

Name:		Index Number:		Class:	
--------------	--	----------------------	--	---------------	--



DUNMAN HIGH SCHOOL
Preliminary Examination
Year 6

H1 BIOLOGY

8876/01

Paper 1 Multiple Choice Questions

25 September 2018

1 hour

Additional Material: OTAS sheet

INSTRUCTIONS TO CANDIDATES:

DO NOT TURN THIS PAGE OVER UNTIL YOU ARE TOLD TO DO SO.

READ THESE NOTES CAREFULLY.

There are **thirty** questions in 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.

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.

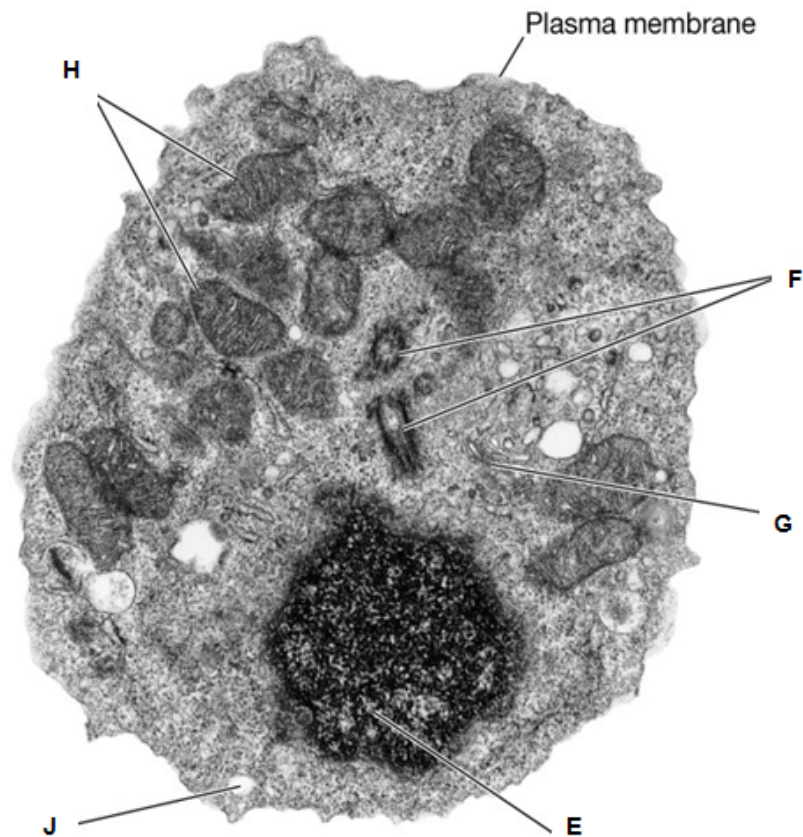
This document consists of **25** printed pages and 1 blank page.

[Turn over

Multiple Choice Questions (30 marks)

Answer **all** questions in this section.

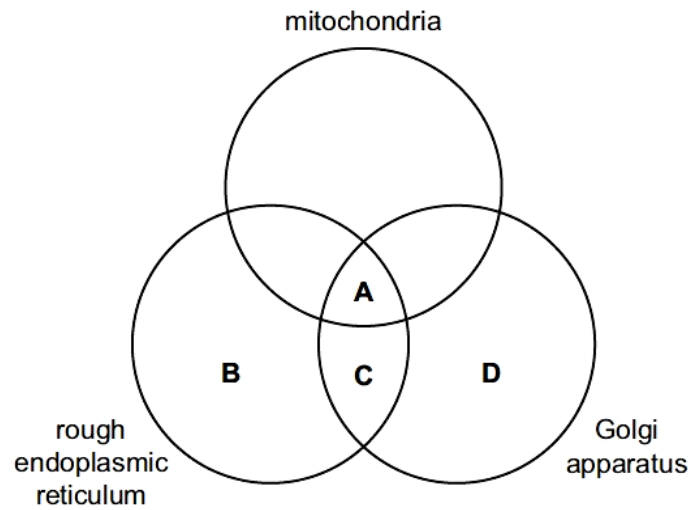
- 1 An electron micrograph of a cell is shown below.



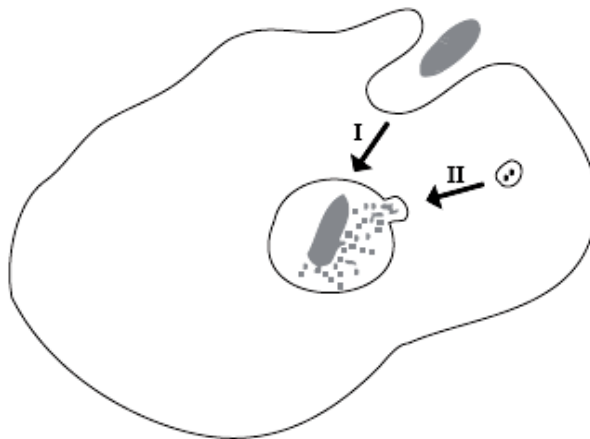
Match the organelles **E, F, G, H** and **J** associated with the cellular processes listed.

	E	F	G	H	J
A	DNA replication	Digestion of material	Organizes the spindle	Oxidative phosphorylation	Packaging of secretory products
B	Oxidative phosphorylation	Organizes the spindle	Digestion of material	DNA replication	Packaging of secretory products
C	Organizes the spindle	Digestion of material	Oxidative phosphorylation	Packaging of secretory products	DNA replication
D	DNA replication	Organizes the spindle	Packaging of secretory products	Oxidative phosphorylation	Digestion of material

- 2 Which organelle(s) is / are required for the formation of the hydrolytic enzymes found in lysosomes?

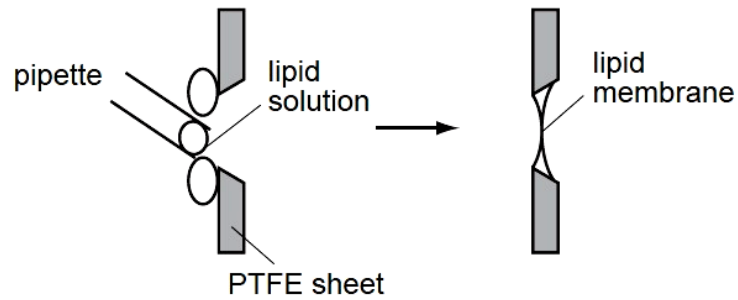


- 3 Which processes are represented by the labels in the diagram below?



