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DUNMAN HIGH SCHOOL Preliminary Examination Year 6

H1 BIOLOGY

8875/01

Paper 1 Multiple Choice Questions

25 September 2017**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.

Section A MCQ [30 marks]

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

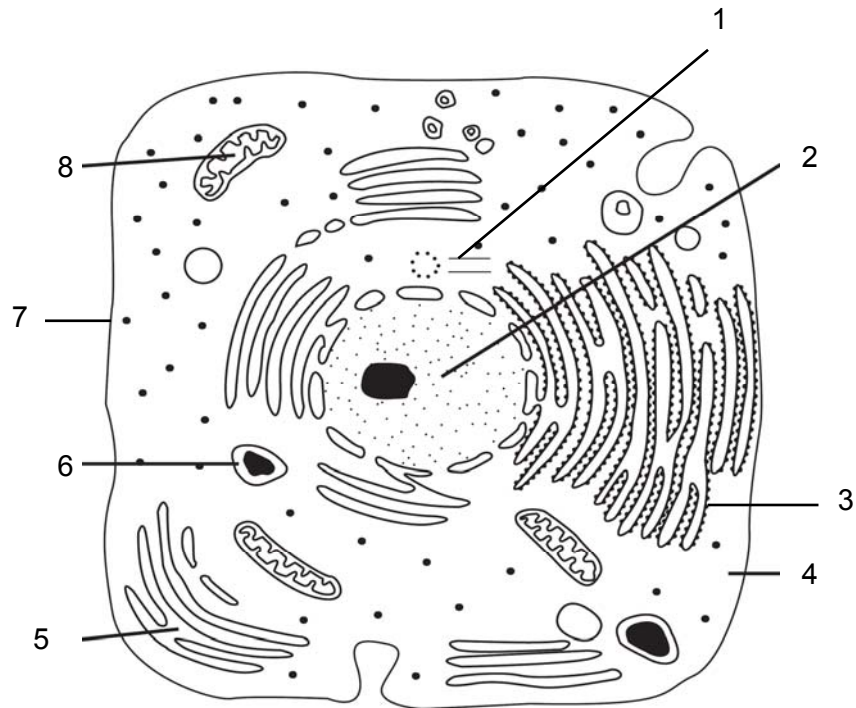
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

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 **21** printed pages and **1** blank page.

Answer **all** questions in this section.

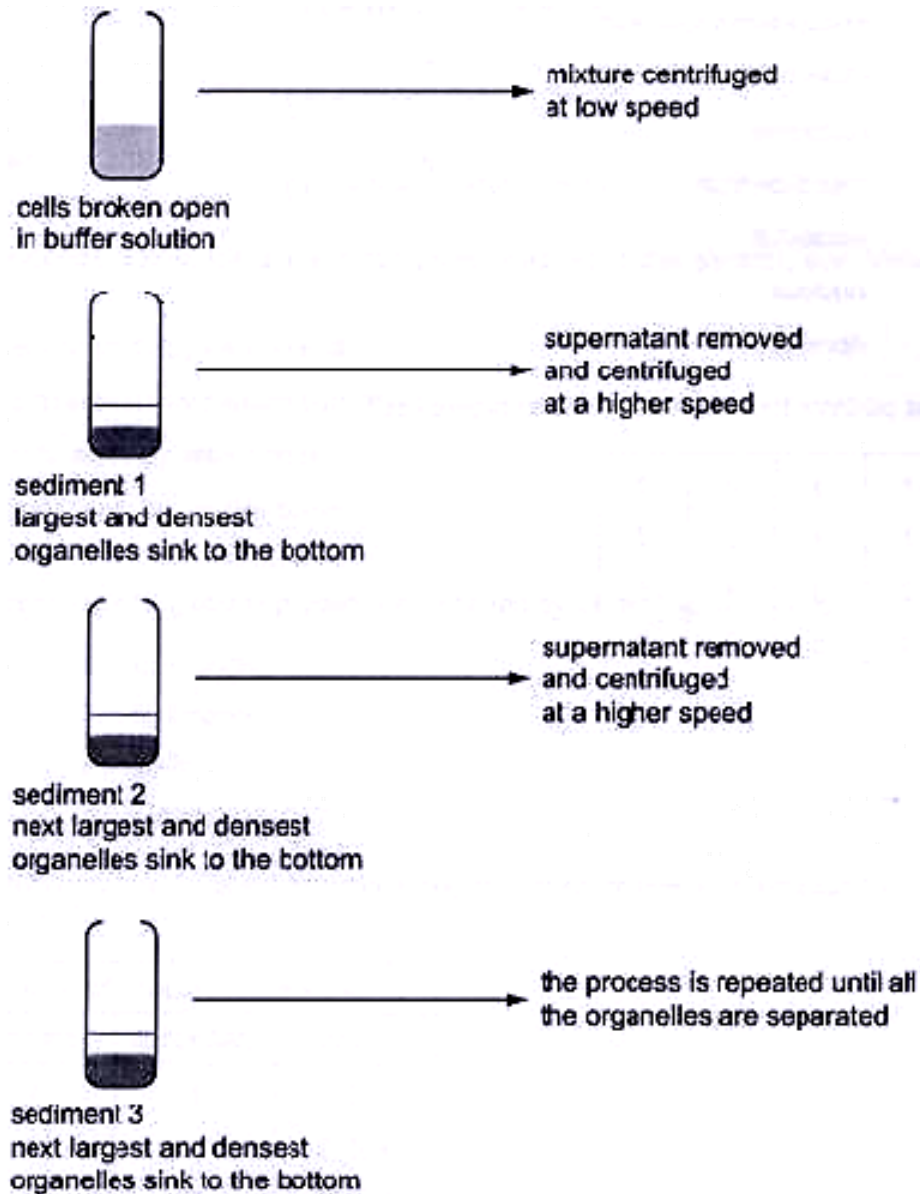
- 1 The diagram shows a drawing of an electron micrograph of an animal cell.



