

# Biology A

## Y12 Summer 2020 Open Book ANSWERS MUST BE DONE ON SEPARATE ANSWER SHEET

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Please note that you may see slight differences between this paper and the original.

Candidates answer on the Question paper.

**OCR supplied materials:**  
Additional resources may be supplied with this paper.

**Other materials required:**

- Pencil
- Ruler (cm/mm)

**Duration: Not set**

Candidate forename		Candidate surname	
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Centre number						Candidate number				
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### INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions, unless your teacher tells you otherwise.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Where space is provided below the question, please write your answer there.
- You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number and question number(s).

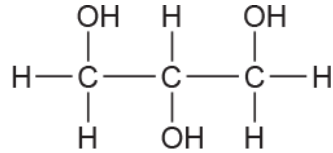
### INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist terminology* is assessed.
- 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 is **100**.
- The total number of marks may take into account some 'either/or' question choices.

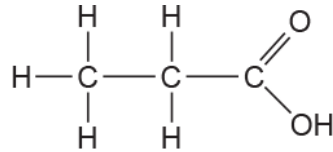
1. Water is known as the universal solvent as it has the ability to dissolve many ionic and covalent compounds due to its polar nature.

Which of the 3-carbon compounds will **not** form hydrogen bonds with water and will therefore **not** dissolve in water?

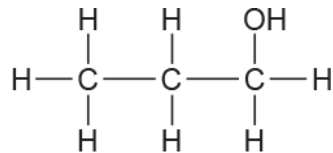
A glycerol



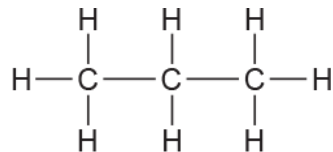
B propanoic acid



C propanol



D propane



Your answer

[1]

2. Which of the options, **A to D**, is a reason why plants require specialised transport tissue?

- A to allow osmosis to take place
- B because they all have a large surface area to volume ratio
- C to carry sucrose to their leaves
- D to overcome the limitations of diffusion over large distances

Your answer

[1]

3. Many plants are adapted to the availability of water in their environment; one group of these plants is the xerophytes.

Which one of the following statements correctly describes a xerophyte?

- A Smooth cordgrass grows in highly saline marine estuary environments.
- B The water lily has aerenchyma tissue to allow the movement of gases to submerged roots.
- C The poison tree has leafless branches covered in thorns to reduce water loss.
- D Water lobelia completes its entire life cycle submerged in shallow ponds.

Your answer

[1]

4. A standard method can be used to extract DNA from the nuclei of cells in kiwi fruit.

The statements below list some of the steps involved in this method.

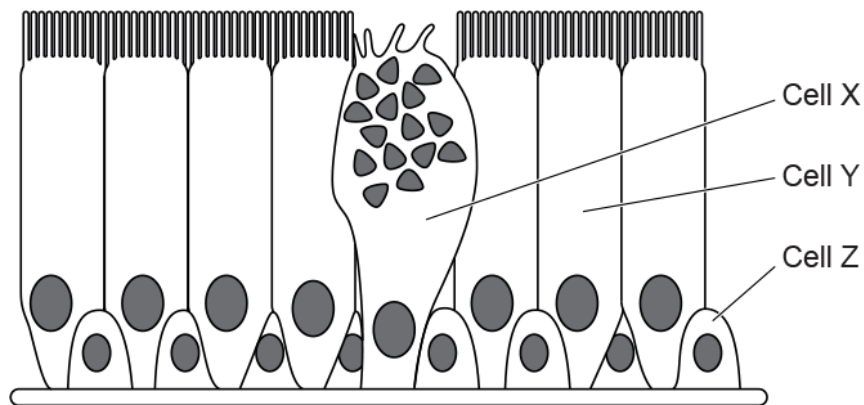
Which statement is **not** correct?

- A chop the kiwi fruit to break open cell membranes
- B add detergent to dissolve nuclear membranes
- C add protease to digest histone proteins
- D pour ice cold ethanol onto filtrate to precipitate DNA

Your answer

[1]

5. Air moves in and out of human lungs through the trachea, which is lined with cells. The diagram below shows a section containing these cells.



Which of the following statements about tracheal cells is correct?

- A Cells X, Y and Z are all columnar epithelial cells.
- B Cells X and Y move mucus and trapped bacteria out of the trachea.
- C Cell X releases mucus into the trachea.
- D Cell Z is a goblet cell.

Your answer

[1]

6. Which of the options, **A to D**, is a correct statement about polysaccharides of glucose?
- A** Cellulose microfibrils are formed by hydrogen bonding between adjacent chains of  $\alpha$ -glucose molecules bonded with 1,4-glycosidic bonds.
  - B** Amylose is a straight chain of  $\alpha$ -glucose monomers bound by 1,6-glycosidic bonds to allow for dense packing.
  - C** Glycogen has a high proportion of 1,6-glycosidic bonds to produce a highly branched molecule for rapid release of  $\alpha$ -glucose.
  - D** Amylopectin has a mixture of 1,4-glycosidic and 1,6-glycosidic bonds between  $\beta$ -glucose molecules for rapid release of energy.

Your answer

[1]

7. Which of the options, **A to D**, is a correct statement about tissue fluid?
- A** Tissue fluid carries carbon dioxide to muscle cells.
  - B** Oncotic pressure in the capillary causes tissue fluid formation from plasma.
  - C** Hydrostatic pressure in the capillary causes tissue fluid formation from plasma.
  - D** Tissue fluid is reabsorbed into the capillary by active transport.

Your answer

[1]

8. The Millennium Seed Bank has over two billion seeds in storage.

Which of the options, **A to D**, describes the type of conservation carried out at the Millennium Seed Bank?

- A** in-situ conservation of species biodiversity
- B** in-situ conservation of habitat biodiversity
- C** ex-situ conservation of species biodiversity
- D** ex-situ conservation of habitat biodiversity

Your answer

[1]

9. A group of students was given a 1% solution of an unknown digestive enzyme.

They were also given three tubes containing an identical mixture of foods.

The students carried out a different biochemical test on each tube before and after adding the unknown enzyme. Their results are shown in the table below.

	Colour before	Colour after
Biuret test	purple	purple
Iodine test	blue / black	yellow / orange
Benedict's test	brick red	brick red

Name the type of enzyme the students used.

- A protease
- B carbohydrase
- C lipase
- D lipase

Your answer

[1]

10. DNA carries the genetic code which is non-overlapping and degenerate.

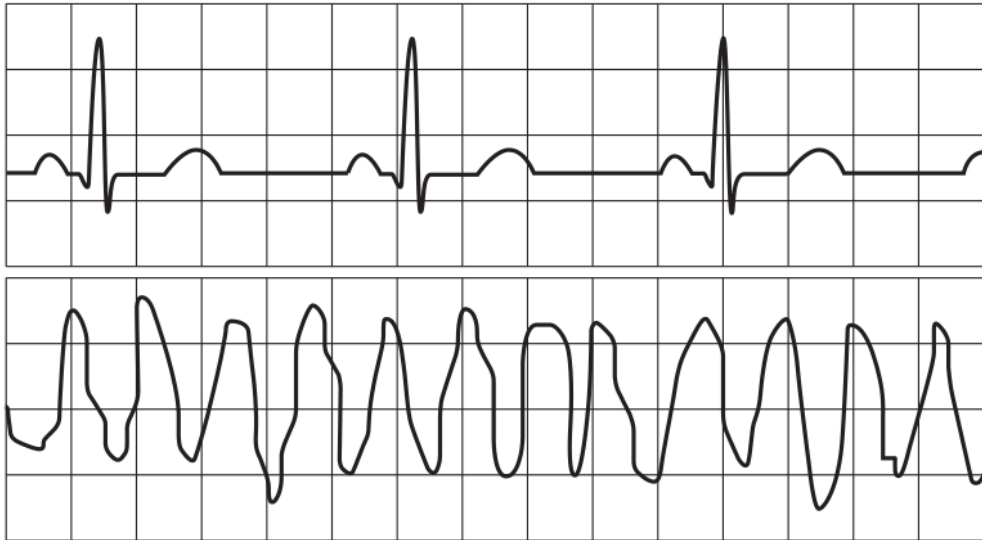
Which of the options, A to D, contains the correct definitions for non-overlapping and degenerate code?

- A Each nucleotide is only part of one triplet of bases and the molecule breaks down easily.
- B The genes follow straight after each other and the molecule breaks down easily.
- C Each nucleotide is only part of one triplet of bases and more than one triplet codes for a specific amino acid.
- D The genes follow straight after each other and more than one triplet codes for a specific amino acid.

Your answer

[1]

11. In the graph below, the top electrocardiogram (ECG) trace shows normal heart activity and the ECG trace below shows abnormal heart activity.



What is the heart condition represented by the bottom ECG trace?

- A fibrillation
- B tachycardia
- C ectopic heartbeat
- D bradycardia

Your answer

[1]

12. Tropical rainforests have a very high biodiversity of plant species.

Which of the statements, **A to D**, is an economic benefit of high biodiversity?

- A High plant biodiversity decreases the animal biodiversity in the rainforest.
- B High plant biodiversity increases the organic matter in rainforest soils.
- C High plant biodiversity supports drug discovery and development.
- D High plant biodiversity protects the ecosystem from environmental changes.

Your answer

[1]

13. Lupus is an autoimmune disease. One symptom is a facial rash, typically in a butterfly shape across the cheeks.

Following a blood test, which of the following would indicate the patient has Lupus?

- A the presence of antibodies for the cell surface antigens of connective tissue
- B the presence of herpes antibodies
- C the presence of high levels of antihistamines
- D the absence of B lymphocytes

Your answer

[1]

14. Biologists use both phylogeny and classification to understand how different species are related.

Which of the options, **A to D**, is a statement about phylogeny?

- A There are 21 species of ladybird in the UK that belong to the sub-family Coccinellinae.
- B *Homo sapiens* and *Pan bonobo* share a common ancestor.
- C The lily family, Liliaceae, consists of fifteen genera.
- D The great white shark, *Carcharodon carcharias*, is a member of the class Chondrichthyes.

Your answer

[1]



15. Which organelle, A to D, is **not** involved in the production and secretion of enzymes in eukaryotes?

- A golgi apparatus
- B ribosomes
- C smooth endoplasmic reticulum
- D vesicle

Your answer

[1]

16. A student studied the structure of a blood vessel and found:

- an outer layer of collagen fibres,
- a thick middle layer of smooth muscle and elastic tissue,
- an innermost layer of endothelial cells.

Which of the options, A to D, identifies the type of blood vessel the student studied?

