



**VICTORIA JUNIOR COLLEGE**  
**BIOLOGY DEPARTMENT**  
**JC2 PRELIMINARY EXAMINATIONS 2016**  
**Higher 1**

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CANDIDATE NAME

CLASS

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**BIOLOGY**

**8875/01**

Paper 1 Multiple Choice

**22 September 2016**

Additional Materials: Multiple Choice Optical Mark Sheet

**1 hour**

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**READ THESE INSTRUCTIONS FIRST**

Write in a soft pencil.

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

Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided.

There are **thirty** 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 Answer Sheet.

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

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

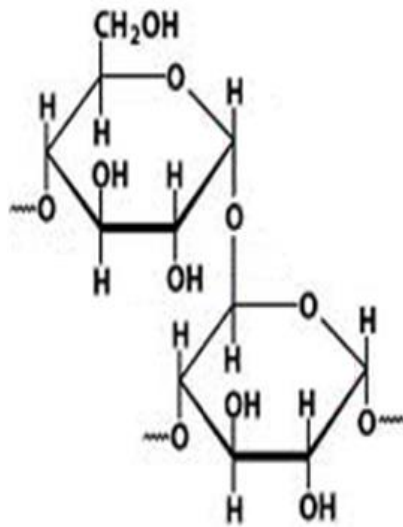
Any rough working should be done in this booklet

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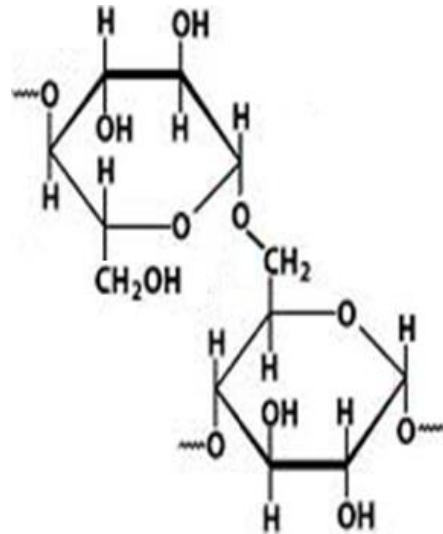
This paper consists of **18** printed pages including this cover page.

- 1 Which of the following correctly shows the  $\alpha$  1,6 glycosidic bond found in amylopectin?

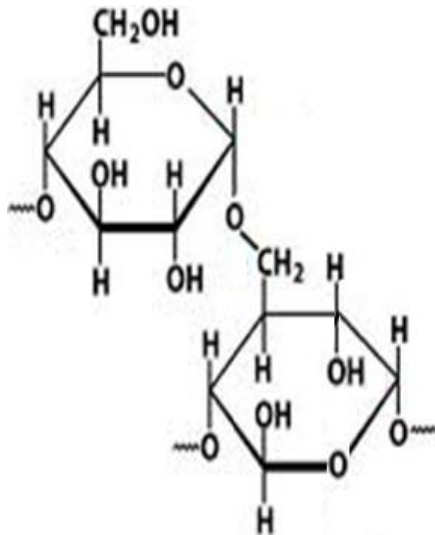
A



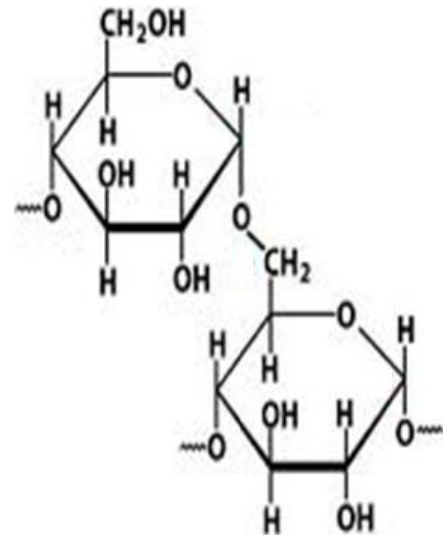
B



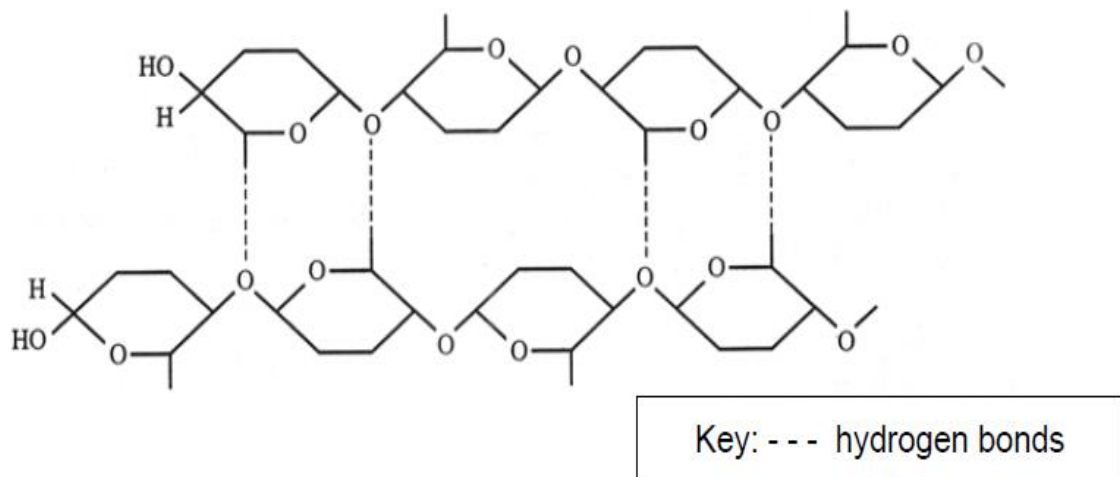
C



D



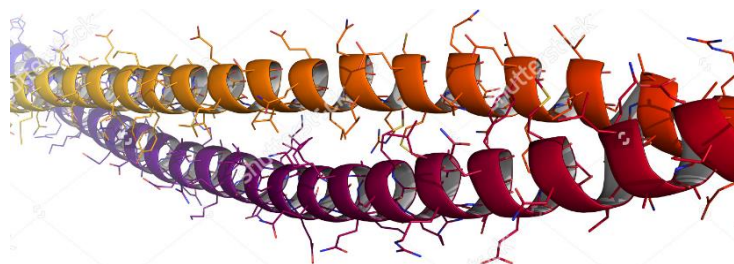
- 2 The figure below shows part of the molecular structure of a polysaccharide.