Which of the following describes the corresponding properties of the labelled structures?

	undergoes doubling during cell division	contain enzymes	contains nucleic acids
A	2	6, 8	2, 5, 8
B	2, 4, 8	5, 6, 8	2, 3, 8
C	1, 2, 8	2, 4, 6, 8	1, 2, 7, 8
D	1, 2	2, 3, 4, 5, 6	2, 3, 8

- 2 Fractionation is a process used to separate cell components according to their size and density. The diagram shows the main stages in fractionation of a plant cell.

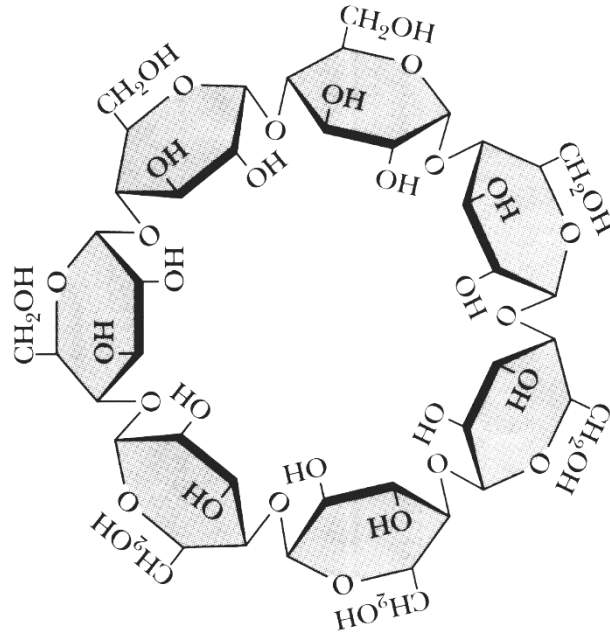


DCPIP and buffer solution (containing glucose, fructose, sodium bicarbonate) were added to each of the sediments, and the mixtures were left in the dark for fifteen minutes. Sediment 2 caused the DCPIP to be reduced.

Which organelle present in Sediment 2 caused reduction of DCPIP?

- A chloroplast
- B mitochondria
- C nuclei
- D ribosomes

- 3 The diagram shows a circular oligosaccharide molecule.



In which other molecule can a similar glycosidic bond be found?

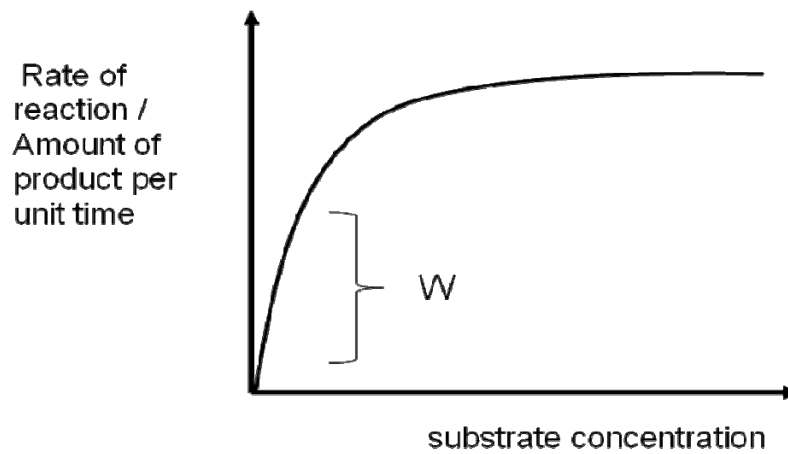
- A lactose
- B maltose
- C sucrose
- D cellulose

