

Biology
Higher level
Paper 1

Monday 1 May 2017 (afternoon)

1 hour

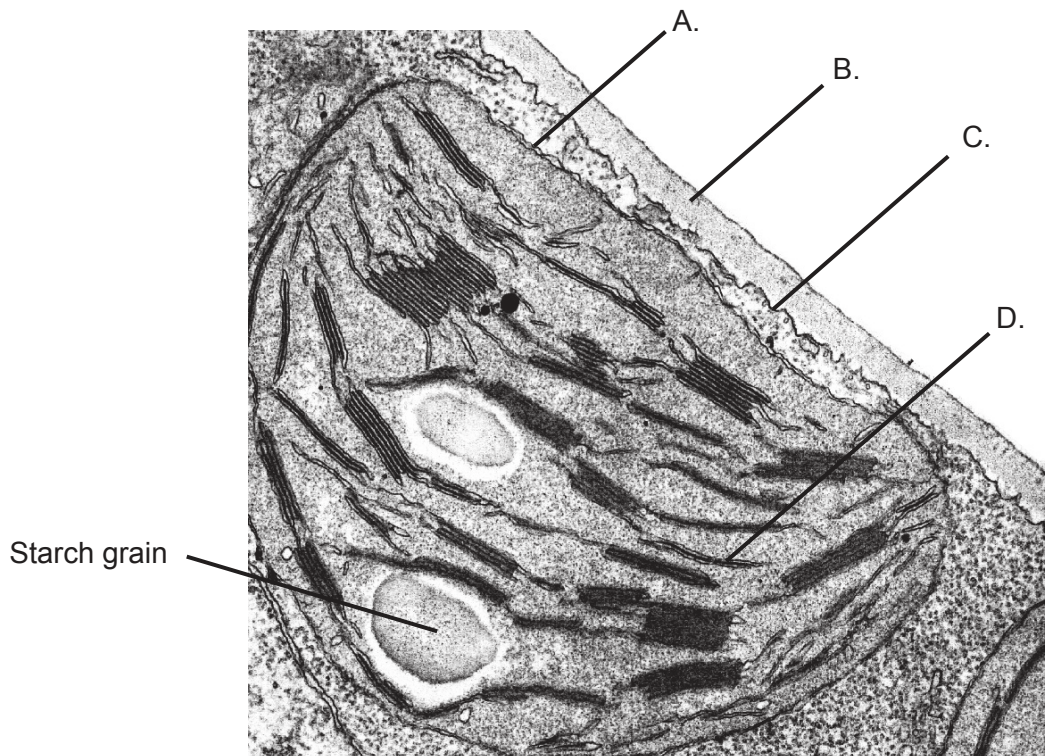
Instructions to candidates

- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.
- The maximum mark for this examination paper is **[40 marks]**.

1. Which structure found in eukaryotes has a single membrane?
 - A. Nucleus
 - B. Lysosome
 - C. Chloroplast
 - D. Mitochondrion

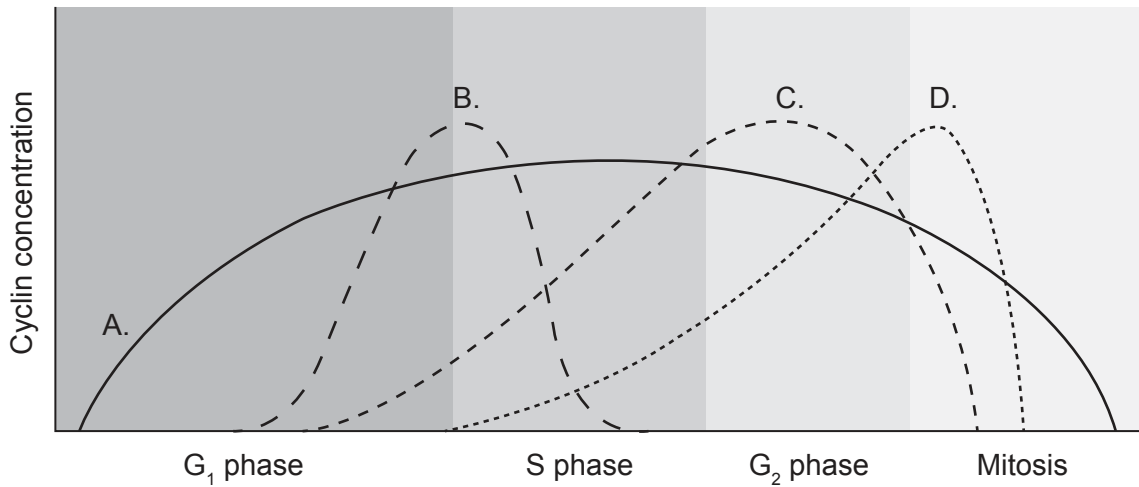
2. Which evidence falsifies the Davson–Danielli model?
 - I. The presence of globular proteins within the phospholipid bilayer
 - II. Non-polar amino acids cause proteins to remain embedded in membranes
 - III. Membrane proteins remain in a fixed position inside a membrane
 - A. I only
 - B. I and II only
 - C. II and III only
 - D. I, II and III

3. The following electron micrograph shows part of a palisade mesophyll cell. Which of the labelled structures controls the exchange of substances to and from the cell?



[Source: adapted from Eldon Newcomb, <http://botit.botany.wisc.edu/about.html>]

4. The diagram shows the concentration of four cyclins during the cell cycle. Which curve represents the cyclin that promotes the assembly of the mitotic spindle?