Which of the following statements are true?

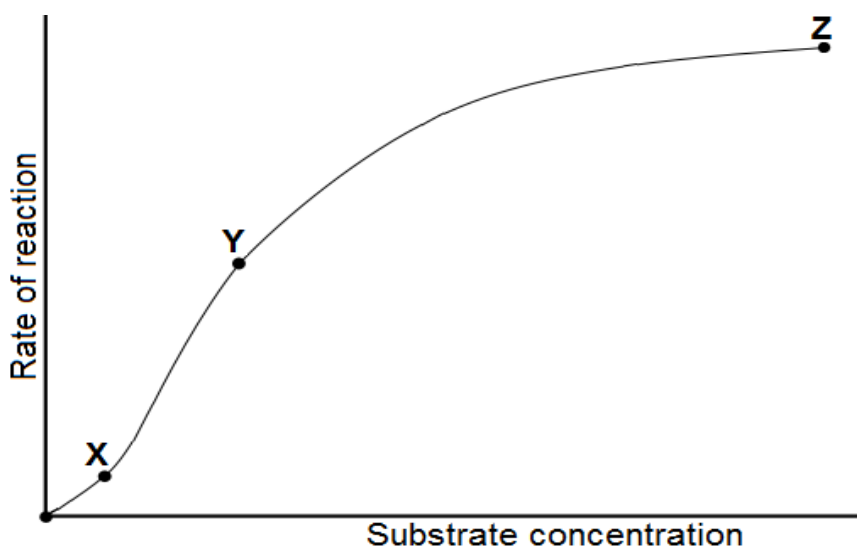
- (i) The hydrogen bonds maintain the double-helical structure of the molecule.
  - (ii) The subunits of each chain are  $\beta$ -glucose.
  - (iii) Water is needed in the formation of bonds between the subunits.
  - (iv) The chains formed by the subunits are unbranched.
- A** (i) and (ii)  
**B** (ii) and (iv)  
**C** (i), (iii) and (iv)  
**D** All of the above
- 3 Which of the following is not a function of lipids?
- A** Cushion against physical impacts  
**B** Framework of cell membrane  
**C** Provide mechanical strength  
**D** Insulation of body heat

- 4 The diagram below shows the structure of a protein found in the hair, claws and horns of many animals.



Which of the following is true about the protein?

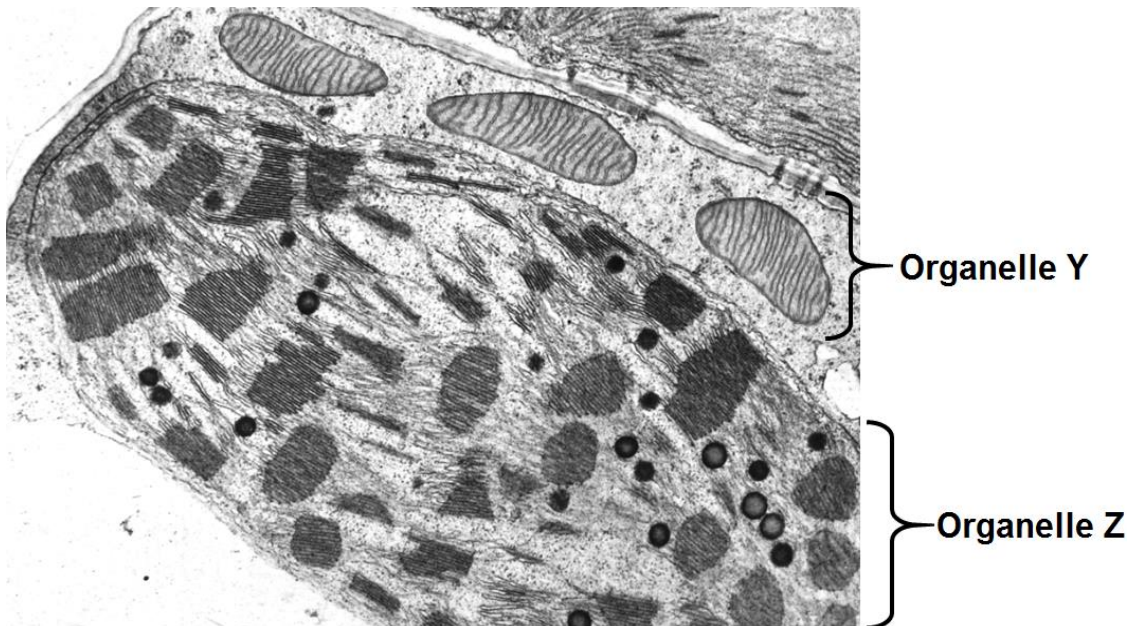
- A The polypeptides are arranged together in a staggered manner to increase stability.
  - B The protein is insoluble in water due to hydrophobic R groups present on the exterior.
  - C The secondary structure of the protein is maintained by hydrogen bonds between R groups.
  - D Every third amino acid in the polypeptide sequence is a proline.
- 5 The graph below shows the effect of increasing substrate concentrations on the activity of an allosteric enzyme under optimum conditions.



Which of the following statements is correct?

- A There is low kinetic energy at **X** to overcome the activation energy, thus resulting in a low rate of reaction.
- B Rate of reaction increases at a faster rate at **Y** as the allosteric activator outcompetes the allosteric inhibitor to bind to the allosteric site.
- C At **Z**, enzyme molecules are in the active state and active sites are saturated.
- D Substrate concentration is the limiting factor at **X** and **Y** but temperature is the limiting factor at **Z**.

- 6 The electron micrograph below shows organelle **Y** and **Z** in a leaf mesophyll cell of a plant.

