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新加坡海星中学  
MARIS STELLA HIGH SCHOOL  
PRELIMINARY EXAMINATION  
SECONDARY FOUR

**BIOLOGY**

Paper 1 Multiple Choice

**6093/01**

**28 August 2020**

**1 hour**

*Additional Materials:*

Optical Test Answer Sheet (OTAS) – 1 sheet

**READ THESE INSTRUCTIONS FIRST**

Write in soft pencil.

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

Write your name, class, index number, Centre number and 'O' Level index number on the Answer Sheet in the spaces provided.

There are **forty** questions on this paper. Answer **all** questions. For each question, there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your 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 use of an approved scientific calculator is expected, where appropriate.

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 The endoplasmic reticulum (ER) comprises of interconnected sacs or tubules suspended in the cytosol, a liquid found inside the cell. It has the following characteristics:

- 1: comprised of mostly tubules
- 2: comprised of flattened membranous sacs
- 3: involved in the synthesis of steroid hormones, e.g. testosterone
- 4: involved in the transport of polypeptides

Which of the characteristics describe rough ER and smooth ER?

	rough ER	smooth ER
<b>A</b>	1 & 3	2 & 4
<b>B</b>	1 & 4	2 & 3
<b>C</b>	2 & 3	1 & 4
<b>D</b>	2 & 4	1 & 3

- 2 A mixture of food gives the following results on testing:

A lilac colour in the biuret test;

A blue colour when heated with Benedict's solution;

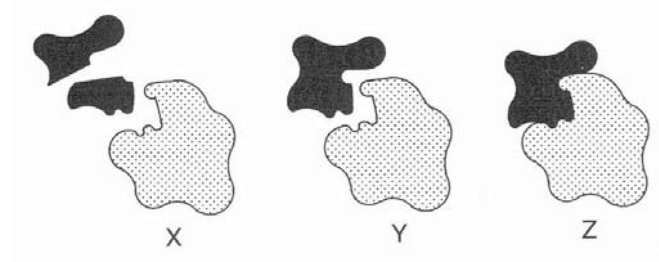
A yellow colour with iodine;

A white emulsion with ethanol.

What does the mixture contain?

- |                                    |                                     |
|------------------------------------|-------------------------------------|
| <b>A</b> fat and protein           | <b>B</b> protein and reducing sugar |
| <b>C</b> reducing sugar and starch | <b>D</b> starch and fat             |

- 3 The diagram shows three stages that occur during an enzyme-controlled reaction.

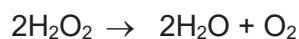


Which of the following indicates the correct sequence in which the three stages would occur if the enzyme promotes the building-up of a complex molecule from simpler ones?

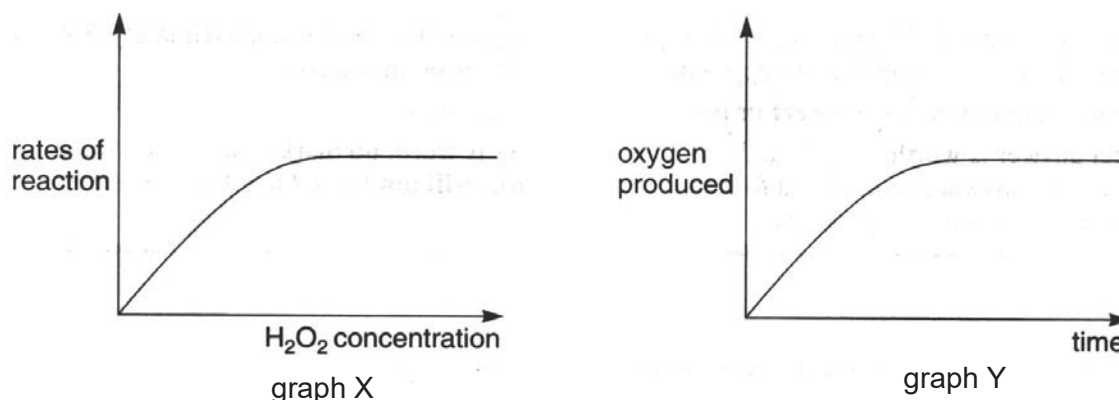
- |  |  |
|--|--|
| <b>A</b> $Y \rightarrow X \rightarrow Z$ | <b>B</b> $Y \rightarrow Z \rightarrow X$ |
| <b>C</b> $X \rightarrow Y \rightarrow Z$ | <b>D</b> $X \rightarrow Z \rightarrow Y$ |

For **Q4-5**, refer to the following information.

An experiment was performed to investigate the effect of the enzyme catalase on hydrogen peroxide. The reaction was as follows:



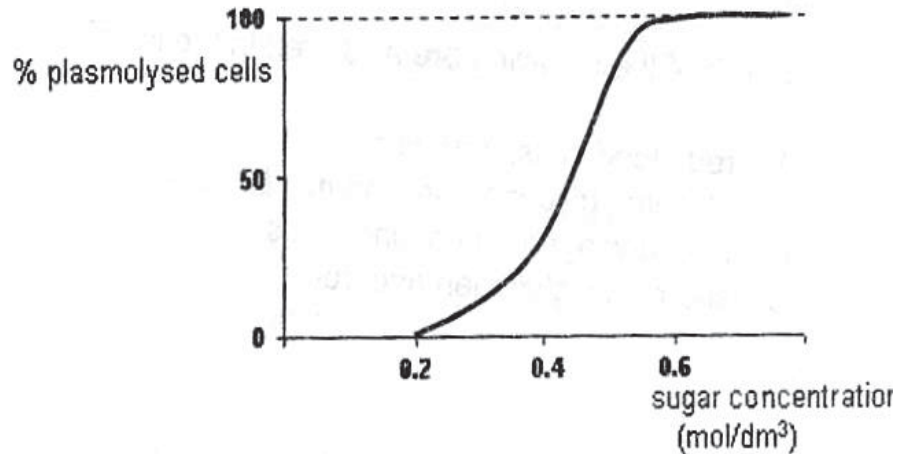
From the results of this investigation, the following graphs X and Y were obtained:



- 4 In graph X, when there is an increase in the catalase concentration,
- the rate will be the same at the start but it will reach a higher plateau.
  - there will be an increase in the rate at the start and it will reach a higher plateau.
  - there will be an increase in the rate at the start but it will reach the same plateau.
  - there will be no change.
- 5 In graph Y, when there is an increase in the catalase concentration,
- the rate will be the same at the start but it will reach a higher plateau.
  - there will be an increase in the rate at the start and it will reach a higher plateau.
  - there will be an increase in the rate at the start but it will reach the same plateau.
  - there will be no change.
- 6 Benedict's Test was performed on a 20 cm<sup>3</sup> sample of four fruit syrups. A second 20 cm<sup>3</sup> sample of each was then hydrolysed and tested with Benedict's solution. The table shows the masses of precipitate formed. Which syrup contains the greatest mass of non-reducing sugar?

