

Amy Vickers

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

## 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 **152**.
- The total number of marks may take into account some 'either/or' question choices.

1. 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]

2. 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
<b>A</b>	active transport	sources	active	raises	osmosis	concentration
<b>B</b>	mass flow	sources	active	lowers	active transport	pressure
<b>C</b>	mass flow	sinks	passive	raises	diffusion	concentration
<b>D</b>	mass flow	sources	active	lowers	osmosis	pressure

Your answer

[1]

3. 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.

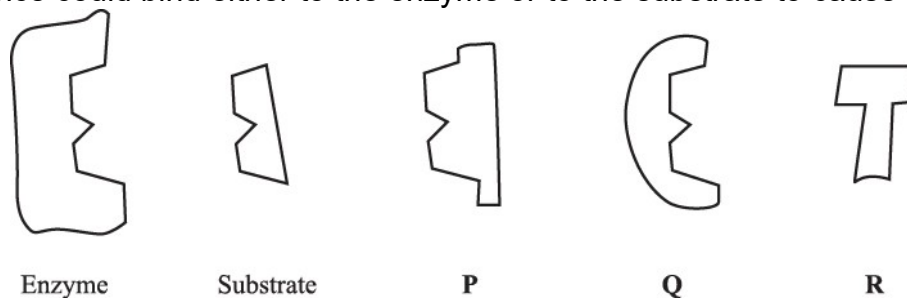


Fig. 2.1

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?

	<b>Tube P</b>	<b>Tube Q</b>	<b>Tube R</b>
<b>A</b>	increased	no effect	no effect
<b>B</b>	decreased	no effect	decreased
<b>C</b>	decreased	no effect	no effect
<b>D</b>	decreased	decreased	no effect

Your answer

[1]

4. 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]

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

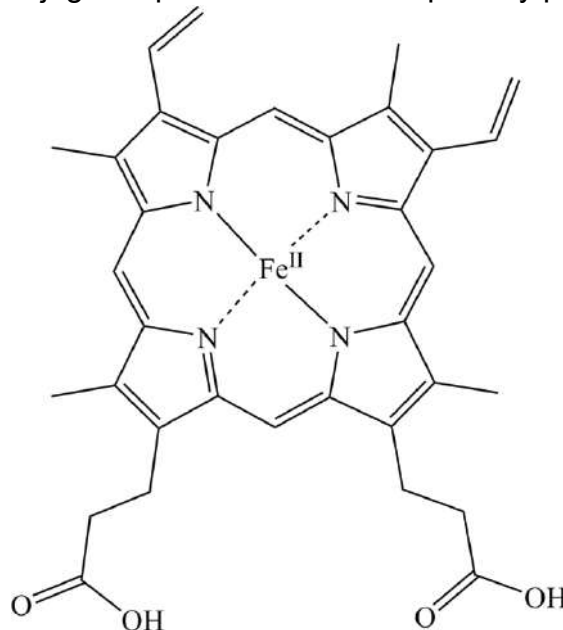


Fig. 5.1

Which part of the molecule does Fig 5.1 represent?

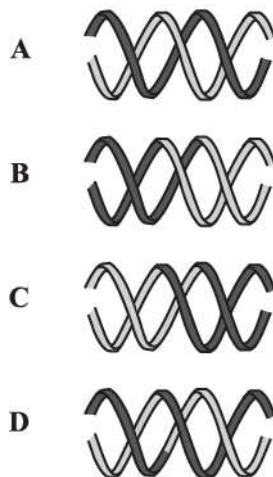
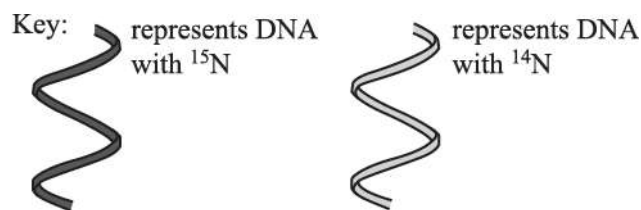
- A prosthetic group
- B disulfide bond
- C quaternary structure
- D polypeptide

Your answer

[1]

6. 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]

7. 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?

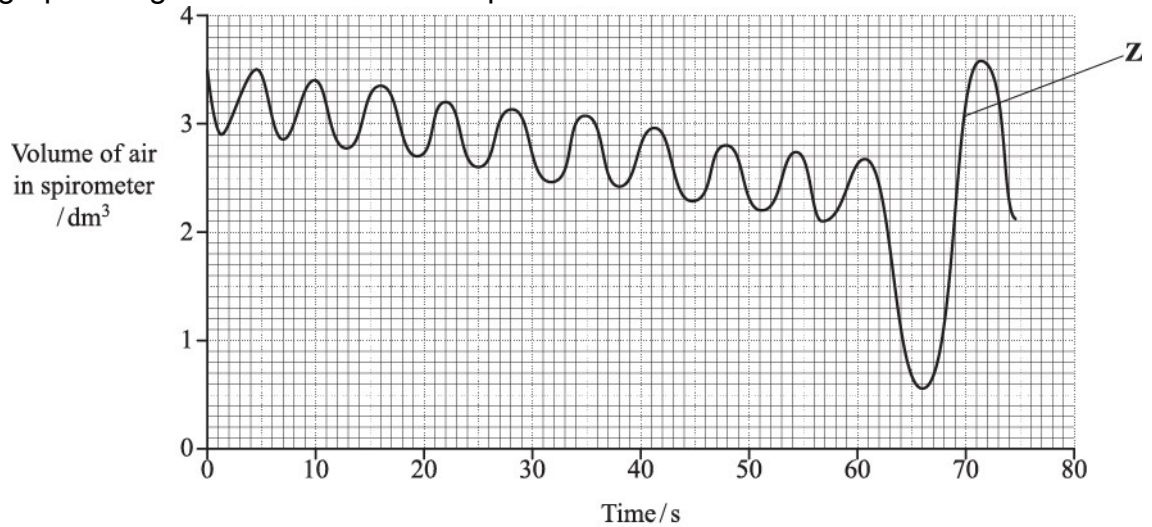
	Pressure (mmHg)			
	Arterial end of capillary		Venous end of capillary	
	Oncotic	Hydrostatic	Oncotic	Hydrostatic
<b>A</b>	-20	13	-20	33
<b>B</b>	-20	-13	-20	13

<b>C</b>	20	33	-20	13
<b>D</b>	-20	33	-20	13

Your answer

[1]

8. 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]

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

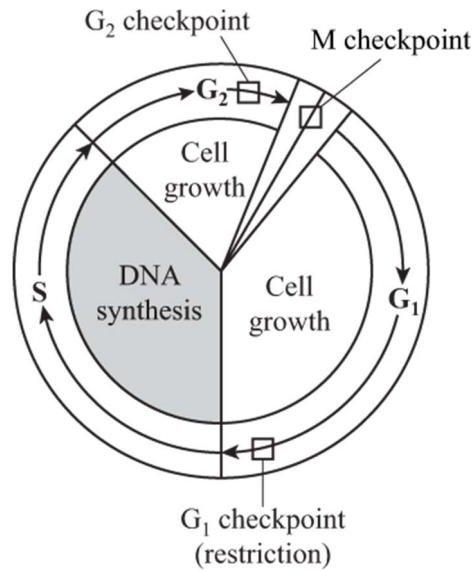


Fig. 9.1

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]

10. 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]

11. 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]

12. 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]

13. 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]

14. 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]

15. 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
<b>A</b>	Spindle fibres clearly visible	Telophase
<b>B</b>	Chromosomes aligned at equator	Anaphase
<b>C</b>	Sister chromatids pulled to poles of cell	Metaphase
<b>D</b>	Dark bodies visible within nucleus	Prophase

Your answer

[1]

16. 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.