[Source: http://upload.wikimedia.org/wikipedia/commons/thumb/c/ce/Cyclin_Expression.svg/400px-Cyclin_Expression.svg.png]

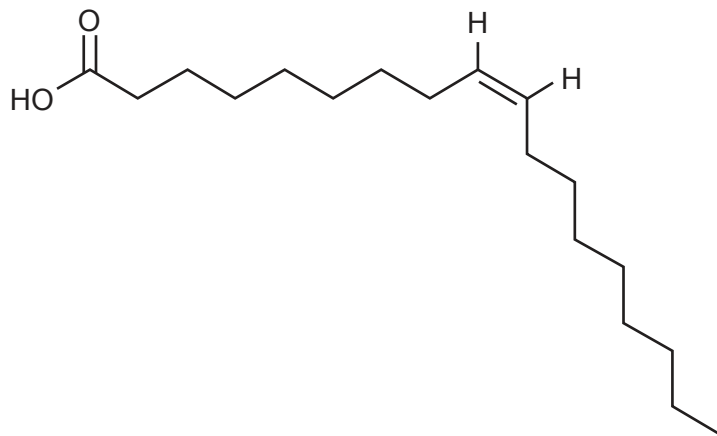
5. A polymer of alpha-D-glucose found in plants has mostly 1,4 linkages and some 1,6 linkages. Which molecule fits this description?
- A. Glycogen
 - B. Cellulose
 - C. Amylose
 - D. Amylopectin
6. In an experiment the effect of changing pH on an enzymatic reaction is tested. Which could be a dependent variable in this kind of experiment?
- A. Changing substrate concentration
 - B. Rate of formation of product
 - C. Variation in temperature
 - D. Change in pH

Turn over

7. Meselson and Stahl conducted experiments using the isotopes ^{14}N and ^{15}N which showed that DNA replication is semi-conservative. What would they have observed about the distribution of isotopes in the DNA after one round of replication if DNA replication was conservative rather than semi-conservative?

- A. Only ^{14}N DNA
- B. Only ^{15}N DNA
- C. All DNA half ^{14}N and half ^{15}N
- D. Half the DNA with only ^{14}N and half with only ^{15}N

8. What type of molecule is shown in this diagram?



- A. Trans saturated fatty acid
 - B. Cis unsaturated fatty acid
 - C. Cis saturated fatty acid
 - D. Trans unsaturated fatty acid
9. A strand of mRNA consists of the following nucleotides:

AUUCUGGCUA

Which of the following represents the non-transcribed (sense) strand of the DNA?

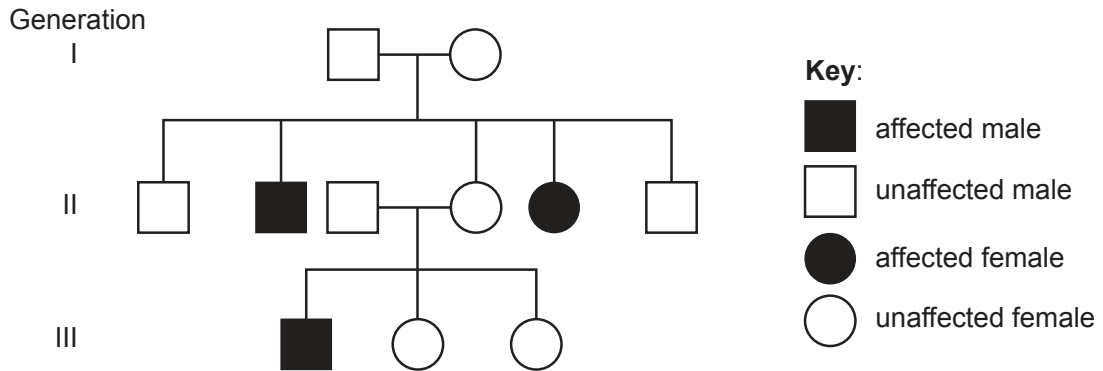
- A. TAAGACCGAT
- B. ATTCTGGCTA
- C. UAAGACCAU
- D. AUUCUGGCUA

10. A child has blood group A. The father of the child has blood group B. What are the possible genotypes of the mother?

- I. $I^A I^A$
- II. $I^A I^B$
- III. $I^A i$

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

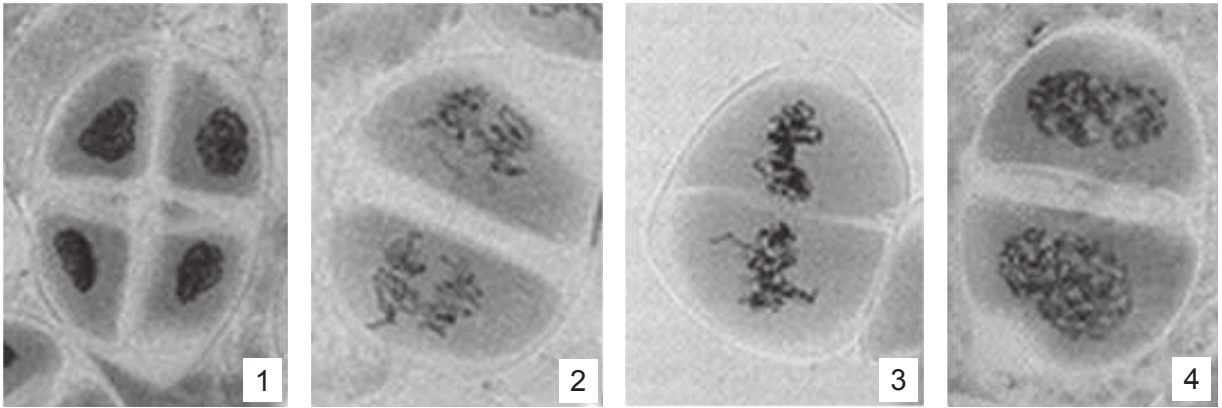
11. What proves that the inheritance of the condition shown in this pedigree chart is autosomal recessive and not autosomal dominant?



- A. There is no affected person in generation I.
- B. Both males and females are affected.
- C. Two unaffected parents have a child that is affected.
- D. Not everybody in generation III is affected.