	I	II
A	A phagocyte ingesting a microbe by exocytosis	Digestion of the microbe with the help of the Golgi apparatus
B	A phagocyte ingesting a microbe by endocytosis	Digestion of the microbe with the help of the lysosome
C	A phagocyte ingesting a microbe by exocytosis	Digestion of the microbe with the help of the lysosome
D	A phagocyte ingesting a microbe by endocytosis	Digestion of the microbe with the help of the Golgi apparatus

- 4 Lipid membranes can be formed in the laboratory by painting phospholipids over a support (PTFE sheet) with a hole in it.



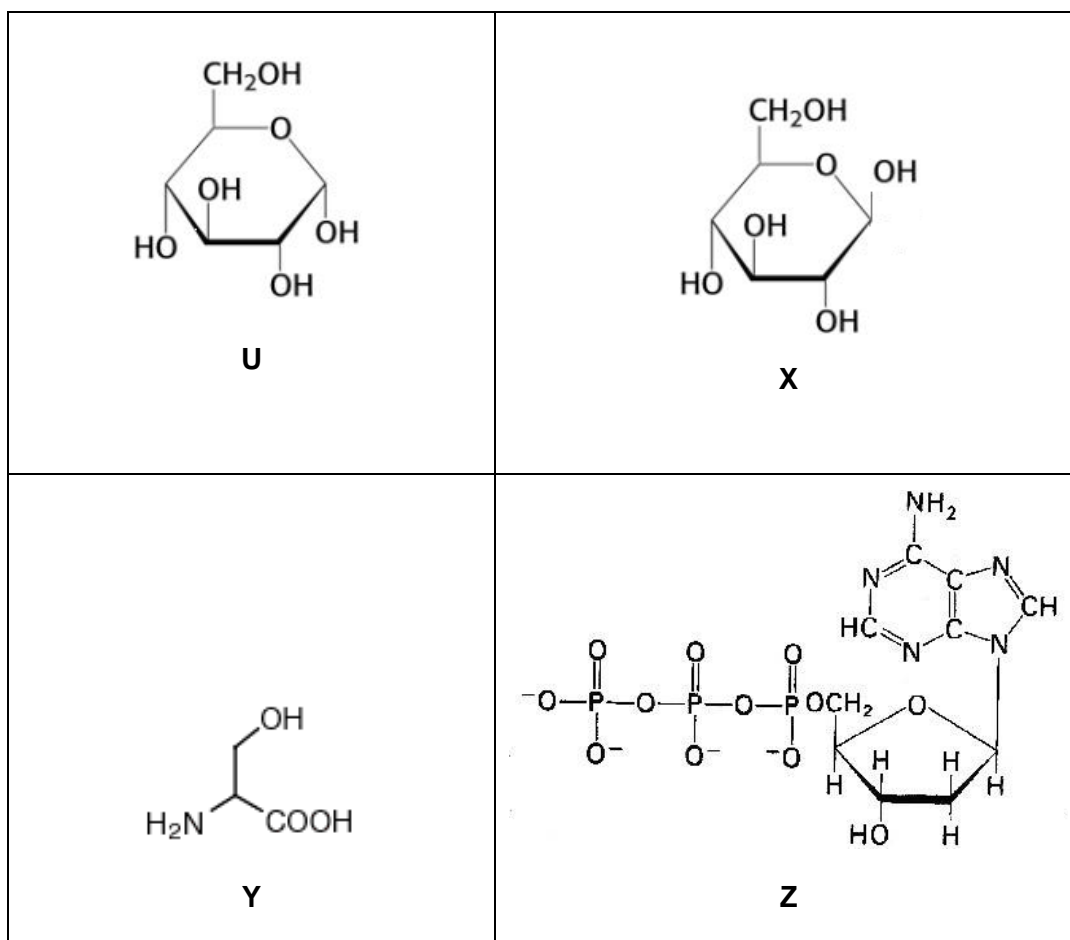
Such a lipid membrane is impermeable to water-soluble materials including charged ions such as Na^+ or K^+ . In one experiment with Na^+ ions, no current flowed across the membrane until a substance called gramicidin was added.

Which statement is consistent with this information and your knowledge of membrane structure?

Gramicidin becomes incorporated into the membrane and is _____.

- A a carbohydrate molecule found only on the outside of the membrane.
- B a non-polar lipid which passes all the way through the membrane.
- C a protein molecule with both hydrophilic and hydrophobic regions.
- D a protein molecule which has only hydrophobic regions.

5 The diagram below shows the structure of 4 monomers.



Which of the following combination of polymer, monomer and bond formed between monomers is **CORRECT**?

	<i>starch</i>	<i>cellulose</i>	<i>polypeptide</i>	<i>polynucleotide</i>
A	X , β -1,4 glycosidic bond	U , α -1,4 glycosidic bond	Z , ester linkage	Y , disulphide linkage
B	U , α -1,4 glycosidic bond	X , β -1,4 glycosidic bond	Y , peptide bond	Z , phosphoester linkage
C	Z , peptide bond	X , hydrogen bond	Y , ionic bond	U , hydrogen bond
D	X , ionic bonds	Y , peptide bond	U , hydrogen bond	Z , α -1,6 glycosidic bond

6 Which of the following is / are **TRUE** of triglycerides and phospholipids?

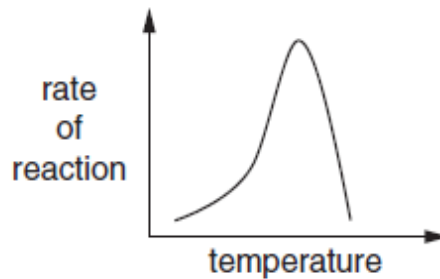
- 1 Both contain glycerol.
- 2 Both are not amphipathic.
- 3 Triglycerides have a higher carbon content than phospholipids for storage purposes.
- 4 Phospholipids have hydrophilic regions to interact with cell cytoplasm unlike triglycerides.
- 5 Triglycerides are formed from glycerol and fatty acids but phospholipids are formed from glycerol and phosphoric acid only.