- 4 Which statement is **TRUE** for phospholipids, but not for protein?
- A It has hydrophilic and hydrophobic components.
 - B It is synthesized from non-identical sub-units.
 - C It can form a barrier to water soluble molecules.
 - D It is found in cell membranes.
- 5 The hydrolysis of triglycerides leads to _____.
- 1 formation of products which are more soluble in water than triglycerides.
 - 2 formation of products which are less soluble in water than triglycerides.
 - 3 an increase in pH.
 - 4 a decrease in pH.

Choose the correct statements to complete the sentence.

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

- 6 The graph below shows the rate of an enzyme catalyzed reaction occurring in lysosome with increasing substrate concentration. The reaction is carried out at 37°C and a pH of 4 for all substrate concentrations.



Which of the following(s) would result in a decrease in the rate of reaction at W?

- 1 Addition of co-factor
 - 2 Decrease in temperature to 27°C
 - 3 Increase in pH to 9
 - 4 Addition of competitive inhibitor
- A** 1 and 4
- B** 2 and 3
- C** 2, 3 and 4
- D** 1, 2, 3 and 4

- 7 Some inhibitors of enzyme reactions bind to the enzyme-substrate complex. Which statements about this type of inhibition are correct?

- 1 The active site changes shape.
- 2 The inhibitor is non-competitive.
- 3 The initial rate of reaction is reduced.
- 4 The maximum rate of reaction (V_{max}) is increased.

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

- 8 A 19-base pair long DNA molecule was analysed to find the number of nucleotide bases in each of the polynucleotide strands. Some of the results are shown.

	number of nucleotide bases			
	A	C	G	T
strand 1				4
strand 2		7		5

How many hydrogen bonds are present in this DNA molecule?

- A** 31 **B** 48 **C** 39 **D** 57

- 9 When DNA replicates, new nucleotides containing the common isotope of nitrogen (^{14}N) are used to build new nucleic acids.

In the laboratory, nucleotides can be synthesised using the heavy isotope of nitrogen (^{15}N). Cells grown in ^{14}N nucleotides for many generations are allowed to replicate once using these ^{15}N nucleotides, then twice more using ^{14}N nucleotides.

What will be the percentage of ^{14}N to ^{15}N nucleotides in the final molecules?

- A** 50% **B** 75% **C** 83% **D** 87.5%

- 10** An insertion mutation occurs in the gene coding for an enzyme, tyrosinase. Nucleotide sequences of the gene (the non-template strand), as well as the corresponding amino acid sequence of tyrosinase, are shown below.

	Wild-type allele	ATG	AAG	TTG	GCT	AAA	TGG	GGA
	Wild-type protein	Met	Lys	Leu	Ala	Lys	Trp	Gly
	Mutant allele	ATG	AAG	TTA	GGC	TAA	ATG	GGG
	Mutant protein	Met	Lys	Leu	Gly	-		

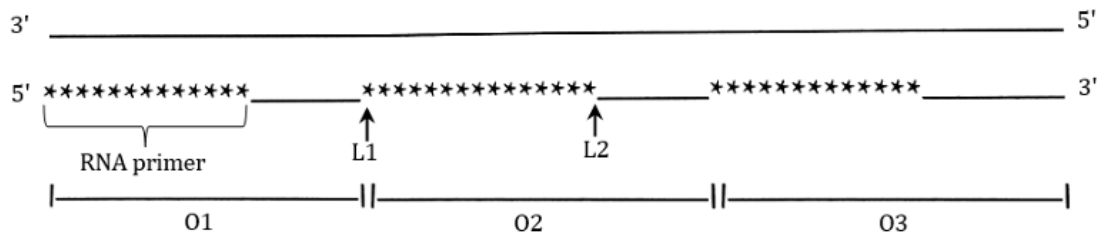


Insertion of adenine

Which feature of the genetic code cannot be observed based on the information given?

- A** The genetic code is degenerate.
- B** The genetic code is punctuated.
- C** The code is non-overlapping.
- D** The code is universal.

- 11 The diagram shows a DNA template with the lagging strand prior to the removal of the RNA primers.



