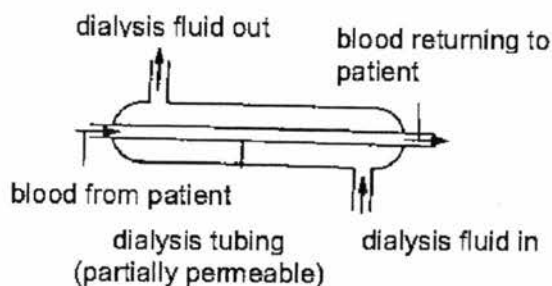
What is the correct order of the processes involved in the mechanism of breathing in?

- A 3, 4, 5, 1
- B 3, 1, 2, 4
- C 4, 3, 2, 5
- D 5, 1, 3, 4

19 The graph below shows how the pressure and volume inside the lungs change during one complete breath. At which point are the muscles of the diaphragm starting to contract?



- 20 What is the main limiting factor on the amount of work that muscles can perform during aerobic exercise?
- The volume of blood flowing through the lungs.
  - The volume of blood flowing through the muscles.
  - The percentage saturation of haemoglobin with oxygen in the lungs.
  - The speed at which oxygen leaves the haemoglobin in the muscles.
- 21 An engineer has been tasked to improve the efficiency of the dialysis machine shown in the diagram below.



Which of the following recommendations will improve the process of dialysis?

- increasing the length of the dialysis tubing
  - increasing the rate at which dialysis fluid is replaced
  - reducing the diameter of the dialysis tubing
- I only
  - II and III only
  - I and II only
  - I, II and III only
- 22 A person enters an air-conditioned room from a warm surrounding. The following are changes that will occur within the body inside the air-conditioned room.
- the temperature of the blood increases
  - shivering
  - brain detects the change in blood temperature
  - the temperature of the blood decreases
- Which of the following shows the order in which these changes occur?
- IV→III→II→I
  - I→III→II→IV
  - IV→II→III→I
  - I→II→III→IV

23 The following shows some of the information on adrenaline, insulin and glucagon in the body.

- I adrenaline is broken down in the liver.
- II glucagon decreases the blood glucose level.
- III insulin is transported by red blood cells.
- IV insulin and glucagon are produced by pancreas.

Which of the above statements is/are correct?

- |          |               |          |                    |
|----------|---------------|----------|--------------------|
| <b>A</b> | I only        | <b>B</b> | II and III only    |
| <b>C</b> | I and IV only | <b>D</b> | I, III and IV only |

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

- I absorption of glucose through the cell surface membrane
- II production of lactic acid in skeletal muscles
- III maintenance of body temperature
- IV regulation of secretion of anti-diuretic hormone

Which two processes are directly controlled by negative feedback?

- |          |           |          |            |
|----------|-----------|----------|------------|
| <b>A</b> | I and II  | <b>B</b> | I and III  |
| <b>C</b> | II and IV | <b>D</b> | III and IV |

25 Two organs secrete substances that affect the body.

Organ 1 → Product 1

Organ 2 → Product 2

Negative feedback control of product 2 would be achieved if \_\_\_\_\_.

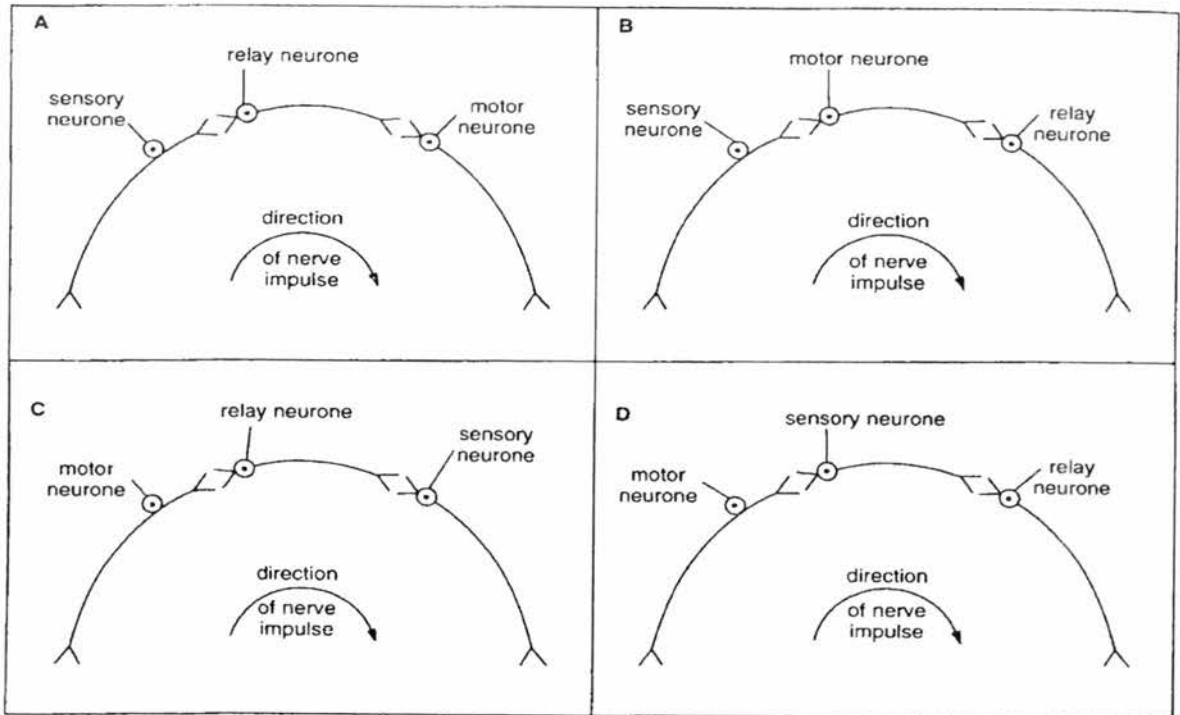
- A** Product 1 counteracts product 2
- B** Product 1 reinforces the effect of product 2
- C** Product 2 inhibits organ 1 and product 1 stimulates organ 2
- D** Product 2 stimulates organ 1 and product 1 stimulates organ 2

26 Mark was on the street in the middle of the night when a robber came up to him and demanded him for money at knifepoint. Which of the following are likely to take place in Mark's body immediately following that moment?