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

7 Which set of statements correctly describes haemoglobin?

A	Four polypeptide chains, each containing a prosthetic group	Iron ions can associate with oxygen forming oxyhaemoglobin	In each chain, hydrophobic R groups of amino acids point towards the centre of the molecule	At 50% saturation, two oxygen molecules are transported by the molecule
B	Polypeptide chains interact to produce a globular chain	Each chain contains a prosthetic group of amino acids surrounding an iron ion	Two identical alpha chains and two identical beta chains	Each chain can transport an oxygen molecule
C	Polypeptide chains interact to produce an almost spherical molecule	An iron ion is present within each haem group	Quaternary structure of two alpha chains and two beta chains	Each molecule can transport a total of four oxygen atoms
D	Polypeptide chains produce a loose helical shape, which curls to form a spherical molecule	Iron ions in the molecule can bind reversibly with oxygen	In each chain, hydrophobic R groups of amino acids surround the iron ion	Each molecule can transport a total of eight oxygen atoms

- 8 The graph below shows how the rate of an enzyme reaction varies with temperature.



Which **TWO** statements, taken together, explain why the graph has this shape?

- I Enzymes speed up reactions.
- II Increasing temperature increases the effective collisions between enzyme and substrate.
- III The optimum temperature is the only temperature at which the enzyme works.
- IV At high temperatures the enzyme is denatured.
- V At high temperatures the rate of reaction falls sharply.

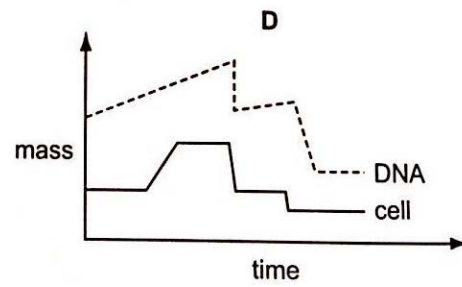
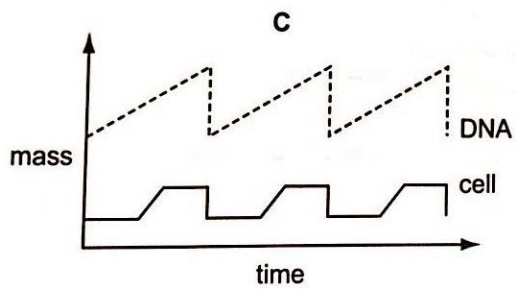
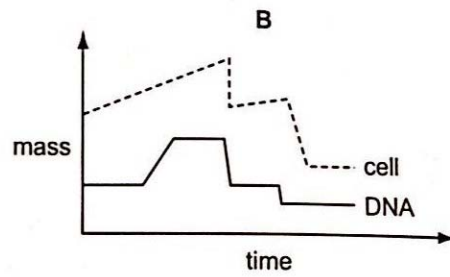
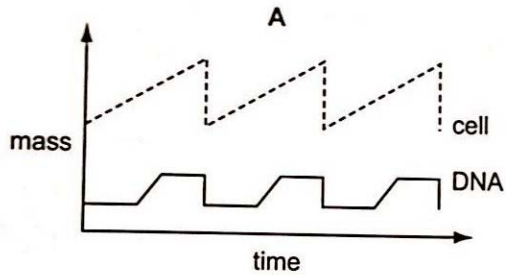
- A I and IV
- B III and IV
- C II and IV
- D II and V

- 9 What are the conditions in a human cell just before the cell enters prophase?

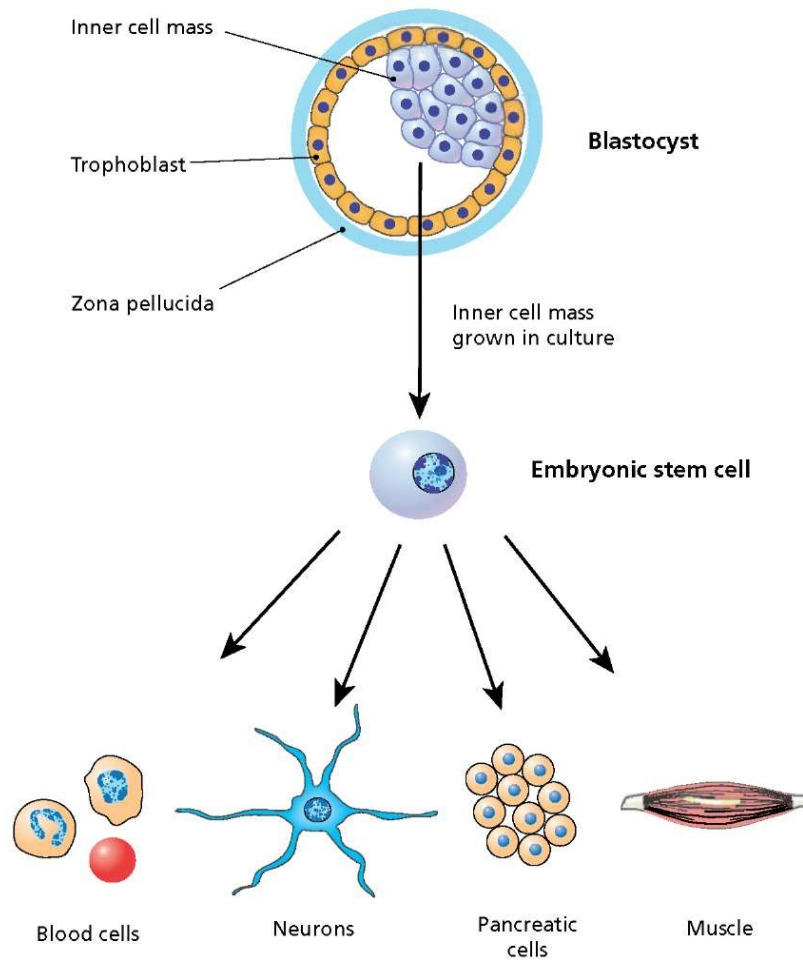
	number of chromatids	number of molecules of DNA in nucleus	spindle present	nuclear envelope present
A	46	46	yes	no
B	92	46	no	no
C	46	92	yes	yes
D	92	92	no	yes

10 Cell division is the means of almost all growth and reproduction.

Which graph correctly represents a form of cell division that maintains genetic stability at expense of variation?