Turn over

12. The micrographs show four different phases from meiosis II. What is the correct order?



[Source: <http://biologyforhighschool.net>]

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

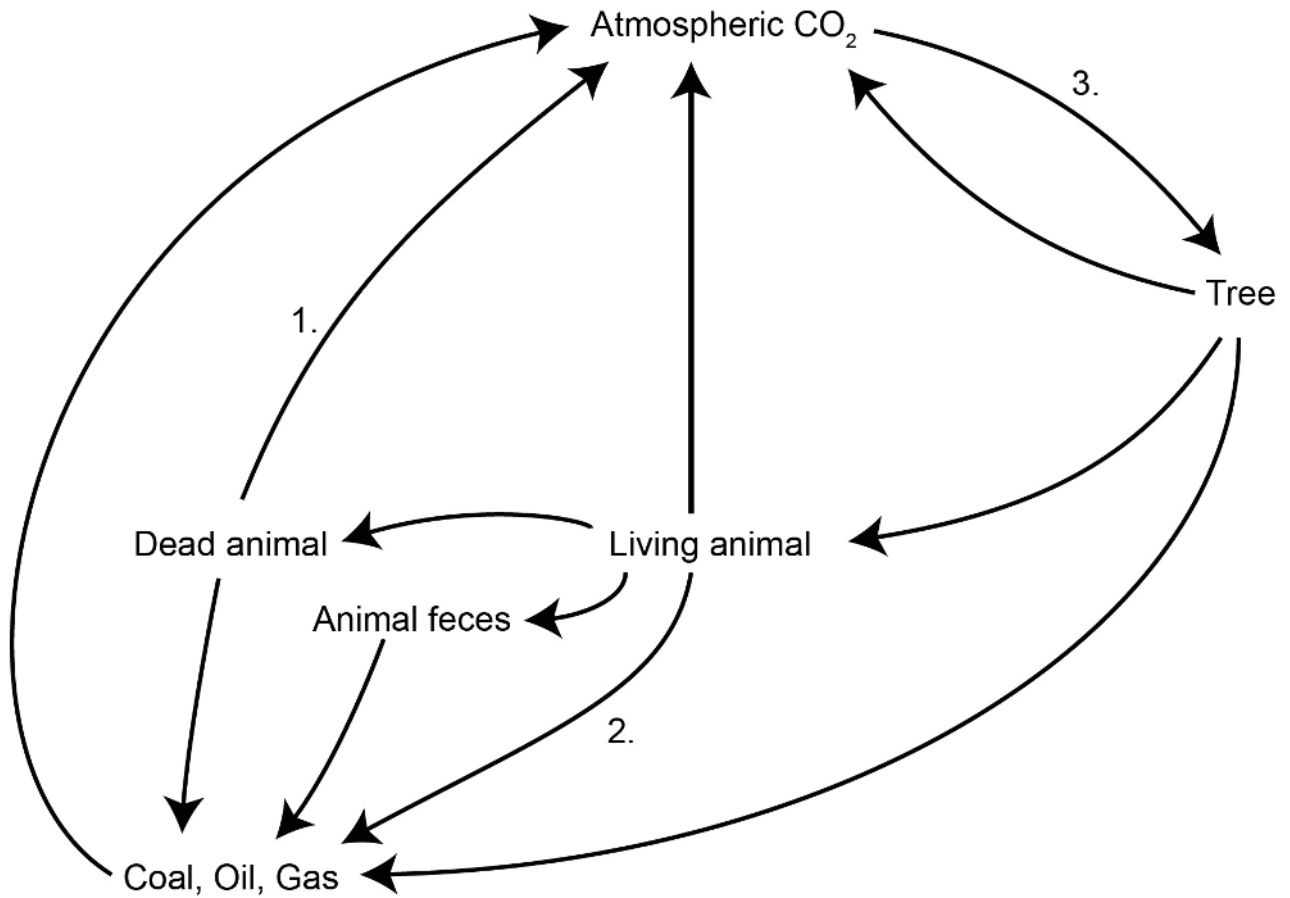
13. In which of the three DNA profiles could the alleged father be the biological father of the child?

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- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. III only
14. *Euglena* is a unicellular organism that feeds on bacteria and uses CO₂ as a carbon source. Which describes the nutrition of this organism?
- A. Autotrophic only
 - B. Heterotrophic only
 - C. Saprotrophic only
 - D. Autotrophic and heterotrophic

Turn over

15. The diagram shows a version of the carbon cycle. What is indicated by the numbers?



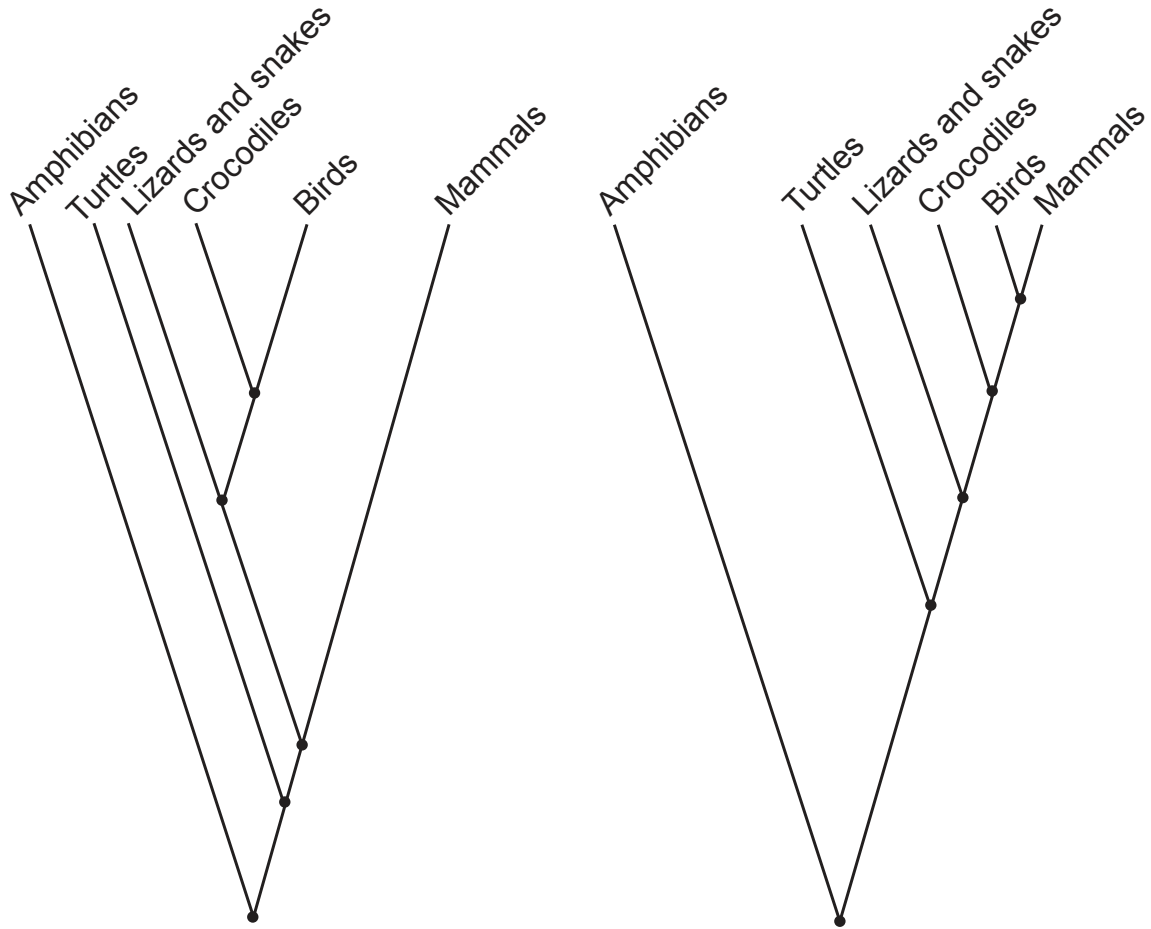
[Source : © International Baccalaureate Organization, 2017]