- A artery
- B capillary
- C venule
- D vein

Your answer

[1]

17. Which option, A to D, describes the role of cholesterol in cell surface membranes in the human body?

- A Cholesterol binds to phospholipid phosphate heads, increasing the packing of the membrane, therefore reducing the fluidity of the membrane.
- B Cholesterol binds to phospholipid fatty-acid tails, reducing the packing of the membrane, therefore increasing the fluidity of the membrane.
- C Cholesterol absorbs ATP, preventing active transport across the membrane.
- D Cholesterol binds to phospholipid fatty-acid tails, increasing the packing of the membrane, therefore reducing the fluidity of the membrane.

Your answer

[1]

18. What is the correct definition of the term **coenzyme**?

- A An inorganic ion that forms the centre of a globular protein.
- B A molecule that binds to the enzyme, changing the shape of the active site, preventing an enzyme substrate complex from forming.
- C A non-protein organic molecule, not permanently attached to an enzyme, but needed to allow the enzyme to function.
- D A metal ion that attaches to the enzyme, changing the shape of the active site, increasing the likelihood of a reaction.

Your answer

[1]

19. Autoimmune diseases are often treated with a course of antibody injections.

Which of the following statements, **A to D**, describes the immunity arising from this treatment?

- A active natural immunity
- B active artificial immunity
- C passive natural immunity
- D passive artificial immunity

Your answer

[1]

20. During DNA replication, DNA polymerase can only work in one direction – from the 3' end to the 5' end. This means that the lagging strand has small gaps left in the backbone. DNA ligase works to seal these gaps.

Which of the options, **A to D**, identifies the bond formed?

- A hydrogen bond
- B phosphodiester bond
- C glycosidic bond
- D peptide bond

Your answer

[1]

21. A student designed an investigation into the rate of transpiration in plants. They used eight leaves of the same size, age and species. They kept environmental conditions such as wind speed, temperature and humidity constant.

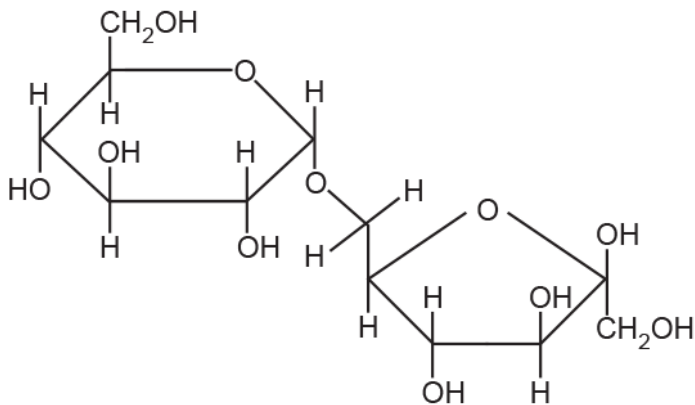
Why did the student take readings from eight different leaves?

- A to make their investigation valid
- B to increase the accuracy of their readings
- C to assess the repeatability of their data
- D to improve the precision of their results

Your answer

[1]

22. The image below shows isomaltulose, a disaccharide formed from  $\alpha$ -glucose and fructose.



Name the bond that holds the  $\alpha$ -glucose and the fructose together

- A 1,6-glycosidic bond
- B phosphodiester bond
- C ester bond
- D 1,4-glycosidic bond

Your answer

[1]

23. The genetic diversity of a population can be estimated using the following formula:  
proportion of polymorphic gene loci =  $\frac{\text{number of polymorphic gene loci}}{\text{total number of loci}}$

In 1992 a study estimated the genetic diversity of four isolated populations of lions. They recorded the number of gene variants at a selection of gene loci in each population.

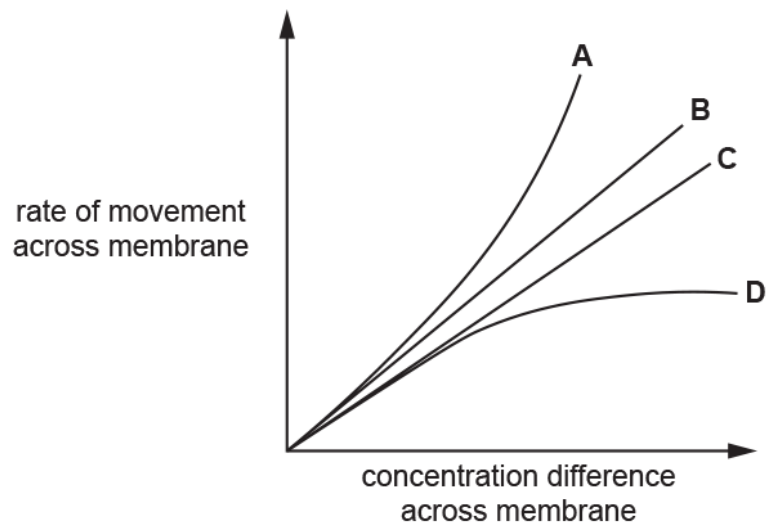
Which of the following populations of lions has the greatest proportion of polymorphic gene loci?

- A Asiatic Lion: 73 polymorphic loci out of 1927.
- B Transvaal Lion: 1110 polymorphic loci out of 2156.
- C Masai Lion: 1030 polymorphic loci out of 2315.
- D West African Lion: 1004 polymorphic loci out of 2008.

Your answer

[1]

24. The graph shows the rate of movement of four different substances across a membrane.



The substances shown in the graph are: carbon dioxide, testosterone (a lipid-based hormone), ethanol and sodium ions.

Which of the lines, A to D, represents the pattern of movement of sodium ions across a membrane?

Your answer

[1]

25. DNA is made up of two polynucleotide chains.

Which of the bonds, A to D, forms between two nitrogenous bases holding the two polynucleotide chains together?

A phosphodiester

B ionic

C covalent

D hydrogen

Your answer

[1]

26. The aquatic crustacean *Daphnia magna* has a heart that pumps a blood-like liquid called haemolymph around the body cavity.

Which of the statements, A to D, describes the circulatory system of *Daphnia magna*?

A single closed

B single open

C double open

D double closed

Your answer

[1]

27. The hydroxyl (-OH) group of carbohydrates is polar and makes the molecule soluble in water. The greater the number of free hydroxyl groups as a proportion of the number of carbon atoms, the more soluble the carbohydrate.

Which of the rows, A to D, lists the carbohydrates in order of most soluble to least soluble?

	Most soluble	←————→		Least soluble
A	glucose	ribose	amylose	amylopectin
B	amylose	amylopectin	glycogen	ribose
C	glucose	ribose	amylopectin	amylose
D	ribose	amylose	glucose	amylopectin

Your answer

[1]

28. DNA polymerase catalyses the formation of phosphodiester bonds during DNA replication.

Which of the statements, A to D, will not affect the rate of phosphodiester bond formation?

- A temperature
- B length of DNA molecule
- C pH
- D free nucleotide availability

Your answer

[1]



29. Which of the following types of cells is **not** involved in a primary immune response?

- A T-memory cells
- B T-helper cells
- C T-killer cells
- D plasma cells

Your answer

[1]

30. An individual bitten by a rabid dog can be treated by an injection of human rabies antibodies.

Which option, **A to D**, describes the type of immunity provided by this treatment?

- A natural passive
- B natural active
- C artificial passive
- D artificial active

Your answer

[1]

31. Which of the following, **A to D**, is **not** an adaptation to reduce water loss in plants?

- A an extensive root system that extends far from the plant
- B leaves that are reduced to spines that prevent damage from animals
- C the ability to store carbon dioxide so stomata only need to open at night
- D the surface covered in reflective hairs

Your answer

[1]

32. A scientist was investigating the effect of two different temperatures on the rate of enzyme controlled decomposition of ammonia, in soil bacteria.

They repeated their experiment ten times for each of the two different temperatures.

Which of the following, A to D, should they use to determine if there was a significant difference between these two sets of times?

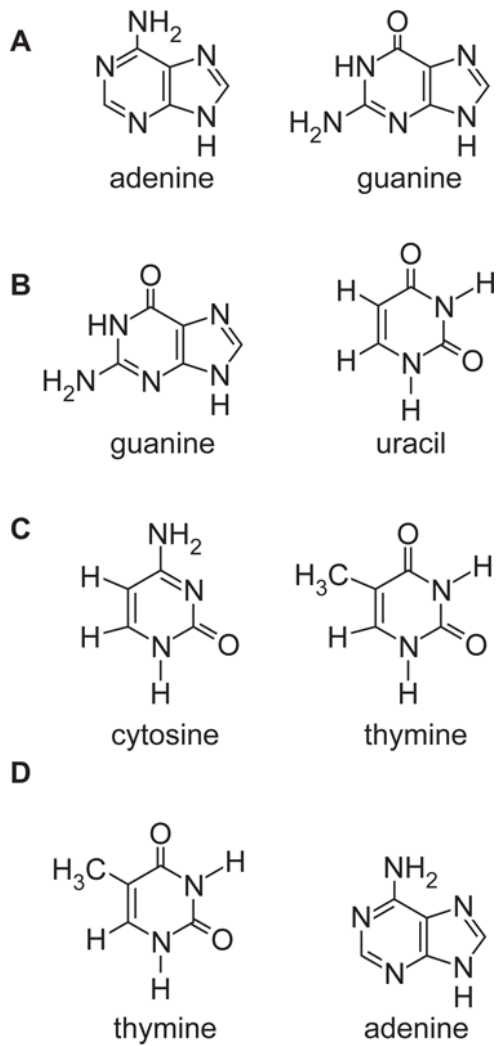
- A standard deviation
- B Student' t-test
- C chi squared test
- D Spearman's rank correlation coefficient

Your answer

[1]

33. DNA is formed from three main groups of molecules: pentose sugars, phosphate groups and nitrogenous bases. The bases can be divided into purines and pyrimidines.

Identify the two purines below.



Your answer

[1]

34. The bacterium *Sorangium cellulosum* and the fungus *Armillaria mellea* are both found in soil.

Which of the rows, A to D, correctly shows the structures present in each organism?

	Free ribosomes in cytoplasm	Membrane bound nucleus	DNA in a single loop	Cell wall present
A	<i>S. cellulosum</i> and <i>A. mellea</i>	<i>A. mellea</i>	<i>S. cellulosum</i>	<i>S. cellulosum</i> and <i>A. mellea</i>
B	<i>S. cellulosum</i> and <i>A. mellea</i>	<i>A. mellea</i>	<i>S. cellulosum</i> and <i>A. mellea</i>	<i>S. cellulosum</i> and <i>A. mellea</i>
C	<i>S. cellulosum</i>	<i>S. cellulosum</i> and <i>A. mellea</i>	<i>S. cellulosum</i>	<i>A. mellea</i>
D	<i>A. mellea</i>	<i>S. cellulosum</i>	<i>S. cellulosum</i> and <i>A. mellea</i>	<i>S. cellulosum</i>

Your answer

[1]

35. Carbon dioxide release during respiration can affect the % oxygen saturation of haemoglobin.

The tertiary structure of haemoglobin is affected when carbon dioxide reacts with water to form carbonic acid. This reaction releases hydrogen ions.