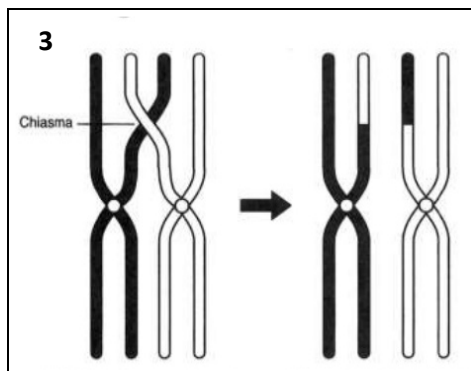
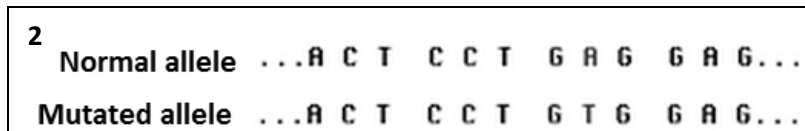
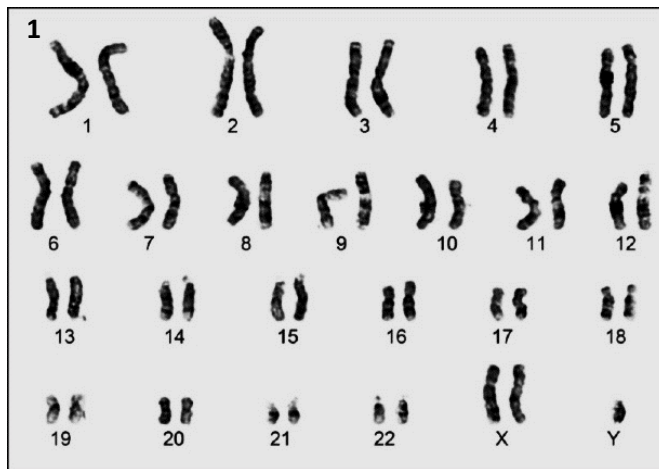


- 11 Which of the following features of the embryonic stem cells and specialized cells shown in the diagram are **TRUE**?



	Embryonic stem cells	Specialized cells
A	Embryonic stem cells display greater plasticity when grown in culture than when in blastocyst.	The blood cells are genetically different from the embryonic stem cells but have shorter telomeres.
B	Embryonic stem cells are totipotent and are capable of differentiating into many different cell types.	The pancreatic cells are genetically identical to the embryonic stem cells but with a different set of genes expressed.
C	Embryonic stem cells are multipotent and are capable of differentiating into limited range of cell types.	The blood cells are genetically different from the embryonic stem cells because different genes are expressed.
D	Embryonic stem cells are pluripotent and are capable of differentiating into many different cells types.	The pancreatic cells are genetically identical to the embryonic stem cells but have shorter telomeres.

12 Which of the following diagrams, 1 – 3, shows gene mutation?



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

- 13 Two genes involved in coat colour of goats are at loci on different chromosomes.

The colour gene C causes the hairs to have uniform colour and has three alleles.

- C^{DB} giving dark brown hairs
- C^B giving black hairs
- C^{MB} giving medium brown hairs

A dominant allele of the agouti gene (A^G) causes the development of white hairs between the coloured hairs giving the coat a shaded appearance.

The table shows the results of crosses between a male goat and two female goats.

parents	offspring
black agouti male x uniformly dark brown female	50% uniform, 50% agouti; 50% dark brown, 50% black
black agouti male x medium brown agouti female	all agouti; 50% black, 50% medium brown

Which row shows the possible genotypes of the male and female goats?

	black agouti male	uniformly dark brown female	medium brown agouti female
A	$C^B C^{MB} A^G A^G$	$C^B C^{DB} A^G A^g$	$C^{MB} C^{MB} A^G A^G$
B	$C^B C^{MB} A^G A^g$	$C^B C^{DB} A^g A^g$	$C^B C^{MB} A^G A^G$
C	$C^B C^{DB} A^G A^G$	$C^{DB} C^{MB} A^G A^g$	$C^B C^{DB} A^G A^g$
D	$C^B C^{MB} A^G A^g$	$C^B C^{DB} A^g A^g$	$C^{MB} C^{MB} A^G A^G$

- 14 In rats, the allele of a gene for 'mottled' coat (M) and the recessive allele (m) for 'normal' coat are sex linked. The allele of a gene for 'long' whiskers (W) and the recessive allele (w) for 'short' whiskers are autosomal.

A male rat with a normal coat and short whiskers was mated on several occasions to the same female. The offspring showed the following phenotypes in equal proportions.

- Mottled females and males with long whiskers
- Mottle females and males with short whiskers
- Normal females and males with long whiskers
- Normal females and males with short whiskers

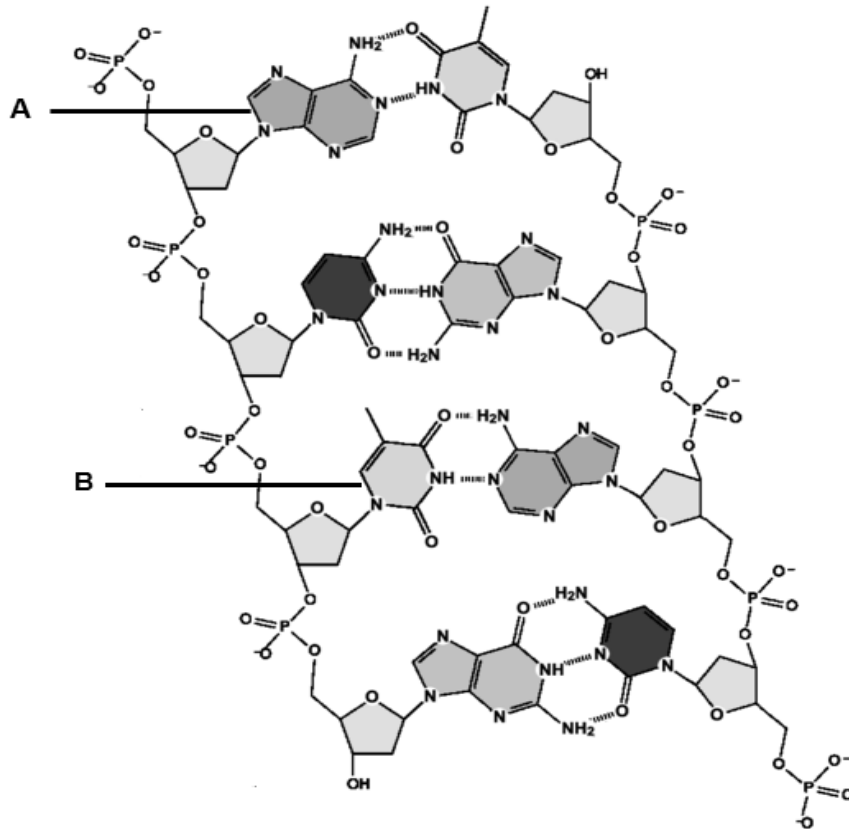
What are the genotypes of the parents?