Which row correctly shows the events taking place during the synthesis of the lagging strand?

	first Okazaki fragment synthesised	site of phosphodiester bond formation catalysed by DNA ligase
A	O1	L1
B	O1	L2
C	O3	L1
D	O3	L2

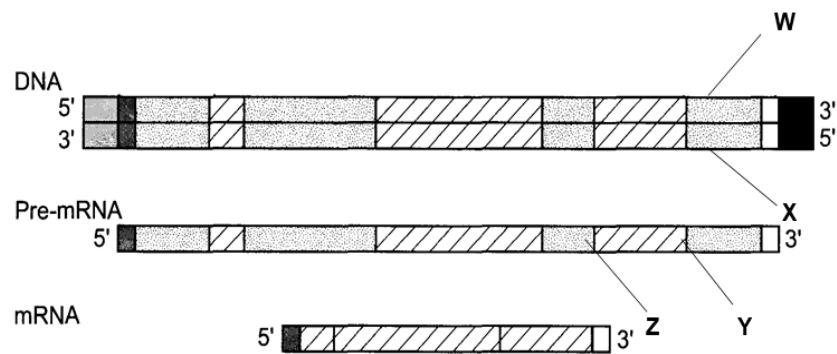
- 12 The following statements describe various steps in translation.

- 1 Large ribosomal subunit binds to mRNA.
- 2 Small ribosomal subunit binds to mRNA.
- 3 Anticodon of activated tRNA base pairs with codon AUG at the A site.
- 4 Anticodon of activated tRNA base pairs with codon AUG at the P site.

Which of the following statements describe the initiation phase?

- A 1 and 2 only
- B 1, 2 and 3
- C 1, 2 and 4
- D All of the above

13 The diagram shows the processing of transcribed pre-mRNA in a eukaryotic cell.



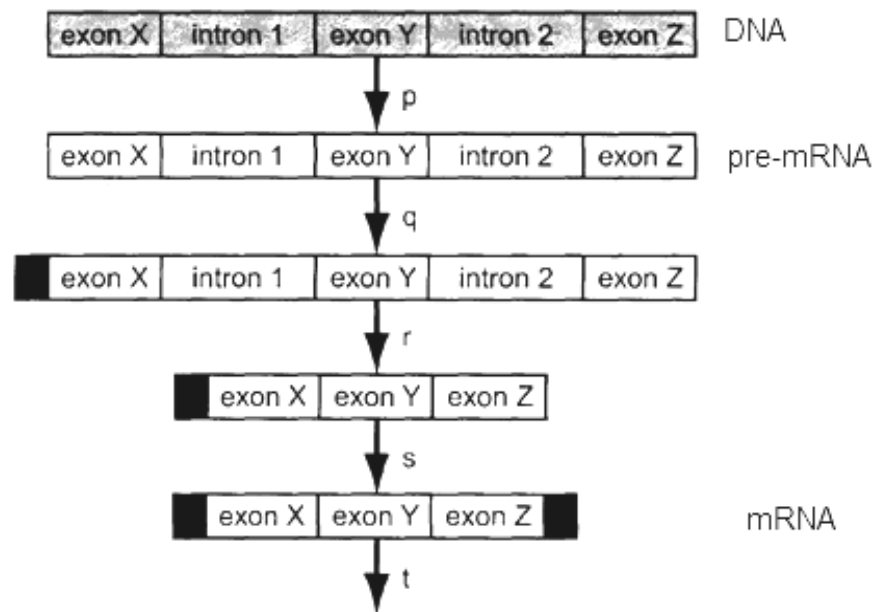
Which of the following identifies structures **W** to **Z**?

	W	X	Y	Z
A	non-template strand	template strand	exon	intron
B	non-template strand	template strand	intron	exon
C	template strand	non-template strand	intron	exon
D	template strand	non-template strand	exon	intron

14 5' – CAU – 3' is a codon in mRNA that specifies the amino acid histidine (His) in position 58 in the α chain of haemoglobin. What is the corresponding anti-codon in tRNA?

- A** 5' – CAU – 3'
- B** 3' – AUG – 5'
- C** 3' – GUA – 5'
- D** 5' – GUA – 3'

15 The diagram represents the processing of pre-messenger RNA.



During the process of pre-messenger RNA each of the listed events occurs:

- 1 capping
- 2 polyadenylation
- 3 splicing
- 4 transcription
- 5 translation

Which correctly identifies the processes **p**, **q**, **r**, **s** and **t**?

	p	q	r	s	t
A	5	1	3	2	4
B	4	1	3	2	5
C	5	2	1	3	4
D	4	2	1	3	5

- 16** Vincristine is a chemical which binds to the tubulin microtubules of the spindle and prevents them from functioning normally.

What effect would vincristine have on meiosis?