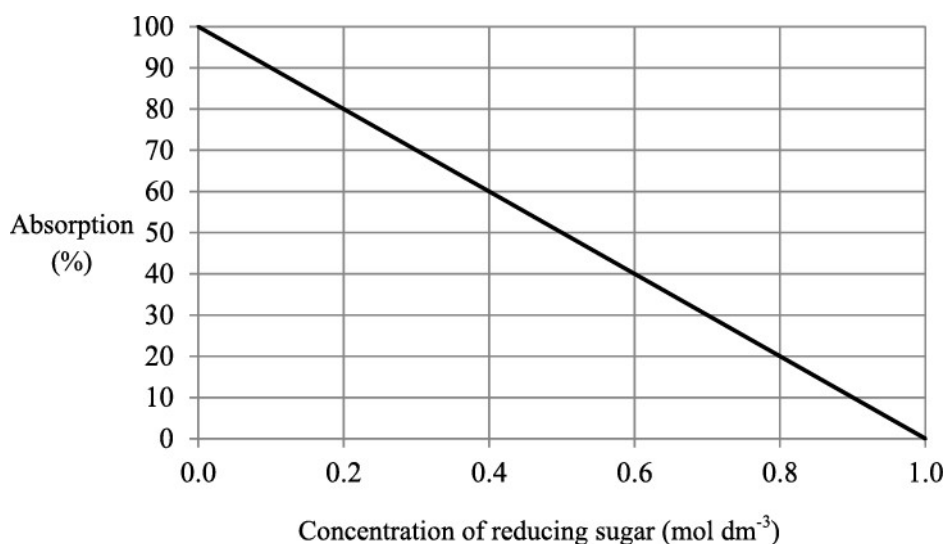


Fig. 14.1

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



17. 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.

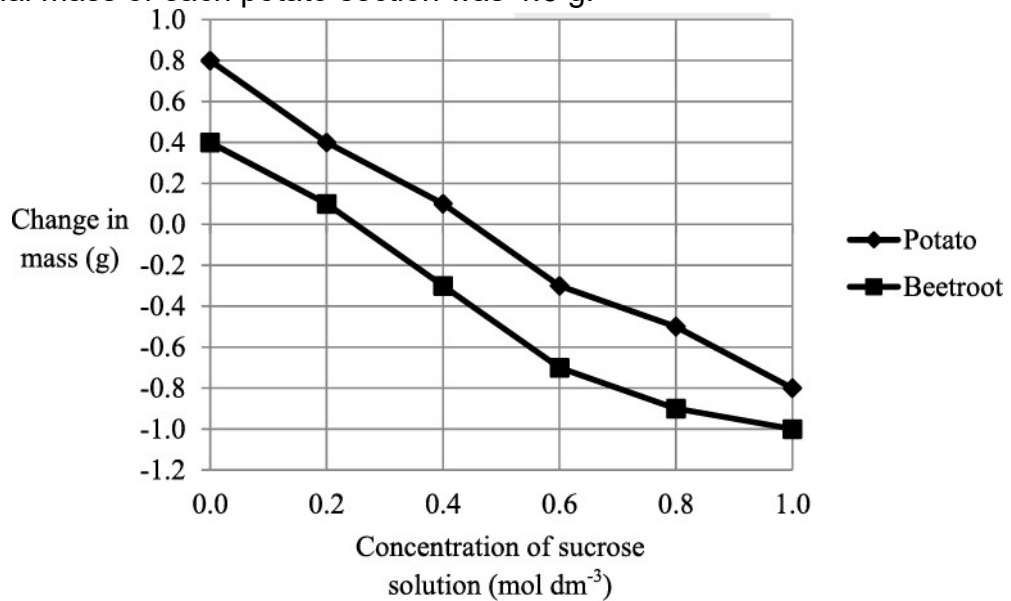


Fig. 16.1

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]

18. 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]

19. 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]

20. 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]

21. 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]

22. 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]

23. 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]

24. 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]

25. 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]

26. 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
<b>A</b>	an object at a certain depth within a cell	cell surfaces	organelles
<b>B</b>	an object at a certain depth within a cell	cell surfaces	whole cells and tissues
<b>C</b>	whole cells and tissues	organelles	cell surfaces
<b>D</b>	whole cells and tissues	organelles	an object at a certain depth within a cell

Your answer

[1]

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

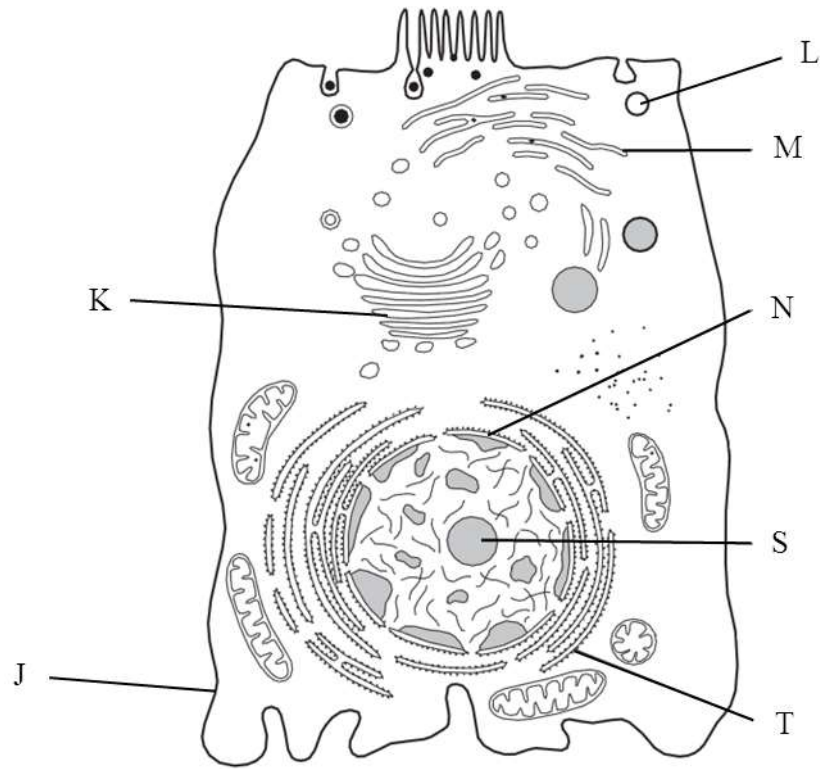
Which row describes the structure of cyanobacteria?