- 1 relaxation of the radial muscle of the iris.
- 2 dilation of arterioles supplying the gastro-intestinal tract.
- 3 dilation of arterioles supplying skeletal muscle.

- |          |         |          |         |
|----------|---------|----------|---------|
| <b>A</b> | 1 and 3 | <b>B</b> | 2 and 3 |
| <b>C</b> | 1       | <b>D</b> | 3       |

27 Which of the following diagrams, **A**, **B**, **C** or **D**, shows the correct sequence of neurones in a reflex arc?



28 When the eye is focused on far objects, which of the following sequences gives the correct state of the lens, the ciliary muscles and the suspensory ligaments?

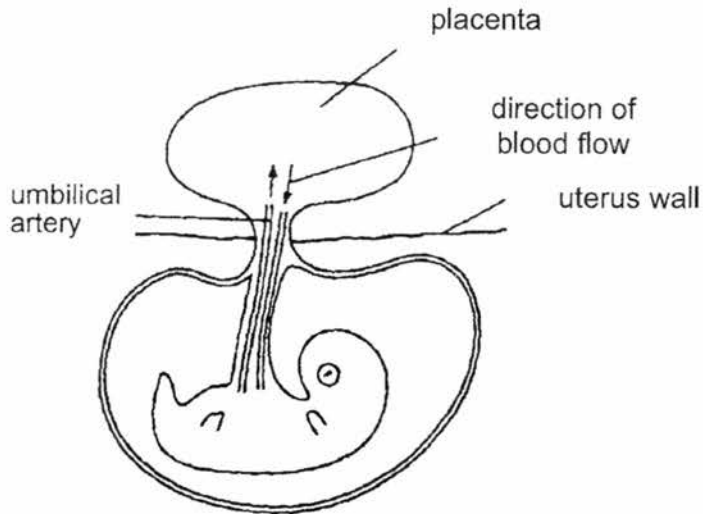
	lens	muscle	ligament
<b>A</b>	most convex	relaxed	relaxed
<b>B</b>	least convex	contracted	relaxed
<b>C</b>	least convex	relaxed	taut
<b>D</b>	most convex	contracted	taut

29 An elderly man found he could no longer see to read clearly. His optician prescribed spectacles with converging lenses. This was because his

- A** corneas were losing their transparency.
- B** eyeballs had become longer from back to front.
- C** ciliary muscles were weakened.
- D** lenses were losing their elasticity.



- 33 The following diagram shows a developing foetus in the uterus.



Which of the following shows the composition of blood in the umbilical artery?

	glucose concentration	oxygen concentration	carbon dioxide concentration
<b>A</b>	high	high	high
<b>B</b>	high	low	low
<b>C</b>	low	low	low
<b>D</b>	low	low	high

- 34 The figure shows the chromosomes of one cell during meiosis.



Which phase of meiosis is shown and what is the number of chromosomes in the gamete of this species?

	phase of meiosis	number of chromosomes
<b>A</b>	I	5
<b>B</b>	I	10
<b>C</b>	II	5
<b>D</b>	II	10

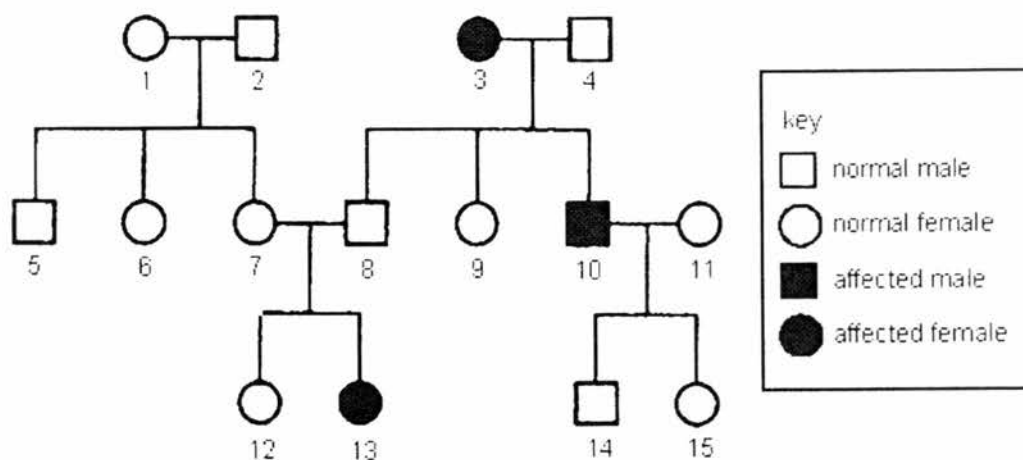
35 Homologous chromosomes contain the same \_\_\_\_\_.

- A DNA sequences
- B number of guanine and adenine
- C alleles
- D genes

36 Which of the following is true of a mutation that produces an allele that is dominant?

- A It would be expected to cause death.
- B It would be expected to spread more quickly through a population than a recessive mutation.
- C It could give an observable phenotype in a heterozygous genotype.
- D It could give an observable phenotype only in a homozygous genotype.

37 The chart shows the inheritance of a genetic disease, caused by a recessive allele, Q.



Which females are certain to have the genotype Qq?

- A 1, 6, and 7 only
- B 1, 7, and 12 only
- C 7, 9, and 15 only
- D 9, 12, and 15 only

38 A DNA molecule contains 20% of thymine. What is the percentage of guanine and phosphate in the DNA molecule?

	percentage of	
	guanine	phosphate
A	30	100
B	20	30
C	60	100
D	30	50

39 In a DNA molecule, the base sequence AGT codes for the amino acid serine. What is the

base sequence of the anti-codon on the tRNA to which serine becomes attached?

- A UGU                      B GAU                      C AGU                      D UCA

- 40 Sickle cell anemia is caused by the mutation of one base pair in the gene controlling the formation of haemoglobin.

If the original code 'GAA' mutated to 'GUA', deduce the resultant substitution of amino acids by referring to the chart below.