Which of the statements, A to D, explains this change?

- A The release of hydrogen ions causes the pH to rise, which reduces haemoglobin's affinity for oxygen.
- B The release of hydrogen ions causes the pH to rise, which increases haemoglobin's affinity for oxygen.
- C The release of hydrogen ions causes the pH to fall, which increases haemoglobin's affinity for oxygen.
- D The release of hydrogen ions causes the pH to fall, which reduces haemoglobin's affinity for oxygen.

Your answer

[1]

36. During translocation of photosynthetic products in the phloem sieve tube, hydrogen ions are moved out of companion cells, then sucrose enters the companion cells and moves through plasmodesmata into the sieve tube.

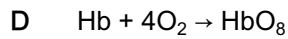
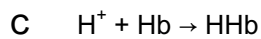
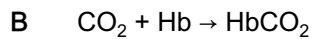
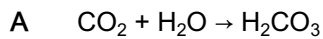
Which of the rows, A to D, correctly identifies how these substances enter or leave companion cells?

	hydrogen ions out of companion cell	sucrose into companion cell	sucrose out of companion cell
A	diffusion	facilitated diffusion	diffusion
B	diffusion	active transport	active transport
C	active transport	facilitated diffusion	diffusion
D	active transport	active transport	facilitated diffusion

Your answer

[1]

37. Which of the following, A to D, shows the reaction catalysed by carbonic anhydrase?



Your answer

[1]

38. Plants such as the soybean have a number of defence strategies to prevent infection by pathogens.

Which of the following strategies is a chemical defence against pathogen infection?

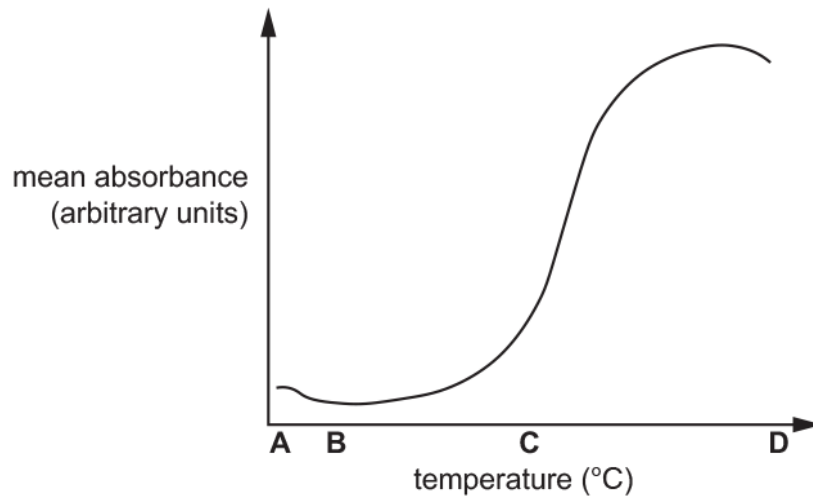
- A callose deposits at sieve tube ends that prevent pathogen movement in phloem
- B hydrolytic enzymes such as chitinase found between cells
- C stomata can be closed by guard cells if pathogens are detected
- D cell walls can be thickened by lignin, making cell entry very difficult for pathogens

Your answer

[1]

39. Swiss chard is a leafy green vegetable related to spinach. Some varieties have yellow stalks that have vacuoles containing yellow betaxanthin pigments.

The graph below shows the effect of temperature on the release of these pigments recorded as mean absorbance, when measured with a colorimeter



It was deduced that the betaxanthins were released from the vacuole due to the denaturing of proteins in the tonoplast (vacuolar membrane).

Which letter, A to D, shows the temperature at which the proteins denature?

Your answer

[1]

40. An investigation into how a change in sodium chloride concentration effects osmosis in potato cells concluded that the isotonic point of the potato was 0.25 M.

Which of the statements, A to D, describes what is happening at the isotonic point?

- A there is a net movement of water from the sodium chloride solution into the potato cells
- B there is a net movement of water from the cytoplasm of the potato cells into the sodium chloride solution
- C there is no movement of water into or out of the potato cell cytoplasm
- D the movement of water into the potato cells is equal to the movement of water out of the potato cells

Your answer

[1]



41. In human cells, the tumour suppressor gene *TP53* codes for a protein that interrupts the cell cycle if there is any damage to the DNA and prevents the copying of damaged DNA.

Which of the stages, A to D, could *TP53* interrupt the cell cycle?

A mitosis

B G<sub>1</sub>

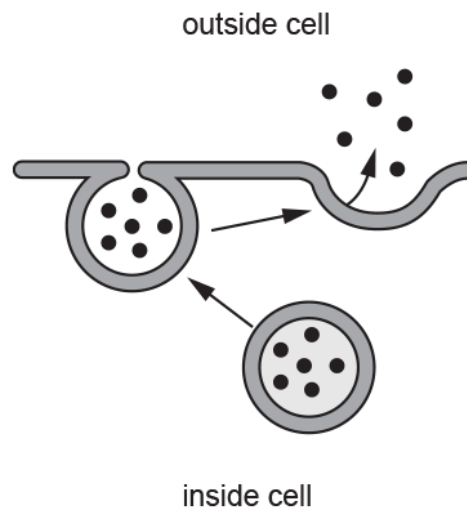
C S

D cytokinesis

Your answer

[1]

42. The diagram below shows one method of transport across a cell membrane.



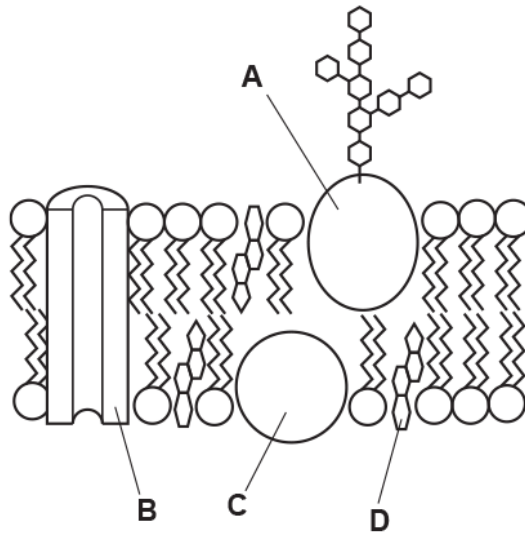
Which of the following options, A to D, is the name of this method of transport?

- A cytokinesis
- B endocytosis
- C exocytosis
- D phagocytosis

Your answer

[1]

43. The diagram below shows the structure of a plasma membrane.

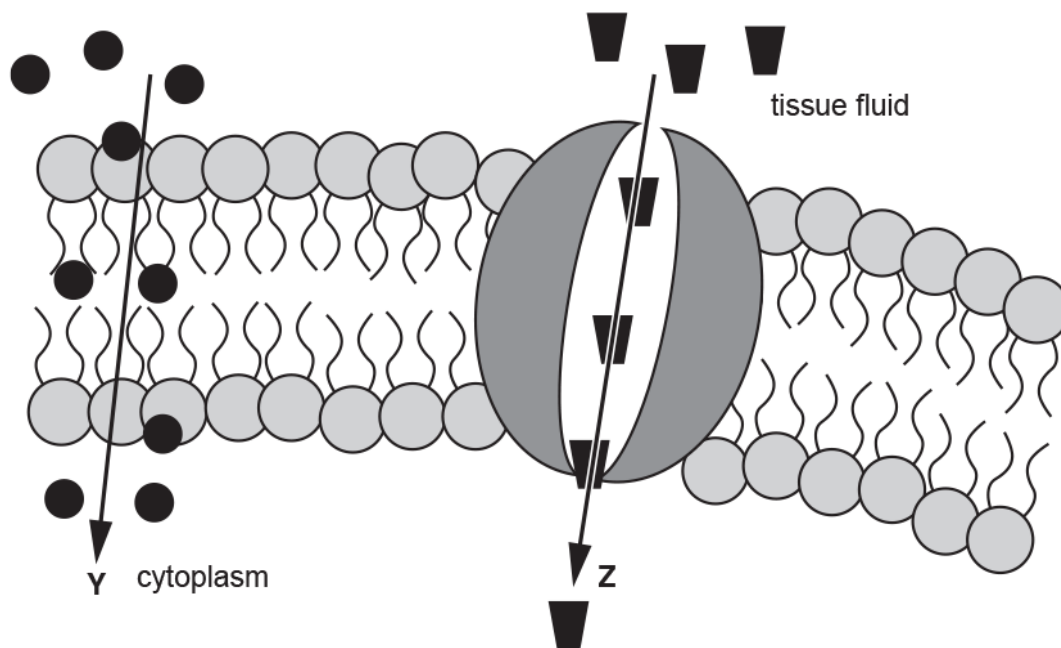


Which label, A to D, indicates the component of the membrane that can affect its fluidity?

Your answer

[1]

44. This diagram shows the transport of two molecules across a plasma membrane.



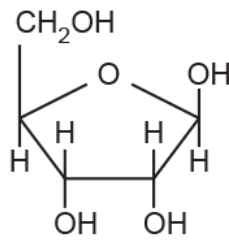
Which row, A to D, correctly identifies the molecule being transported and the mechanism of transport across the plasma membrane?

	Y	Z
A	glucose by active transport	oxygen by diffusion
B	glucose by diffusion	oxygen by active transport
C	oxygen by active transport	glucose by active transport
D	oxygen by diffusion	glucose by diffusion

Your answer

[1]

45. The structure of a biological molecule is shown below.



Which of the following options, **A** to **D**, correctly describes the molecule?

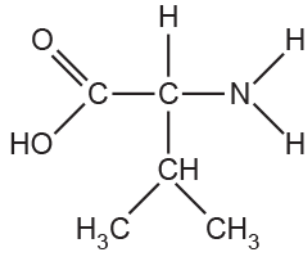
- A hexose monosaccharide glucose
- B hexose monosaccharide ribose
- C pentose monosaccharide glucose
- D pentose monosaccharide ribose

Your answer

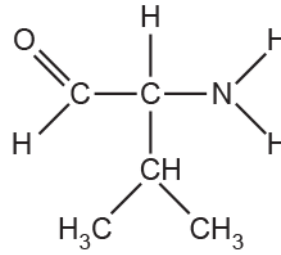
[1]

46. Which of the following molecules, A to D, could be a product of breaking a peptide bond during a hydrolysis reaction?