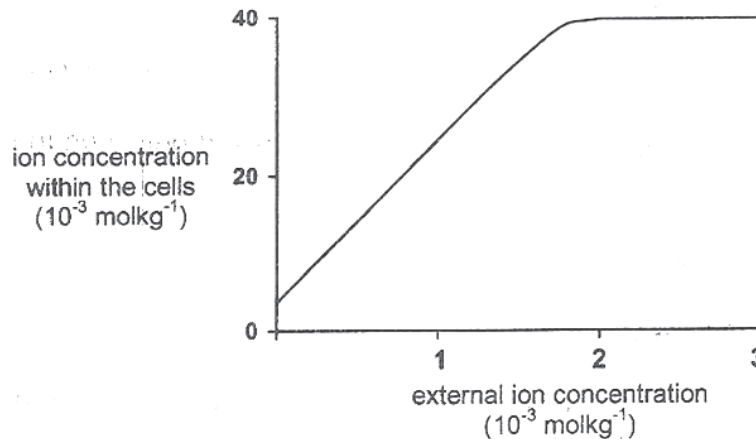
syrup	mass of precipitate before hydrolysis/ mg	total mass of precipitate after hydrolysis/ mg
<b>A</b>	25	55
<b>B</b>	75	85
<b>C</b>	55	55
<b>D</b>	50	70

- 7 The following graph illustrates the percentage of plasmolysed leaf cells at different concentrations of sugar solution.



The above results suggest that the leaf cells

- A are resistant to low sugar concentration.
  - B have cell sap of different concentration.
  - C are of different shapes.
  - D are of different sizes.
- 8 The graph below shows the effect of the change in the external concentration of an ion on the concentration of the same ion within the same plant cells.

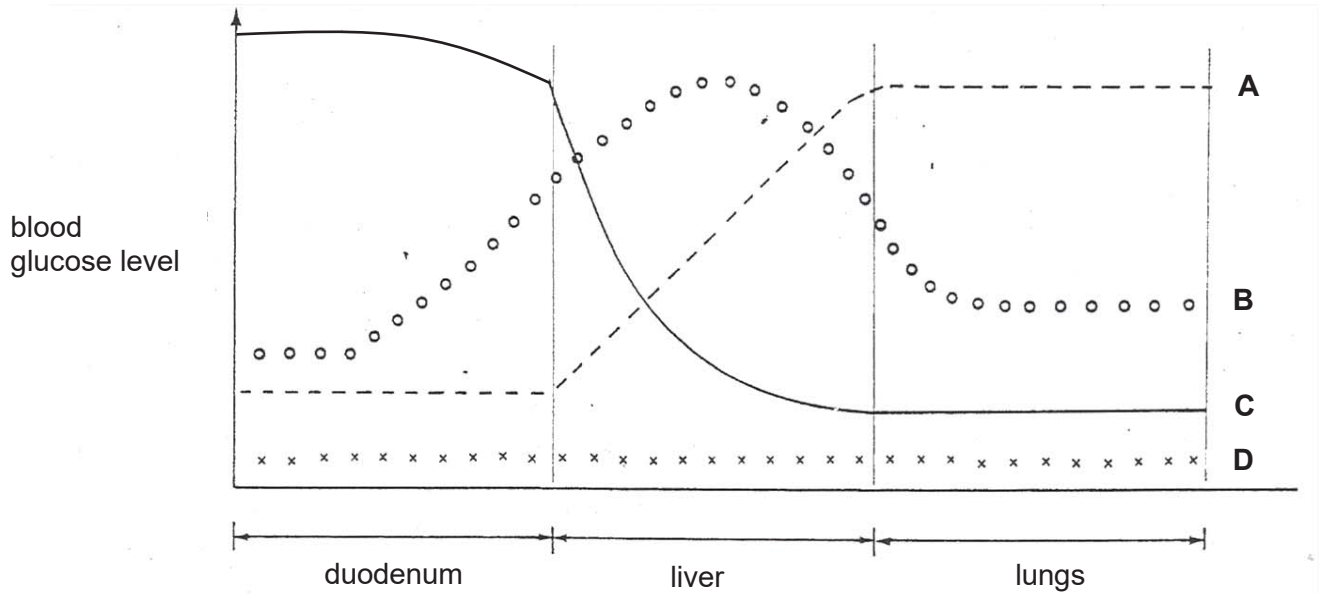


Which of the following conclusion(s) can be drawn from the graph?

- I The ion is taken up by the cells against a concentration gradient.
- II The uptake of the ion occurs only in living cells.
- III The cell surface membrane becomes impermeable to the ion when the external ion concentration reaches  $2 \times 10^{-3} \text{ mol kg}^{-1}$ .

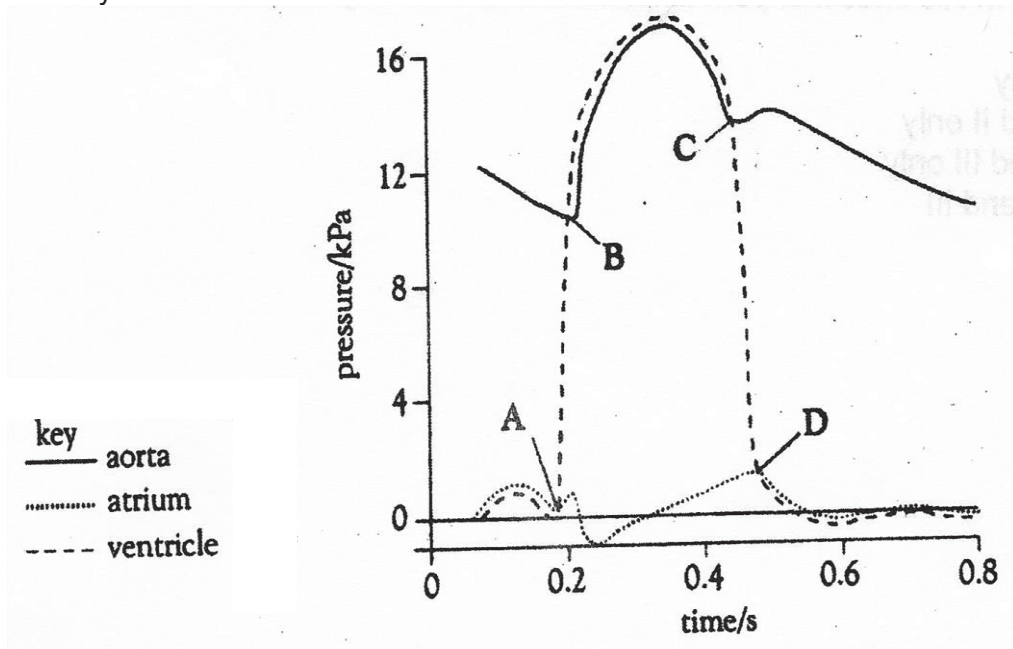
- A I only
- B III only
- C I and II only
- D II and III only