	1	2	3
A.	Death of consumers	Cell respiration in saprotrophs	Cell respiration in producers
B.	Death of consumers	Incomplete decomposition	Photosynthesis in producers
C.	Cell respiration in saprotrophs	Incomplete decomposition	Photosynthesis in producers
D.	Cell respiration in consumers	Cell respiration in saprotrophs	Cell respiration in producers

16. Methanogens produce methane gas. What is this gas converted to in the atmosphere?
- A. Carbon dioxide and oxygen
 - B. Ethanol and carbon dioxide
 - C. Carbon monoxide and ozone
 - D. Carbon dioxide and water
17. A bacterial population with no resistance to an antibiotic may develop into a bacterial population with some resistance to an antibiotic. Which event could lead to this?
- A. Antibiotic resistance was inherited from an ancestral population.
 - B. An antibiotic resistance plasmid is received from a bacterium in another population.
 - C. The enzyme needed for antibiotic resistance is received from a bacterium in another population.
 - D. The bacterial population mutated in response to antibiotics in the environment.
18. An animal shows radial symmetry, has only one opening leading to a digestive cavity and is soft without a skeleton. To which phylum does this animal belong?
- A. Platyhelmintha
 - B. Annelida
 - C. Mollusca
 - D. Cnidaria

Turn over

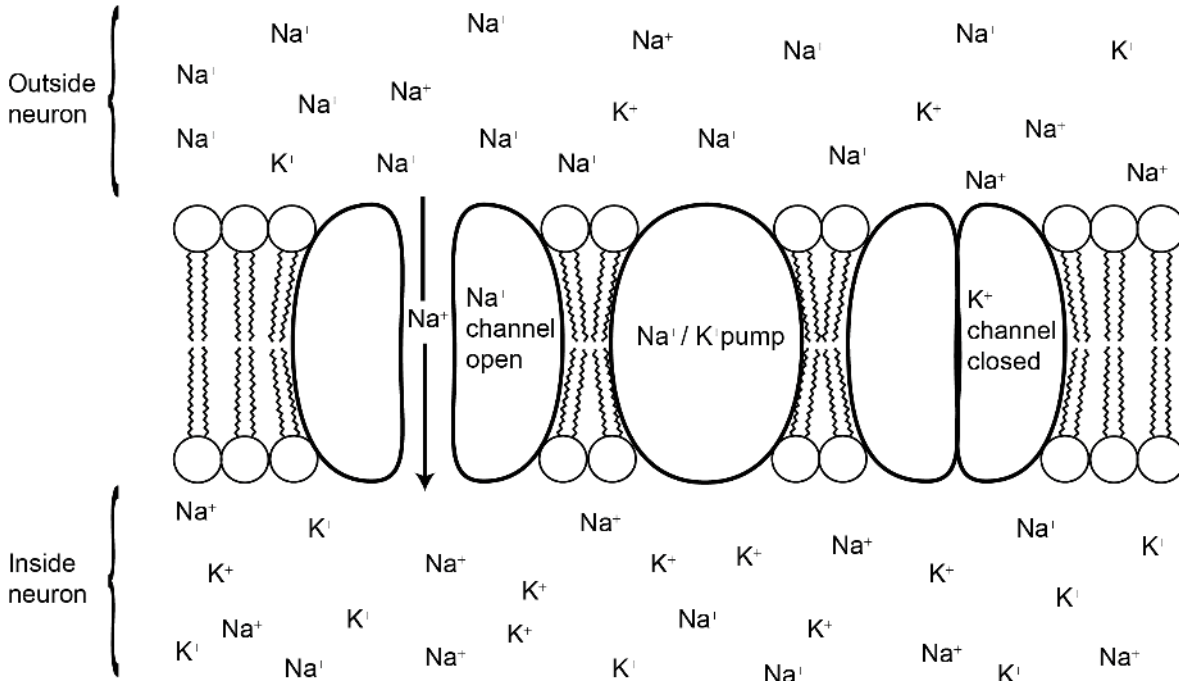
19. Cladograms can be created by comparing DNA or protein sequences. The cladogram on the left is based on DNA sequences and the cladogram on the right is based on comparing protein sequences.



What is the reason that cladograms based on DNA sequences are more reliable predictors of the phylogenetic relationship of species than cladograms based on protein sequences?