- A** Bivalents would fail to separate.
- B** Centromeres would fail to form.
- C** Centrioles would fail to move to the poles of the cell.
- D** Crossing over would fail to occur.

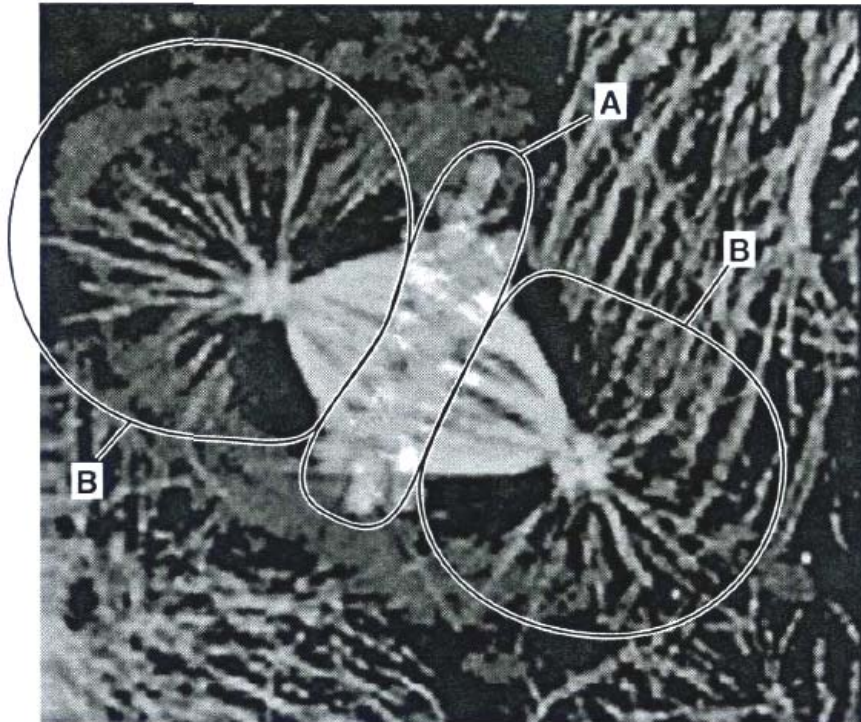
- 17** Below are descriptions of different gene mutations.

- 1 deletion toward the end of the code sequence
- 2 insertion in the middle of the code sequence
- 3 substitution close to the beginning of the code sequence

Which row correctly identifies the possible effects of these mutations on the synthesis of polypeptides?

	premature ending of a polypeptide	a non-functional polypeptide	a polypeptide with unchanged function	a polypeptide with a different function
A	2, 3 only	2, 3 only	1, 2, 3	2, 3 only
B	1, 2, 3	2 only	1, 3 only	1, 2 only
C	1, 3 only	1, 2, 3	3 only	1, 2, 3
D	1, 2, 3	1, 2, 3	1, 2, 3	1, 2, 3

- 18** The figure below shows an immune-fluorescent image of a cell undergoing mitosis. In immune-fluorescence, specific antibodies with fluorescent dyes attached are used to target specific bio-molecules within a cell. In the figure, dark regions contained little fluorescent dye. The pale regions within A and B show the location of structures that have been stained with two fluorescent dyes.



Which of the following correctly explains the mitotic stage shown in the figure?

	Mitotic stage	Explanation
A	Metaphase	Structures in region B are the centrioles and they are at opposite poles.
B	Metaphase	Structures in region A are the chromosomes and they are seen aligned along the metaphase plate.
C	Anaphase	Structures in region A are the spindle fibres organised at the centrosome and are pulling the chromosomes in region B towards the pole.
D	Anaphase	Structures in region B are the spindle fibres and they are no longer attached at region A.

- 19 The diagram shows the banding pattern of two human chromosomes. **P** is a normal chromosome and **Q** carries a mutation.



What type of mutation occurred on chromosome **Q**?

- A deletion of part of the chromosome
 - B duplication of part of the chromosome
 - C inversion of part of the chromosome
 - D translocation of part of another chromosome
- 20 Purple buds of the morning glory flower, *Ipomoea*, open into blue flowers. As the flower opens, the pH on the vacuoles of the flower epidermal cells increases and this results in a change of colour from purple to blue.

A mutant purple-flowered morning glory plant carries recessive alleles of a gene **B/b**, coding for a membrane-bound ion pump, and is unable to increase the pH of the vacuole.

Both normal blue flowers and mutant purple flowers have the same anthocyanin pigment, coded by the dominant allele of the gene **A/a**. Plants with **aa** cannot produce anthocyanin and they have white flowers.