Feature						
	Nucleus	Circular DNA	Mitochondria	Ribosomes	Chloroplast	Cell wall
<b>A</b>	✓		✓		✓	
<b>B</b>			✓		✓	✓
<b>C</b>	✓	✓		✓		
<b>D</b>		✓		✓		✓

Your answer

[1]

28. **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]

29. 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.

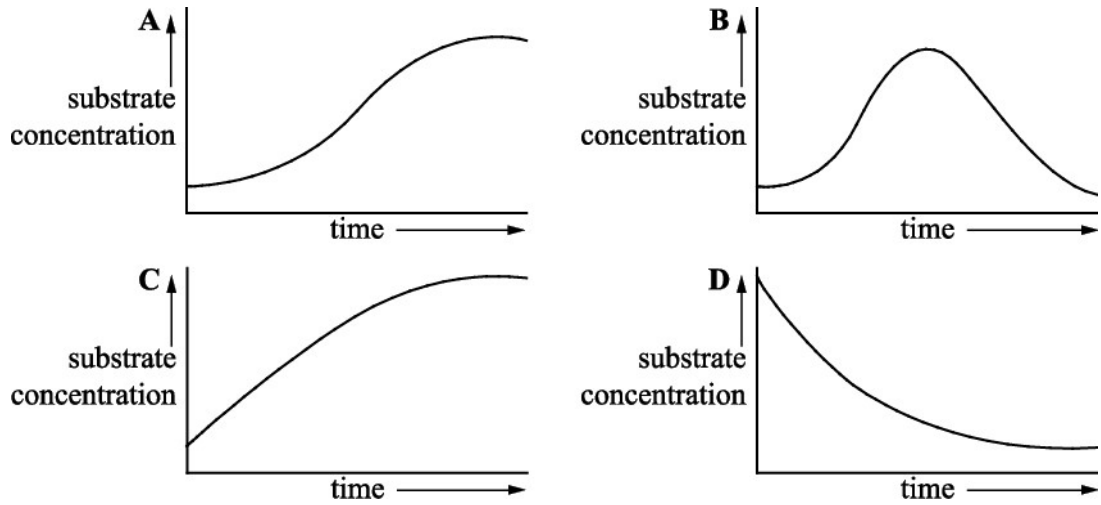
	<b>Complementary DNA sequence</b>	<b>mRNA sequence</b>
<b>A</b>	AATCGCGGTCGCTCA	UUAGCGCCAGCGAGU
<b>B</b>	TTAGCGCCAGCGAGT	UUAGCGCCAGCGAGU
<b>C</b>	TTAGCGCCAGCGAGT	TTAGCGCCAGCGAGT
<b>D</b>	TTAGCGCCAGCGAGT	AAUCGCGGUCGCUCA

Your answer

[1]

30. 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]

31. 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.

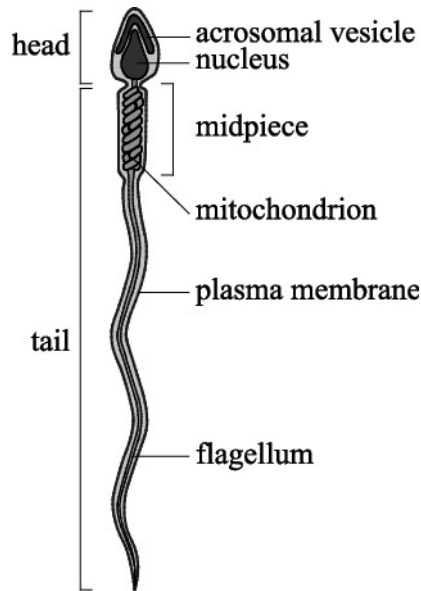
In which sequence do they occur?

	First step <span style="font-size: 2em;">→</span> Final step			
<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]

32. 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]

33. 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.

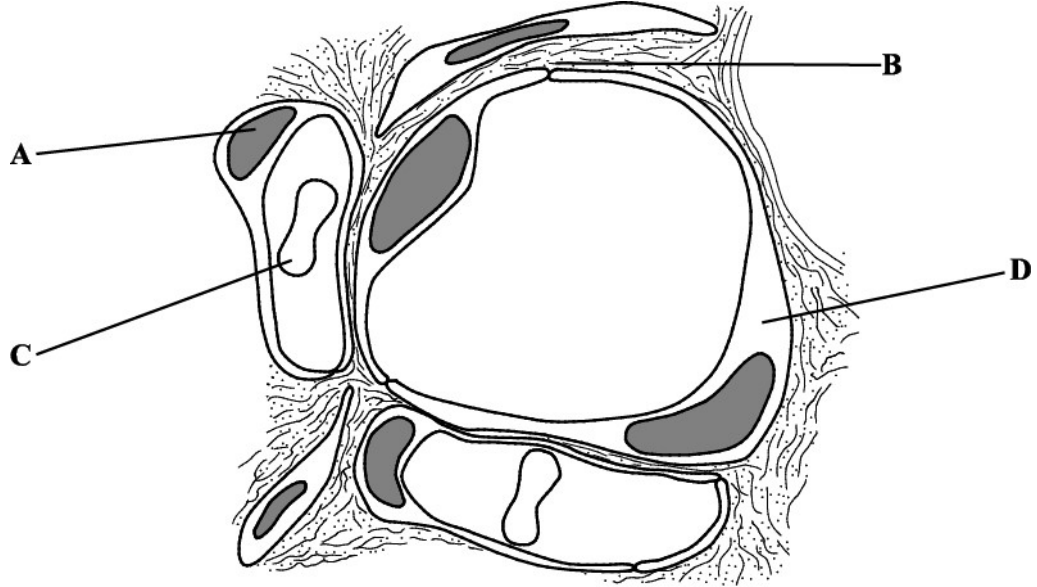
Your answer

[1]

34. 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.



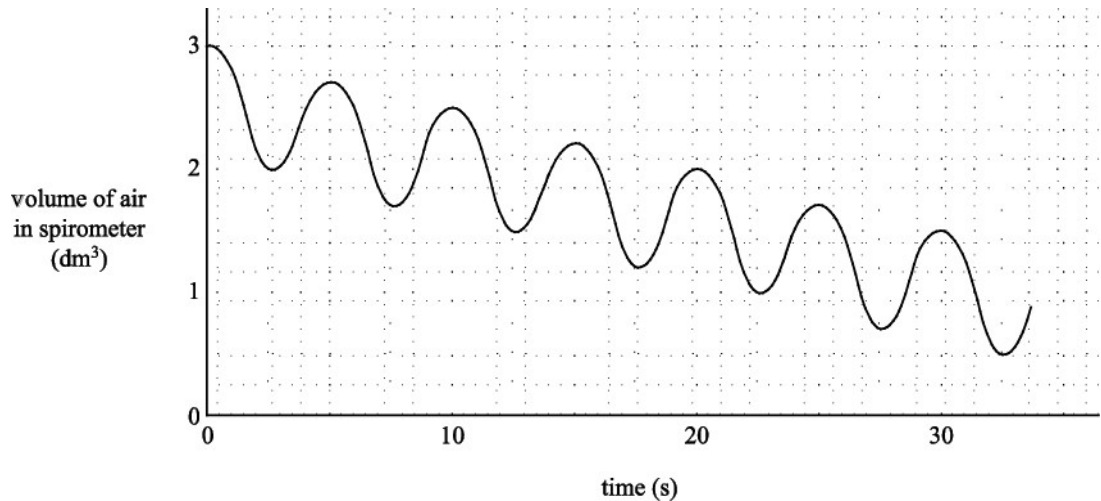
**Fig. 15.1**

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

Your answer

[1]