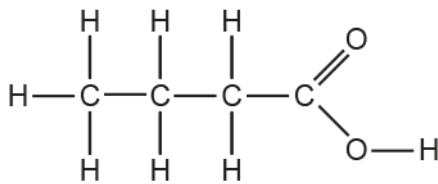
**A**



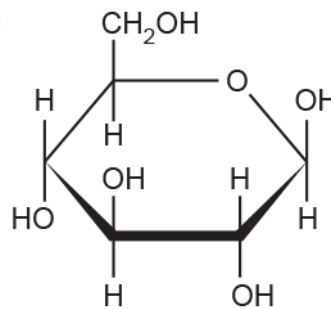
**B**



**C**



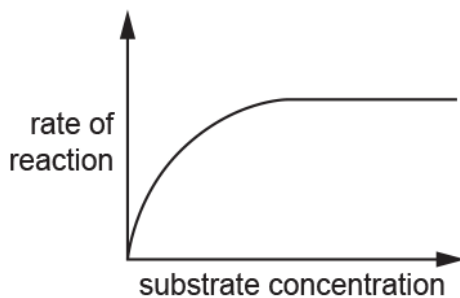
**D**



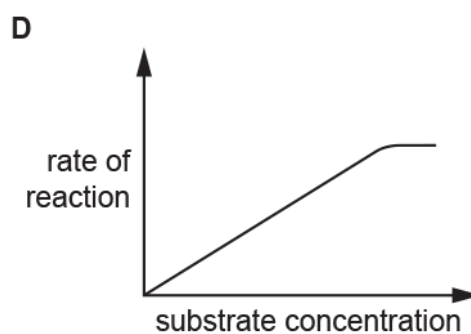
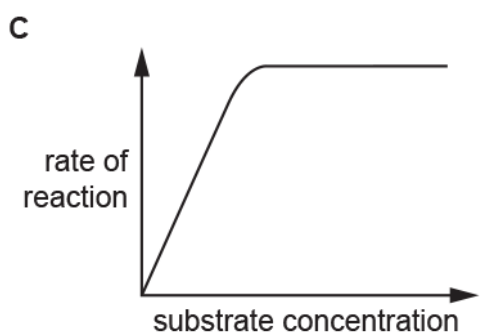
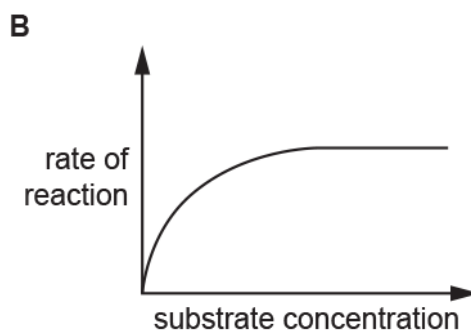
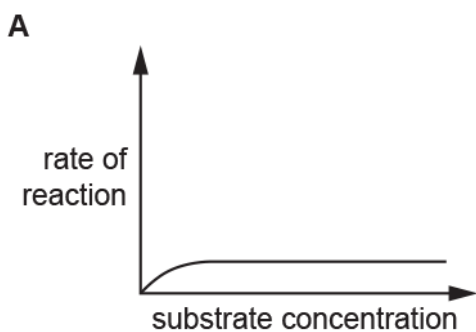
Your answer

[1]

47. The diagram below shows the effect of changing substrate concentration on the rate of an enzyme-controlled reaction.



Which of the following graphs, A to D, shows how a **non-competitive** inhibitor would affect the rate of this reaction?



Your answer

[1]

48. Which of the following ions, A to D, is required for the hydrolysis of starch by an enzyme?

A  $Cl^-$

B  $K^+$

C  $Na^+$

D  $Zn^{2+}$

Your answer

[1]

49. The giant water lily, *Victoria amazonica*, grows in the shallow waters of the Amazon river basin.

Which of the following adaptations, A to D, enables *Victoria amazonica* to survive in its watery environment?

A thick waxy cuticle

B leaves with stomata on upper surface only

C leaves with sunken stomata

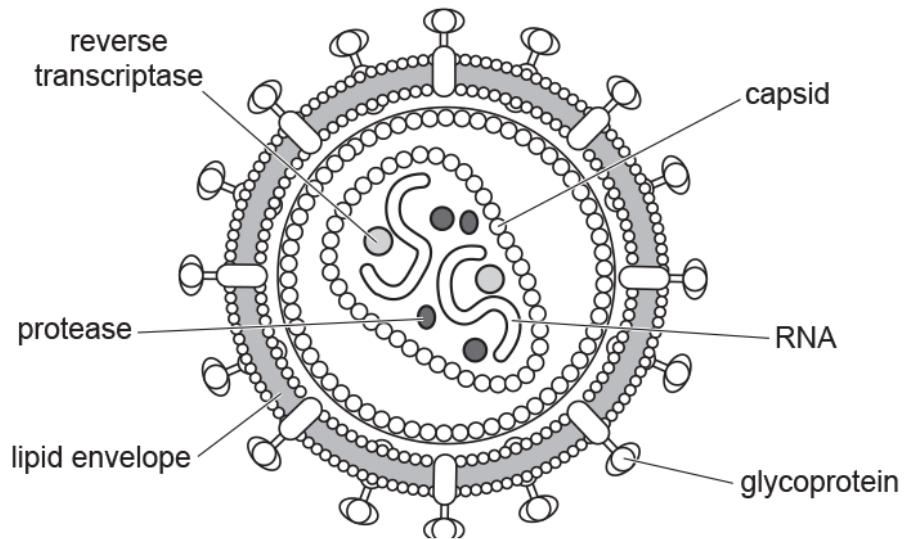
D extensive shallow root system

Your answer

[1]



50. The diagram below shows a pathogen.



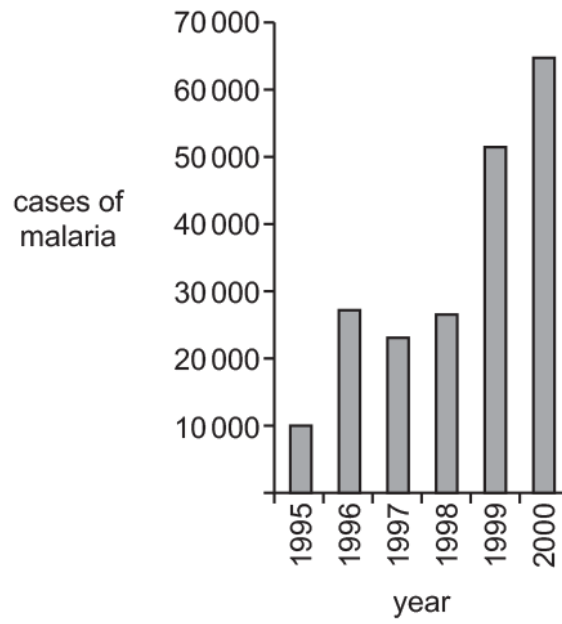
Which of the options, **A** to **D**, is the disease caused by this pathogen?

- A HIV / AIDS
- B potato blight
- C ringworm
- D tuberculosis

Your answer

[1]

51. The chart shows the number of reported cases of malaria in South Africa between 1995 and 2000.



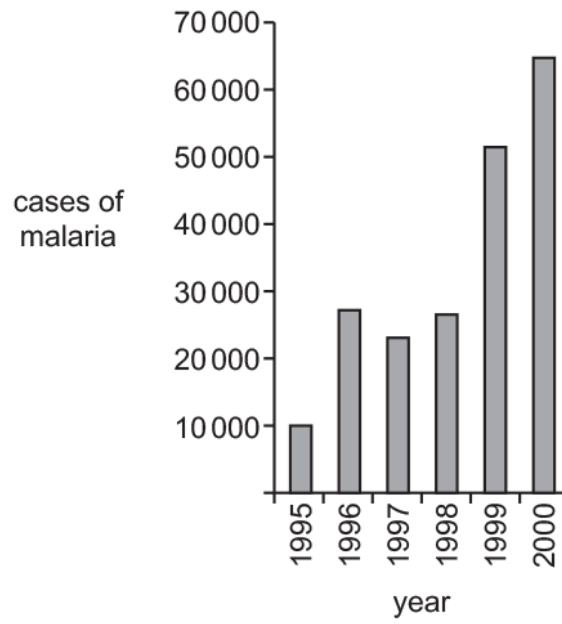
Which of the following, A to D, is the percentage increase from the number of cases of malaria in 1995 to 2000?

- A 85%
- B 550%
- C 650%
- D 55 000%

Your answer

[1]

52. The chart shows the number of reported cases of malaria in South Africa between 1995 and 2000.



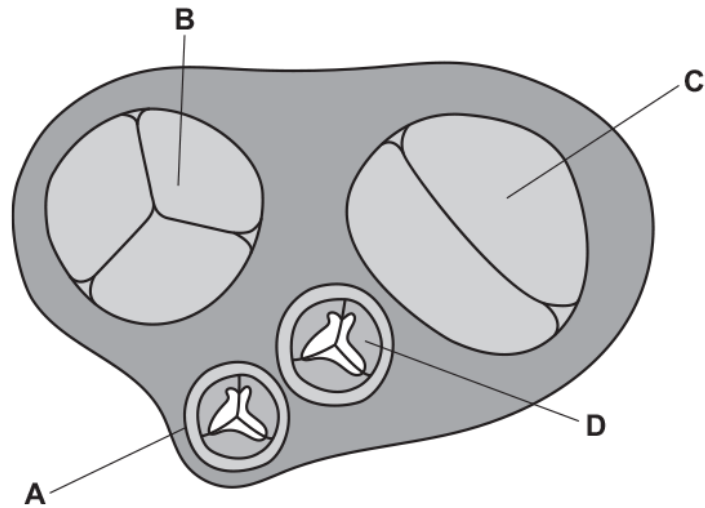
Which of the following statements, A to D, could explain the data shown for 1999-2000?

- A the malarial parasite had developed resistance to insecticides
- B the vector had developed resistance to antibiotics
- C the malarial parasite had developed resistance to antiviral drugs
- D the vector had developed resistance to insecticides

Your answer

[1]

53. The diagram below shows an internal view of the mammalian heart with the atria removed so valves can be seen.



Which of the valves, labelled A to D, is pushed open by oxygenated blood entering a ventricle?

Your answer

[1]

54. The sea marigold, *Calendula maritima*, is a rare species that is critically endangered and has been included in an *ex situ* conservation project.