- A. Amino acids are not as chemically stable as DNA nucleotides.
- B. DNA mutates but amino acids do not.
- C. Several different triplets of bases can code for the same amino acid.
- D. There are 20 different amino acids but only 4 nucleotides.

20. The diagram below shows part of the membrane of a neuron. What stage of the action potential does it depict?



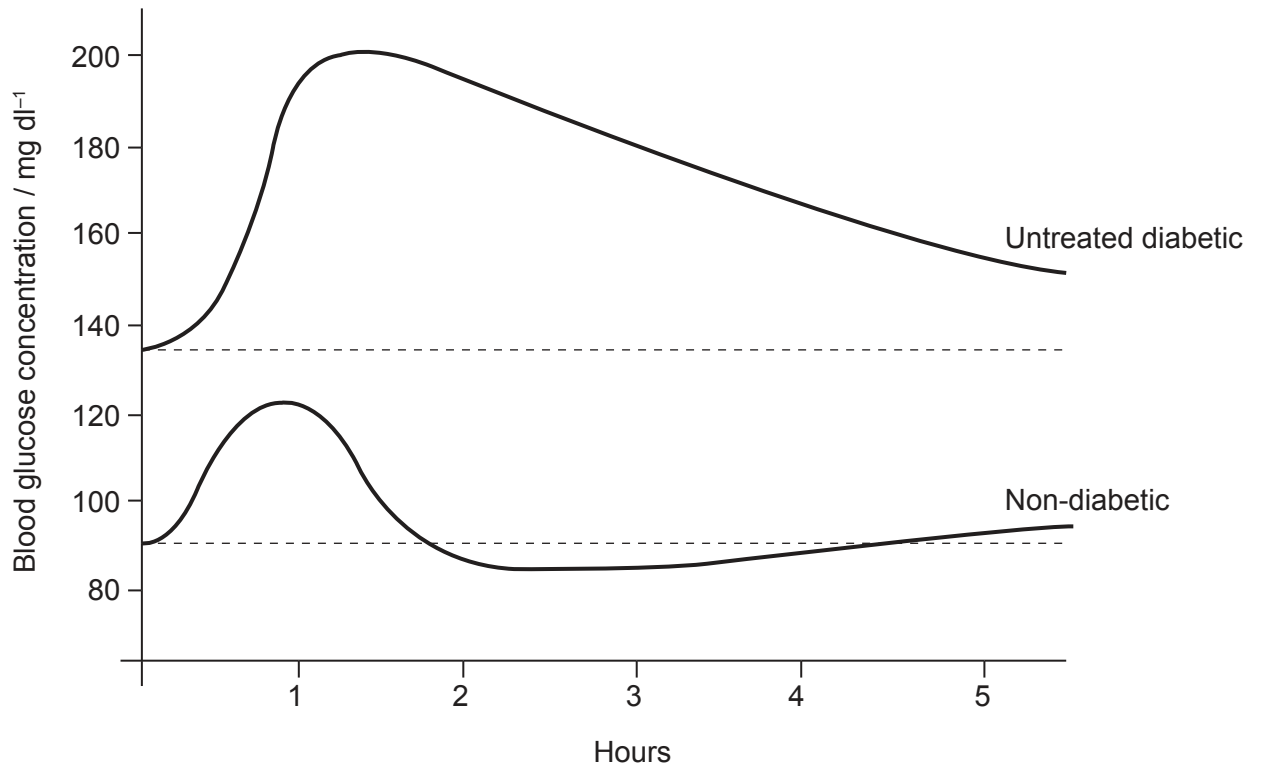
[Source : © International Baccalaureate Organization, 2017]

- A. Depolarization
 B. Repolarization
 C. Resting potential
 D. Hyperpolarization
21. Glucose is absorbed through protein channels in the plasma membrane of epithelium cells in the small intestine. Which characteristics of glucose prevent its diffusion through the phospholipid bilayer?
- A. It is non-polar and therefore hydrophobic.
 B. Its hydrogen bonds link with amino acids in the protein channel.
 C. It is polar and therefore hydrophilic.
 D. Its covalent bonds interact with the phospholipids.

Turn over

- 22.** In which blood vessel connected to the heart does blood have the lowest carbon dioxide concentration?
- A. Pulmonary vein
 - B. Vena cava
 - C. Pulmonary artery
 - D. Coronary vein
- 23.** Which organ in the human body secretes lipase, amylase and protease?
- A. Pancreas
 - B. Liver
 - C. Gall bladder
 - D. Small intestine
- 24.** Which hormone promotes the thickening of the endometrium and also inhibits the hormone that promotes the development of the follicle wall into the corpus luteum?
- A. LH
 - B. Progesterone
 - C. FSH
 - D. Estrogen

25. The graph shows the changes in blood glucose concentration of an untreated patient with type I diabetes and a non-diabetic person after a meal.



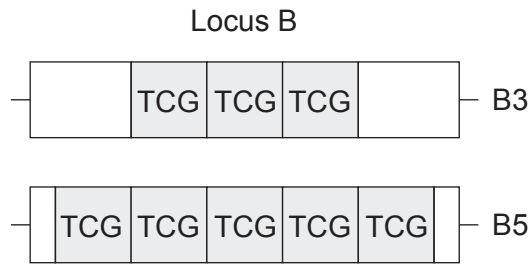
[Source: Reproduced with permission of themedicalbiochemistrypage, LLC]

Which statement correctly describes the events in this untreated diabetic patient immediately after a meal was eaten?