35. 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 breaths  $\text{min}^{-1}$



Your answer

[1]

36. 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]

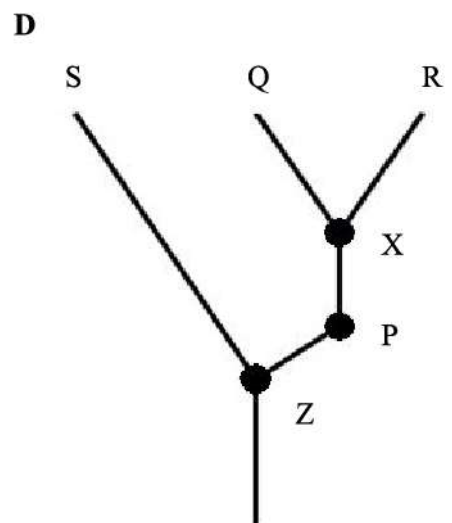
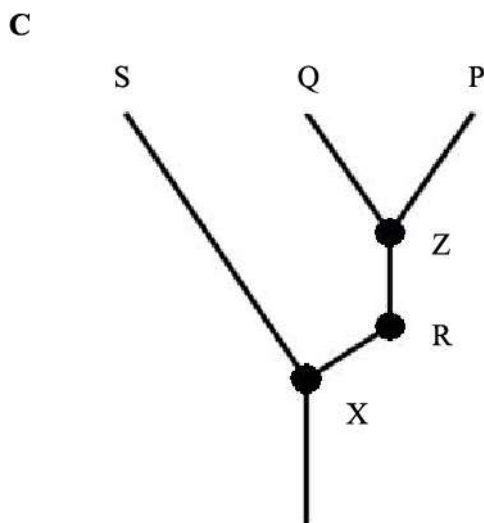
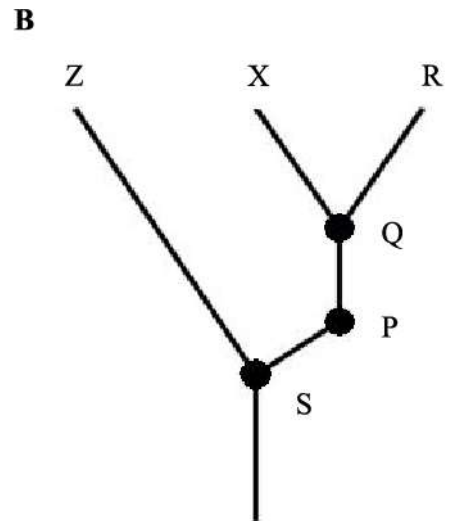
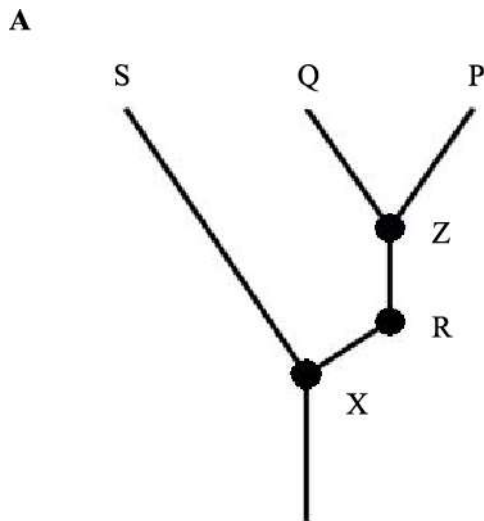
37. Q, P, R and S are related species of organisms.

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?



Your answer

[1]

38. 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]

39. 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]

40. 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?

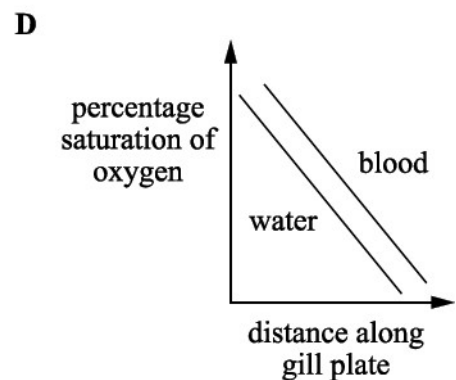
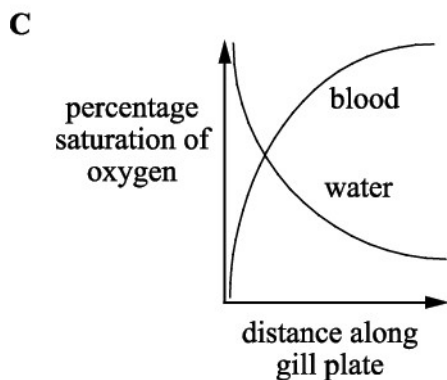
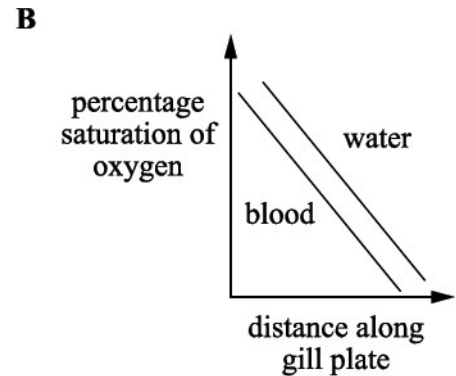
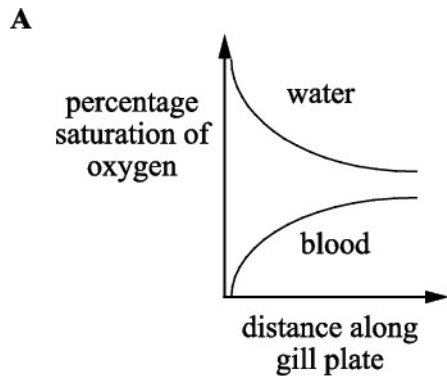
- Statement 1:** Most of the water moves across the root cortex by the apoplast pathway.  
**Statement 2:** At the endodermis water has to enter the symplast pathway.  
**Statement 3:** Casparian strips in the endodermis contain the chemical lignin.

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

Your answer

[1]

41. Which graph represents the counter-current exchange system in fish gills?



Your answer

[1]

42. Which statement explains the significance of mitosis in the development of whole organisms?

- A** Mitosis can be controlled at certain points in development, which will change body plans.
- B** Sex cells are produced by mitosis, which allows new organisms to be produced.
- C** Mitosis limits the total number of cells in an organism, which will change its shape.
- D** Budding in yeast is an example of mitosis, producing new multicellular organisms.

Your answer

[1]

43. Cells require vitamins and minerals in order to function correctly. These vitamins and minerals need to cross the plasma membrane.