The genes **A/a** and **B/b** are on different chromosomes.

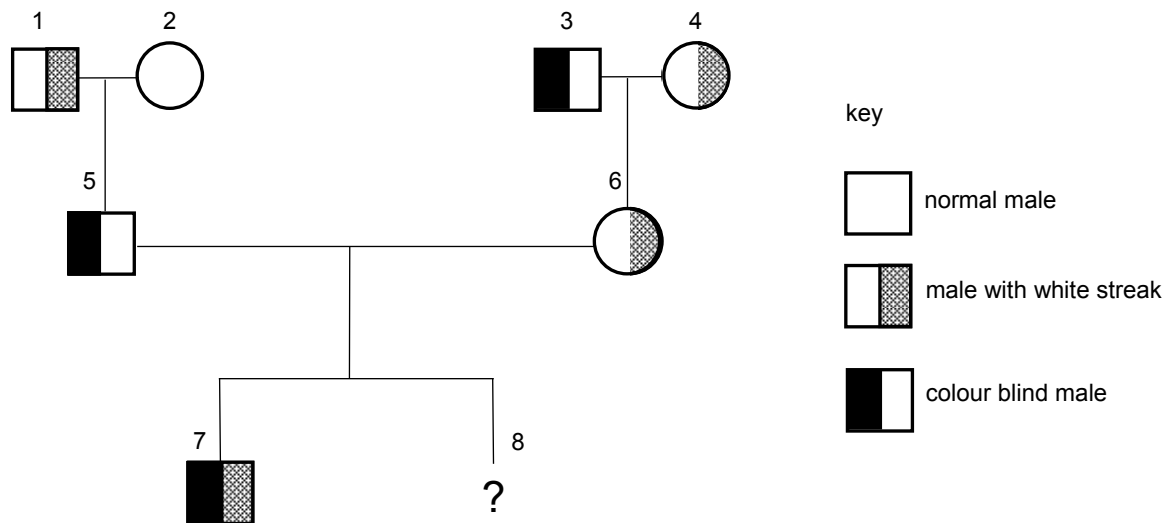
A blue-flowered morning glory plant was crossed with a purple-flowered plant. Their offspring consisted of plants which are blue-flowered, purple-flowered as well as white-flowered.

What were the genotypes of the blue-flowered and purple-flowered parents?

	Blue-flowered parent	Purple-flowered parent
A	AABB	AaBb
B	AaBb	Aabb
C	AaBB	Aabb
D	AABb	aabb

- 21** Colour blindness is controlled by a gene on the X chromosome. The allele for colour blindness, X^b , is recessive to the allele for normal colour vision, X^B . The gene controlling the presence of a white streak in the hair is not sex-linked, with the allele for the presence of a white streak, H , being dominant to the allele for the absence of a white streak, h .

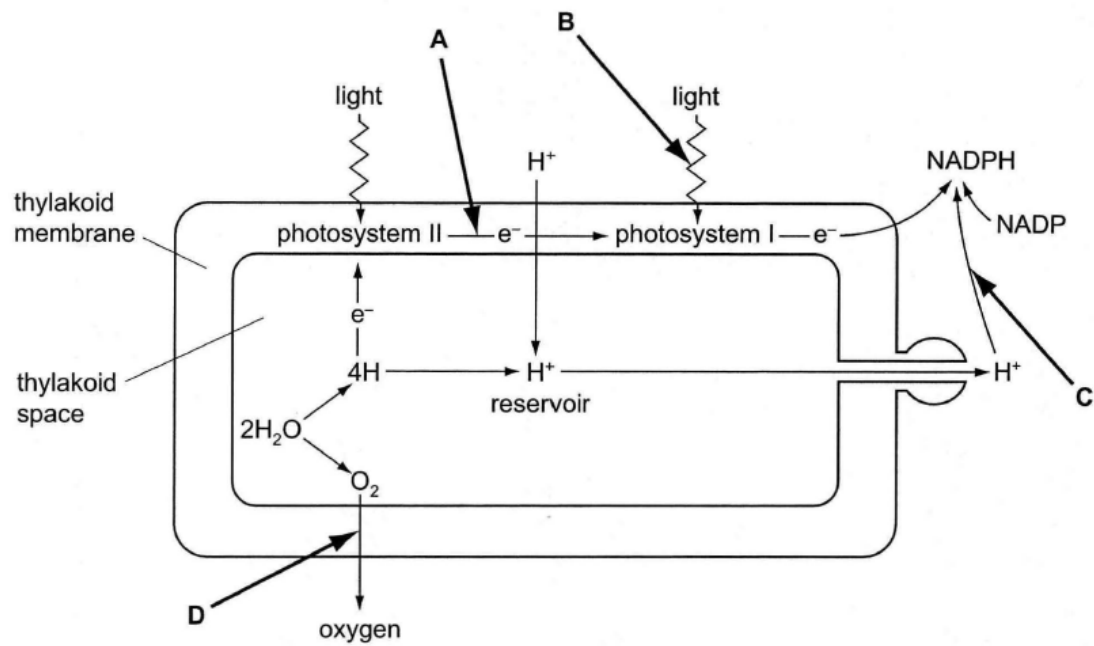
The diagram shows a pedigree in which some of the individuals have colour blindness or have a white streak present in the hair.