- 9 Which of the following curves best represents the change in the glucose level of blood flowing through the following organs of a man who has starved for eight hours?



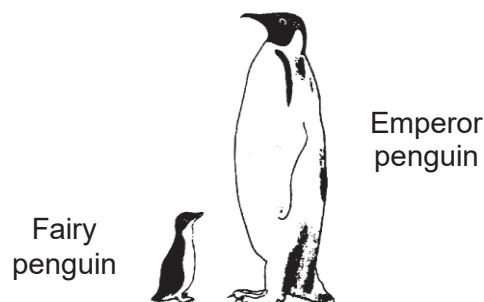
- 10 Shutting of the cuspid valves (atrio-ventricular) of the heart is caused by
- blood pressure in the ventricles rising.
  - blood pressure in the atria (auricles) rising.
  - the muscles attached to the valves contracting.
  - the heart strings contracting.
- 11 Human blood passes from the inferior (posterior) vena cava into the diastolic right atrium of the heart as a result of
- mass flow of blood.
  - the closure of venous valves.
  - the closure of tricuspid valve.
  - a pressure difference between the atrium and the vena cava.

- 12 The diagram below shows information on blood pressure in the aorta, left atrium and left ventricle during a cardiac cycle.



At which labelled point does the semi-lunar valve of the aorta close?

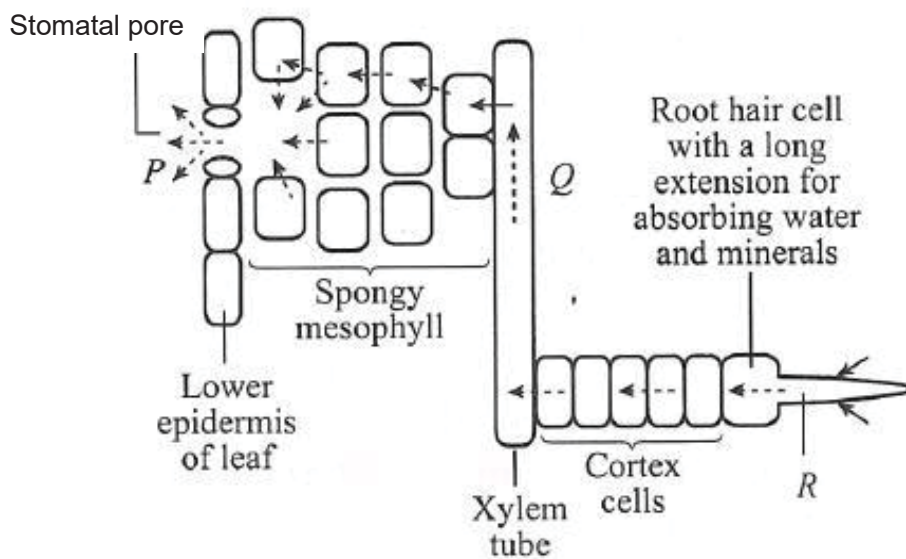
- 13 The cut surface of apples turns brown after exposure to air due to an enzyme present. Dipping the apples in some diluted lemon juice stops the browning. Which of the following offers the best explanation?
- A The lemon juice washed away the enzymes.  
 B The acidity of the lemon juice denatured the enzymes.  
 C The lemon juice sealed off exposure to the air.  
 D Osmosis took place.
- 14 The diagram shows a Fairy penguin and an Emperor penguin.



Which statement correctly explains why Fairy penguins are found in Australia and Emperor penguins found in Antarctica? Compared to Emperor penguins, Fairy penguins have

- A smaller surface area to volume ratio and lose heat more easily.  
 B larger surface area to volume ratio and lose heat more easily.  
 C smaller surface area to volume ratio and lose heat less easily.  
 D larger surface area to volume ratio and lose heat less easily.

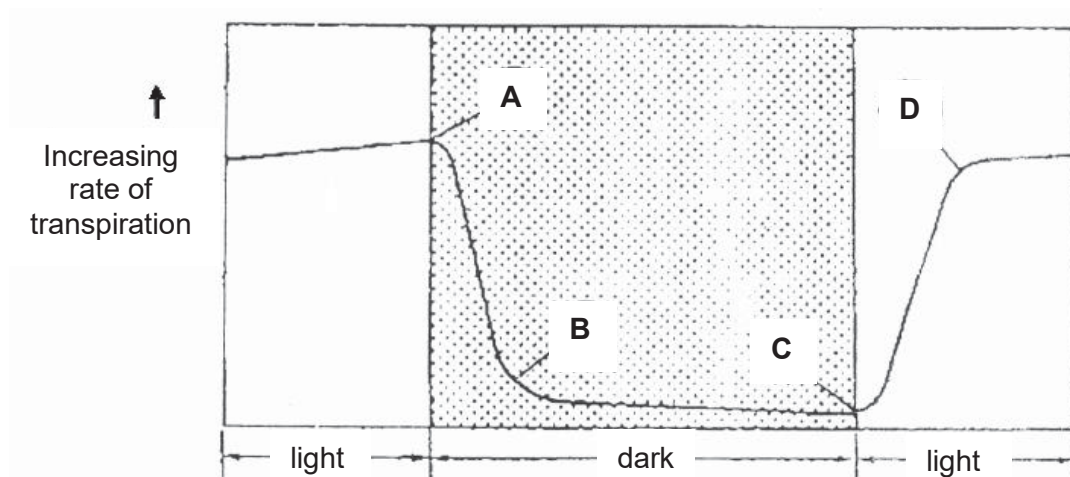
- 15 The diagram shows the transport of water through a plant.