Vitamins are either fat soluble or water soluble. Vitamins A, D, E and K are fat soluble.

Which of the following combinations enter a cell by facilitated diffusion?

- A vitamin A and calcium ions
- B vitamin C and calcium atoms
- C vitamin C and calcium ions
- D vitamin A and calcium atoms

Your answer

[1]

44. Animals receive different stimuli from their environment. Their synapses can manage multiple stimuli, often resulting in one response (such as a muscle twitching).

This action of the synapse is an example of

- A spatial summation
- B all or nothing response
- C temporal summation
- D cell signalling

Your answer

[1]

45. The kidneys of a healthy individual filter  $178 \text{ dm}^3 \text{ day}^{-1}$  of fluid from the glomeruli into the renal capsules. However, only  $1.5 \text{ dm}^3 \text{ day}^{-1}$  of urine is produced.

What percentage of the filtrate is reabsorbed back into the blood?

- A 176.5
- B 0.8
- C 11.8

Your answer

[1]

46. The following mechanisms are used to move water through plants:

- i. diffusion
- ii. osmosis
- iii. mass flow.

Which row correctly identifies the mechanism used at each point of the transpiration stream?

	Into root cells	Across root via symplast pathway	Up the stem in the xylem	Across leaf via apoplast pathway	Out of leaf via stomata
<b>A</b>	osmosis	osmosis	mass flow	mass flow	diffusion
<b>B</b>	diffusion	osmosis	osmosis	mass flow	diffusion
<b>C</b>	diffusion	osmosis	osmosis	mass flow	osmosis
<b>D</b>	osmosis	osmosis	mass flow	mass flow	osmosis

Your answer

[1]

47. Citrate synthase catalyses the conversion of oxaloacetate into citric acid in the Krebs cycle. It exhibits product inhibition.

Which of the following is the correct description of citrate synthase?

	Type of respiration involved in	Location of enzyme	Inhibitor
<b>A</b>	anaerobic	cytoplasm	citric acid
<b>B</b>	aerobic	mitochondria	citric acid
<b>C</b>	aerobic	mitochondria	oxaloacetate
<b>D</b>	anaerobic	cytoplasm	oxaloacetate

Your answer

[1]

48. Which of the following describes the process that happens during **repolarisation** of a neurone during the action potential?

	<b>Sodium channels</b>	<b>Potassium channels</b>	<b>Membrane potential</b>
<b>A</b>	closed	open	decreasing
<b>B</b>	open	closed	decreasing
<b>C</b>	open	closed	increasing
<b>D</b>	closed	open	increasing

Your answer

[1]

49. An unknown solution of a single sugar was tested. The results were recorded in **Table 9.1**.

<b>Colours observed after testing</b>	
<b>Benedict's test for reducing sugars</b>	<b>Benedict's test for non-reducing sugars</b>
blue	brick red

**Table 9.1**

Identify the unknown sugar.

- A** fructose
- B** lactose
- C** sucrose
- D** glucose

Your answer

[1]

50. An anticodon sequence of five successive tRNA molecules involved in protein synthesis was analysed and found to have the following percentage base composition.

Adenine 40; Cytosine 27; Guanine 13; Thymine 0; Uracil 20 %

Which row shows the percentage base composition of the template strand of the original DNA molecule?

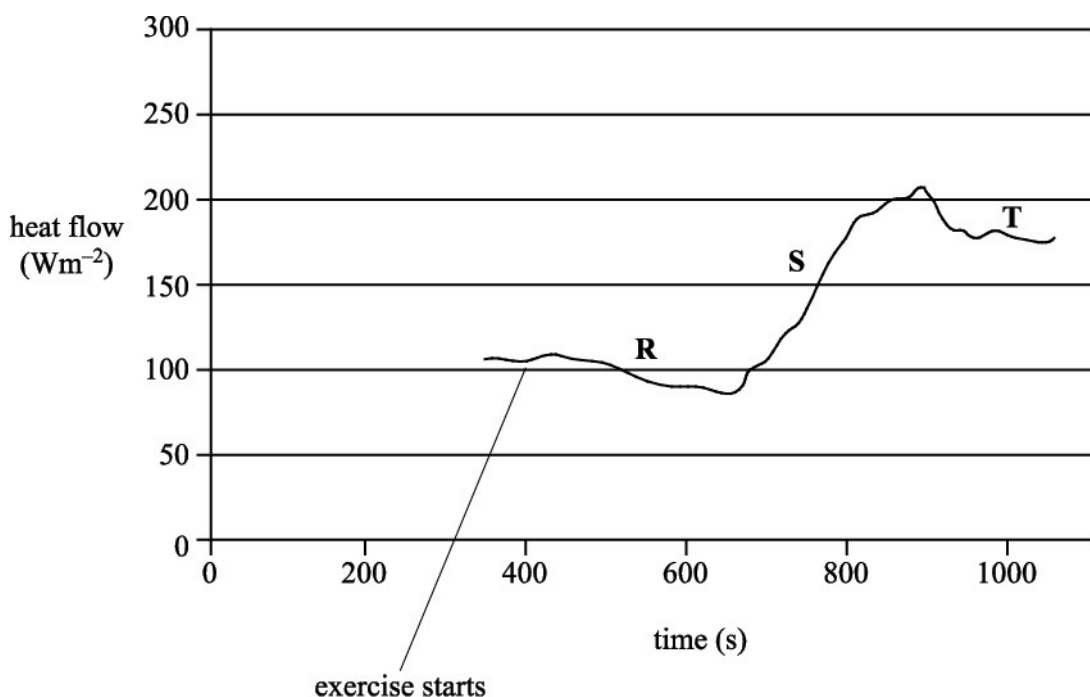
	<b>Adenine</b>	<b>Cytosine</b>	<b>Guanine</b>	<b>Thymine</b>	<b>Uracil</b>

<b>A</b>	40	27	13	20	0
<b>B</b>	20	13	27	40	0
<b>C</b>	20	13	27	0	40
<b>D</b>	40	27	13	0	20

Your answer

[1]

51. **Fig. 11.1** shows the heat flow through the skin of an athlete during vigorous exercise. Exercise starts at 400 seconds.



**Fig. 11.1**

Blood flow can be directed to those parts of the body that make the greatest demands.

Which row gives the best explanation of the stages in **Fig. 11.1**?

	<b>R</b>	<b>S</b>	<b>T</b>
<b>A</b>	Blood directed away from skin to avoid excess heat loss	Blood directed towards skin to release excess heat	Balance achieved between loss of excess heat and the need for oxygen in the muscles
<b>B</b>	Blood directed away from skin and towards the muscles to supply more oxygen for respiration	Blood directed towards skin to release excess heat	Balance achieved between heat loss and excess heat created in the muscles
<b>C</b>	Blood directed away from skin to avoid excess heat loss	Blood directed towards skin to gain heat from the environment	Balance achieved between heat loss and



			excess heat created in the muscles
<b>D</b>	Blood directed away from skin and towards the muscles to supply more oxygen for respiration	Blood directed towards skin to gain heat from the environment	Balance achieved between loss of excess heat and the need for oxygen in the muscles

Your answer

[1]

52. Which of the following is / are interventions in the control of blood glucose concentration?

**Statement 1:** Insulin injection.

**Statement 2:** Regular cardiovascular exercise.

**Statement 3:** Glucagon injection.

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

Your answer

[1]

53. Which of the following statements is / are true?

**Statement 1:** Microtubules are part of the '9 + 2' formation in bacterial flagella.

**Statement 2:** Microtubules can be prevented from functioning by a respiratory inhibitor.

**Statement 3:** Microtubules are involved in moving chromosomes from the equator to the poles of the cell during mitosis.