- A $X^M Y w w$ and $X^M X^M W W$
- B $X^m Y w w$ and $X^M X^M W w$
- C $X^m Y w w$ and $X^M X^m W W$
- D $X^m Y w w$ and $X^M X^m W w$
- 15 Which statement(s) about RNA is / are **CORRECT**?

- 1 It is less stable than DNA as it contains a ribose sugar that lacks a 2' OH group.
- 2 It is able to form double-stranded regions with some areas of base pairing.
- 3 It is a polymer of pyrimidine joined by phosphodiester bonds.
- 4 It is synthesised in the 5' to 3' direction where the 5'-phosphate group of the growing RNA strand is joined to the 3'-hydroxyl group of an incoming nucleotide.

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

16 The figure below shows a DNA molecule.



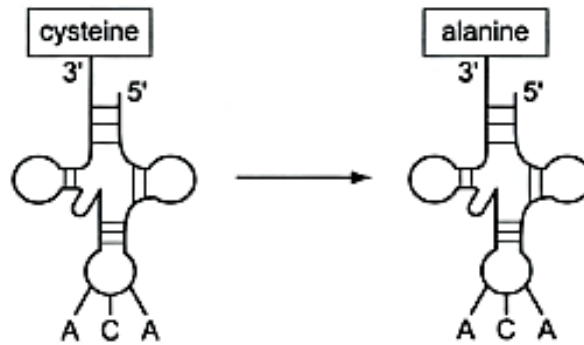
Which statement(s) **CORRECTLY** describe the polynucleotide?

1	The structure labelled A corresponds to that of a purine, while the structure labelled B corresponds to that of a pyrimidine.
2	The antiparallel nature of DNA double helix allows phosphodiester bonds to form between the nitrogenous bases of opposite strands.
3	Width of DNA double helix is $2\mu\text{m}$.
4	The wound DNA double helix consists of alternating major grooves and minor grooves along its axis.

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

- 17 Transfer RNA combined with an amino acid is called amino-acyl tRNA. It is possible to chemically convert the amino acid cysteine into the amino acid alanine whilst it is still attached to its tRNA.

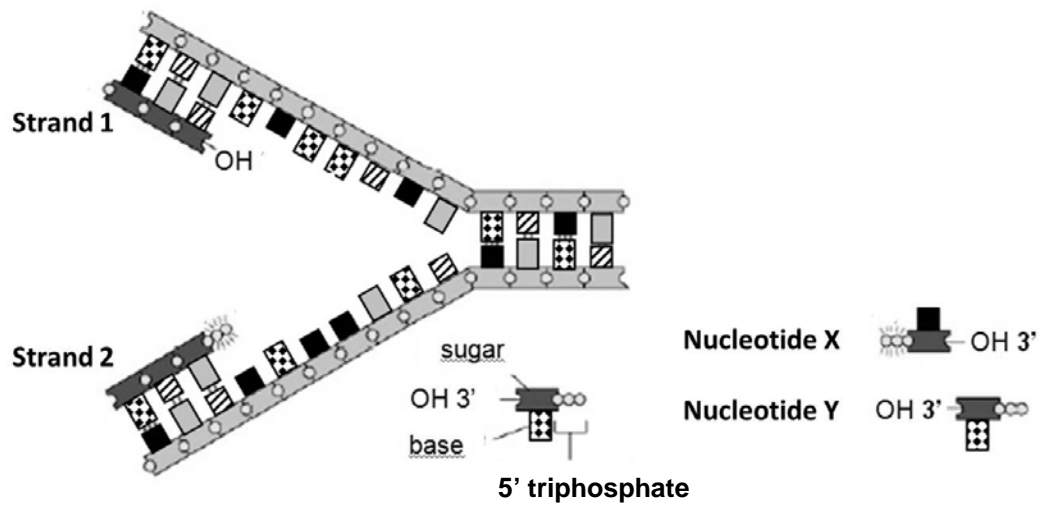
The altered amino-acyl tRNA still binds to UGU triplets on messenger RNA (mRNA), but now incorporates alanine into the resulting polypeptide instead of cysteine.



Which statement is **CORRECT**?

- A A codon on the amino-acyl tRNA determines its specificity.
- B Both the amino acid and the anticodon of an amino-acyl tRNA affect where it binds to mRNA.
- C The amino acid of an amino-acyl tRNA does not influence its binding to mRNA.
- D The codon-anticodon interaction is influenced by the amino acid on an amino-acyl tRNA.

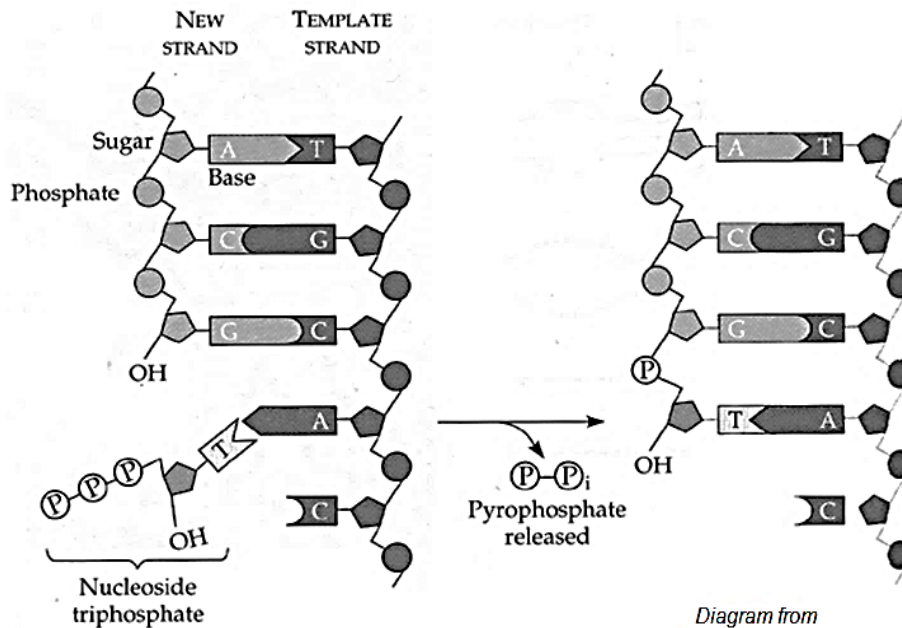
18 DNA replication is illustrated in the following figure.