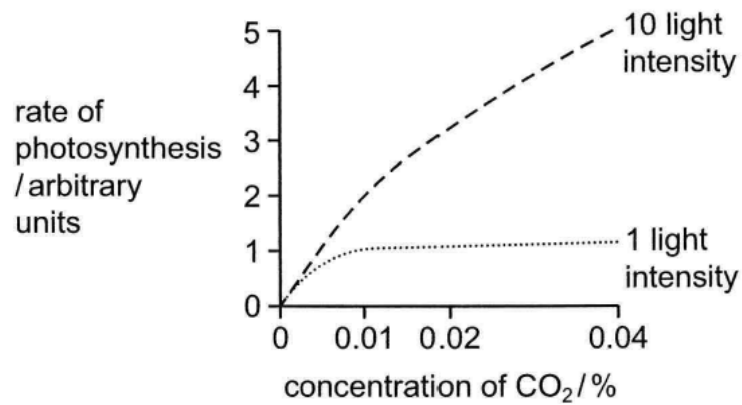
What is the probability that individual 8 is a male with the same phenotype as individual 7?

- A** 0.125
- B** 0.25
- C** 0.5
- D** 0.75

- 22 The diagram shows light dependent reactions of photosynthesis in a chloroplast. Where does the transfer of some of the energy required for the subsequent reduction of carbon dioxide occur?



- 23 The graph shows the effect of carbon dioxide concentration on the rate of photosynthesis, at two different light intensities.

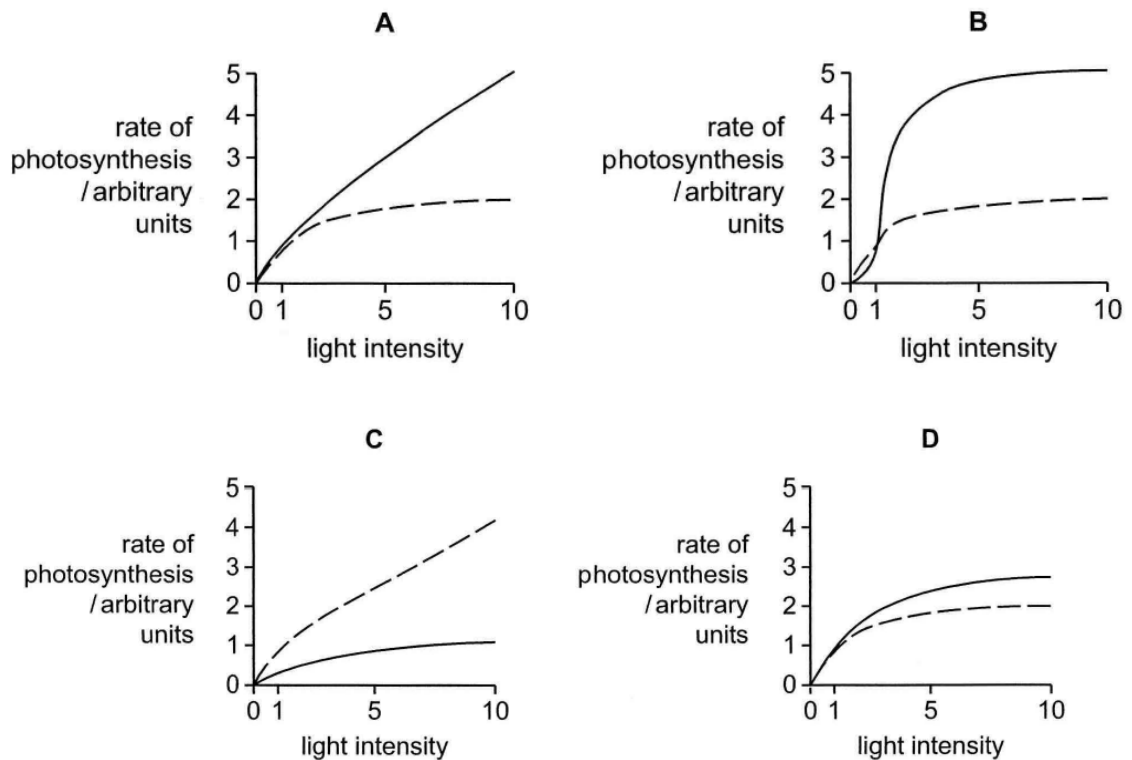


Which graph correctly shows the effect of light intensity on the rate of photosynthesis, at two different carbon dioxide concentrations?