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

Your answer

[1]

54. Blood vessels are adapted for their function.

Which of the following statements is / are true?

**Statement 1:** The walls of arteries near the heart contain a lot of elastic fibres so that they can stretch and recoil to maintain blood pressure.

**Statement 2:** The walls of the venules contain little muscle.

**Statement 3:** The walls of arteries contain a lot of muscle fibres to contract and generate pressure in the blood.

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

Your answer

[1]

55. Phospholipid bilayers play crucial roles within plant cells.

Which of the following statements linked to the importance of membranes in plant cells is / are true?

**Statement 1:** ATP synthase embedded in thylakoid membranes maintains chemiosmotic gradients.

**Statement 2:** Phospholipid bilayers within the chloroplast are impermeable to protons.

**Statement 3:** Thylakoid membranes contain electron transport chain proteins.

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

Your answer

56. The following passage has four key terms missing:  
*Meristem cells in plants are used to generate new plant tissues. When ..... tissue is formed, ..... impregnates the cell walls, making them impermeable to water. All cytoplasm is lost. When ..... tissue is formed, cytoplasm remains, but the ..... become elongated and lose most of their cytoplasm.*

What is the correct order of missing terms?

- A sclerenchyma, phloem, lignin, xylem vessels
- B xylem, lignin, parenchyma, phloem vessels
- C phloem, collenchyma, xylem, sieve tube elements
- D xylem, lignin, phloem, sieve tube elements

Your answer

[1]

57. A student mixed an unknown substance with water and ethanol. A white suspension formed in the tube.

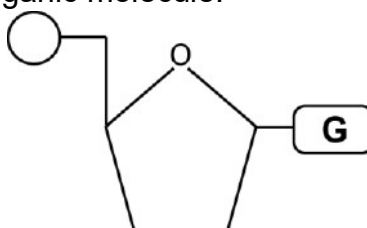
Which of the explanations, **A** to **D**, is correct?

- A lipid is present
- B non-reducing sugar is present
- C protein is present
- D reducing sugar is present

Your answer

[1]

58. The diagram below shows an organic molecule.



What bond is formed when the molecule is polymerised?

- A ester
- B glycosidic
- C peptide
- D phosphodiester

Your answer

[1]

59. The respiratory quotients (RQs) of three respiratory substrates are shown below:

carbohydrates: 1.0  
lipids: 0.7  
proteins: 0.9

An experiment was carried out to investigate which molecules are used as respiratory substrates in different cell types. The results are shown in the table below.

Cell type	Oxygen consumed ( $\text{mm}^3 \text{min}^{-1}$ )	Carbon dioxide produced ( $\text{mm}^3 \text{min}^{-1}$ )
cancerous	12.78	12.82
normal	13.45	9.40

Which of the statements, **A** to **D**, supports these results?

- A cancer cells respire mainly carbohydrates
- B cancer cells respire mainly lipids
- C normal cells respire mainly carbohydrates
- D normal cells respire mainly proteins

Your answer

[1]

60. The following are statements about the liver:

- 1 stores bile in the gall bladder
- 2 contains sinusoids
- 3 receives blood from the gut and heart

Which of these statements relate to the exocrine function of the liver?

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

Your answer

[1]

61. The table below shows a series of statements about systemic and pulmonary circulation.

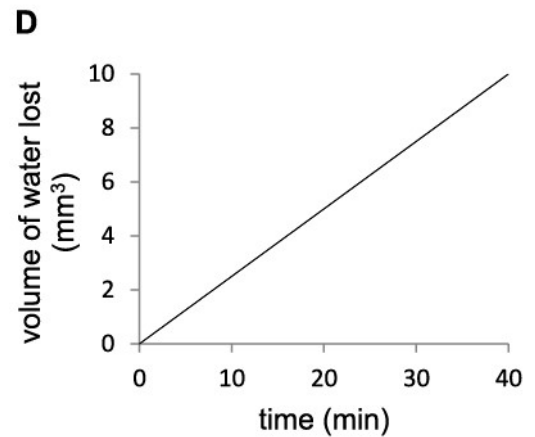
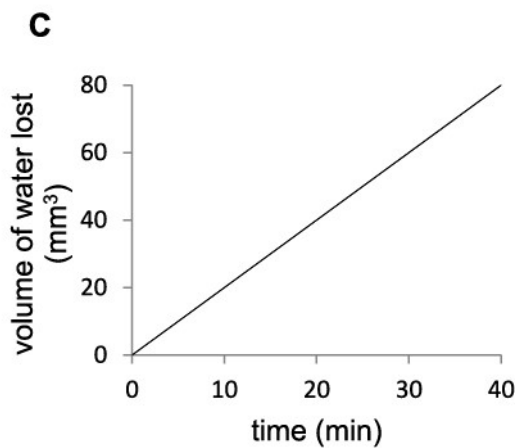
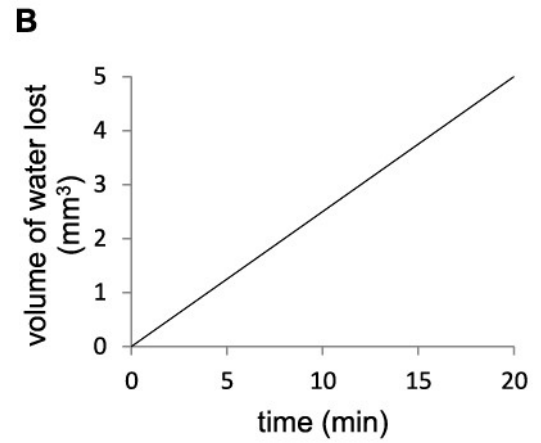
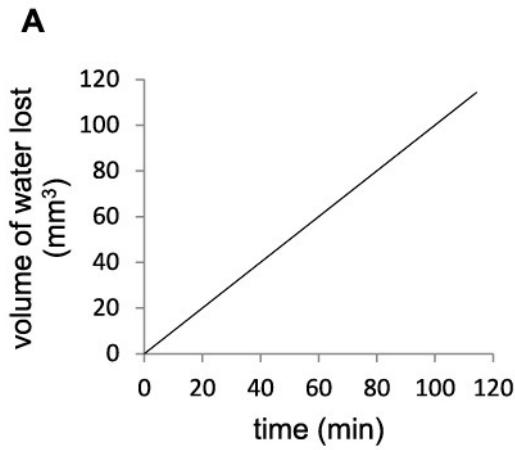
<b>Row</b>	<b>Systemic circulation</b>	<b>Pulmonary circulation</b>
<b>A</b>	higher pressure	lower pressure
<b>B</b>	equal pressure	equal pressure
<b>C</b>	lower pressure	higher pressure
<b>D</b>	medium pressure	absent

Which of the rows, **A** to **D**, correctly describes a closed, double circulatory system?