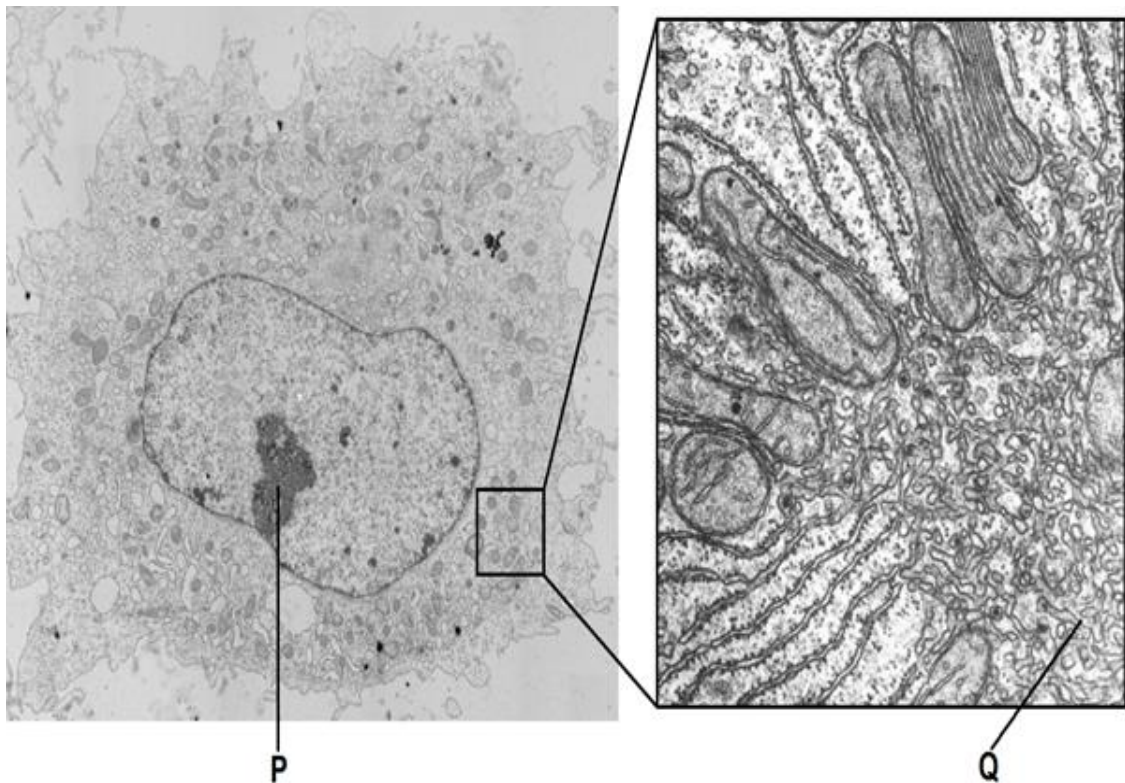


Which of the following statements are not true about organelles **Y** and **Z**?

- (i) Organelle **Z** utilises transporters to export ATP to organelle **Y** to drive cellular activities.
- (ii) Oxygen released by organelle **Z** is used in organelle **Y** during glycolysis.
- (iii) Transcription and translation occurs in both organelles.
- (iv) Organelle **Y** has electron transport chain proteins but organelle **Z** does not.

- A** (i) and (ii)
- B** (iii) and (iv)
- C** (i), (ii) and (iv)
- D** All of the above

- 7 The diagram on the left below shows the electro-micrograph of a cell found in a healthy individual. A region of the cell, indicated by the box, is magnified and shown in the diagram on the right.



Which of the following shows the correct identities and functions of **P** and **Q**?

	Identity of P	Function of P	Identity of Q	Function of Q
<b>A</b>	Nucleosome	Transcription of rRNA	Smooth ER	Detoxification
<b>B</b>	Nucleosome	Assembly of ribosomes	Secretory vesicles	Storage of $\text{Ca}^{2+}$
<b>C</b>	Nucleolus	Assembly of ribosomes	Smooth ER	Synthesis of lipids
<b>D</b>	Nucleolus	Transcription of rRNA	Secretory vesicles	Modification of protein

8 Which of following statements regarding the fluid mosaic model are correct?

- (i) The membrane is fluid due to the hydrophilic and hydrophobic interactions between components of the membrane.
- (ii) Cholesterol maintains membrane fluidity by preventing the two layers of phospholipids from moving too far away from each other.
- (iii) Attachment of different carbohydrates to the components of the membrane gives the look of a mosaic.
- (iv) The fluidity of membrane allows for the bulk transport of large molecules into and out of the cell.
- (v) Cholesterol increases membrane fluidity by binding to the phospholipid tails which causes the tails to bend.

- A (i) and (iv)
- B (ii) and (iii)
- C (i), (iv) and (v)
- D (iii) and (v)

9 An experiment was conducted to determine the mode of entry of a drug into animal cells. Cells which did not contain the drug were placed into separate containers with different concentrations of the drug. The concentrations of the drug inside the cells at the end of 10 minutes were obtained. The experiment was conducted in 2 different temperatures. The results are shown below.

Experiment conducted in 20°C	
Concentration of drug in the container / $\text{mol dm}^{-3}$	Concentration of drug inside the cells after 10 minutes / $\text{mol dm}^{-3}$
0	0
10	4
20	7
30	11
40	13
50	13