		Second letter				
		U	C	A	G	
First letter	U	UUU } Phe UUC } UUA } Leu UUG }	UCU } UCC } Ser UCA } UCG }	UAU } Tyr UAC } UAA Stop UAG Stop	UGU } Cys UGC } UGA Stop UGG Trp	U C A G
	C	CUU } CUC } Leu CUA } CUG }	CCU } CCC } Pro CCA } CCG }	CAU } His CAC } CAA } Gln CAG }	CGU } CGC } Arg CGA } CGG }	U C A G
	A	AUU } AUC } Ile AUA } AUG Met	ACU } ACC } Thr ACA } ACG }	AAU } Asn AAC } AAA } Lys AAG }	AGU } Ser AGC } AGA } Arg AGG }	U C A G
	G	GUU } GUC } Val GUA } GUG }	GCU } GCC } Ala GCA } GCG }	GAU } Asp GAC } GAA } Glu GAG }	GGU } GGC } Gly GGA } GGG }	U C A G

	original amino acid	substituted amino acid (after mutation)
A	Asp	Gly
B	Glu	Val
C	Val	Asp
D	Ala	Glu

----- End of Paper -----

O Level Centre Number/ Index Number	Class	Name
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**新加坡海星中学**  
**MARIS STELLA HIGH SCHOOL**  
**PRELIMINARY EXAMINATION TWO**  
**SECONDARY FOUR**

<b>BIOLOGY</b>	<b>5158/02</b>
Paper 2	
<i>Additional Materials:</i>	<b>21 August 2017</b>
Nil	<b>1 hours 45 minutes</b>

**INSTRUCTIONS TO CANDIDATES**

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

**BOOKLET ONE – SECTION A**

**Section A: Structured Questions**  
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. The total number of marks for this paper (sections A and B) is 80.

At the end of the examination, hand in the following separately:  
(1) Section A  
(2) Section B

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

## Section A

## Structured Questions [50 marks]

Answer all questions. Write your answer in the spaces provided.

- 1 A student was asked to make a model of a plant cell. She took a length of tubing made from a substance that allows only water molecules to pass through and enclosed it in a flexible permeable membrane as shown in Fig. 1.

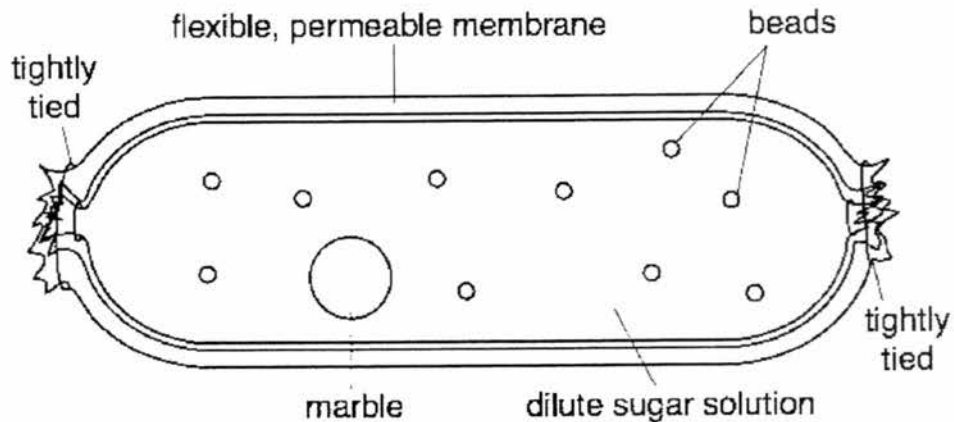


Fig. 1

- (a) Name the structures found in a plant mesophyll cell that are best represented by the following items used in her model:

The marble: \_\_\_\_\_

The beads: \_\_\_\_\_

The tubing: \_\_\_\_\_ [3]

- (b) State a structure found in a plant cell that is **not** represented in the student's model.

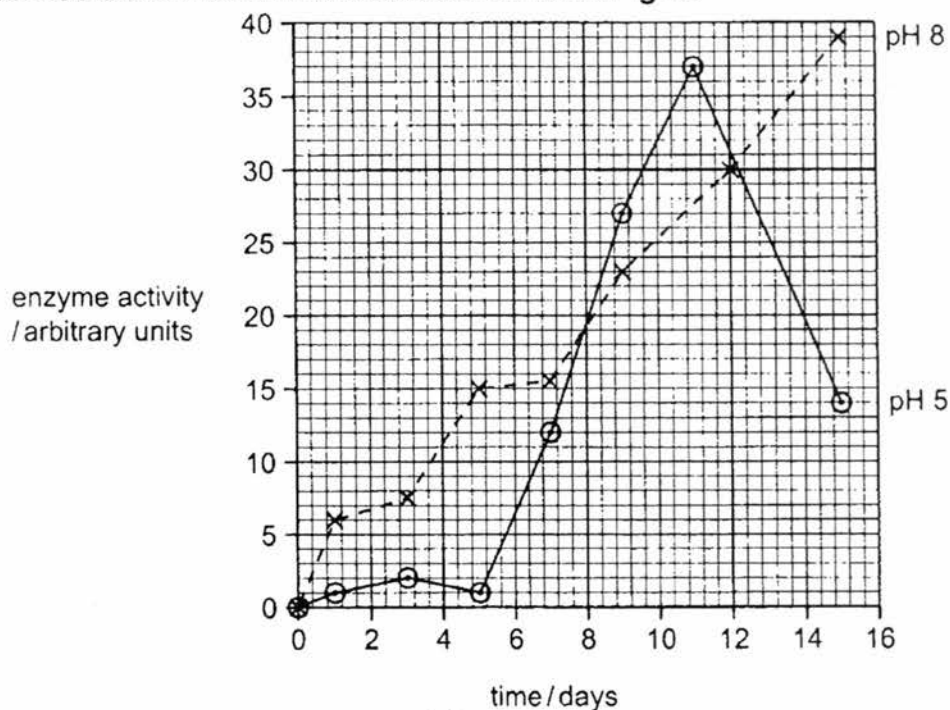
\_\_\_\_\_ [1]



- 2 Enzymes in bean seeds are activated during germination. Some of these enzymes break down proteins stored in the seeds.

A large number of bean seeds were soaked and germinated. Researchers took samples of the germinating seeds over a period of 15 days. The seeds were chopped into small pieces and crushed with water to make an extract. Equal quantities of the extracts were placed into protein solutions at pH 5 and pH 8.