Which of the following correctly describes the addition of the next nucleotide(s) in the DNA strands undergoing replication?

- A Nucleotide X will be added to the leading strand, which is strand 1.
- B Nucleotide Y will be added to the leading strand, which is strand 1.
- C Nucleotide X will be added to the lagging strand, which is strand 1.
- D Nucleotide Y will be added to the leading strand, which is strand 2.

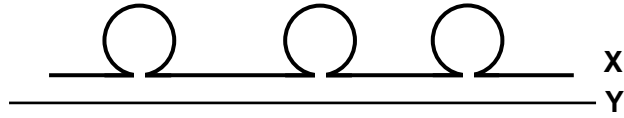
- 19 The diagram below shows the synthesis of a new strand of DNA during interphase.



Which of the following shows the **CORRECT** combination of bond(s) that need to be formed and the kind of reaction that is involved in order for the nucleotide to be added to the DNA chain?

	Bond(s) to be formed	Reaction(s) involved
A	Phosphodiester	Condensation and dephosphorylation
B	Phosphodiester	Condensation and hydrolysis
C	Phosphoester and hydrogen	Condensation and hydrolysis
D	Phosphoester and hydrogen	Condensation

- 20 The diagram below shows the result of hybridizing mature mRNA of ovalbumin to the ovalbumin gene.



Which of the following statement is **CORRECT**?

	X	Y	Number of exons	Number of introns
A	Mature mRNA	DNA	3	4
B	Mature mRNA	DNA	4	3
C	DNA	Mature mRNA	3	4
D	DNA	Mature mRNA	4	3

- 21 The following statements illustrate the processes that occur during translation.

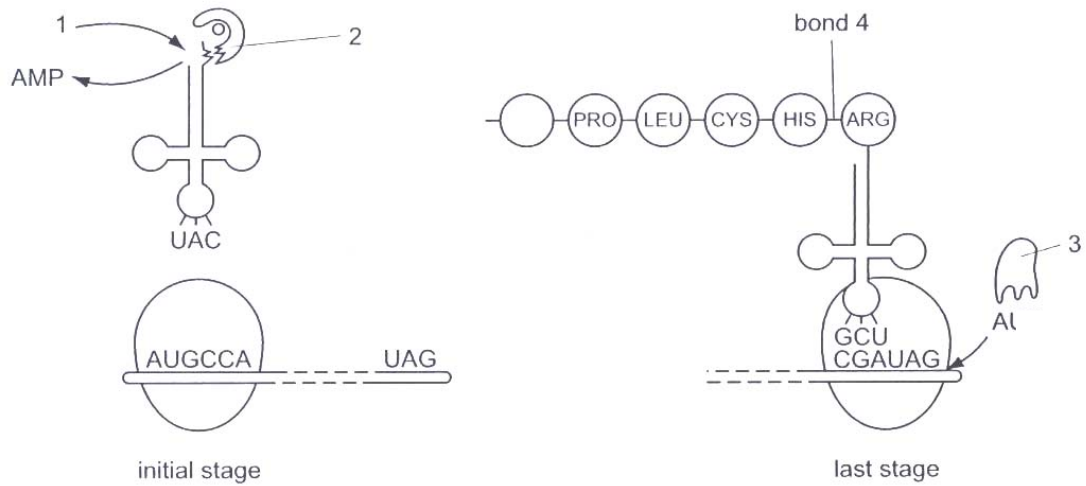
- 1 The large subunit of the ribosome binds and forms the translation initiation complex.
- 2 The second amino acyl-tRNA complex now binds to mRNA at the "A" site of the ribosome.
- 3 The small ribosomal subunit, with initiator tRNA bound, binds to the 5' cap of the mRNA and scans for the first start codon.
- 4 Soluble protein called release factor recognises the stop codon and binds at the "A" site.
- 5 Formation of a peptide bond between the first and the second amino acids by peptidyl transferase.
- 6 The second amino acyl-tRNA complex moves from the "A" site to the "P" site.

Which of the following shows the **CORRECT** order?

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

22 A number of molecules other than tRNA and mRNA are involved during translation.

The diagram below shows some of these molecules and some of the nucleotides in the codon and anticodon positions.



Which of the following **CORRECTLY** label 1 – 4?