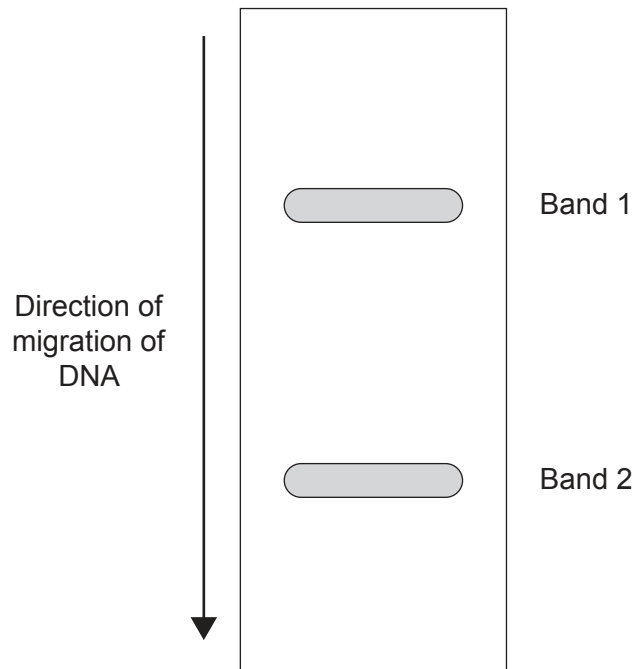
- A. Alpha cells of the pancreas secrete too little glucagon.
- B. Beta cells of the pancreas secrete too little glucagon.
- C. Alpha cells of the pancreas secrete too little insulin.
- D. Beta cells of the pancreas secrete too little insulin.

Turn over

26. A DNA profile was made of one individual in a paternity suit. Locus B was used to distinguish between this individual and other individuals. The individual had two alleles of the gene at locus B which are shown below:



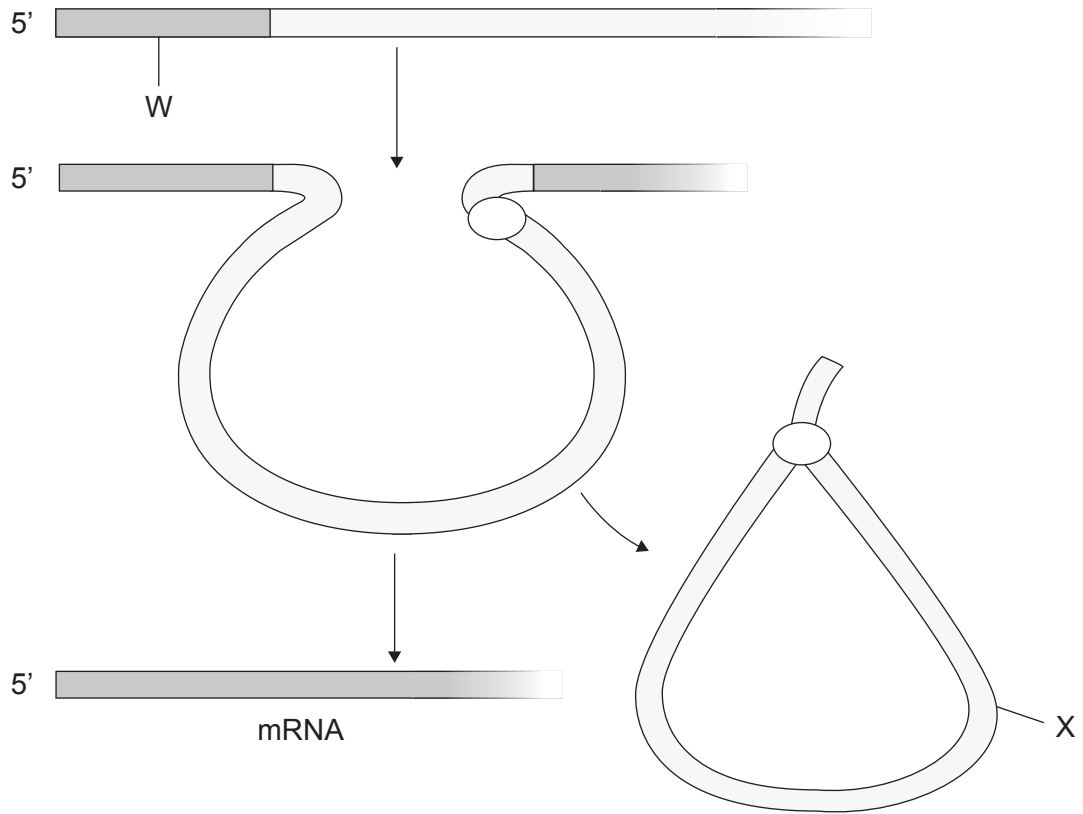
Gel electrophoresis was used to separate and visualize the alleles B3 and B5. The gel, with two bands of DNA, is shown below.



What DNA is in bands 1 and 2?

	Band 1	Band 2
A.	mix of B3+B5	B3 only
B.	mix of B3+B5	B5 only
C.	B5 only	B3 only
D.	B3 only	B5 only