The activity of the enzymes in each extract was determined by recording how quickly the protein was broken down. The results are shown in **Fig. 2**.



**Fig. 2**

- (a) Describe the activity of enzymes in the extracts at pH 5 over 15 days.

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(a) Name transport processes **A** and **B**.

**A:** \_\_\_\_\_

**B:** \_\_\_\_\_

[2]

(b) Explain the rates of transport observed when the concentration difference (gradient) is zero.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

[2]

(c) Describe and suggest an explanation for graph **A** beyond concentration difference (gradient) marked **M**.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

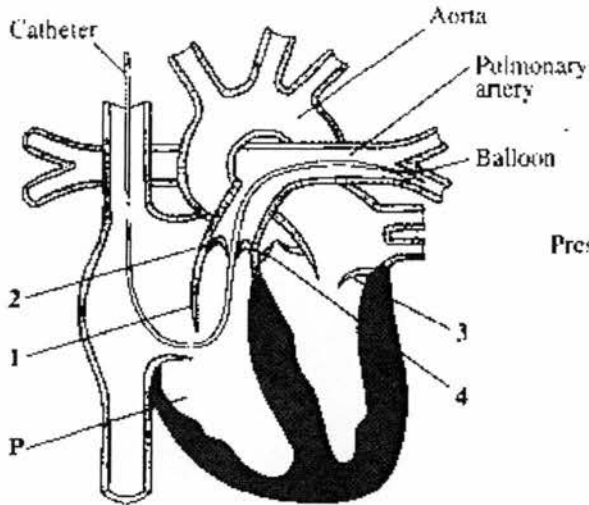
[2]

[Total: 6]

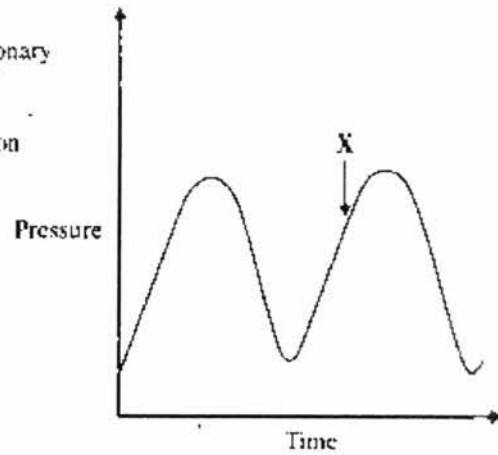
- 4 A small tube called a catheter can be inserted into the blood system through a vein. It can be threaded through the vein and through the heart until its tip is in the pulmonary artery. A tiny balloon at the tip can then be used to measure the pressure changes in the pulmonary artery.

**Fig. 4.1** below shows a section through the heart with the catheter in place.

**Fig. 4.2** shows the pressure changes recorded in the pulmonary artery.



**Fig. 4.1**



**Fig. 4.2**

- (a) Name the chamber of the heart labelled **P** in **Fig. 4.1**.

\_\_\_\_\_ [1]

- (b) Complete the table to show whether the valves 1 to 4 in **Fig. 4.1** are open or closed at time **X** in **Fig. 4.2**.

[2]

Valve 1	Valve 2	Valve 3	Valve 4

- (c) Outline the processes that occur during the 3 phases of the cardiac cycle.

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[4]

- (d) Sketch an additional curve on **Fig. 4.2** to show the pressure changes that would be measured in the aorta at the same time.

[1]

[Total: 8]

- 5 Scientists investigated differences between Tibetans who had lived in Lhasa (altitude 3658 m) all their lives and adult Han Chinese residents who had lived there for about 8 years. The Tibetans and the Han Chinese exercised at maximum effort and various aspects of their breathing were measured. Some of the results are shown in **Table 5**.

	Tibetans	Han Chinese
minute volume / $\text{dm}^3 \text{min}^{-1}$ (volume of air breathed in during one minute)	149	126
oxygen uptake / $\text{cm}^3 \text{kg}^{-1} \text{min}^{-1}$ (volume of oxygen absorbed into the blood during one minute)	51.0	46.0

**Table 5**

- (a) Suggest **two** differences in the structure of the lungs that may account for the greater oxygen uptake by the Tibetans shown in **Table 5**.

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[2]

- (b) When people who have lived all their lives at low altitude go to a place at high altitude, such as Lhasa, they are often breathless and have a lack of energy.

However, with time, their red blood cell count increases about 30% over several weeks. Explain why the red blood cell count increases so much when people visit places at high altitude.

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[2]

[Total: 4]

- 6 Fig. 6.1 shows the variation in the amount of DNA in a whitefish embryonic cell undergoing mitotic cell division. Diagrams (i) to (v) show different stages of mitosis in random order.

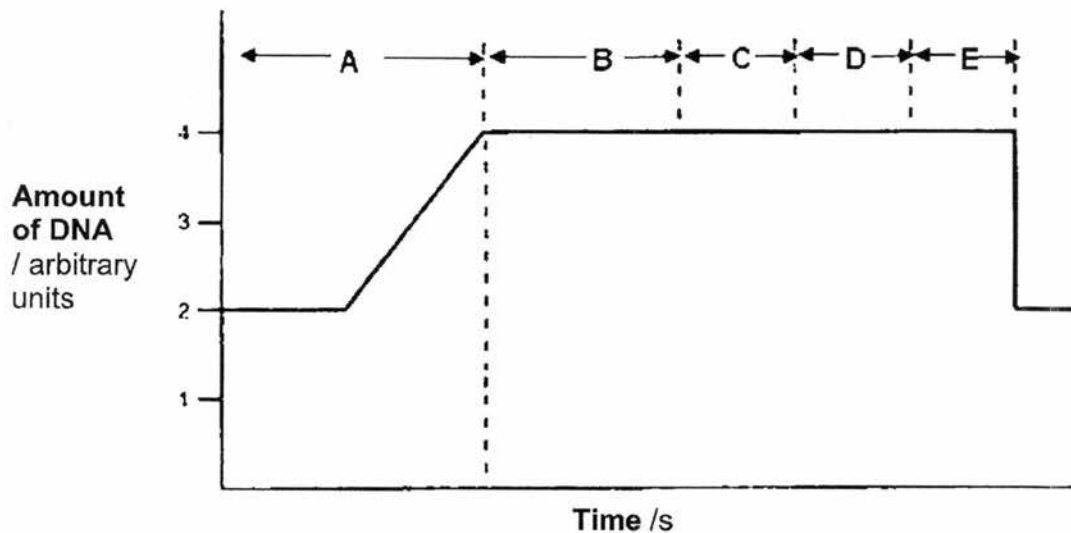
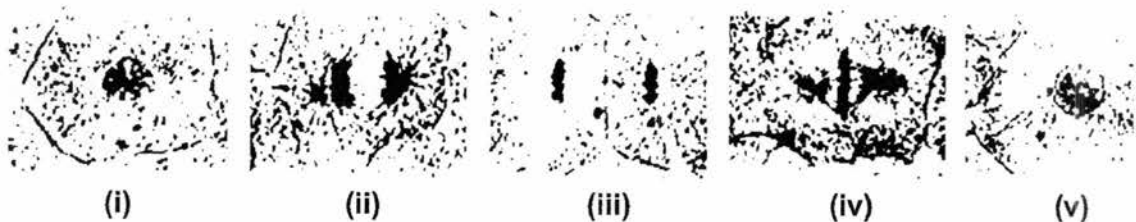