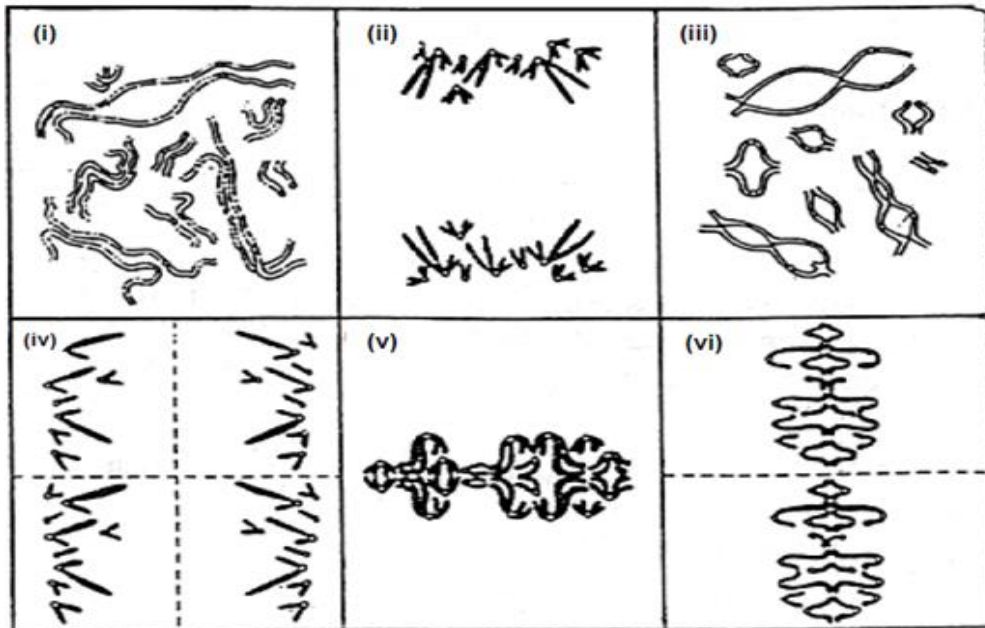
Experiment conducted in 30°C	
Concentration of drug in the container / $\text{mol dm}^{-3}$	Concentration of drug inside the cells after 10 minutes / $\text{mol dm}^{-3}$
0	0
10	5
20	9
30	14
40	20
50	20

Which of the following statements is incorrect?

- A The drug molecule is hydrophilic and water-soluble.
- B A drastic change in extracellular pH will decrease rate of drug entry.
- C No ATP is required for the entry of the drug.
- D Increasing membrane fluidity results in faster drug entry.

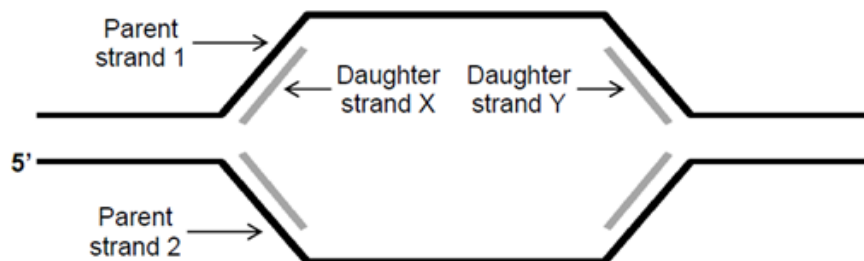


- 10 The figure below shows 6 stages of meiosis occurring in a plant cell. ( $2n = 18$ ).



What is the correct order of these 6 stages?

- A (iii)  $\rightarrow$  (v)  $\rightarrow$  (ii)  $\rightarrow$  (vi)  $\rightarrow$  (iv)  $\rightarrow$  (i)  
 B (iii)  $\rightarrow$  (i)  $\rightarrow$  (v)  $\rightarrow$  (ii)  $\rightarrow$  (vi)  $\rightarrow$  (iv)  
 C (ii)  $\rightarrow$  (iii)  $\rightarrow$  (i)  $\rightarrow$  (v)  $\rightarrow$  (vi)  $\rightarrow$  (iv)  
 D (i)  $\rightarrow$  (iii)  $\rightarrow$  (v)  $\rightarrow$  (ii)  $\rightarrow$  (vi)  $\rightarrow$  (iv)
- 11 A simplified replication bubble is shown in the figure below. Parental strands 1 and 2 and the growing daughter strands X and Y are indicated.



Which of the following statements about the syntheses of daughter strands X and Y is correct?

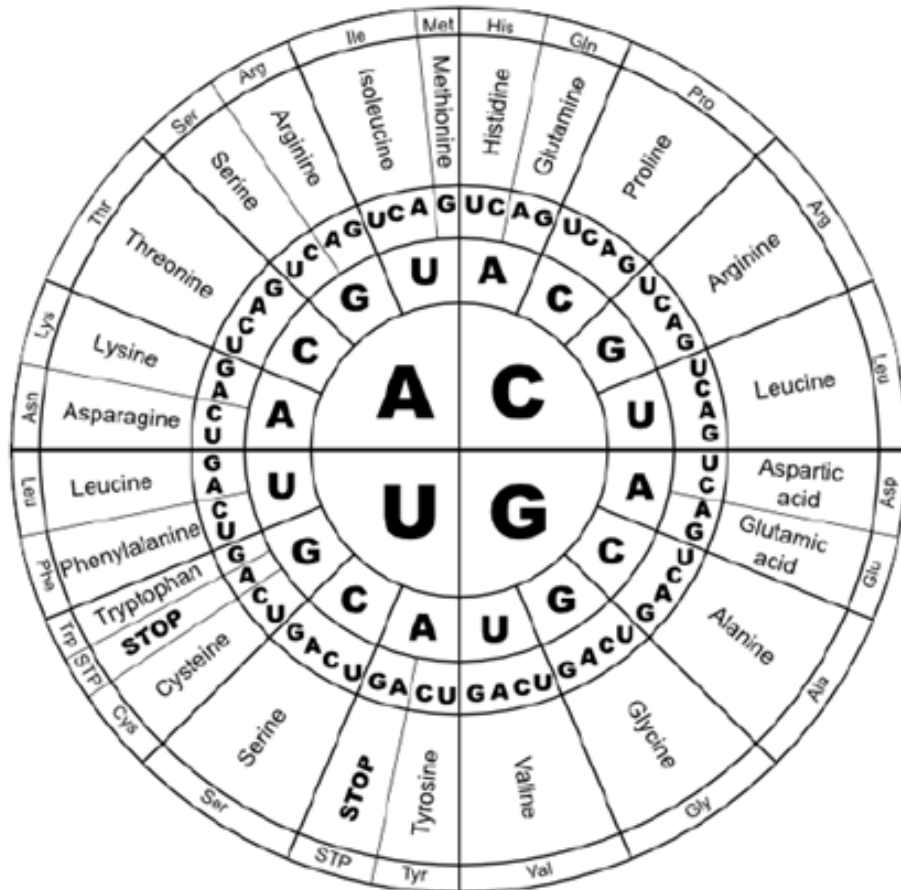
- A Both daughter strands X and Y are synthesised away from their respective replication forks.  
 B Daughter strand X is synthesised continuously while daughter strand Y is synthesised in the form of Okazaki fragments.  
 C Daughter strand X is synthesised in the  $5' \rightarrow 3'$  direction while daughter strand Y is synthesised in the  $3' \rightarrow 5'$  direction.  
 D DNA ligase will eventually catalyse the fusion of daughter strand X with daughter strand Y.