Your answer

[1]

62. The following graphs show results from an experiment to investigate the rate of transpiration of the same plant in different environments.



Which graph, **A** to **D**, shows the results for when the plant is being grown in the least humid environment?

Your answer

[1]

63. The following advice is given to mothers of babies under 6 months:

Don't let your baby get too hot or too cold. A room temperature of 16–20°C, with light bedding or a lightweight baby sleeping bag, will provide a comfortable sleeping environment for your baby.

Which of the statements, **A** to **D**, best explains this advice?

- A** newborn babies have poorly-developed osmoregulation mechanisms
- B** newborn babies have poorly-developed thermoregulation mechanisms
- C** newborn babies have poorly-developed ectothermic mechanisms
- D** newborn babies have poorly-developed glucoregulation mechanisms

Your answer

[1]

64. The table below shows features of the five kingdoms.

Kingdom	Nerves present	Hormones present
Prokaryotae	x	x
Protoctista	x	x
Fungi	x	✓
Plantae	x	✓
Animalia	✓	✓

Which of the statements, **A** to **D**, is correct?

- A** only autotrophic organisms require hormones
- B** only heterotrophic organisms need to interact with their environment
- C** only multicellular organisms require hormones
- D** only unicellular organisms require nervous systems

Your answer

[1]

65. Which of the following, **A** to **D**, is a feature of **both** light microscopy **and** confocal microscopy?

- A** can be used to observe ribosomes
- B** can be used with live tissues
- C** obtain images using laser light
- D** require a great deal of training to use

Your answer

[1]

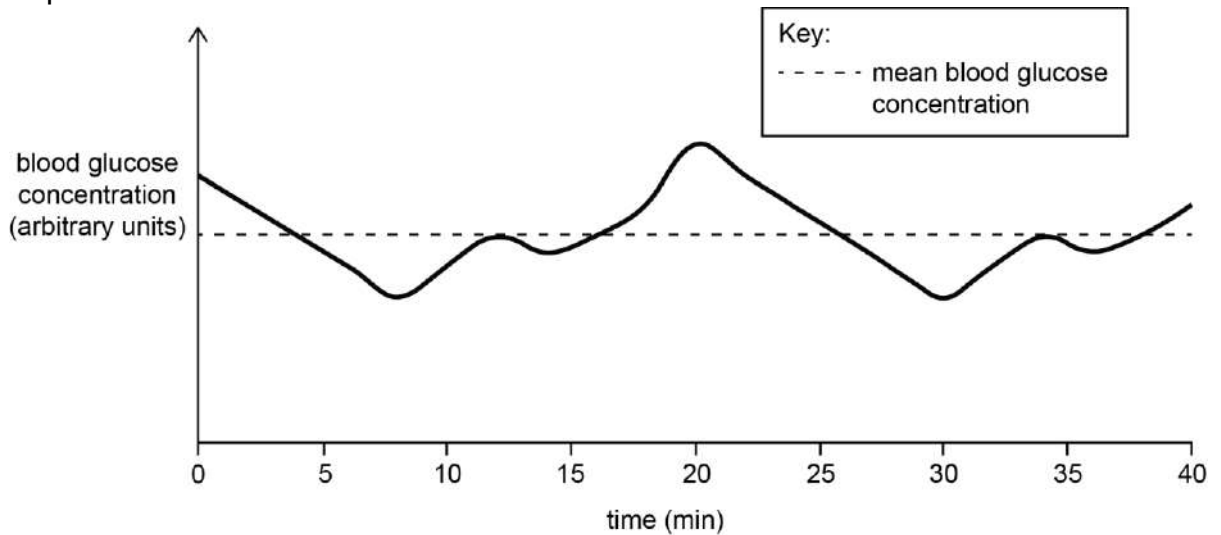
66. Which of the following, **A** to **D**, is the correct summary of the net products of the Krebs cycle for **one** molecule of pyruvate?

- A** 3 reduced NAD, 1 reduced FAD, 2 CO<sub>2</sub>, 1 ATP
- B** 2 reduced NAD, 2 CO<sub>2</sub>, 2 ATP
- C** 4 reduced NAD, 2 reduced FAD, 3 CO<sub>2</sub>, 2 ATP
- D** 2 reduced NAD, 1 reduced FAD, 3 ATP

Your answer

[1]

67. The graph below shows the change in glucose concentration in a rat's bloodstream over a short period of time.



Which of the statements, **A** to **D**, is correct?

- A** blood glucose concentration at 15 min > blood glucose concentration at 20 min
- B** blood glucose concentration at 9 min << blood glucose concentration at 20 min
- C** blood glucose concentration at 0 min < blood glucose concentration at 40 min
- D** blood glucose concentration at 5 min >> blood glucose concentration at 28 min

Your answer

[1]

68. LHON is an inherited mitochondrial condition that causes problems with aerobic respiration. It is the result of a mutation in mitochondrial DNA (mtDNA) and is passed from mother to child. LHON is presently incurable, but one theoretical treatment involves removing the mutation from the mother's mtDNA.



Which of the statements, **A** to **D**, correctly explains why this could be a viable treatment for LHON?

- A** enzymes involved in glycolysis are unaffected by mtDNA
- B** enzymes involved in the Krebs cycle, link reaction and electron transport chain are affected by mtDNA
- C** enzymes involved with oxidative phosphorylation are unaffected by mtDNA
- D** enzymes involved with photophosphorylation are affected by mtDNA

Your answer

[1]

69. Melvin Calvin studied the light-independent reaction (Calvin cycle) in plant cells.

He used radiolabelled  $^{14}\text{CO}_2$  to measure the production of organic molecules in chloroplasts.

- He placed an aquatic plant in water.
- The plant was given light for 20 minutes.
- The light was then turned off (dark conditions) for a further 30 seconds.

He measured the radioactivity of the solutions produced and used these values to calculate the number of molecules of triose phosphate (TP) and ribulose biphosphate (RuBP) present.

The results are shown in the table below.

Molecule	Activity of $^{14}\text{C}$ ( $\times 10^{27}$ Bq)	
	after 20 minutes light	30 seconds dark conditions
TP	5.5	10.1
RuBP	4.9	0.6

Assuming  $8.5 \times 10^{18}$  Bq are generated by each  $^{14}\text{C}$  atom in the molecule, how many **new** TP molecules are produced after 30 seconds in the dark?

- A**  $6.47 \times 10^8$
- B**  $1.80 \times 10^8$
- C**  $1.83 \times 10^{27}$
- D**  $3.37 \times 10^{27}$

Your answer

[1]

70. The following terms relate to the metabolism of carbohydrates in the human body:

- 1 gluconeogenesis
- 2 glycogenesis
- 3 glycolysis

Which of these processes will be stimulated when glucagon is released into the bloodstream?

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

Your answer

[1]

71. If a person is bitten by a venomous snake, the immediate treatment is normally to inject the person with the appropriate antibodies.