Fig. 6.1



- (a) Complete the table below by filling in the corresponding stage (**A, B, C, D** or **E**) for each diagram. The answer for diagram (i) has been filled in for you. [2]

Diagram	(i)	(ii)	(iii)	(iv)	(v)
Stage	B				

- (b) Briefly explain how mitosis is important for the development of the embryo.

---



---

[1]

- (c) Fig. 6.2 below shows an animal cell undergoing meiosis.



Fig. 6.2

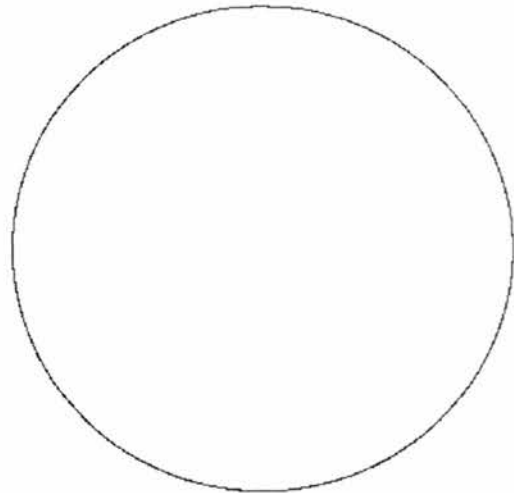


Fig. 6.3

- (i) State the stage of meiosis shown and the diploid number of the animal cell.

Stage: \_\_\_\_\_

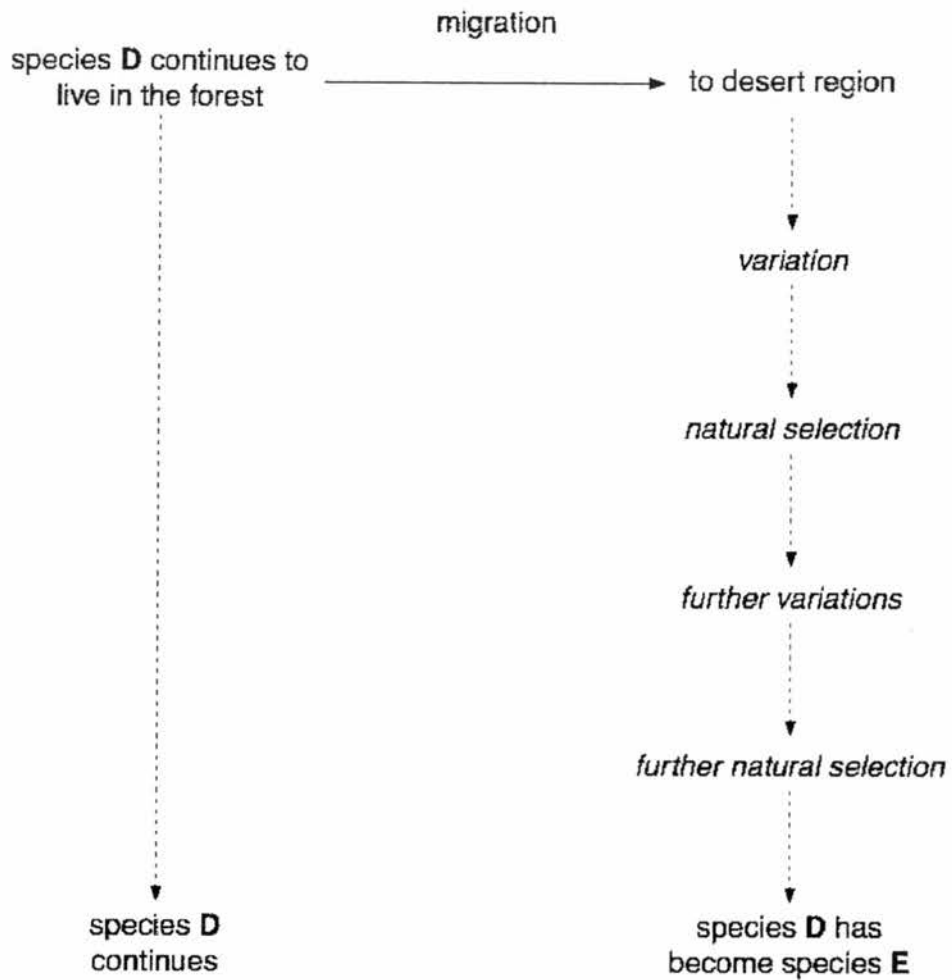
Diploid number of cell: \_\_\_\_\_

[1]

- (ii) In the space provided in Fig. 6.3, draw how the animal cell would have appeared at **anaphase I**. Circle and label a pair of **homologous chromosomes**. [2]

[Total: 6]

- 7 Species **D** lives in a forest. **Fig. 7** shows what can happen, over the same period of time, if some members of species **D** migrate from the forest to a desert region.



**Fig. 7**

- (a) Name the two main causes of variation in organisms.