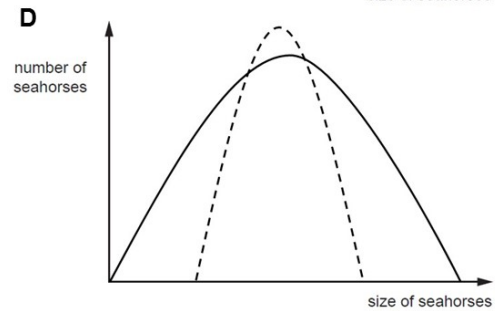
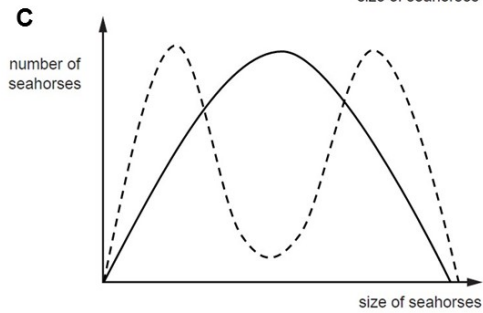
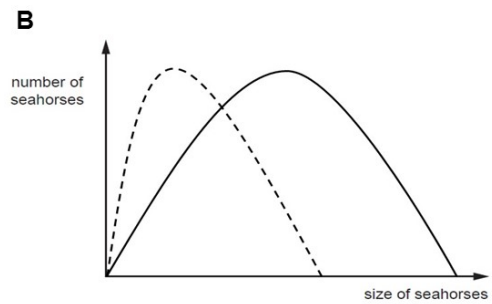
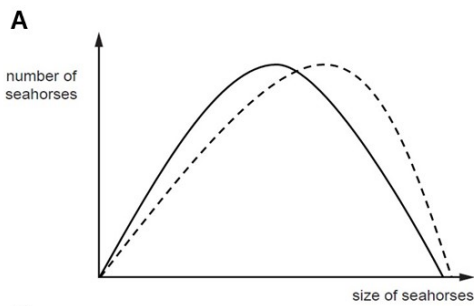
	1	2	3	4
A	ADP	Aminoacyl tRNA synthetase	Amino acid	Hydrogen bond
B	ADP	Amino acid	Translation releasing factor	Hydrogen bond
C	ATP	Amino acid	Aminoacyl tRNA	Peptide bond
D	ATP	Aminoacyl tRNA synthetase	Releasing factor	Peptide bond

- 23 The seahorse, *Hippocampus*, is an unusual small fish. It gives birth to live young and it is the male rather than the female that becomes pregnant.

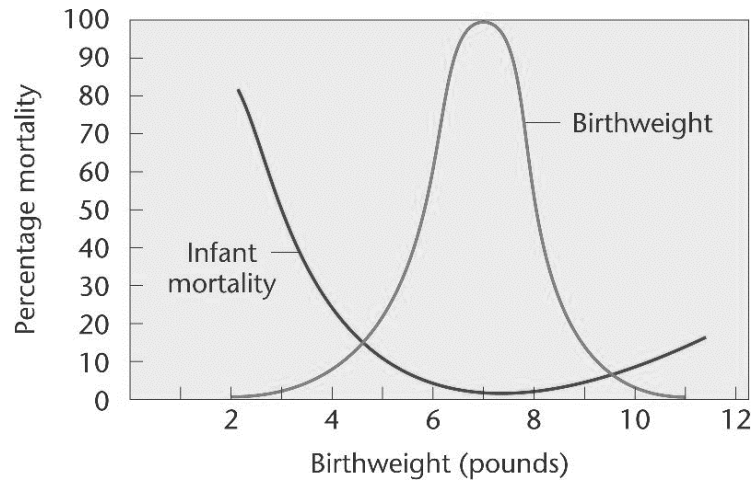
In one species of seahorse, large females within a population mate with large males and small females mate small males. Few medium-sized individuals are produced and they have a low survival rate.

Which graph shows the effect of natural selection on size of seahorses after a fixed period of time?

Legend: — Original population — — — after selection



- 24 The graph below shows the relationship between birthweight and infant mortality in humans.



What type of selection is demonstrated above?

- A Directional selection
- B Disruptive selection
- C Stabilising selection
- D Artificial selection

- 25 2,6-dichlorophenolindophenol (DCPIP) is a blue dye that can be converted to colourless reduced DCPIP by accepting electrons, as shown as follows.



In an experiment, green chloroplast extract was first mixed with DCPIP and the extract turned blue-green. After exposure to 2 hours of light in the presence of fixed volumes of carbon dioxide and water, the extract became completely green again.

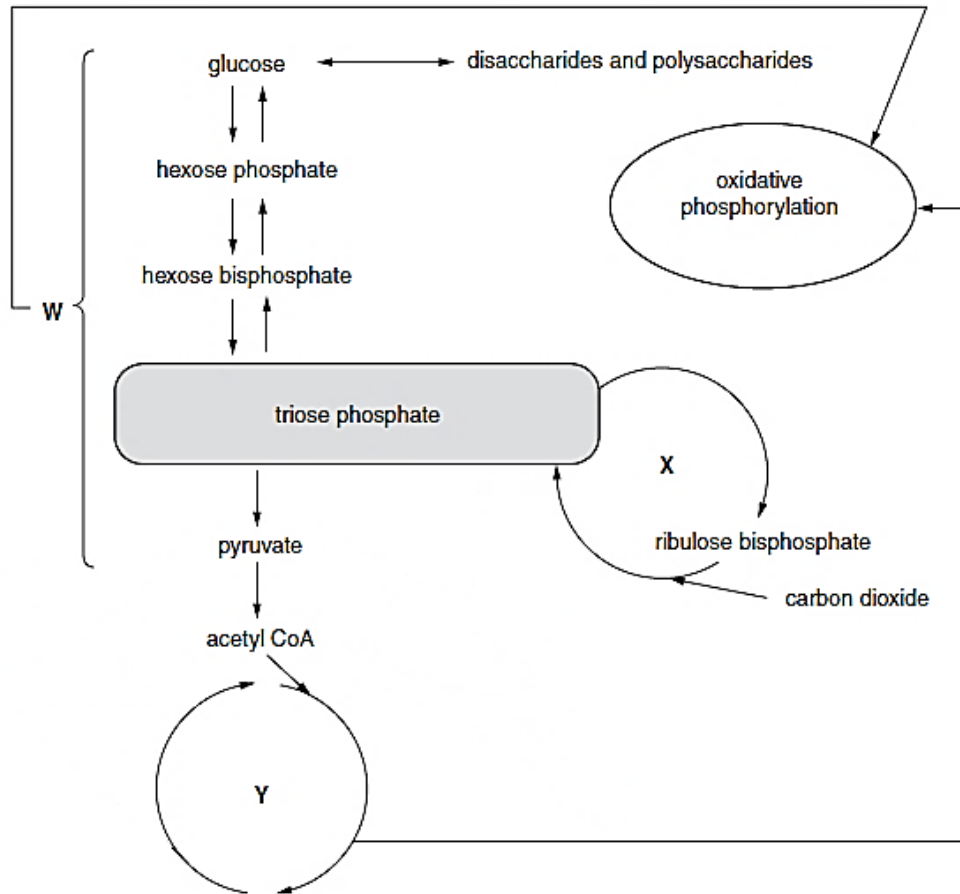
Which of the following shows a likely combination of products that was being formed towards the end of the experiment?