- 12 The first five DNA triplets that code for a particular protein is shown below:

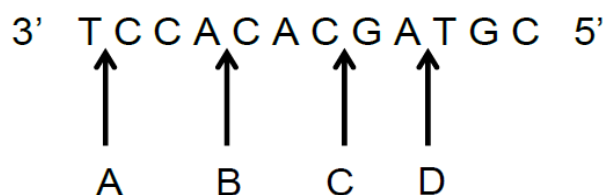
**3' TAC GGA AGC CCA GAA 5'**

The genetic information in the sequence above is eventually converted into a specific amino acid sequence according to the figure below.

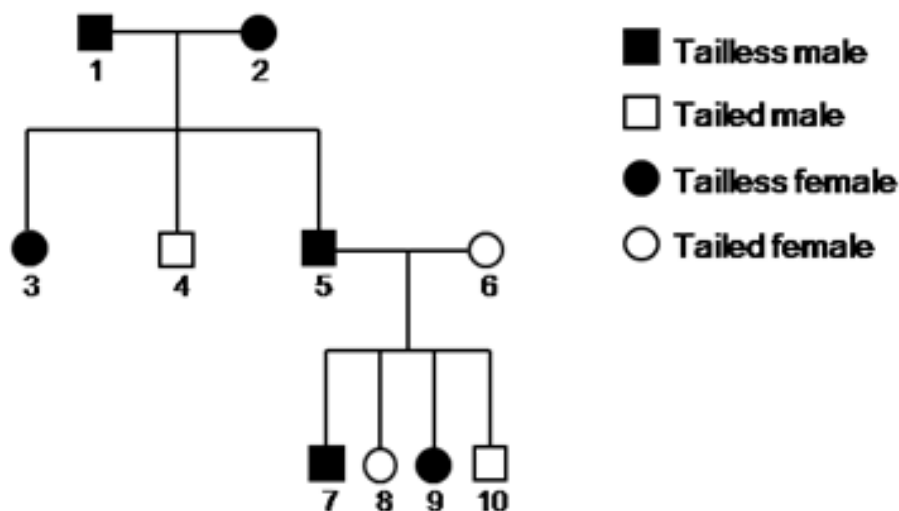


With the aid of figure, what is the sequence of the protein encoded by the DNA sequence above?

- A** Tyr – Gly – Ser – Pro – Glu
  - B** Met – Pro – Ser – Gly – Leu
  - C** Lys – Thr – Arg – Arg – His
  - D** Phe – Try – Ala – Ser – Val
- 13 The diagram below shows a DNA template strand coding for four amino acids. Where would an insertion mutation, introducing a thymine nucleotide, result in the termination of translation?



- 14 The Manx gene determines the presence or absence of tails in cats. Cats that do not possess the dominant allele develop tails. The pedigree below shows the absence or presence of tails in three generations of cats.



If Cat 3 is mated with a tailed male cat, what is the probability that their offspring will be a tailless female?

- A  $1/4$   
 B  $1/3$   
 C  $1/2$   
 D  $2/3$
- 15 Fur colour in hamsters is controlled by a gene with 3 alleles. The phenotypes are black, brown and white fur. 4 crosses were repeated many times. The crosses and the outcomes of these crosses are shown in the table below.

Cross	Parents	Offspring phenotype and ratio
1	black x black	3 black : 1 white
2	brown x white	1 brown : 1 white
3	black x black	3 black : 1 brown
4	white x white	all white

From the data, it is possible to conclude that

- A brown fur is recessive to white fur.  
 B all of the white fur offspring are heterozygous.  
 C two thirds of the black fur offspring in cross 3 are heterozygous.  
 D the black fur parents in cross 1 have the same genotype as the black fur parents in cross 3.

- 16** A male guinea pig with black fur and rough coat was crossed with a female with white fur and smooth coat. The F1 all had black fur and rough coat. The F1 were then interbred to give the F2 generation.

What is the proportion of pure-breeding individuals in the F2 generation?

- A** 1/16  
**B** 1/8  
**C** 1/4  
**D** 1/2
- 17** In an experiment, fruit flies homozygous for long wings were crossed with fruit flies homozygous for vestigial wings. The F1 and F2 generations were raised in three different temperatures.

At each temperature, the F1 generation all had long wings.

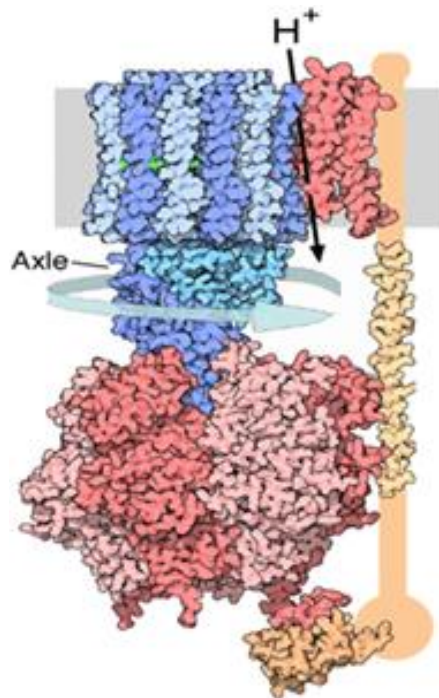
The table below shows the results in the F2 generation.

Temperature	Result
21°C	$\frac{3}{4}$ long wings, $\frac{1}{4}$ vestigial wings
26°C	$\frac{3}{4}$ long wings, $\frac{1}{4}$ intermediate wing length
31°C	all long wings

Which statement explains these results?