1. \_\_\_\_\_

2. \_\_\_\_\_ [2]

- (b) Name the process involving variation and natural selection that has led to the development of species **E**.

\_\_\_\_\_ [1]



O Level Centre Number/ Index Number	Class	Name
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新加坡海星中学

MARIS STELLA HIGH SCHOOL  
PRELIMINARY EXAMINATION TWO  
SECONDARY FOUR

**BIOLOGY**

Paper 2

5158/02

*Additional Materials:*

Nil

**21 August 2017**  
**1 hours 45 minutes**

**INSTRUCTIONS TO CANDIDATES**

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

Write in dark blue or black pen.

Do not use paper clips, glue or correction fluid.

You may use a pencil for any diagrams or graphs.

**BOOKLET TWO – SECTION B**

**Section B: Free Response Questions**

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. The total number of marks for this paper (sections A and B) is 80.

At the end of the examination, hand in the following separately:

(1) Section A

(2) Section B

Examiner's Use

**Section B****Free Response Questions [30 marks]**

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

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

- 8 Tom was curious about the inheritance of traits in the garden pea plant. He decided to collect 100 seeds from each of the three pea plants in his mother's garden. He noticed that the pea seeds are either smooth or wrinkled. He counted the number of smooth and wrinkled seeds from each plant and recorded them in a table. His results are shown in the table below.

Plant	Number of smooth seeds	Number of wrinkled seeds
1	78	22
2	74	26
3	47	53

- (a) On the graph paper, draw a bar chart to show the number of each seed type produced by each pea plant.

[3]

- (b) Tom remembered from his Biology lessons in school that the allele for smooth seeds was dominant to the allele for wrinkled seeds. Based on the results above, he hypothesized that plants 1 and 2 were heterozygous for this trait while plant 3 was homozygous recessive.

Explain how Tom arrived at this hypothesis.

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[4]

- (c) Suggest the experiments that Tom should do to test his hypothesis and the results he should expect if his hypothesis is correct.

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[3]

[Total: 10]

- 9 Fig. 9.1 below shows how genetic engineering can be used to manufacture the enzyme, chymosin.

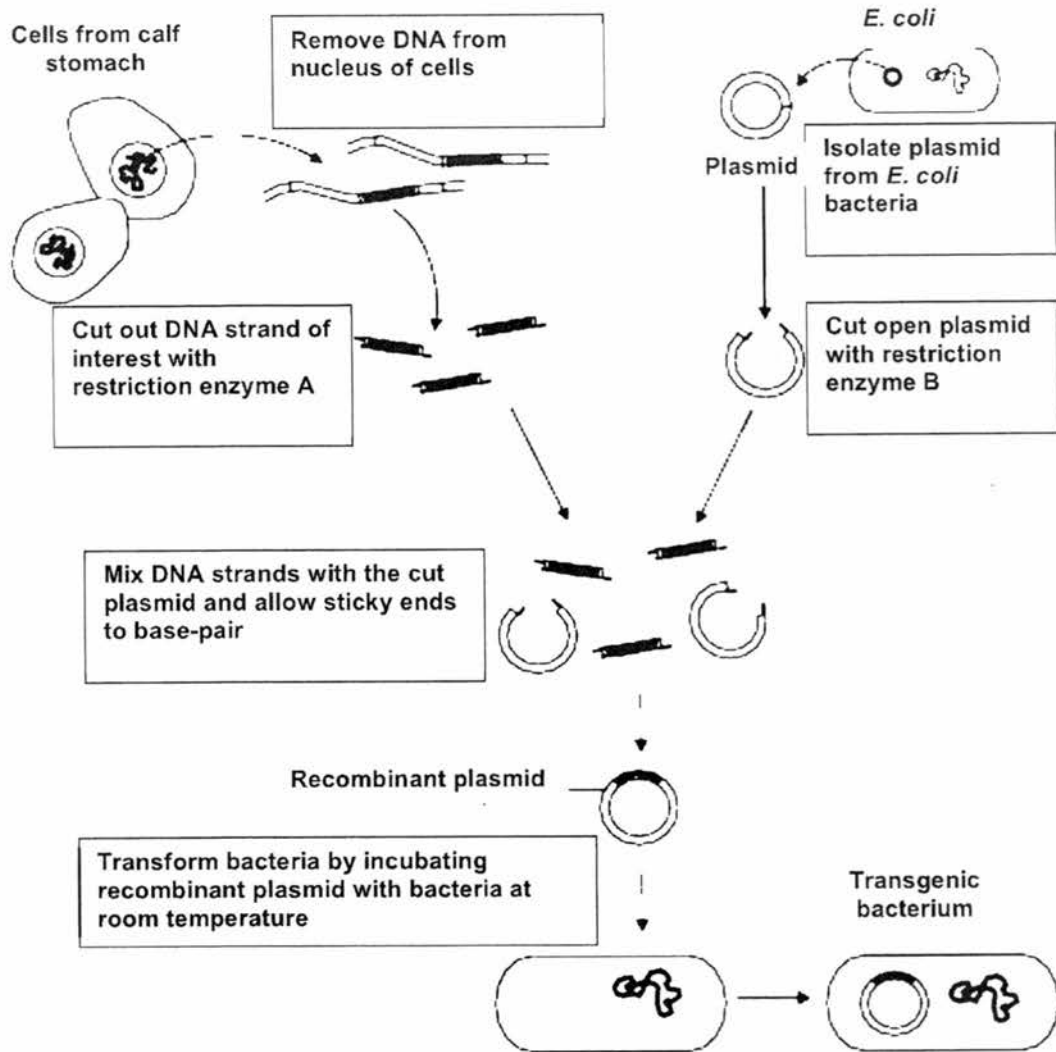


Fig. 9.1

- (a) (i) Name the DNA strand of interest cut from the calf stomach in Fig. 9.1.

[1]

- (ii) Fig. 9.1 contains some key errors or missing information regarding the genetic engineering process. Suggest **two** ways in which the procedure should be modified and explain why the change or additional step is necessary.

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[2]

- (iii) Genetic engineering has some social and ethical issues. However, there are still many useful benefits of genetic engineering in our society. What are **two** such benefits?