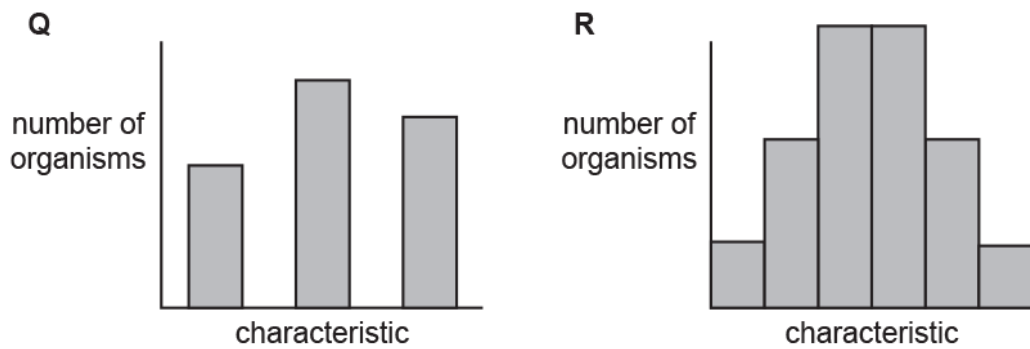
Which of the following options, **A** to **D**, is a disadvantage of conserving the sea marigold *ex situ*?

- A it could reduce genetic diversity in sea marigolds
- B sea marigolds are collected from the wild as seeds
- C sea marigold seeds are stored in large numbers
- D sea marigolds will be at risk from grazing by herbivores

Your answer

[1]

55. The two histograms represent the frequency distribution for the two different types of variation.



Which of the statements, A to D, about characteristic Q is correct?

- A controlled by many genes and unaffected by the environment
- B controlled by one or two genes and unaffected by the environment
- C controlled by many genes and influenced by the environment
- D controlled by one or two genes and influenced by the environment

Your answer

[1]

56. Some of the taxonomic groups for the beach sunflower, *Helianthus debilis*, are shown in the table below.

Kingdom	Plantae
Phylum	Magnoliophyta
W	Magnoliopsida
Order	Asterales
X	Asteraceae
Y	Helianthus

Which of the following rows, A to D, correctly identifies the missing taxonomic groups from the classification of *Helianthus debilis*?

	W	X	Y
A	class	genus	species
B	class	family	genus
C	family	genus	species
D	family	class	genus

Your answer

[1]

57. Ventilation is a process that involves various parts of the body.

Which of the following options, **A** to **D**, describes **exhalation** in a mammal?

- A** ribcage moves upwards and outwards; external intercostal muscles relax; diaphragm relaxes
- B** ribcage moves downwards and inwards; external intercostal muscles relax; diaphragm relaxes
- C** ribcage moves upwards and outwards; external intercostal muscles contract; diaphragm relaxes
- D** ribcage moves downwards and inwards; external intercostal muscles contract; diaphragm contracts

Your answer

[1]

58. The table below shows four biological molecules and their component elements.

Which of the rows, **A** to **D**, correctly identifies the elements in each molecule?

	sucrose	cholesterol	insulin	ATP
<b>A</b>	C, H, O	C, H, O, N	C, H, O, N, S	C, H, O, N, P
<b>B</b>	C, H, O, N	C, H, O	C, H, O, N, S	C, H, O, N, S
<b>C</b>	C, H, O	C, H, O	C, H, O, N, S	C, H, O, N, P
<b>D</b>	C, H, O	C, H, O	C, H, O, N, P	C, H, O, N, P

Your answer

[1]



59. Fig. 9.1 shows some of the checkpoints of the cell cycle.

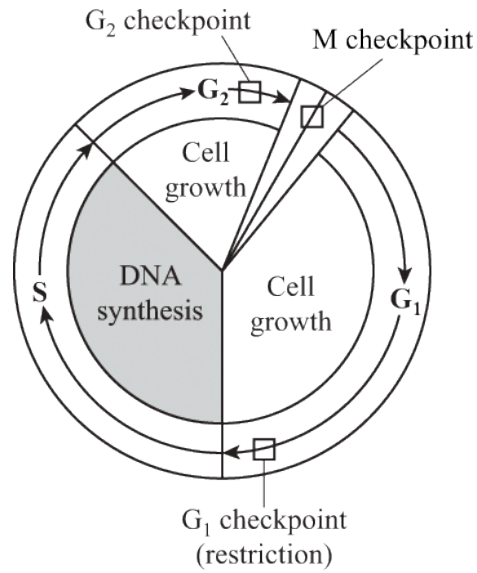


Fig. 9.1

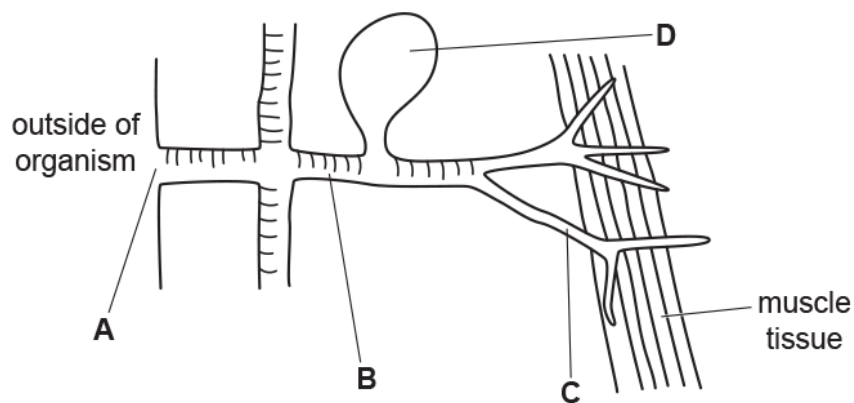
Which statement correctly describes the events that happen if DNA damage is discovered at the G<sub>2</sub> checkpoint?

- A The cell cycle continues to mitosis and the DNA will be replicated during metaphase.
- B The cell cycle is halted and the cell tries to repair the DNA.
- C The cell cycle returns to the G<sub>1</sub> phase to try to correct the damage.
- D The cell cycle stops and the cell dies.

Your answer

[1]

60. The diagram shows part of the gas exchange system of an insect.



Which of the labels, A to D, indicates the trachea?

Your answer

[1]

61. The table below shows the stages of the cell cycle.

Which row, A to D, shows the correct order of the different stages?

	Cytokinesis	G1	G2	Mitosis	S
A	four	two	three	one	five
B	five	one	three	two	four
C	three	four	one	two	five
D	four	two	five	one	three

Your answer

[1]

62. Which inorganic ion can act as a cofactor for amylase?

- A  $\text{OH}^-$
- B  $\text{PO}_4^{3-}$
- C  $\text{Cl}^-$
- D  $\text{HCO}_3^-$

Your answer

[1]

63. Translocation occurs through the sieve elements by \_\_\_\_\_ 1 \_\_\_\_\_. Sucrose is loaded into the phloem at regions of the plant known as \_\_\_\_\_ 2 \_\_\_\_\_. This mechanism is \_\_\_\_\_ 3 \_\_\_\_\_ . The addition of sucrose \_\_\_\_\_ 4 \_\_\_\_\_ the water potential of the sieve element sap. This causes water to enter from surrounding tissues by \_\_\_\_\_ 5 \_\_\_\_\_ which in turn increases the \_\_\_\_\_ 6 \_\_\_\_\_ of the sap.

Which words correctly complete the numbered gaps 1–6?

	1	2	3	4	5	6
A	active transport	sources	active	raises	osmosis	concentration
B	mass flow	sources	active	lowers	active transport	pressure
C	mass flow	sinks	passive	raises	diffusion	concentration
D	mass flow	sources	active	lowers	osmosis	pressure

Your answer

[1]

64. Fig. 2.1 shows the shapes of an enzyme molecule, its substrate and the molecules of three substances, P, Q and R.

Each substance could bind either to the enzyme or to the substrate to cause an effect.

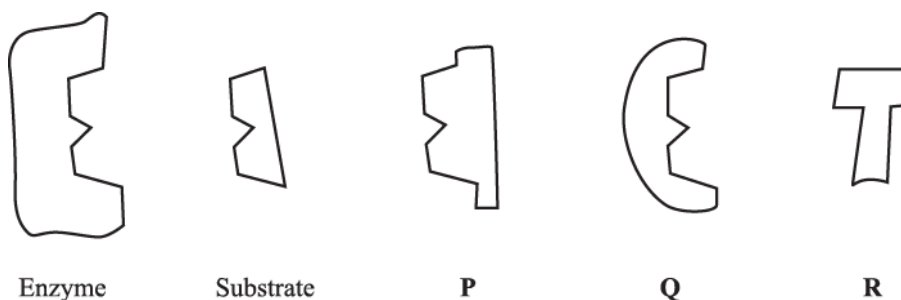


Fig. 2.1

Four tubes were set up:

- The control contained enzyme and substrate only
- Tube P contained enzyme, substrate and substance P
- Tube Q contained enzyme, substrate and substance Q
- Tube R contained enzyme, substrate and substance R.

Which option describes the most likely effect on the rate of reaction in each tube compared with the control?

	Tube P	Tube Q	Tube R
A	increased	no effect	no effect
B	decreased	no effect	decreased
C	decreased	no effect	no effect
D	decreased	decreased	no effect

Your answer

[1]

65. After being mixed with iodine, which of the following would show a blue / black colour?

- A potato tuber cells
- B erythrocytes
- C sieve tube elements
- D neutrophils

Your answer

[1]

66. Fig. 5.1 shows part of a conjugated protein that is a respiratory pigment in muscle cells.

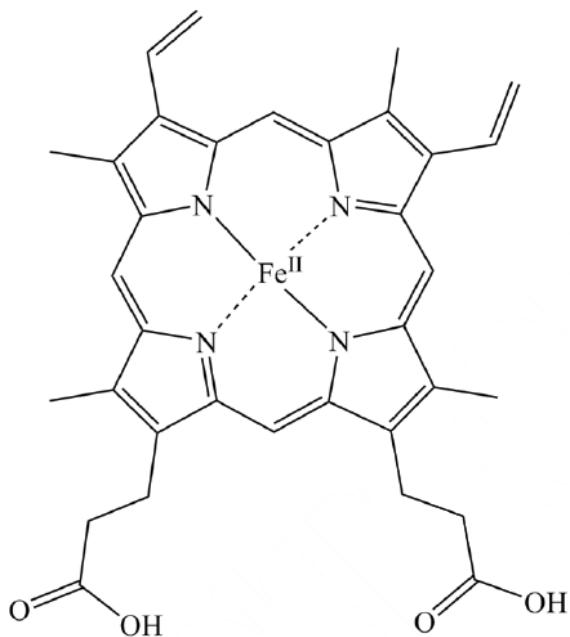


Fig. 5.1

Which part of the molecule does Fig 5.1 represent?