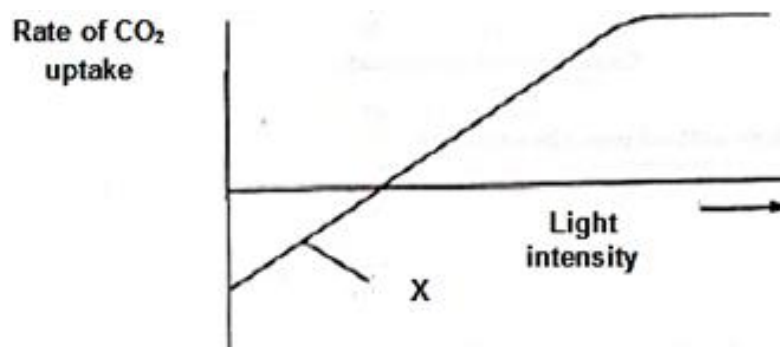
- A** Wing length is under polygenic control.  
**B** Long wing and vestigial wing illustrate codominance at 26°C.  
**C** Heterozygous flies have vestigial wings only at 21°C or below but have long wings at 31°C or above.  
**D** Vestigial wing allele is recessive but causes a vestigial wing phenotype only at lower temperatures.

- 18 The diagram below shows the structure of a transmembrane protein involved in photophosphorylation.



Which of the following statements is true?

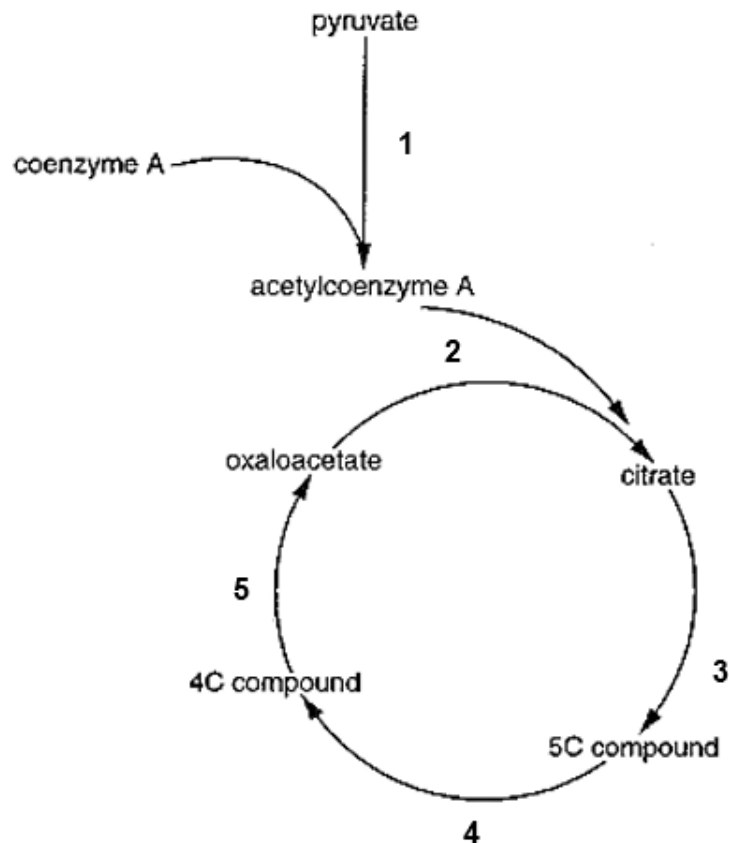
- A It utilises the energy of ATP to do work.
  - B Its activation results directly in the production of water.
  - C It carries out an oxidation reaction.
  - D It transports ions through it via facilitated diffusion.
- 19 In the graph below, the rate of CO<sub>2</sub> uptake by green algae cells is shown to vary with increasing light intensity.



Which of the following is true at point X?

- A The algae cells are photosynthesising.
- B Rate of carbon fixation by the Calvin cycle equals rate of respiration.
- C CO<sub>2</sub> concentration is a limiting factor.
- D There is not enough light for photosynthesis to have commenced.

20 The diagram below shows steps involved in a cellular process.



At which numbered stages does decarboxylation take place?

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

21 Six tubes were set up as shown in the table.

Tube	Contents
1	Glucose + Homogenised animal cells
2	Glucose + Mitochondria suspension
3	Glucose + Cytoplasm without organelles
4	Pyruvate + Homogenised animal cells
5	Pyruvate + Mitochondria suspension
6	Pyruvate + Cytoplasm without organelles

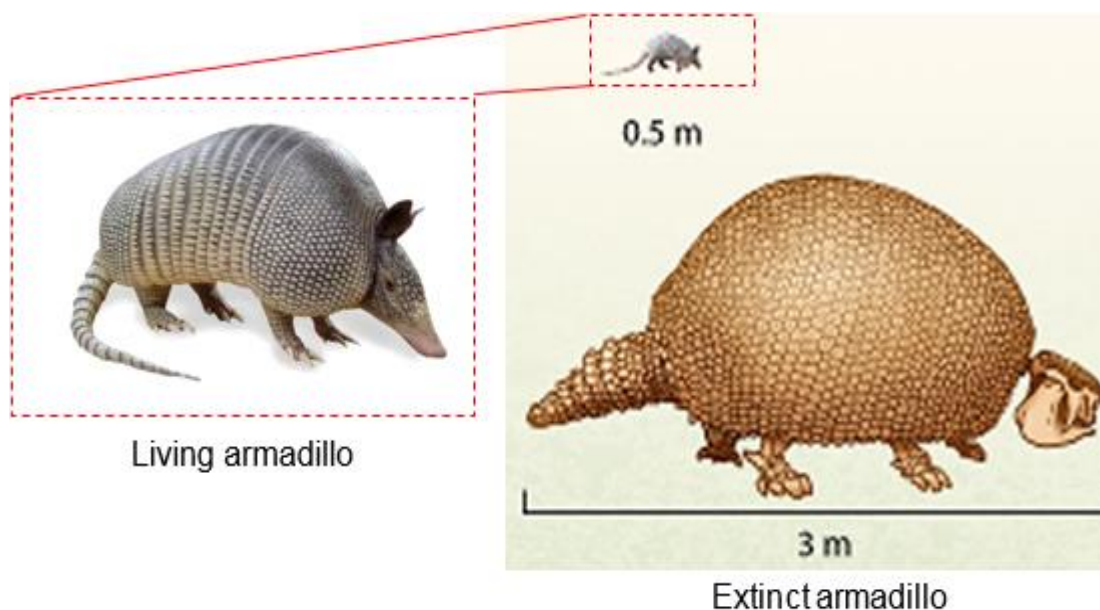
After incubation, each tube was analysed to determine the presence of carbon dioxide and lactate. In which tube do you expect lactate to be present?