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[2]

- (b) Fig. 9.2 below shows a section of DNA.

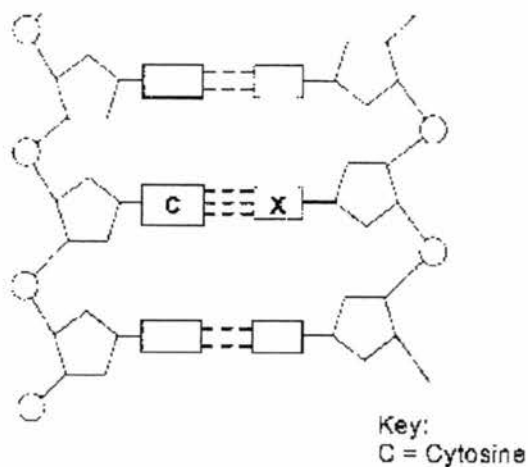


Fig. 9.2

- (i) On Fig. 9.2, **circle** one nucleotide. [1]

- (ii) Identify base X. [1]

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- (iii) Explain briefly the relationship between DNA, genes and chromosomes. [3]

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[3]

[Total: 10]



10 Or

(a) Describe the part played by an ovule in the reproduction of a plant.

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[4]

(b) State the products of an ovary in a woman and describe the roles of each of these products.

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[6]

[Total: 10]

**END OF SECTION B**

## PRELIM 2 ANSWER SCHEME

### Paper 1: MCQ (40m)

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

### Paper 2 Section A: Structured Questions [50m]

- 1 (a) The marble: nucleus;  
The beads: chloroplasts; [A: mitochondria]  
The tubing: (cell) membrane; [3]
- (b) vacuole /ribosomes /starch grains /mitochondria or chloroplasts /tonoplast; [1]
- (c) water **molecules** leave; [1]  
by osmosis;  
ref. water potential (A any ref. to differential in concentration);  
cell /cytoplasm /protoplasm /model shrinks (R ref. vacuole);  
ref. decreased pressure / turgidity / firmness / flaccidity;  
tubing pulls away from permeable membrane OR cytoplasm or cell membrane pulls away from (cell) wall;  
ref. **plasmolysis**;  
no sugar leaves cell /enters space between tubing and permeable membrane OR between cell membrane and wall; [max 6]
- 2 (a) Very little activity from day 0 to day 5; [linked -1]  
this followed by sharp increase from 1 to 37/ arbitrary units till day 11; [1]  
After that, activity decreases from 37 to 14 / arbitrary units; [1]  
[data quoted with day and activity. One point linked. Others no data – 0.5m]
- (b) There are 2 separate curve (lines) which show enzyme activities at 2 different pH, showing that enzyme activity is influenced by different pH; [1]  
Enzyme activity at each pH peaks at different days; [1]  
Data quote: quote of activity at pH 8 and pH 5 on a specific day [day 15, enzyme activity for pH 5 decreased but the enzyme activity at pH 8 still increasing]; [1]  
Suggesting one enzyme which prefers acidic pH is produced in large amount on day 11 of seed germination, beyond day 11, the activity of this enzyme is reduced; [1]

- 3 (a) A: active transport; [1]  
 B: diffusion; [1]
- (b) No (net) diffusion. Diffusion only occurs if there is a concentration gradient (across the membrane); @ no concentration gradient [1]  
Active transport can occur because it uses energy; [1]
- (c) Cannot provide additional energy/energy requirement too high/max energy reached;  
 All membrane channels occupied;

4 (a) Right Ventricle; [1]

- (b) 1: Closed;  
 2: Open;  
 3: Closed;  
 4: Open; [0.5 each]

(c) Atrial systole:

- Atrial muscles contract; [0.5]
- *Pressure in atria higher than pressure in ventricle resulting in opening of bicuspid and tricuspid valves* [0.5]
- Blood is forced from atria to ventricles; [0.5]

Ventricular systole:

- Period of rising pressure (no blood flow out yet); [0.5]
- Closing of bi & tricuspid valves; prevent backflow of blood into atria; [0.5]
- Ventricular muscles contract; [0.5]
- Blood is forced out of ventricles when pressure exceeded those in arteries; [0.5]
- *Due to opening of pulmonary and aortic valves* [0.5]

Diastole:

- Atrial and ventricular muscles relax; [0.5]
- *Pressure in ventricles drop below pressure in arteries resulting in the closure of the pulmonary and aortic valves to prevent backflow of blood into ventricles* [0.5]
- Blood moves from veins into atria, and subsequently the ventricles; [0.5]

(d)



Graph higher than original; [0.5]  
 Crests and troughs at similar time points as original; [0.5]

- 5 (a) more alveoli/ a greater surface area of alveoli;  
more /wider bronchioles;  
more blood capillaries (around alveoli);  
larger lung capacity; [any 2]
- (b) low concentration of oxygen /less oxygen, more haemoglobin is required /produced; [1]  
compensates for smaller volume of oxygen absorbed, more oxygen can be carried (per unit of blood); [1]
- 6 (a) B, D, E, C, A; [0.5 each]
- (b) Produces genetically identical cells /maintains genetic stability  
so that cells can continually replicate without loss of genetic information; [1]
- (c) (i) Stage: **Metaphase II**; [0.5]      Diploid number of cell: **4**; [0.5]
- (ii) Circle and label homologous chromosome [1]  
- Shows crossing over of chromatids;
- Draws cells with: [1]  
- 4 chromosomes (2 pairs of homologous chromosome);  
- spindle fibre attached to centromere;  
- chromosomes moving to opposite poles;
- 7 (a) - genes (Crossing over during prophase I / Independent assortment during metaphase I)/  
random fertilisation of gametes/ mutation /named common mutagen; [1]  
- environment /habitat / named environmental factor; [1]
- (b) evolution; [1]
- (c) different/changed environment;  
mutation(s);  
variations + advantageous AW /better adapted;  
survive;  
reproduce /passed on;  
cumulative effect /over many generations;  
leading to change in phenotype /appearance /or e.g.; [max 4]
- (d) difference in genes /DNA;  
difference in chromosomes;  
ref to problems with fertilisation;  
no sexual attraction /incompatible;  
geographical separation; [max 2]