27. The diagram shows how pre-mRNA is processed into mature mRNA. Which structures are indicated by the letters W and X?



	W	X
A.	Exon	Poly-A tail
B.	Poly-A tail	Exon
C.	Intron	Exon
D.	Exon	Intron

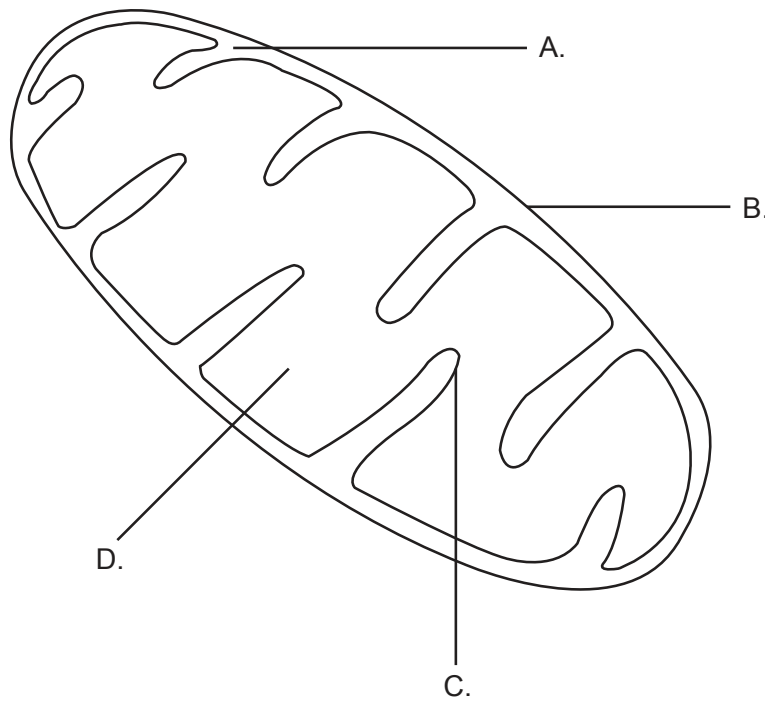
Turn over

28. Which types of interactions are found in a part of a protein with secondary but not tertiary structure?

- I. Hydrogen bonds
- II. Disulphide bridges
- III. Ionic bonds

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

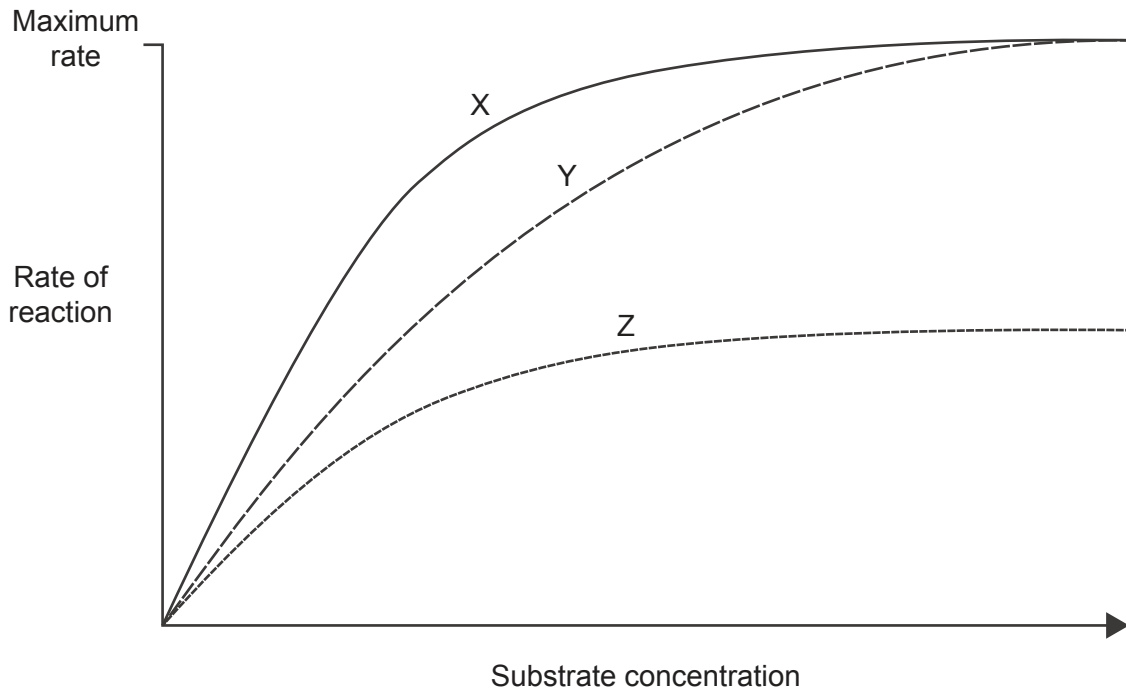
29. The diagram shows a mitochondrion. Which letter indicates the structure where ATP synthase is located?



30. Which space has the highest H⁺ concentration in a chloroplast?

- A. Thylakoid space
- B. Stroma
- C. Space between inner and outer membrane
- D. Matrix

31. The graph shows the rate of an enzymatic reaction versus the substrate concentration, in the absence or presence of an enzyme inhibitor.



Which condition is indicated by lines Y and Z?

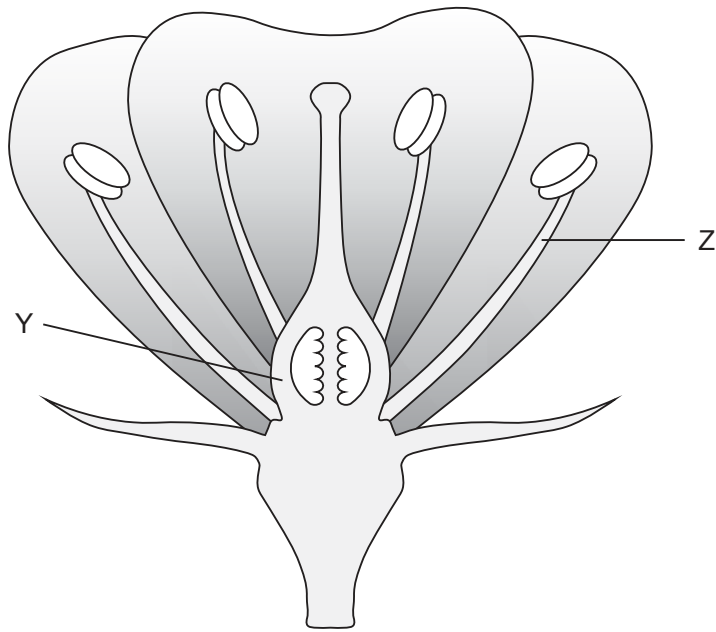
	Y	Z
A.	Non-competitive inhibitor present	No inhibitor present
B.	Non-competitive inhibitor present	Competitive inhibitor present
C.	Competitive inhibitor present	Non-competitive inhibitor present
D.	Competitive inhibitor present	No inhibitor present

32. Which process and cause are responsible for water uptake by the roots?

	Process	Cause
A.	Simple diffusion	Solute concentration in the root lower than in the soil
B.	Osmosis	Solute concentration in the root greater than in the soil
C.	Osmosis	Solute concentration in the root lower than in the soil
D.	Cohesion	Solute concentration in the root greater than in the soil