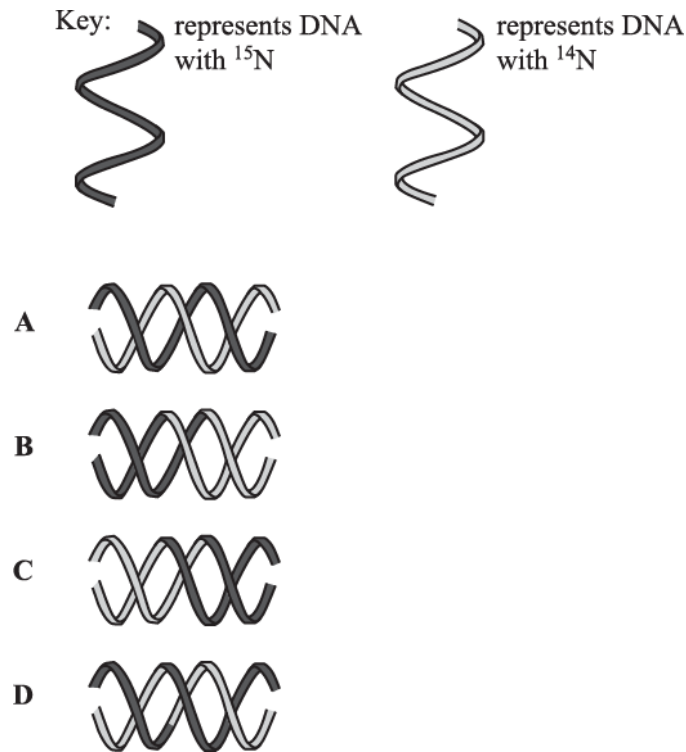
- A prosthetic group
- B disulfide bond
- C quaternary structure
- D polypeptide

Your answer

[1]

67. A sample of DNA containing only one isotope of nitrogen,  $^{15}\text{N}$ , was incubated with nucleotides containing only the  $^{14}\text{N}$  isotope along with the enzymes needed for replication.

Which of the following diagrams would represent the resulting DNA after one round of replication?



Your answer

[1]

68. Dissolved material gives rise to oncotic pressure, which is related to water potential,  $\Psi$ .

Which of the following shows the typical oncotic and hydrostatic pressures in blood at the arterial and venous ends of capillaries?

	Pressure (mmHg)			
	Arterial end of capillary		Venous end of capillary	
	Oncotic	Hydrostatic	Oncotic	Hydrostatic
<b>A</b>	-20	13	-20	33
<b>B</b>	-20	-13	-20	13
<b>C</b>	20	33	-20	13
<b>D</b>	-20	33	-20	13

Your answer

[1]

69. The graph in Fig. 8.1 shows a normal spirometer trace.

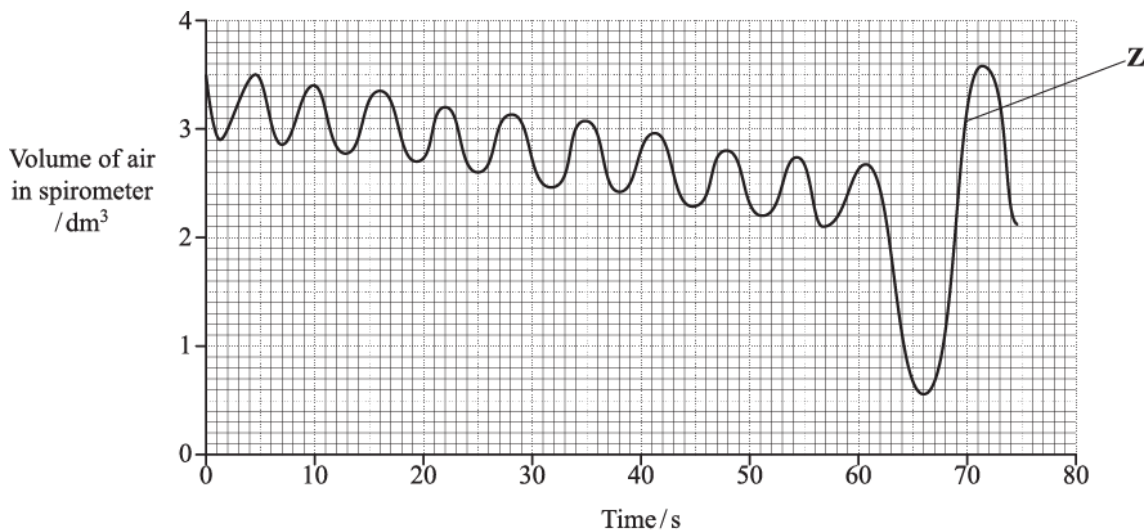


Fig. 8.1

Which option correctly describes what is happening at point Z?

- A pressure inside lungs is low
- B volume of thorax is large
- C diaphragm is contracted
- D internal intercostal muscles are contracted

Your answer

[1]

70. Which of the following is **not** a role of an intracellular membrane?

- A cell to cell signalling
- B partially permeable barrier
- C site of chemical reactions
- D transport of substances across the membrane

Your answer

[1]

71. The mitotic cell cycle is divided into a number of stages.

In which of the following stages will the chromosomes line up at the equator of the cell?

- A anaphase
- B interphase
- C metaphase
- D telophase

Your answer

[1]



72. Which of the following factors does **not** affect the shape of the active site of an enzyme?

- A a drop in temperature
- B non-competitive inhibitor
- C a change in pH
- D binding of substrate

Your answer

[1]

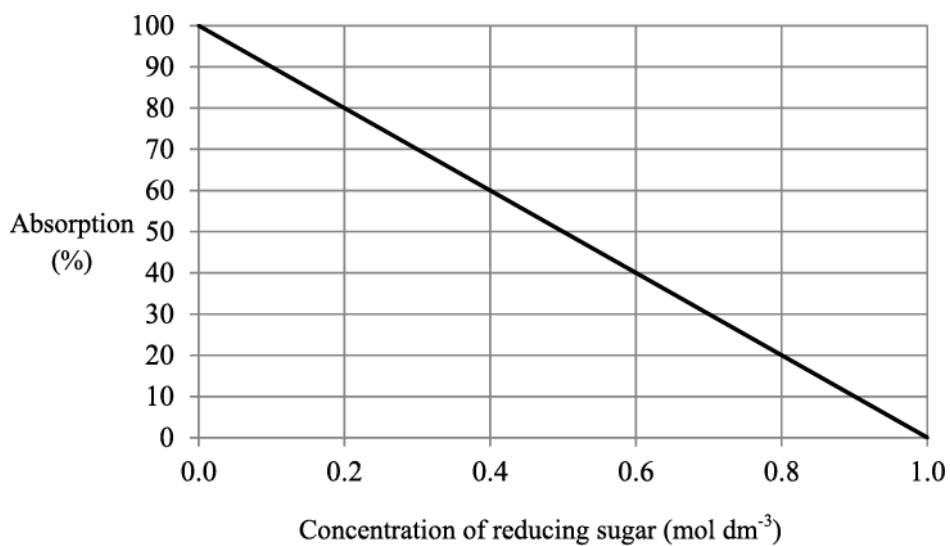
73. Which of the following statements is a step in meiosis that can lead to variation within a species?

- A Mutations occurring during DNA replication.
- B Random fusion of gametes.
- C Independent assortment of homologous chromosomes.
- D Chromosomes forming homologous pairs called bivalents.

Your answer

[1]

74. A student tested a range of solutions of known concentrations of reducing sugar using Benedict's solution and colorimetry. Fig. 14.1 shows the calibration curve drawn by the student.



**Fig. 14.1**

The student then tested four solutions of **unknown** concentrations of reducing sugar. Table 14.1 shows the results:

Solution	P	Q	R	S
Absorption (%)	60	40	70	100

**Table 14.1**

Select the option that gives the correct sequence of reducing sugar concentrations from **highest** to **lowest**.

- A S, R, P, Q
- B Q, R, P, S
- C S, P, R, Q
- D Q, P, R, S

Your answer

[1]

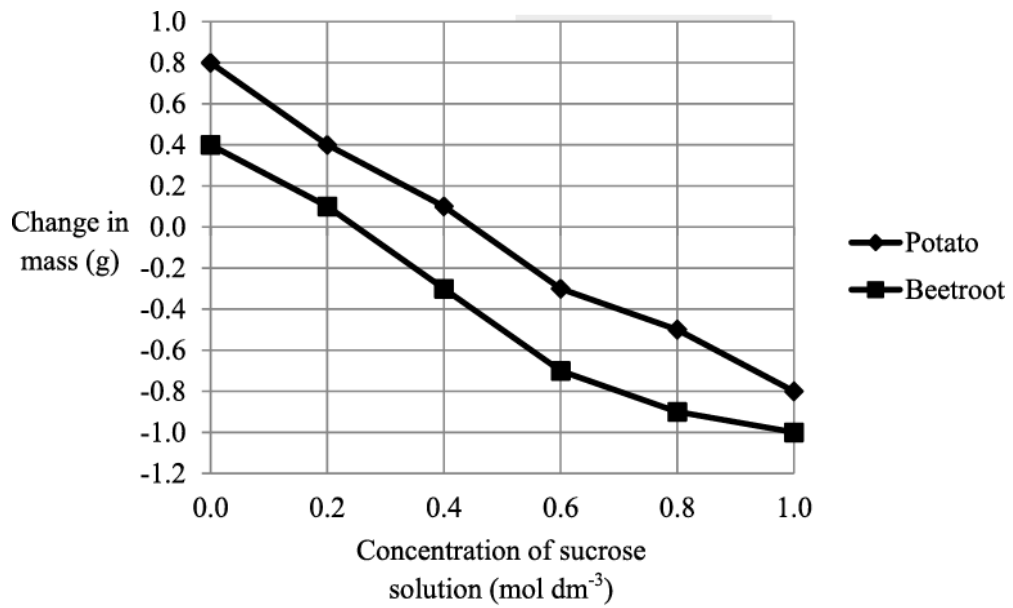
75. Enzymes are capable of affecting the metabolism and structure of whole organisms. Which of the following enzymes will have the greatest effect on the **development** of an organism as a whole?

- A Methyltransferase: adds methyl groups to DNA allowing genes to be switched on or off.
- B Reverse transcriptase: generates complementary DNA from an RNA template.
- C Deoxyribonuclease: digests free DNA molecules outside of the nucleus.
- D Telomerase: lengthens ends of chromosomes by adding DNA sequences, preventing them from being degraded.