- A** 1, 3 and 5
- B** 2, 5 and 6
- C** 1, 2, 4 and 5
- D** 1, 3, 4 and 6

22 In which situation would evolution be slowest for an interbreeding population?

	Migration	Selection Pressure	Variation due to mutation
A	high	high	low
B	high	low	high
C	absent	high	high
D	absent	low	low

23 Armadillos are medium-sized mammals with tough bony covering that protects the body. When harassed, armadillos will coil under their shield to minimise the amount of exposed flesh. They are insectivores, feeding on the adult and larval forms of ants and termites. Once they have detected their prey, armadillos use their claws to dig rapidly to tear into the ant and termite mounds and their sticky tongues to effectively lick up the scurrying insects. Fossils of a recently extinct species of giant armadillo were found to be similar to another smaller species of armadillo presently inhabiting the same area where the fossils were discovered.



Which of the following statement explains the evolution of armadillo?

- A Some environmental conditions remains similar whereas other conditions changed between the past and the present.
- B The similar characteristics between the two species are due to divergent evolution.
- C Mutations occurred in the gene controlling growth rate due to a selective pressure favouring a smaller size.
- D The ancestor armadillo switched their diet to insects due to the relative abundance of ants and termites in the area.

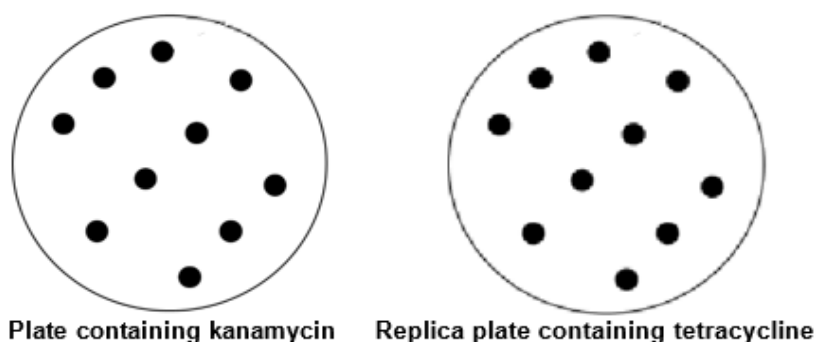


**24** Which of the following statements support Darwin's theory of evolution?

- (i) Insects with major structural differences may have very similar larvae.
- (ii) Both the frog and duck evolved webbing in their feet for swimming.
- (iii) Both the potato (modified stem) and radish (modified root) perform storage function in plants.
- (iv) All bears have 5 fingers in their paws but the finger lengths differ between species.

- A** (i) and (iv)
- B** (ii) and (iv)
- C** (i) and (iii)
- D** (ii) and (iii)

**25** A plasmid contains 3 genetic markers – ampicillin resistance gene, kanamycin resistance gene and tetracycline resistance gene. A gene of interest is inserted into one of the genetic markers. *E. coli* were then transformed and plated onto a nutrient plate with kanamycin. Replica plating was then carried out on another nutrient plate with tetracycline. The growth of bacteria on the 2 nutrient agar plates is shown below.

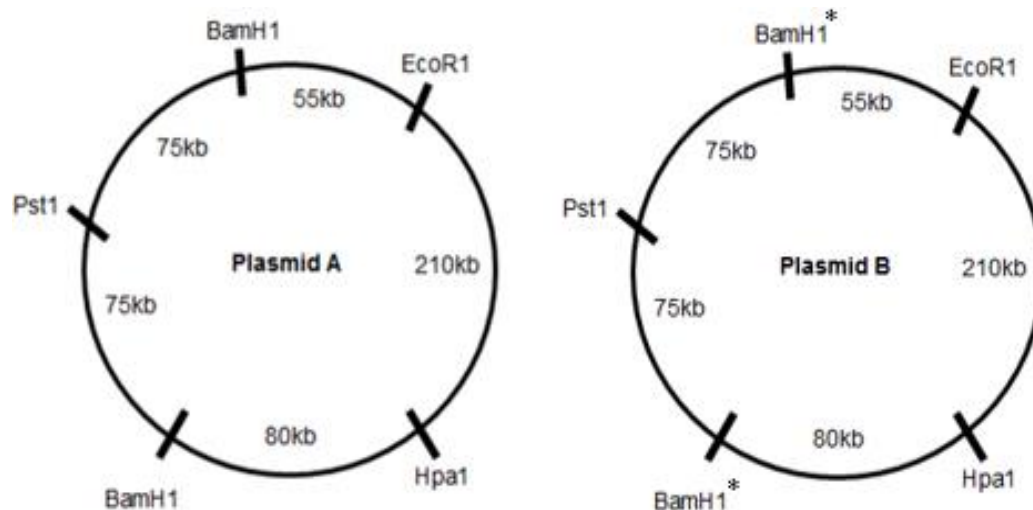


Deduce the genetic marker into which the gene was inserted, and the type of bacterial colonies on each plate.

	Genetic marker	Plate with kanamycin	Replica plate with tetracycline
<b>A</b>	Ampicillin resistance gene	Transformed cells with reannealed and recombinant plasmids	Transformed cells with reannealed plasmids
<b>B</b>	Ampicillin resistance gene	Transformed cells with reannealed and recombinant plasmids	Transformed cells with reannealed and recombinant plasmids
<b>C</b>	Kanamycin resistance gene	Transformed cells with reannealed and recombinant plasmids	Transformed cells with reannealed and recombinant plasmids
<b>D</b>	Kanamycin resistance gene	Transformed cells with reannealed plasmids	Transformed cells with reannealed and recombinant plasmids

- 26 The figure below shows 2 plasmids (A and B) and the respective restriction sites of various restriction enzymes.