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

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



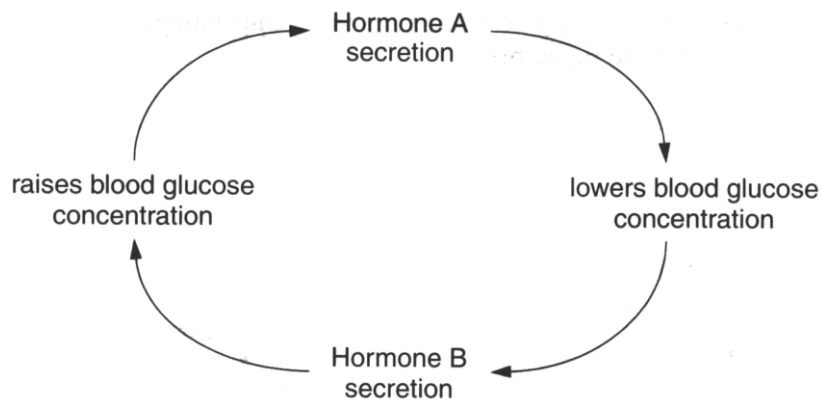
At which point (A, B, C, or D) does the stomata begin to open?



20 Energy would be required for the absorption of \_\_\_\_\_.

- |                      |                |
|----------------------|----------------|
| <b>A</b> amino acids | <b>B</b> water |
| <b>C</b> urea        | <b>D</b> salt  |

For Q21-24, refer to the following information.



21 Hormone A would be secreted \_\_\_\_\_.

- |                          |                          |
|--------------------------|--------------------------|
| <b>A</b> before a meal   | <b>B</b> after a meal    |
| <b>C</b> before exercise | <b>D</b> during exercise |

22 Hormone B would be secreted \_\_\_\_\_.

- |                          |                          |
|--------------------------|--------------------------|
| <b>A</b> before a meal   | <b>B</b> after a meal    |
| <b>C</b> before exercise | <b>D</b> during exercise |

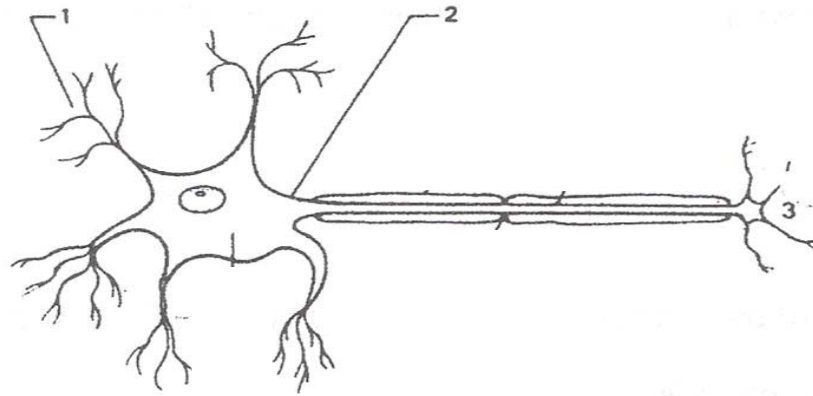
23 The above pathway is an example of \_\_\_\_\_.

- |                            |                            |
|----------------------------|----------------------------|
| <b>A</b> negative feedback | <b>B</b> stimulus response |
| <b>C</b> homeostasis       | <b>D</b> reflex action     |

24 Hormone B is \_\_\_\_\_.

- |                                     |                      |
|-------------------------------------|----------------------|
| <b>A</b> antidiuretic hormone (ADH) | <b>B</b> insulin     |
| <b>C</b> glucagon                   | <b>D</b> pancreatase |

25 Refer to the diagram of a motor (effector) neurone below:



Which of the following shows the correct path of nervous impulse flow through the motor neurone?

**A** 1 → 2 ← 3

**B** 1 ← 2 ← 3

**C** 1 → 2 → 3

**D** 1 ← 2 → 3

26 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	slackened
<b>B</b>	least convex	contracted	slackened
<b>C</b>	least convex	relaxed	taut
<b>D</b>	most convex	contracted	taut



- 30** Independent assortment of chromosomes is one of the most important events in meiosis because
- A** it produces new combinations of the genetic information in gametes.
  - B** it limits variation in genetic information.
  - C** it halves the number of chromosomes in each cell during segregation.
  - D** it allows for exchange of genetic information between chromosomes.

- 31** The table shows the percentages of bases in DNA from various types of cell.

source of DNA	adenine	guanine	thymine	cytosine
ox thymus	28.2	21.5	27.8	22.5
ox spleen	27.9	22.7	27.3	22.1
ox sperm	28.7	22.2	27.2	22.0
rat bone marrow	28.6	21.4	28.4	21.5
yeast	31.3	18.7	32.9	17.1

Which of the following is a valid deduction from these data?

- A** DNA is composed of two strands twisted around each other.
  - B** DNA occurs in about the same amounts in all cells from the same species.
  - C** The four bases show complementary base pairing.
  - D** The structure of DNA is the same in both yeast and animal cells.
- 32** Two organisms with the same genotype
- A** must have the same phenotype.
  - B** would have the same appearance regardless of the environment.
  - C** could have the same phenotype.
  - D** must be related.
- 33** If a man who belongs to blood Group A marries a woman of blood Group B, what will be the possible blood groups of their children if both parents are heterozygous for this character?
- A** all Group A
  - B** all Group B
  - C** 1 Group A : 1 Group B : 1 Group AB : 1 Group O
  - D** 1 Group A : 1 Group B : 1 Group AB



- 39 The diagram shows the nucleotide sequence of a gene on a DNA template:

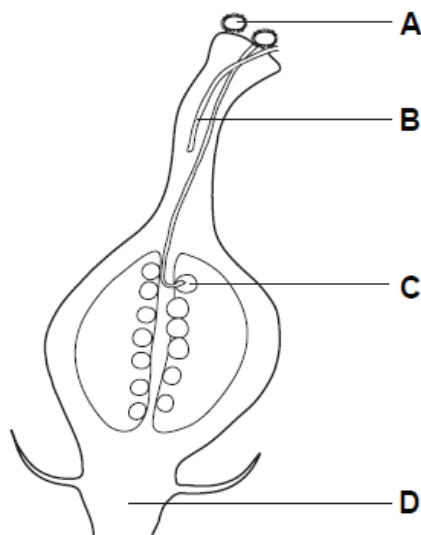
CGCCGCACGCGC

The table shows the amino acids coded for by 10 mRNA codons.

mRNA codon	amino acid
AAG	Lys
ACG	Thr
CGG CGC CGU	Arg
CCG	Pro
GCC GCG	Ala
GGC	Gly
UGC	Cys

What is the order of the four amino acids in the polypeptide translated from this small section of a gene?