**Section C: Free Response Questions [30m]**

8 (a) axes labeled [0.5], accurate plotting of both datasets [2], key/legend [0.5]

(b) [Original MS]:

The phenotypic ratio of the seeds from plants 1 and 2 is 3 smooth: 1 wrinkled [1]

This can only happen if the parental plants are both heterozygotes [1]

by either self-pollination or cross-pollination between plants 1 and 2 [1extra]

The phenotypic ratio of the seeds from plant 3 is 1 smooth: 1 wrinkled [1]

This can only happen from cross-pollination between a homozygous recessive and a heterozygous plant [1]

Since plants 1 and 2 are heterozygous, plant 3 has to be the homozygous recessive individual [1]

**Change to:**

The phenotypic ratio of the seeds from plants 1 and 2 is 3 smooth: 1 wrinkled; [1]

This can only happen if the parental plants are both heterozygotes by either self-pollination or cross-pollination between plants 1 and 2; [1]

Plants 1 and 2:  $Ss \times Ss$  gives  $SS, Ss, Ss, ss$

Therefore 3 smooth: 1 wrinkled

The phenotypic ratio of the seeds from plant 3 is 1 smooth: 1 wrinkled; [1]

This can only happen from cross-pollination between a homozygous recessive and a heterozygous plant; [1]

Since plants 1 and 2 are heterozygous, plant 3 has to be the homozygous recessive individual; [1]

Plant 3:  $ss \times Ss$  gives  $Ss, Ss, ss, ss$

Therefore 1 smooth: 1 wrinkled

(c) [Original MS]:

Tom should self-pollinate all 3 plants, taking precaution to prevent cross-pollination by covering the flowers of the plants [1] If his hypothesis is correct, the expected results should be

Plants 1 and 2:  $Ss \times Ss$  gives  $SS, Ss, Ss, ss$

3 smooth: 1 wrinkled [1]

Plant 3:  $ss \times ss$  gives all wrinkled (ss) [1]

**Change to:**

Tom should do a Test Cross for all 3 plants / crossing all 3 plants with a homozygous recessive plant (ss);

For Plants 1 and 2:  $Ss \times ss$

If his hypothesis is correct, he should get 1 Smooth (Ss): 1 wrinkled (ss)

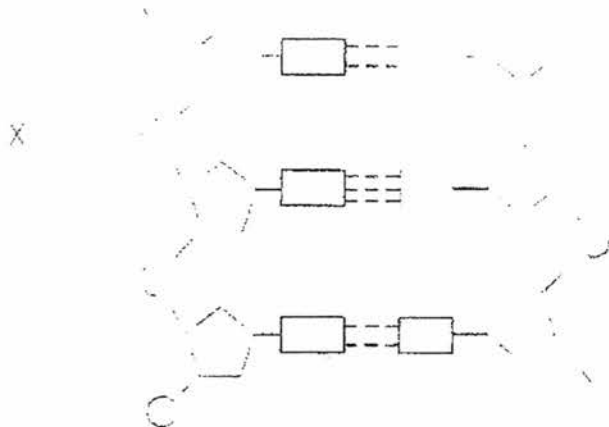
For plant 3:  $ss \times ss$

He should get all smooth (ss)

- 9 (a) (i) DNA strand containing Chymosin gene;
- (ii) Cut out the DNA strand containing the chymosin gene and the plasmid from E.coli bacteria with the same restriction enzyme to generate complementary sticky ends; Add DNA ligase to permanently join chymosin gene with the plasmid from E.coli; Apply heat shock / electric shock to open up pores in host cell membrane for the uptake of the recombinant plasmid; [any 2]

- (iii) Low cost production of medicines;  
 Production of crops that can grow in extreme conditions / development of foods designed to have higher nutritional value. E.g. golden rice;  
 Development of pest resistant crops / disease resistant livestock / higher yield; [any 2]

(b) (i)



(ii) Guanine;

(iii) A gene:

- is a unit of inheritance on a DNA molecule; occupies a segment of a DNA molecule;
- is made up of a specific sequence of nucleotides (on a DNA) that codes for a particular polypeptide / protein;
- A nucleotide contains a pentose sugar, a phosphate group and a nitrogen containing base.

**DNA:**

- are chemicals that make up the gene;
- are **polynucleotides**, made up of many similar, smaller molecules called nucleotides joined into a long chain;

**A chromosome:**

- is made up of DNA molecule wrapped around proteins;
- contains many genes. Each gene has a specific locus (position) on a chromosome;
- Each molecule of DNA is a chromosome;
- DNA organises into many chromosomes within the nucleus; [3]

**10 Either**

**(a)** Similarities between sweating and transpiration:

Loss of water;  
involves evaporation / as vapour;  
to the atmosphere / surroundings;  
cooling effect;  
through pores AW;  
in epidermis;  
both affected by temp / humidity / wind (speed);

[max 3]

**(b)** In contrasting statements. (Accept reverse arguments where relevant).

1. Sweating occurs in animals; transpiration occurs in plants;
2. sweating (from) skin; transpiration (from) leaves / stems;
3. sweat ref. (extracted) from blood, to sweat gland / ducts; in transpiration, water travelled from roots via xylem vessels to leaves;
4. sweating ref. (loss of) urea / ions / salts / minerals; transpiration ref. (helps to) bring ions up stem / xylem / to leaves / cells;
5. sweating ref. under nervous control / homeostasis / determined by body temperature; transpiration ref. consequence of stomata open for photosynthesis;

[max 7]

**10 Or**

**(a)** Describe the part played by an ovule in the reproduction of a plant:

Contains female gamete / female nucleus / egg cell;  
in ovary;  
fertilized / fuse;  
(by the) male gamete / male nucleus;  
(to form) zygote / embryo;  
seed + germinates (to form new plant);

[max 4]

**(b)** State the products of an ovary in a woman and describe the roles of each of these products.

Produces haploid;  
ovum / egg;  
fertilization + ref. zygote/embryo;  
oestrogen;  
progesterone;  
any two functions of oestrogen (e.g. devpt. of sex organs / secondary sexual characteristics / thickening of uterus lining / stimulates production of LH);  
any two function of progesterone (maintains uterus lining / inhibits FSH / inhibits LH AW

[max 6]