In plasmid B, mutations were introduced and the restriction sites affected by the mutations are denoted by \*. The lengths of the plasmid DNA between restriction sites are also indicated.



A scientist carried out experiments by adding different restriction enzymes to the 2 plasmids in different tubes. Each tube was then left to incubate at 37°C for 60 minutes (sufficient time for complete digestion). The results of the experiments are shown in the table below.

Tube number	Components	Fragment sizes / kb
1	Plasmid A + 2 restriction enzymes	80, 150, 265
2	Plasmid B + 2 restriction enzymes	155, 340

Identify the enzymes that were added to tubes 1 and 2.

	Tube number	Restriction enzymes
<b>A</b>	1	HpaI , EcoRI
	2	EcoRI , HpaI
<b>B</b>	1	BamHI , PstI
	2	PstI , EcoRI
<b>C</b>	1	BamHI , HpaI
	2	HpaI , PstI
<b>D</b>	1	BamHI , EcoRI
	2	HpaI , BamHI

- 27** A scientist wished to amplify the following DNA sequence for his research.

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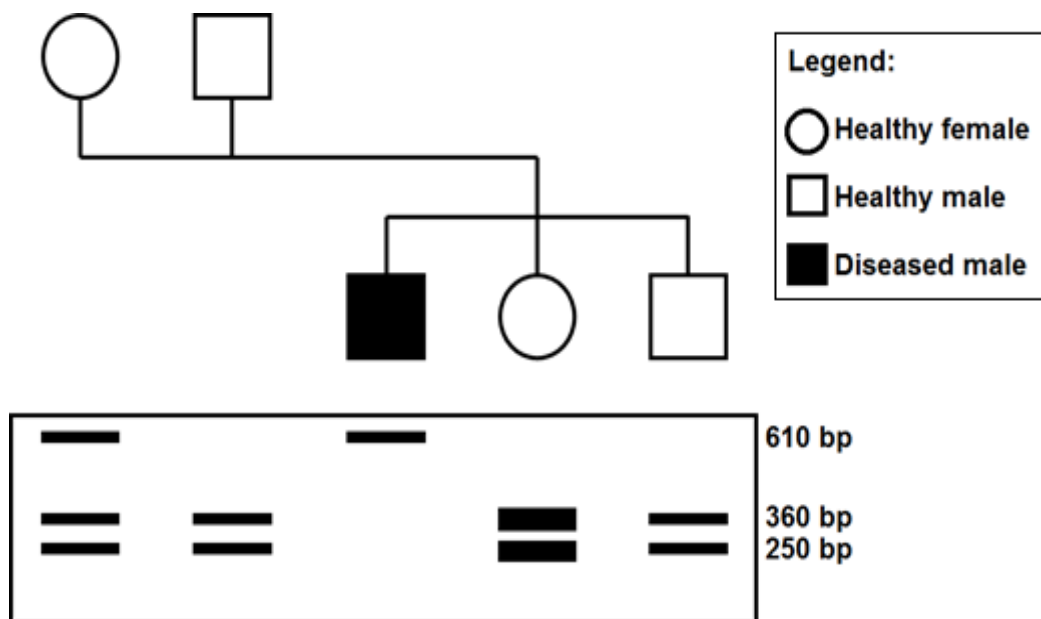
5'  A  T  T  C  G  A  C  G  .....  T  A  G  C  T  G  G  T  3'
3'  T  A  A  G  C  T  G  C  .....  A  T  C  G  A  C  C  A  5'

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Which of the following primers should the scientist use?

- A** 5' TAAGCTGC 3' and 5' TGGTCGAT 3'  
**B** 5' CGTCGAAT 3' and 5' TAGCTGGT 3'  
**C** 5' ATTCGACG 3' and 5' ACCAGCTA 3'  
**D** 5' ATTCGACG 3' and 5' ATCGACCA 3'
- 28** To investigate the inheritance of a particular genetic disease, a group of medical biologists gathered DNA samples from a family in which the son was diagnosed with the disease. The disease gene was isolated from the family members and cut with the same restriction enzyme. The products of the restriction digest were then subjected to gel electrophoresis and Southern blotting.

The diagram below shows the pedigree of the family and the results obtained.



Which of the following can be concluded from the results?

- A** The disease gene has 3 alleles, each represented by a DNA band.  
**B** The disease allele is a recessive allele found on the X chromosome.  
**C** The disease allele contains an additional restriction site compared to the healthy allele.  
**D** The parents were both heterozygous for the disease gene.

- 29** Which of the following correctly describes the role of stem cells in adult tissues and organs?
- A** Stem cells are undifferentiated cells found amongst differentiated cells and they take over the function of the tissue when the overlying cells become damaged or worn out.
  - B** Stem cells are embryonic cells that persist in the adult, and can give rise to all of the cell types in the body.
  - C** Stem cells are partially differentiated cells that have yet to express the genes and proteins characteristic of their differentiated state, and do so when needed for repair of tissues and organs.
  - D** Stem cells are undifferentiated cells that can divide asymmetrically, giving rise to one daughter cell that remains a stem cell and one daughter cell that will differentiate to replace damaged and worn out cells in the adult tissue or organ.
- 30** Some crop plants have been genetically modified to be resistant to herbicide. Which feature is least likely to be affected by this development?
- A** Amount of herbicide sprayed
  - B** Fertilisers applied to the field
  - C** Population of pests in the crop field
  - D** Yield of crop plants

**2016 Prelim H1 Biology Paper 1 Answers**

<b>1</b>	D	<b>11</b>	D	<b>21</b>	D
<b>2</b>	B	<b>12</b>	B	<b>22</b>	D
<b>3</b>	C	<b>13</b>	B	<b>23</b>	A
<b>4</b>	B	<b>14</b>	B	<b>24</b>	A
<b>5</b>	C	<b>15</b>	C	<b>25</b>	B
<b>6</b>	C	<b>16</b>	C	<b>26</b>	C
<b>7</b>	C	<b>17</b>	D	<b>27</b>	C
<b>8</b>	A	<b>18</b>	D	<b>28</b>	B
<b>9</b>	D	<b>19</b>	A	<b>29</b>	D
<b>10</b>	D	<b>20</b>	B	<b>30</b>	C