- A Ala-Ala-Cys-Ala  
 B Ala-Arg-Gly-Ala  
 C Arg-Ala-Pro-Arg  
 D Arg-Arg-Thr-Arg
- 40 New plants may be grown from groups of cells that are taken from other plants. The diagram shows part of plant X. From which structure will cell samples grow into new plants that are genetically identical to plant X?



Plant X

End of Paper

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<p><b>BIOLOGY</b> Paper 2</p> <p>Candidates to answer on the Question Paper. No Additional Materials are required.</p>	<p><b>6093/02</b>  <b>25 August 2020</b>  <b>1 hour 45 minutes</b></p>
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**READ THESE INSTRUCTIONS FIRST**

Write your class, index number, Centre number, O level index number and name in the spaces at the top of this page.  
Write in dark blue or black pen.  
You may use an HB pencil for any diagrams or graphs.  
Do not use staples, paper clips, glue or correction fluid.

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

Electronic calculators may be used.

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





- (ii) Explain the decrease in muscle glycogen concentration during the run.

.....

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[2]

- (iii) Describe and explain the changes in lactic acid concentration during rest.

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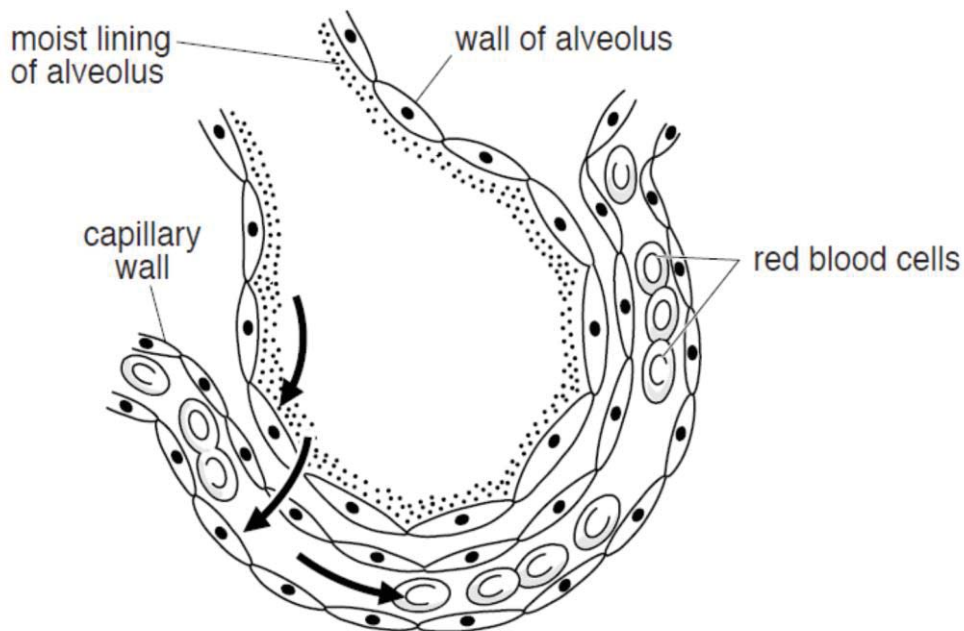
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[3]

- (b) **Fig. 3.2** below shows the relationship between an alveolus and a blood capillary in the lung of a mammal. The arrows show the path taken by oxygen from inhaled air entering the blood during gas exchange.



**Fig. 3.2**

- (i) Draw two arrows on **Fig. 3.2** to show the path taken by most carbon dioxide leaving the blood.

[1]

(ii) Explain why this movement of carbon dioxide is considered a form of excretion.

.....

.....

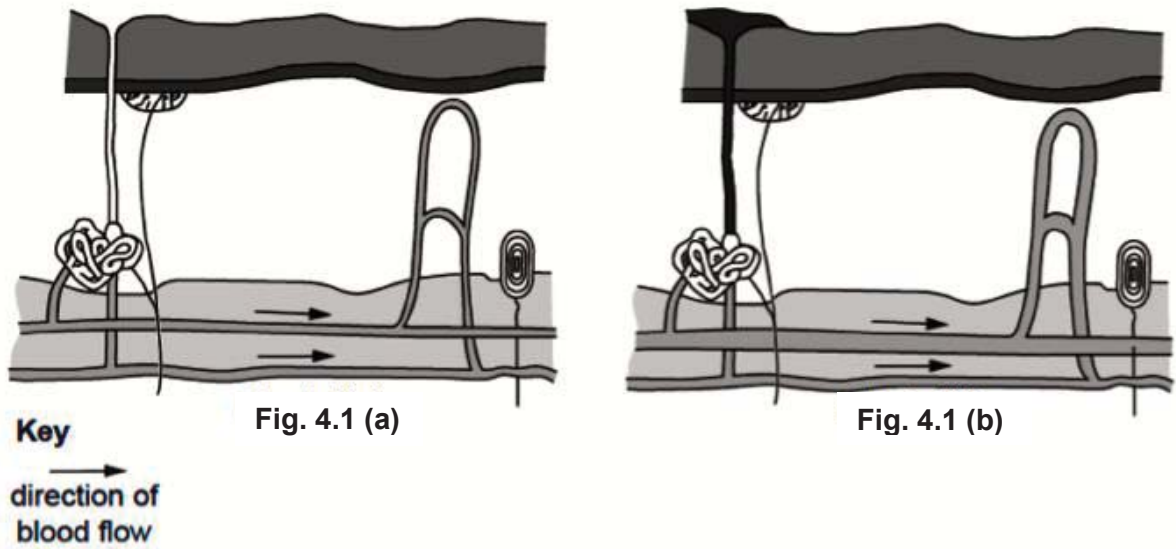
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[1]

[Total: 8]

4 Fig. 4.1(a) and Fig. 4.1(b) show a section through the skin of a person at two different temperatures.



(a) On Fig 4.1(a), identify and label the sweat gland and temperature receptor. [1]

(b) State what happened to the body temperature to cause the changes shown in Fig. 4.1(b) compared with Fig. 4.1(a). Explain your answer.