	O₂	ATP	reduced NADP
A	+	+	-
B	+	+	+
C	-	-	-
D	-	-	+

- 26 Which row shows the correct locations of some stages of aerobic respiration occurring in a eukaryotic cell?

	Link reaction	Oxidative phosphorylation
A	inner mitochondrial membrane	mitochondrial intermembrane space
B	mitochondrial matrix	inner mitochondrial membrane
C	mitochondrial matrix	mitochondrial matrix
D	outer mitochondrial membrane	inner mitochondrial membrane

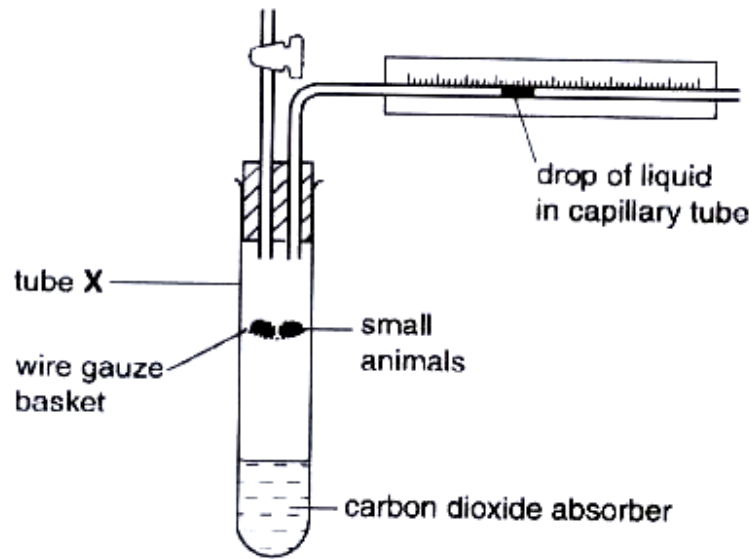
27 The diagram represents some of the reactions that take place in a leaf cell.



Which statement explains why the three reaction pathways, W, X and Y, are able to work concurrently in the same leaf cell?

- A Only X and Y can take place in the absence of oxygen.
- B W, X and Y are separated by membranes, allowing for the formation of separate proton gradients to synthesise ATP.
- C W, X and Y are separated by membranes, allowing for the maintenance of different conditions for enzymes to function.
- D X occurs independently of light unlike W and Y.

28 The diagram shows a simple respirometer.



The changes in gas volume in the tube are measured at intervals.

Time (minutes)	Gas volume with carbon dioxide absorber (cm ³)	Gas volume without carbon dioxide absorber (cm ³)
0	0.0	0.0
10	-0.4	-0.1
20	-0.8	-0.2
30	-1.2	-0.3

Tube X contains 2 g of small animals.

What is the carbon dioxide output per g per hour for these organisms?

- A 0.9 cm³
- B 1.8 cm³
- C 2.4 cm³
- D 4.8 cm³

- 29** Rice crops in Japan are damaged by the green rice leafhopper (*Nephotettix cincticeps*), a pest that reduces crop yield.

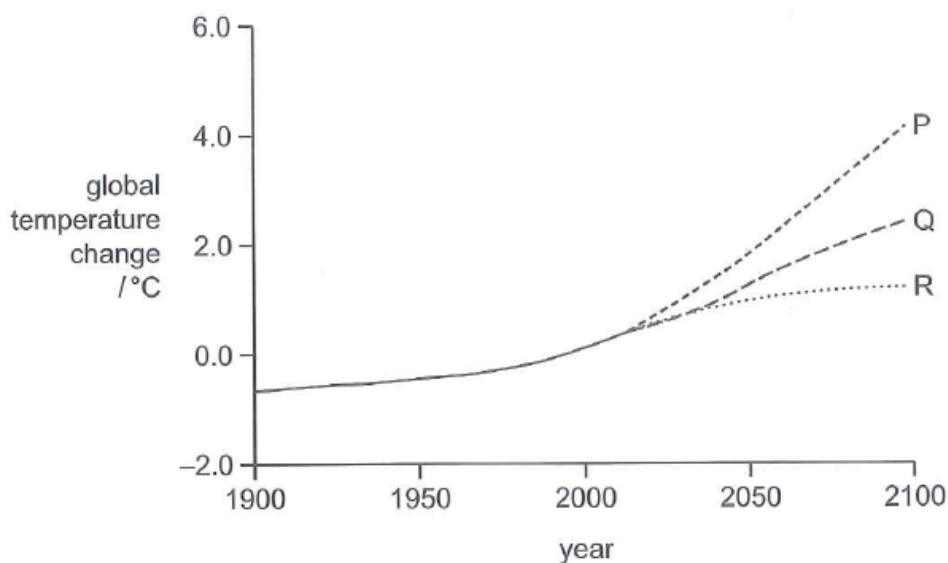
In a study of the effect of climate change on crop damage by the green rice leafhopper, it was found that an increase in winter temperatures caused an increase in crop damage, while an increase in summer temperatures caused a decrease in crop damage.

Which of the following are possible explanations for these findings?

- 1 Increased temperatures in the summer disrupt metabolic reactions in pests.
- 2 Increased temperatures in the summer cause a rise in the pests' metabolic rate that results shorter life cycle.
- 3 Increased temperatures in the winter disrupt the pests' life cycle and result in fewer being able to reproduce.
- 4 Increased temperatures in the winter allow more pests to survive and results in an increase in the pest population.

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

- 30 The graph shows the predicted change in global temperatures using three different models, P, Q and R. Model Q assumes that no new factors act to influence the rate of climate change.



The predictions of models P and R can be explained using some of the following statements.

- 1 Expansion of rainforest.
- 2 Increase in frequency of forest fires.
- 3 Permanently frozen soil and sediment in the Arctic begin to thaw.
- 4 Rising sea temperatures will reduce the solubility of greenhouse gases in the oceans.

Which of these statements support prediction of models P and R?

	Statements that support prediction P	Statements that support prediction R
A	2, 3 and 4	1
B	1 and 3	2 and 4
C	2	1, 3 and 4
D	3 and 4	1 and 2

BLANK PAGE

2018 Y6 Preliminary Exam H1**MCQ Answer Scheme**

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