Your answer

[1]

76. Fig. 16.1 shows the results of an osmosis experiment on sections of potato and beetroot. The original mass of each potato section was 4.6 g.



**Fig. 16.1**

Which option shows the correct percentage change in mass when a potato section was placed in the solution with the highest water potential?

- A -17.4%
- B 10.8%
- C -27.0%
- D 17.4%

Your answer

[1]

77. A student observed mitosis in a prepared slide of a root tip.  
The student recorded a description for each of four cells (A-D) and then tried to identify which stage of mitosis had been observed.

Which of the mitotic stages has been identified correctly?

	Description	Mitotic stage identified
A	Spindle fibres clearly visible	Telophase
B	Chromosomes aligned at equator	Anaphase
C	Sister chromatids pulled to poles of cell	Metaphase
D	Dark bodies visible within nucleus	Prophase

Your answer

[1]

78. The **second division** of meiosis is different from mitosis because...

- A ...individual chromosomes line up randomly on the equator.
- B ...each chromosome replicates during metaphase.
- C ...chiasmata form between the chromatids of a bivalent.
- D ...the separating chromatids of a pair are not the same.

Your answer

[1]

79. Tuberculosis is an infectious disease that affects humans. It is caused by a pathogen.

Pathogens can also cause diseases in plants.

Which of the following plant diseases is caused by the same **type** of pathogen that causes tuberculosis in humans?

- A black sigatoka in bananas
- B 'mosaic' leaf discolouration in tobacco plants
- C ring rot in tomatoes
- D late blight in potatoes

Your answer

[1]

80. Which of the following **best** describes the term *biodiversity*?

- A the variety of species
- B the number of individuals of each species
- C the variety of genes, species and habitats
- D the variety of genes within a species

Your answer

[1]

81. Young mammals receive antibodies in their mother's milk.

This is an example of which type of immunity?

- A artificial active immunity
- B artificial passive immunity
- C natural active immunity
- D natural passive immunity

Your answer

[1]

82. Which of the following descriptions is correct?

- A Vaccination gives long-term protection, immunisation gives short-term protection.
- B Vaccination involves injection of antigenic material and immunisation is the process of developing immunity.
- C Vaccination involves injection of antigenic material, immunisation is injection of antibodies.
- D Vaccination and immunisation have the same meaning.

Your answer

[1]

83. When you listen to a human heartbeat through a stethoscope you can hear a two stage 'lub-dub' sound.

Which of the following causes the first 'lub' component?

- A closing of the atrioventricular valves
- B sound of blood rushing into the atria
- C sound of blood rushing into the ventricles
- D closing of semilunar valves

Your answer

[1]

84. Zinc ions are necessary for the enzyme carbonic anhydrase to work.

Which statement correctly describes the nature and function of zinc ions in their interaction with carbonic anhydrase?

- A inorganic ions and coenzymes
- B vitamins and prosthetic groups
- C inorganic ions and prosthetic groups
- D vitamins and coenzymes

Your answer

[1]

85. Which formula would you use to estimate the volume of a neutrophil?

- A  $4\pi r^2$
- B  $2\pi r$
- C  $\pi r^2 h$
- D  $\frac{4}{3}\pi r^3$

Your answer

[1]



86. Three types of microscope are listed below.

Select the row that shows the correct use for each type of microscope.

	Type of microscope and what it is used to observe		
	Light microscope	Transmission electron microscope	Laser scanning confocal microscope
A	an object at a certain depth within a cell	cell surfaces	organelles
B	an object at a certain depth within a cell	cell surfaces	whole cells and tissues
C	whole cells and tissues	organelles	cell surfaces
D	whole cells and tissues	organelles	an object at a certain depth within a cell

Your answer

[1]

87. Cyanobacteria are photoautotrophs and fossil records confirm their existence 3.5 billion years ago.

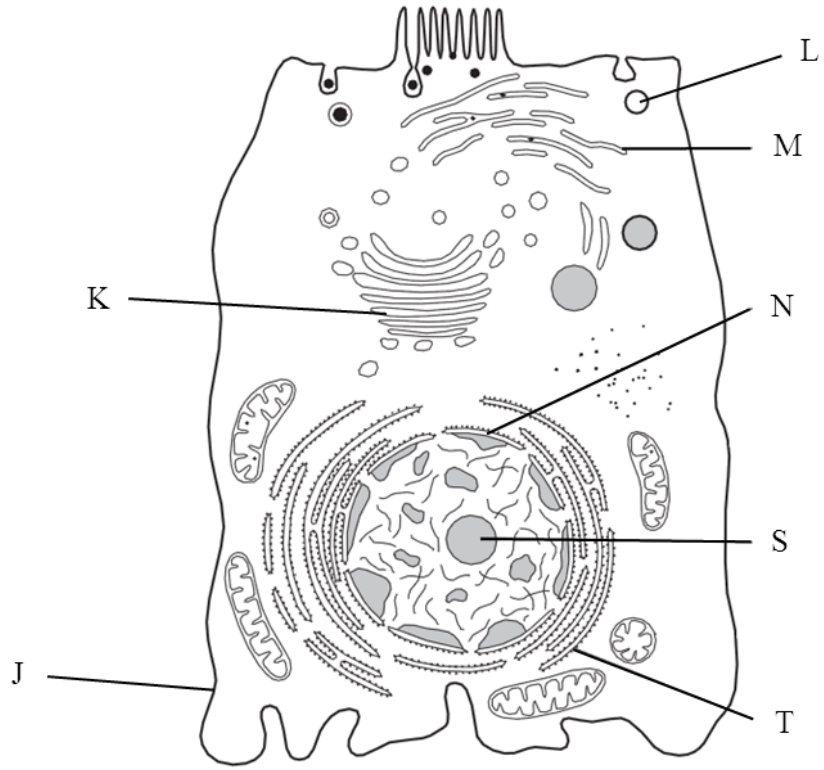
Which row describes the structure of cyanobacteria?

	Feature					
	Nucleus	Circular DNA	Mitochondria	Ribosomes	Chloroplast	Cell wall
A	✓		✓		✓	
B			✓		✓	✓
C	✓	✓		✓		
D		✓		✓		✓

Your answer

[1]

88. Fig. 8.1 shows an animal cell.



**Fig. 8.1**

Which option describes the correct sequence of organelles involved during the production and secretion of a protein from this cell?

A S, K, L, J

B T, K, L, J

C T, M, L, J

D S, T, K, L

Your answer

[1]

89. A length of DNA has the base sequence AATCGCGGTCGCTCA.

Select the row that shows the correct complementary DNA strand and the sequence of mRNA made during transcription of the DNA sequence above.

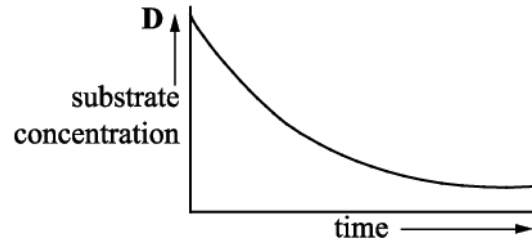
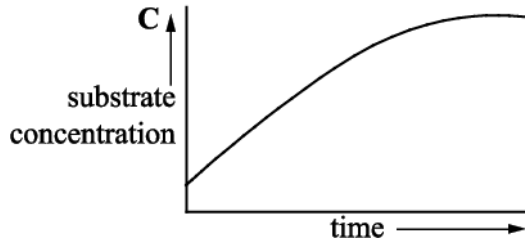
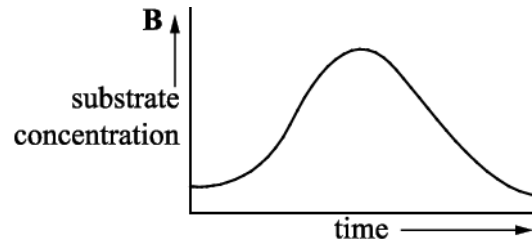
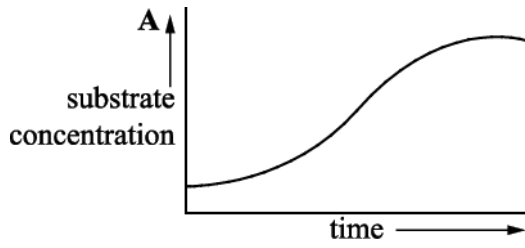
	Complementary DNA sequence	mRNA sequence
A	AATCGCGGTCGCTCA	UUAGCGCCAGCGAGU
B	TTAGCGCCAGCGAGT	UUAGCGCCAGCGAGU
C	TTAGCGCCAGCGAGT	TTAGCGCCAGCGAGT
D	TTAGCGCCAGCGAGT	AAUCGCGGUCGCUCA

Your answer

[1]

90. A group of students monitored the **substrate** concentration during an enzyme-controlled reaction.

Select the graph that correctly shows how the substrate concentration changes during the course of the reaction.



Your answer

[1]

91. There are two types of nuclear division, mitosis and meiosis. Meiosis incorporates two divisions of the nucleus.

Which table shows the correct results of nuclear division?

**A**

	<b>Genetic variation</b>	<b>Reduction division</b>
<b>Mitosis</b>	<b>x</b>	<b>x</b>
<b>Meiosis 1</b>	<b>✓</b>	<b>✓</b>
<b>Meiosis 2</b>	<b>x</b>	<b>x</b>

**C**

	<b>Genetic variation</b>	<b>Reduction division</b>
<b>Mitosis</b>	<b>x</b>	<b>✓</b>
<b>Meiosis 1</b>	<b>✓</b>	<b>x</b>
<b>Meiosis 2</b>	<b>✓</b>	<b>✓</b>

**B**

	<b>Genetic variation</b>	<b>Reduction division</b>
<b>Mitosis</b>	<b>x</b>	<b>x</b>
<b>Meiosis 1</b>	<b>✓</b>	<b>✓</b>
<b>Meiosis 2</b>	<b>✓</b>	<b>x</b>

**D**

	<b>Genetic variation</b>	<b>Reduction division</b>
<b>Mitosis</b>	<b>x</b>	<b>x</b>
<b>Meiosis 1</b>	<b>✓</b>	<b>✓</b>
<b>Meiosis 2</b>	<b>x</b>	<b>✓</b>

Your answer

[1]

92. The following events occur when carbon dioxide enters an erythrocyte in a capillary.

- 1 Hydrogencarbonate ions diffuse into the plasma from the erythrocyte.
- 2 Dissociation of carbonic acid.
- 3 Carbon dioxide reacts with water forming carbonic acid.
- 4 Chloride ions diffuse into erythrocyte from plasma.