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[4]

[Total: 5]

- 5 (a) Define the term *limiting factor*.

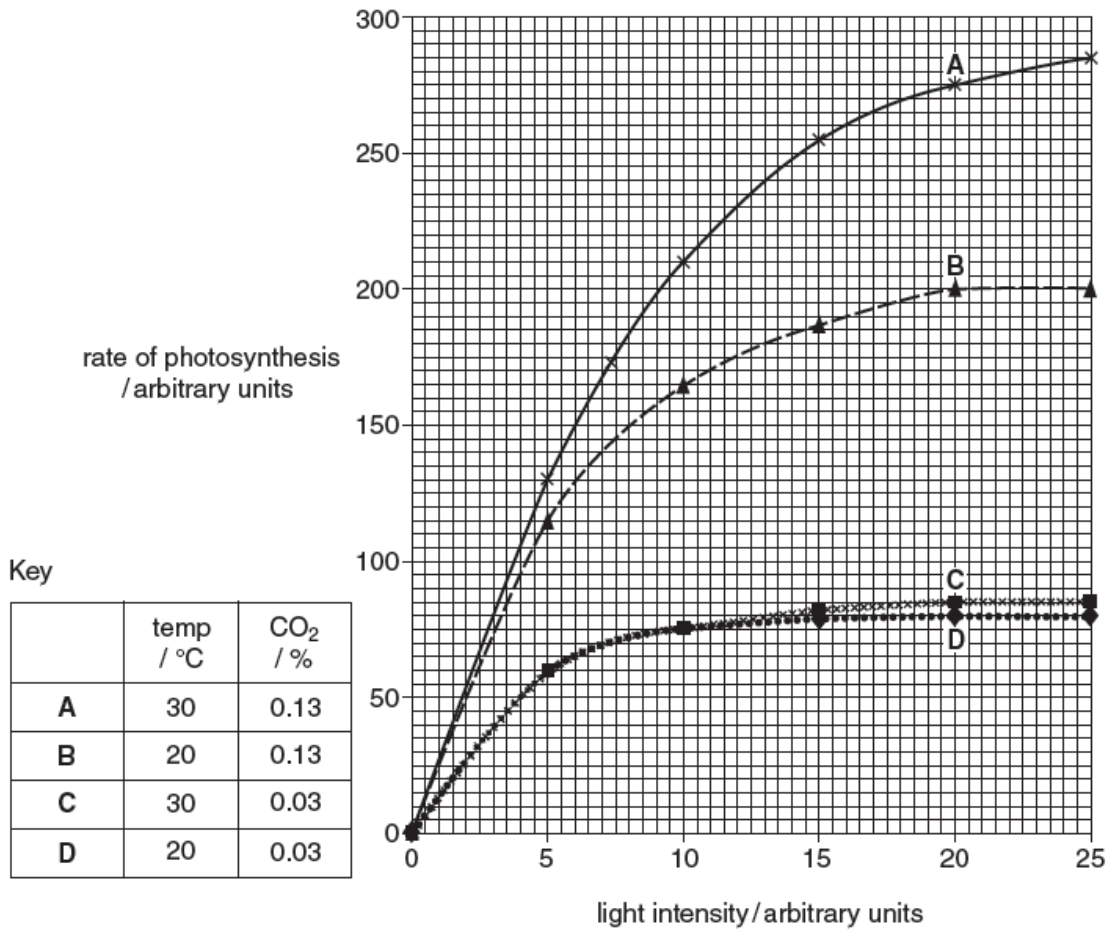
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[1]

- (b) A researcher carried out four experiments, **A** to **D**, to investigate the effect of light intensity on the rate of photosynthesis of cucumber plants. The experiments were carried out at two concentrations of carbon dioxide and at two temperatures.

The results are shown in **Fig. 5.1**



**Fig. 5.1**

Use the results in **Fig. 5.1** to identify the limiting factor for the rate of photosynthesis at the light intensities given in **Table 5.1**. Write your answers in **Table 5.1**.

**Table 5.1**

experiment	light intensity/arbitrary units	limiting factor
<b>A</b>	20	
<b>B</b>	20	
<b>C</b>	20	
<b>D</b>	5	light intensity

[3]

[Total: 4]

- 6 An investigation was carried out in China using crop residues and animal manure mixed together in composting units that were placed into a glasshouse containing crop plants.

Fig. 6.1 shows a composting unit in which decomposition takes place.

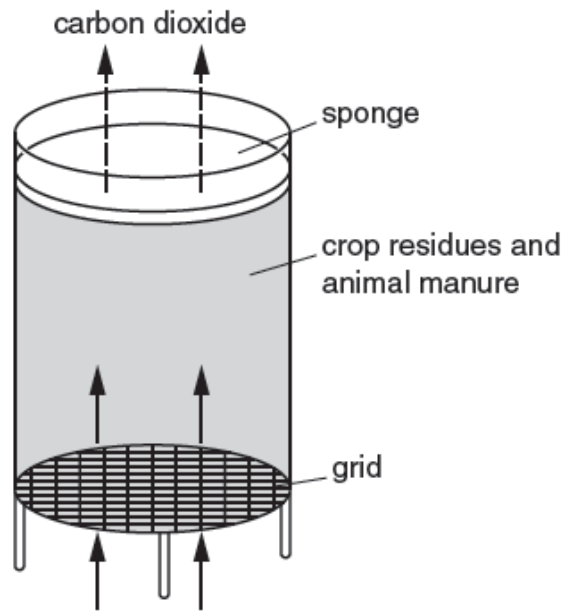


Fig. 6.1

Two glasshouses were used in this investigation. One glasshouse contained composting units and the other did not. Each glasshouse contained the same number and type of crop plants.

The concentration of carbon dioxide in both glasshouses was measured at midday. The results are shown in Fig. 6.2.