Turn over

33. Which flower structures are indicated by the letters Y and Z?



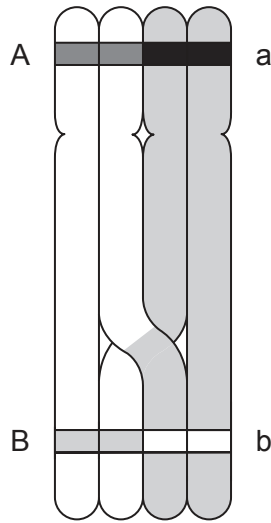
[Source: www.ib.bioninja.com.au]

	Y	Z
A.	Ovule	Filament
B.	Ovule	Style
C.	Ovary	Style
D.	Ovary	Filament

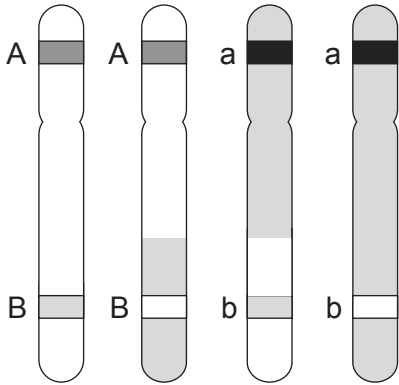
34. Positive phototropism makes a plant grow towards the light. Which plant hormone and which process make this possible?

	Plant hormone	Process
A.	Auxin	Cell elongation on the shady side of the plant
B.	Cytokinin	Cell elongation on the shady side of the plant
C.	Cytokinin	Cell elongation on the sunny side of the plant
D.	Auxin	Cell elongation on the sunny side of the plant

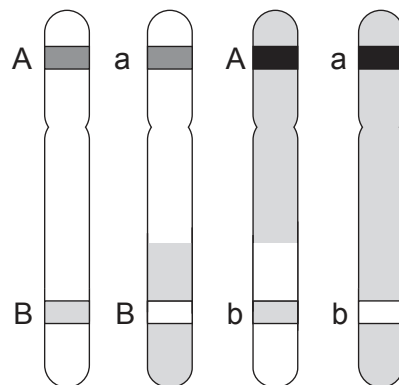
35. Which gametes can result from the following crossover?



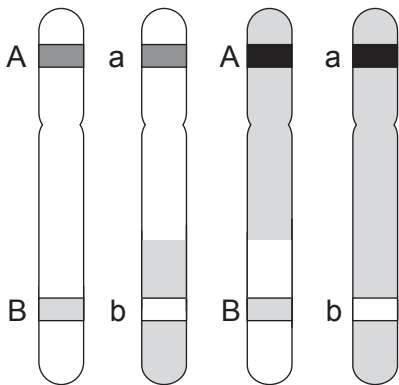
A.



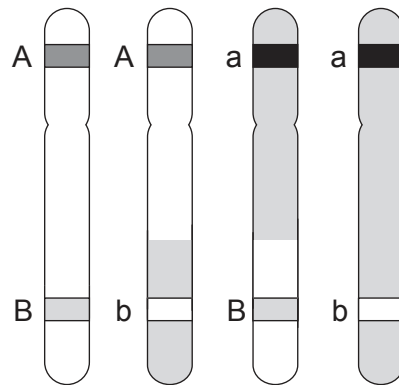
B.



C.



D.



[Source: www.ib.bioninja.com.au]

Turn over

- 36.** What can lead to reproductive isolation after just one generation?
- A. Polyploidy
 - B. Increased mutation rate
 - C. Changed allele frequencies
 - D. Independent assortment of chromosomes
- 37.** A secondary immune response occurs when an antigen is encountered on a second occasion, due to exposure to a pathogen that previously caused infection. Which property of some viruses explains the lack of a secondary immune response?
- A. Viruses fail to induce a primary response.
 - B. Viruses can have a high mutation rate.
 - C. B cells do not interact with viruses.
 - D. Antibodies cannot interact with viruses.
- 38.** Which hormone is inhibited during pregnancy in order to prevent contractions of the uterus?
- A. Oxytocin
 - B. Progesterone
 - C. Estrogen
 - D. FSH

39. The table shows solute concentrations in normal blood plasma and the fluid in one section of the nephron.

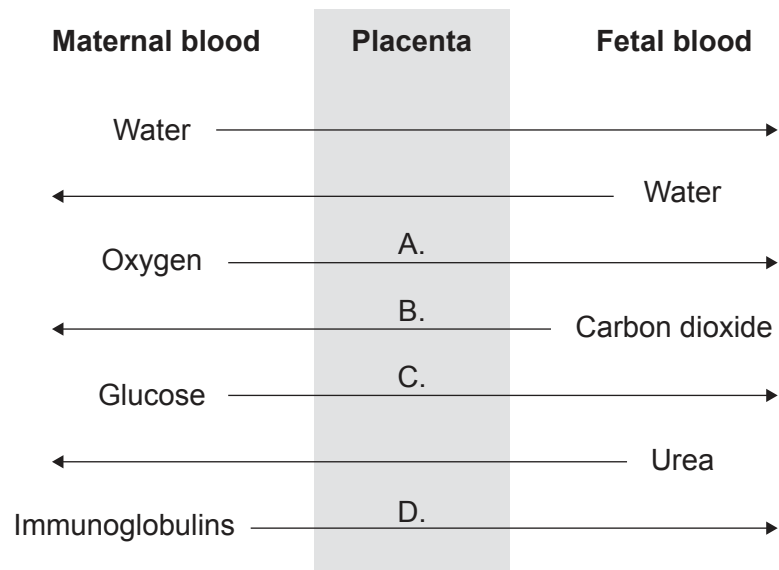
Solutes	Plasma	Fluid inside the nephron
Cl ⁻ ions	110 mol dm ⁻³	110 mol dm ⁻³
Glucose	5 mol dm ⁻³	5 mol dm ⁻³
Urea	5 mol dm ⁻³	5 mol dm ⁻³
Proteins	750 mg dm ⁻³	3–4 mg dm ⁻³

In which section of the nephron would you expect to find these concentrations?

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Turn over

40. The diagram shows the exchange processes that take place in the placenta between the maternal and fetal blood. Which process requires endocytosis?



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