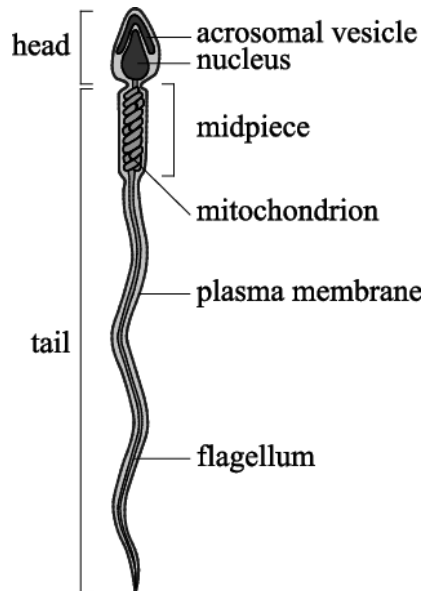
In which sequence do they occur?

	<b>First step</b> $\longrightarrow$			<b>Final step</b>
<b>A</b>	2	4	1	3
<b>B</b>	3	2	1	4
<b>C</b>	3	1	4	2
<b>D</b>	2	3	4	1

Your answer

[1]

93. Sperm cells are an example of a specialised cell.



Which statement correctly describes one specialisation of a sperm cell?

- A tail contains flagellum which generates ATP
- B head contains chromosomes in homologous pairs
- C acrosome contains enzymes to digest outer portion of egg
- D midpiece contains mitochondria which enter egg

Your answer

[1]

94. Which of the following statements correctly describes the mechanism behind water movement between plasma and tissue fluid at the venule end of a capillary?

- A The hydrostatic pressure is greater than the oncotic pressure so water moves out of the capillary.
- B The hydrostatic pressure is greater than the oncotic pressure so water moves into the capillary.
- C The oncotic pressure is greater than the hydrostatic pressure so water moves out of the capillary.
- D The oncotic pressure is greater than the hydrostatic pressure so water moves into the capillary.

Your answer

[1]



95. Emphysema is a chronic respiratory disease where elastase is produced by phagocytes in the lungs, which breaks down lung tissue. This means that a person with emphysema cannot fully exhale.

Fig. 15.1 is a diagram of a small section of a healthy lung.

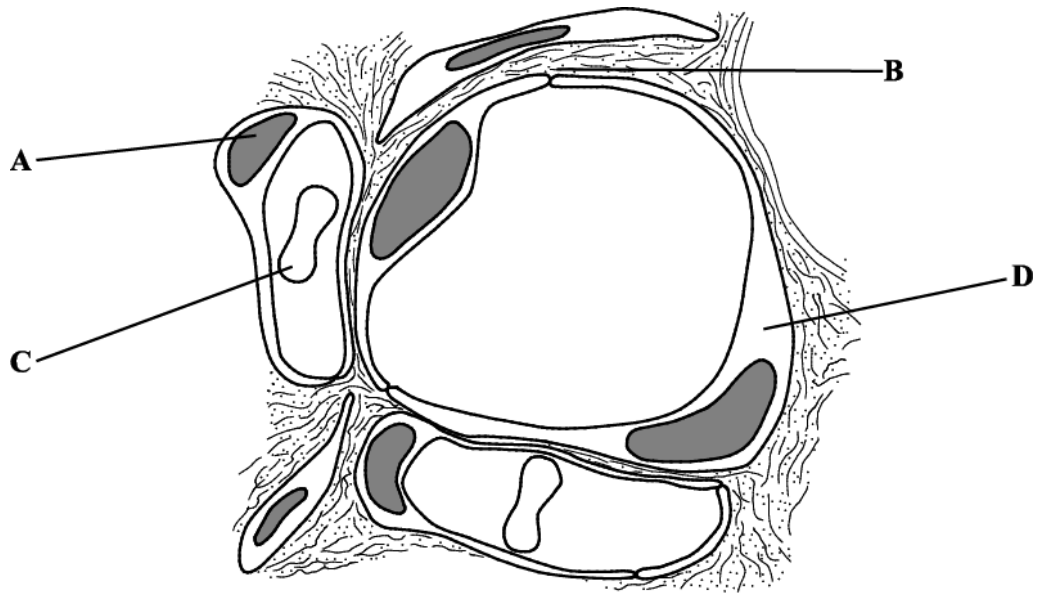


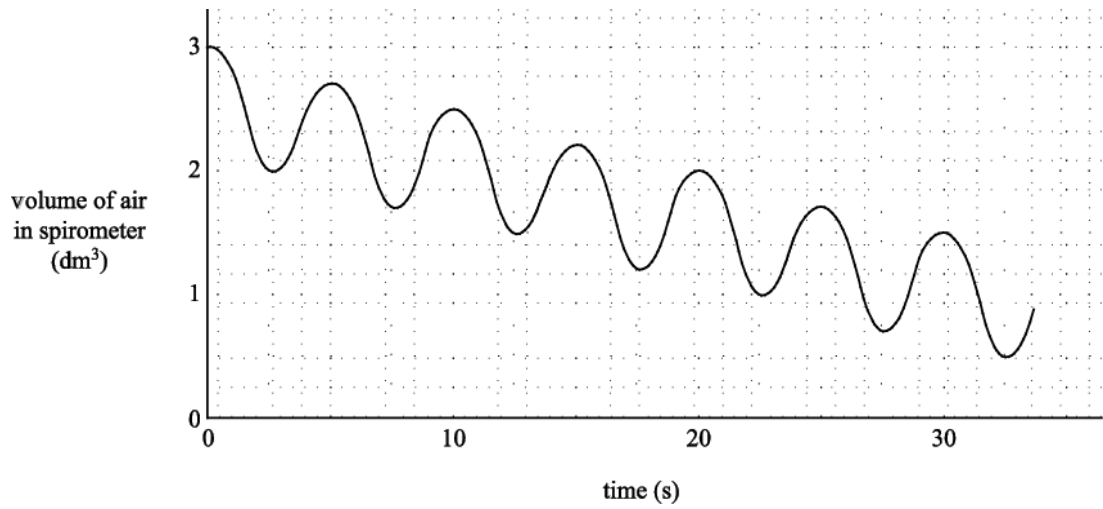
Fig. 15.1

Which label shows the area of lung tissue that is broken down by elastase?

Your answer

[1]

96. The following spirometer trace shows the results of an experiment. Soda lime was used to extract carbon dioxide from exhaled air.



What is the rate of oxygen consumption in the experiment?

- A  $1.0 \text{ dm}^3$
- B  $3.0 \text{ dm}^3 \text{ min}^{-1}$
- C  $5.0 \text{ dm}^3 \text{ min}^{-1}$
- D  $12 \text{ breaths min}^{-1}$

Your answer

[1]

97. Q, P, R and S are related species of organisms.

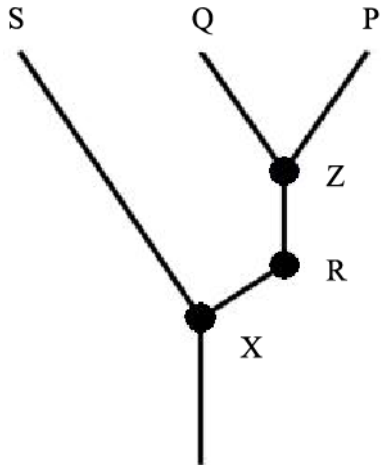
Species X is an extinct recent common ancestor of species Q and R.

X, Q and R all evolved from species P.

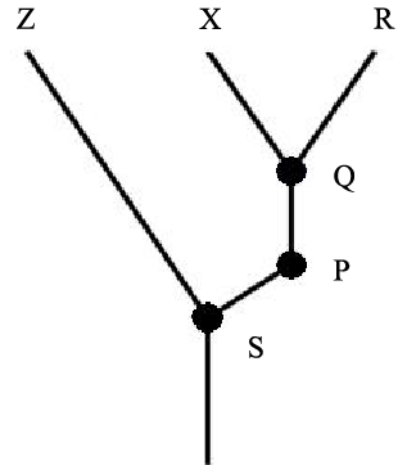
Species S is the least related to the others, with extinct species Z being its most recent phylogenetic link to the other species.

Which of the following phylogenetic trees correctly represents the relationships described above?

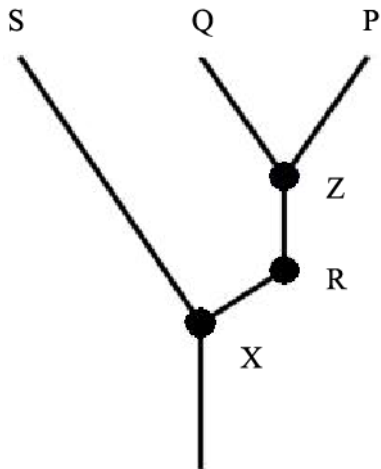
**A**



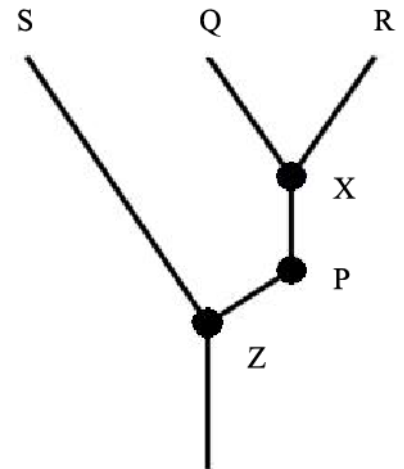
**B**



**C**



**D**



Your answer

[1]

98. Which of the following formulae of fatty acids represents a saturated fatty acid?

**Statement 1:** Palmitic acid,  $C_{15}H_{31}COOH$

**Statement 2:** Oleic acid,  $C_{17}H_{33}COOH$

**Statement 3:** Linoleic acid,  $C_{17}H_{31}COOH$

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

Your answer

[1]

99. A chemical produced by a metabolic pathway binds to the initial enzyme in the pathway. The chemical binds to the enzyme at a site away from the active site and inhibits the enzyme action.

Which of the following statements about the mode of action of the chemical is / are correct?

**Statement 1:** It is an end product inhibitor.

**Statement 2:** It is a competitive inhibitor.

**Statement 3:** It binds to the allosteric site of the enzyme.

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

Your answer

[1]

100. The following statements refer to the movement of water from the cortex of the root into the xylem.

Which of the following statements is / are true?

**Statement 1:** Most of the water moves across the root cortex by the apoplast pathway.

**Statement 2:** At the endodermis water has to enter the symplast pathway.

**Statement 3:** Casparian strips in the endodermis contain the chemical lignin.

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

Your answer

[1]

END OF QUESTION PAPER