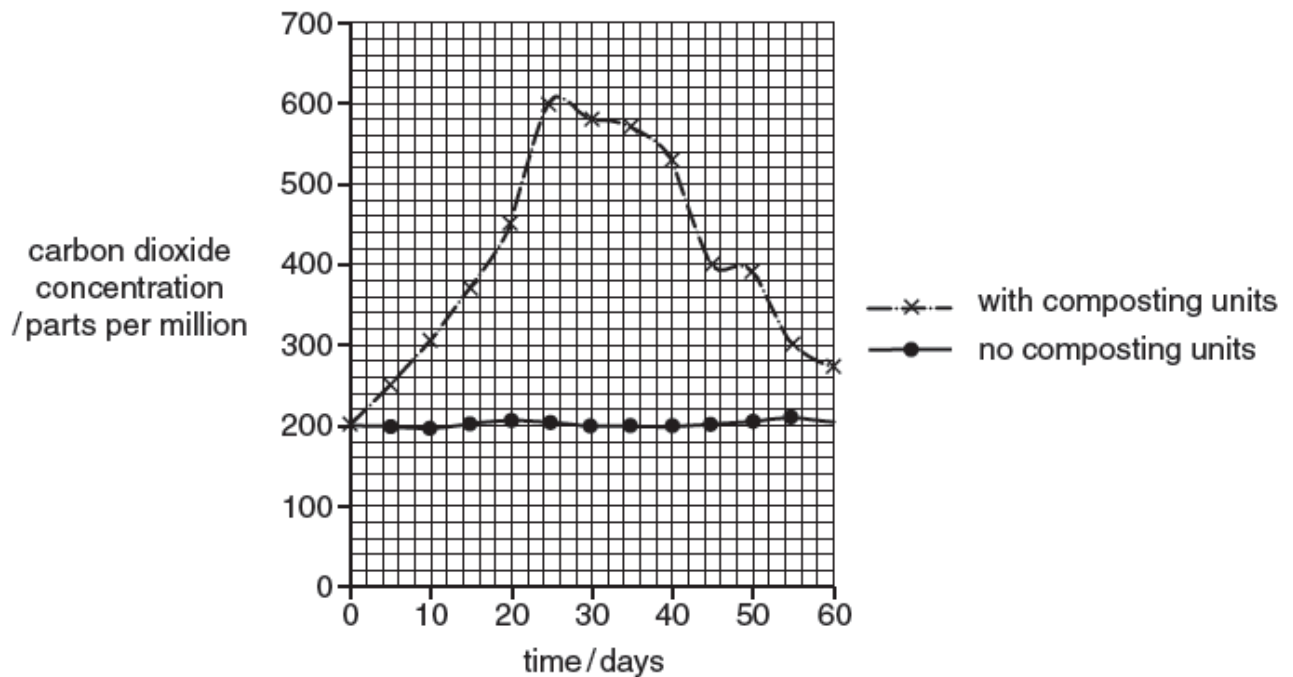


Fig. 6.2

Describe the results shown in **Fig. 6.2** and suggest two reasons why the two graphs show very different trends.

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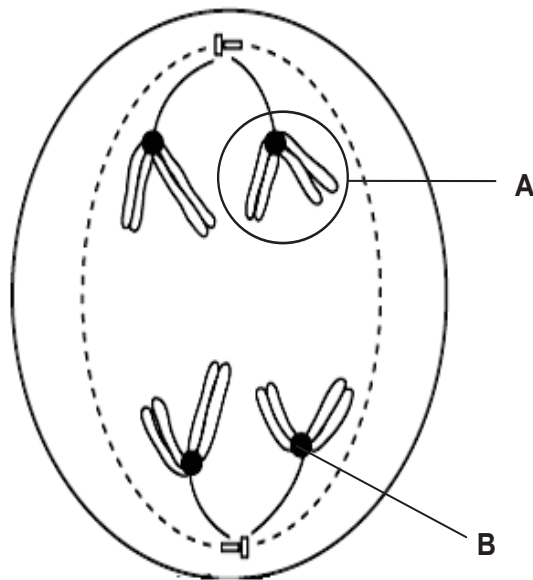
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[4]

[Total: 4]

- 7 **Fig. 7** shows an actively dividing cell taken from the testes of a male fruit-fly.



**Fig. 7**

- (a) Label the following structures:

**A:** .....

**B:** .....

[2]

- (b) Name the stage of cell division shown in **Fig. 7**.

.....

[1]

(c) Describe the events taking place in the stage stated in (b).

.....

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[2]

(d) Explain how meiosis results in offspring that do not look like the parents.

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[4]

[Total: 9]