key

--- 0.01 % concentration of CO₂

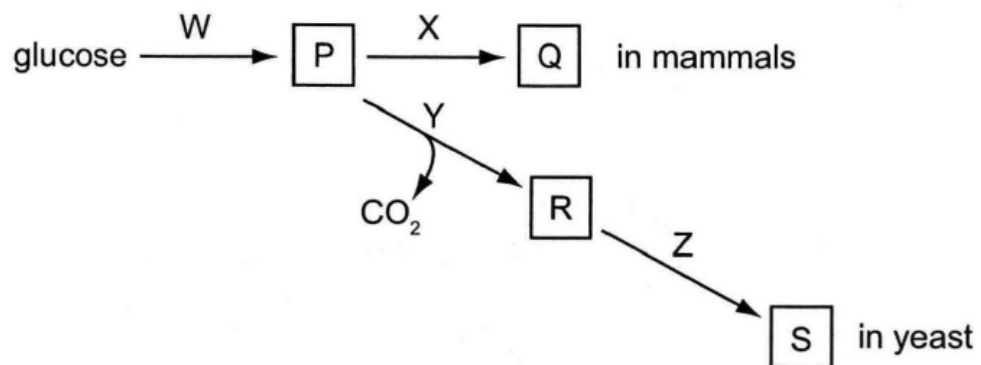
— 0.04 % concentration of CO₂



24 Which of the following will increase the pH of the chloroplast stroma?

- A Increasing O_2 concentration
- B Increasing temperature
- C Addition of electron transport chain inhibitor
- D Addition of ATP synthase inhibitor

25 The diagram shows a summary of the processes of anaerobic respiration.



Which process(es) results in the formation of reduced NAD?

- A W only
- B X and Z only
- C W, X and Y only
- D W, X and Z only

- 26** Before the settlement of California in the 1800s, the elk population was very large. By about 1900 there were only a few dozen elk left. Owing to protection, there are now about 3000 elk living in a small number of isolated herds. Unfortunately, some of the elk in all the herds have difficulty grazing due to a shortened lower jaw.

- 1 The early settlers only hunted elk that could graze.
- 2 There was a mutation affecting jaw size.
- 3 There is random mating within each herd.
- 4 There was directional selection favouring short jaws

Which statements best explain this?

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

- 27** A piece of mouse DNA sequence is to be amplified by PCR.

5' AGAGGGCGGT CCGTATCGGC CAATCTGCTC ACCACTAAGC 3'

Which pair of primers should be used?

- | | | |
|----------|------------------|-------------------|
| A | 5' AGAGGGCGGT3' | 5' CGTTAGTGGT 3' |
| B | 5' CCGTATCGGC 3' | 5' TGGTGATTCTG 3' |
| C | 5' CCGTATCGGC 3' | 5' GCTTAGTGGT 3' |
| D | 5' AGAGGGCGGT3' | 5' GCTTAGTGGT 3' |

28 Some stages of a procedure involved in paternity testing are listed.

- 1 Alkali denatures DNA
- 2 Fragments migrate at different rate depending on the number of base pairs
- 3 Probes bind to DNA are identified using autoradiography
- 4 DNA samples are obtained from different individuals
- 5 Fragments are transferred from agarose gel to nylon membrane
- 6 Several STR loci are isolated using suitable restriction enzymes

Which sequence shows the correct order of these stages?

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

- 29** It has been found that stem cells transferred from the intestinal lining to the bone marrow produce all of the different types of blood cells instead of intestinal cells.

Which statement explains this?

- A** All stem cells are totipotent.
 - B** Environmental factors change the expression of specific genes.
 - C** Specific genes are destroyed by endonucleases.
 - D** Specific genes are hidden by condensation of some chromosomes.
- 30** Which genetic modification would enable higher yield in crops grown on fertile soil in a tropical region?
- A** Drought tolerance
 - B** Increased carbon fixation
 - C** Increased vitamin A content
 - D** Salt tolerance

END OF PAPER

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2017 Y6 Preliminary Exam H2
MCQ Answer Scheme

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