8 Fig. 8.1 shows two processes taking place in a cell.

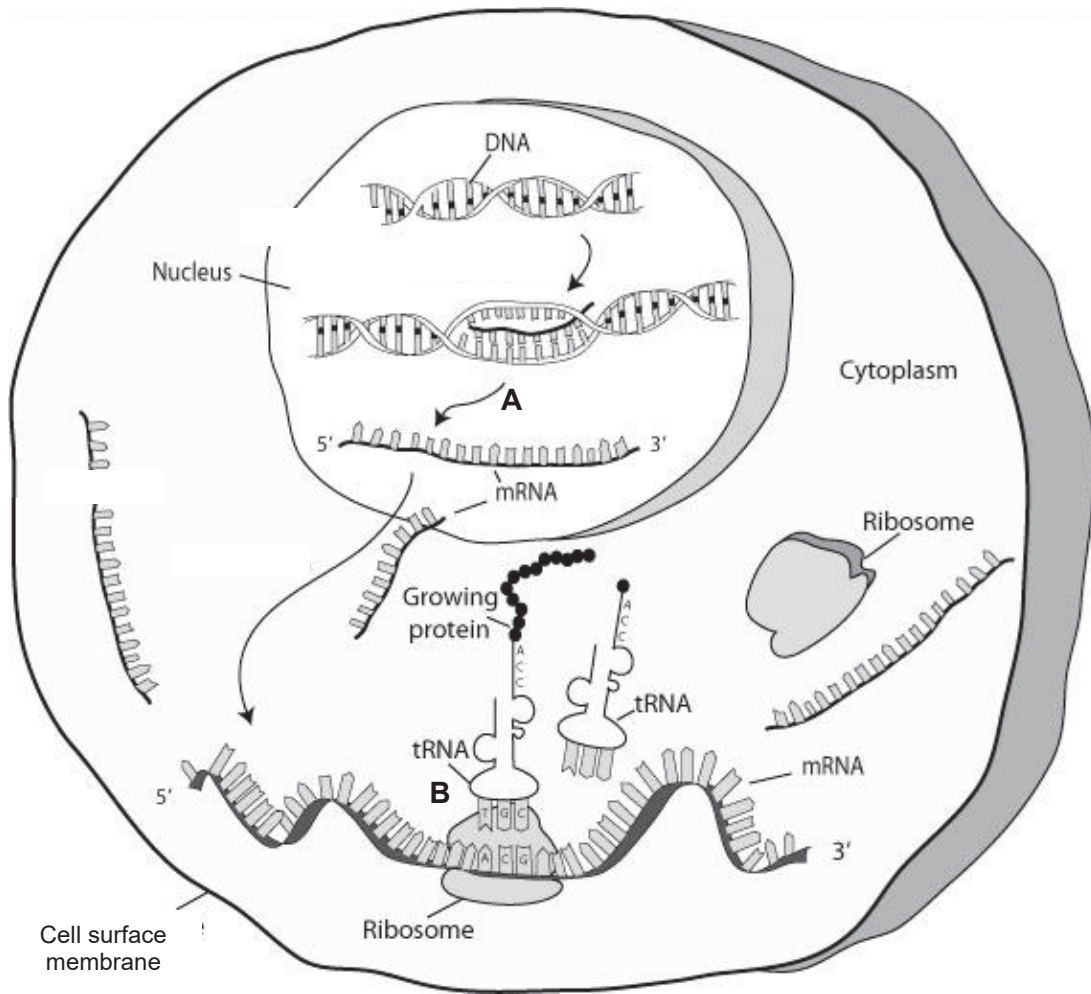


Fig. 8.1

(a) Name the processes A and B.

A: ..... B: ..... [2]

(b) Suggest why process A does not take place in the cytoplasm.

..... [1]

(c) Fig. 8.2 shows a nucleotide sequence in part of the unwound DNA:

TGAGGACTCCTC

Fig. 8.2

(i) Write the resulting sequence of the messenger RNA produced by process A.

..... [1]

- (ii) A mutation has occurred in the DNA in **Fig. 8.2**. The mutated DNA sequence is shown in **Fig. 8.3**.

TGAGGACACCTC

**Fig. 8.3**

State the type of mutation shown in **Fig. 8.3**.

..... [1]

- (iii) Explain how a change in the bases leads to a different protein being formed.

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

[Total: 7]

**END OF SECTION A**

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<p><b>BIOLOGY</b> Paper 2</p> <p>Candidates to answer on the Question Paper. No Additional Materials are required.</p>	<p><b>6093/02</b>  <b>25 August 2020</b>  <b>1 hour 45 minutes</b></p>
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Write in dark blue or black pen.  
You may use an HB pencil for any diagrams or graphs.  
Do not use staples, paper clips, glue or correction fluid.

**This is Section B of the paper.**  
Answer **all** questions.  
Write your answers in the spaces provided on the question paper.

Electronic calculators may be used.

You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.  
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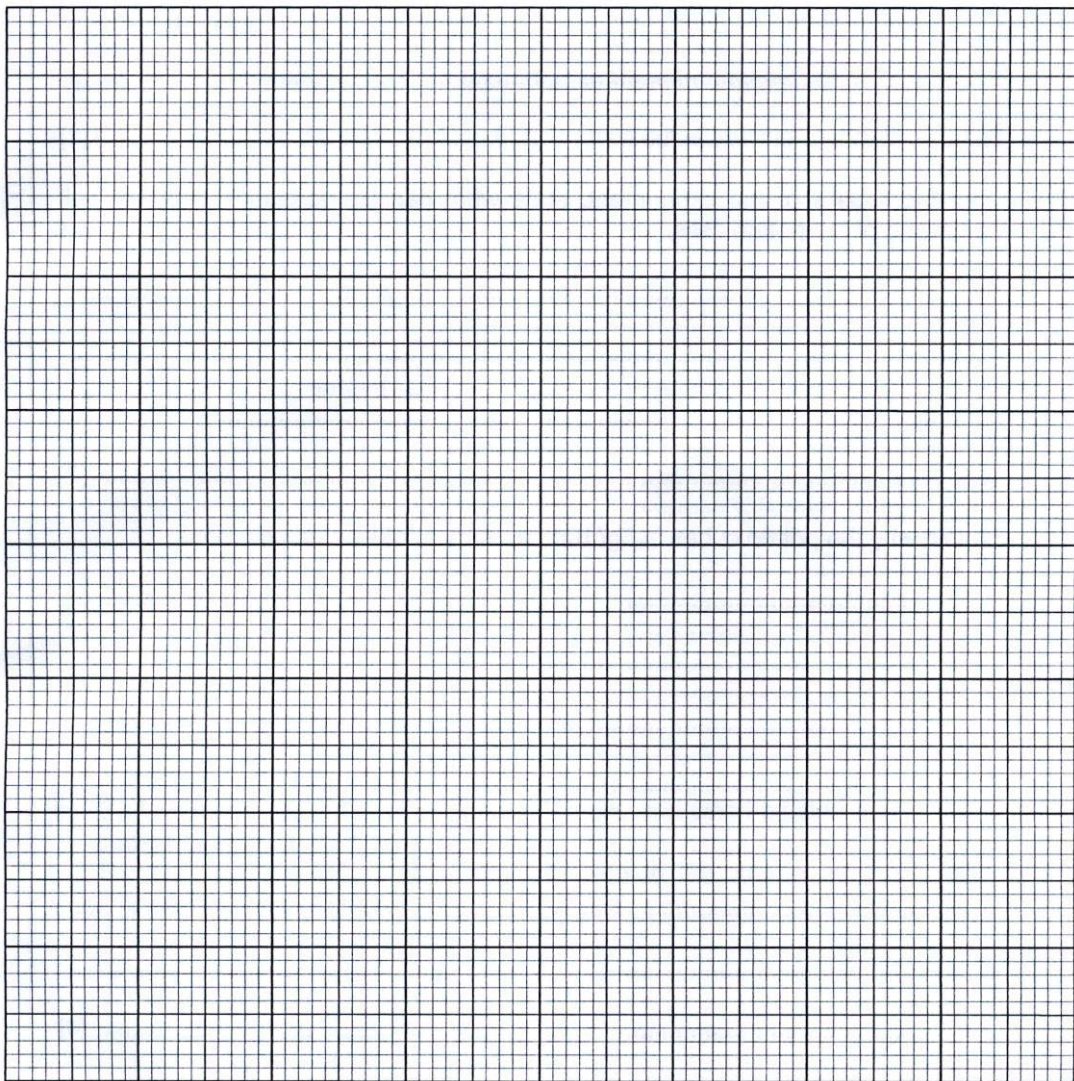
<b>For Examiner's Use</b>	
Question 9	10
Question 10	10
Question 11	10
Total	30

**Section B**Answer **three** questions.

- 9 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 below, draw a bar chart to show the number of each seed type produced by each pea plant.



[2]