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]

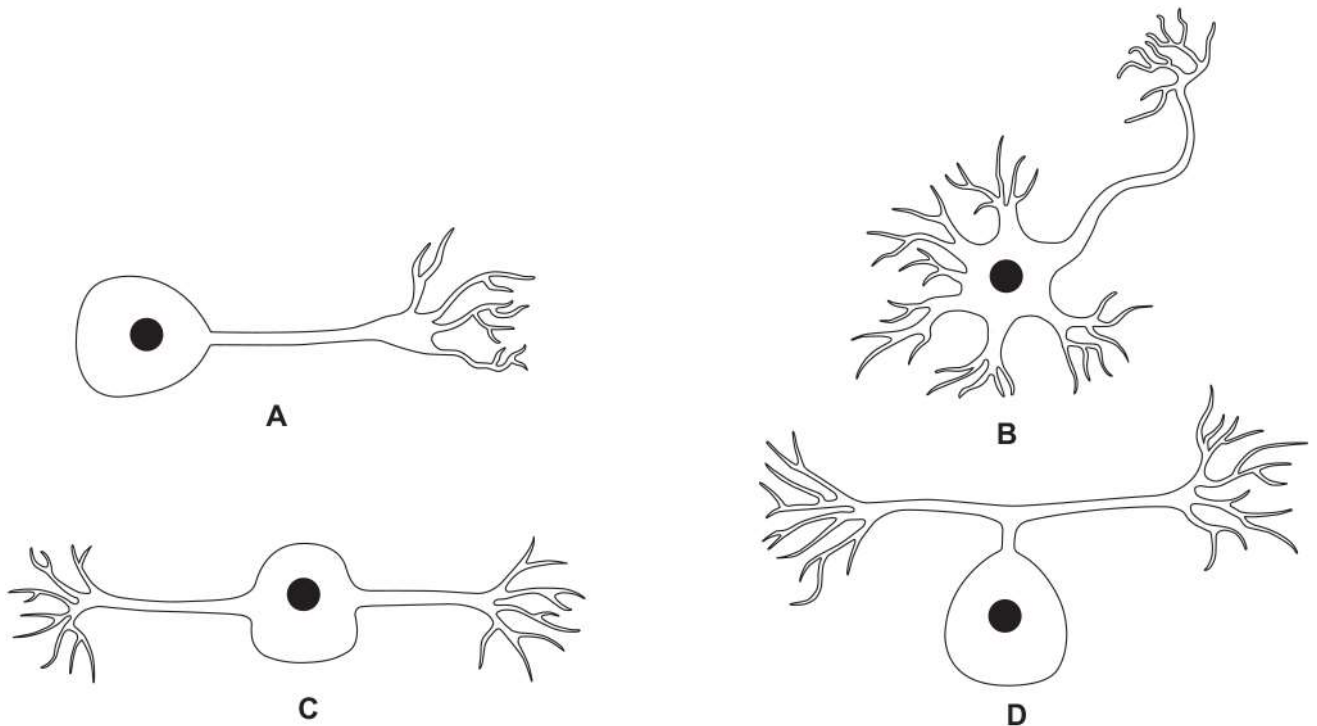
72. What is an operon?

- A. The binding site for a repressor protein.
- B. Any group of genes responsible for the metabolism of lactose in prokaryotes or eukaryotes.
- C. A cluster of genes under the control of a promoter.
- D. A regulatory gene.

Your answer

[1]

73. Which of the following diagrams, **A** to **D**, shows a sensory neurone?



Your answer

[1]

74. The table below shows the membrane potentials of different neurones at a cholinergic synapse. The data were recorded on five separate occasions, as shown in the five rows.

Membrane potential (mV)				
	<i>Presynaptic neurone A</i>	<i>Presynaptic neurone B</i>	<i>Presynaptic neurone C</i>	<i>Postsynaptic neurone</i>
<b>1</b>	+40	-70	-70	-70
<b>2</b>	-70	+40	-70	-70
<b>3</b>	-70	-70	+40	-70
<b>4</b>	+40	+40	-70	-70
<b>5</b>	+40	+40	+40	+40

Which of the following, **A** to **D**, explains these data?

- A** divergence
- B** hyperpolarisation
- C** spatial summation
- D** temporal summation

Your answer

[1]

75. The drug metoprolol prevents stimulation of post-synaptic receptors in the sympathetic nervous system.

Which of the following conditions could this drug be used to treat?

- 1 Muscle fatigue
- 2 Tachycardia
- 3 High blood pressure

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

Your answer

[1]

76. Which of the statements, **A** to **D**, explains why diastole follows systole in the mammalian heart?

- A** Cardiac muscle is myogenic.  
**B** Cardiac muscle takes a short time to repolarise after being stimulated.  
**C** The aorta is capable of maintaining the pressure generated by the left ventricle.  
**D** The SAN receives impulses from the AVN.

Your answer

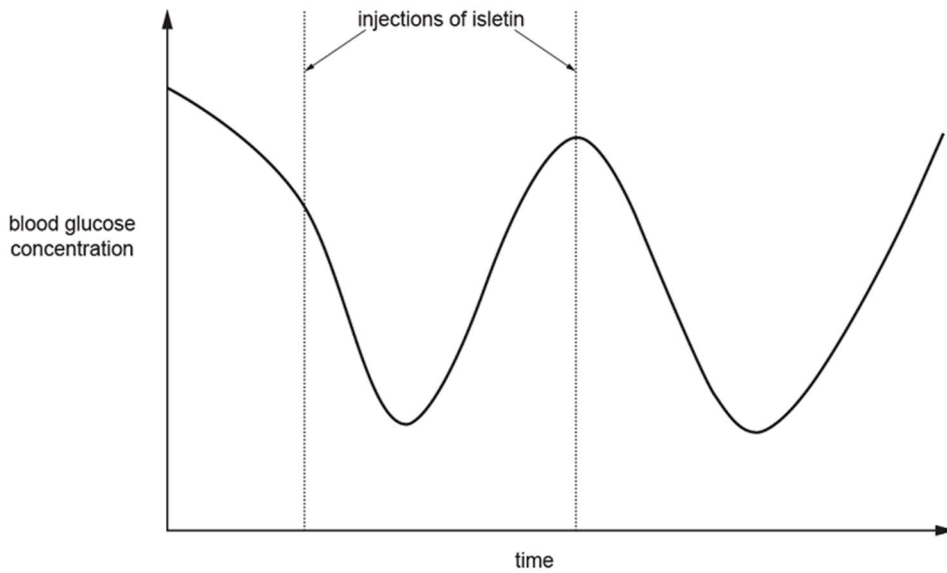
[1]

77. Banting and Best pioneered experiments into the functions of the pancreas.

In one experiment, they removed the pancreas of dogs. Shortly afterwards, the dogs developed the symptoms of diabetes.

- Banting ground up the removed pancreas to produce an extract.
- He called the extract "isletin".
- The isletin was then injected into dogs that had had their pancreas removed.
- He then tested the blood glucose concentration.

The graph below is a summary of the results.



Which of the following statements correctly explains these results?

- 1 Isletin is made in the  $\alpha$  cells in the islets of Langerhans.
- 2 Isletin reduces blood glucose concentration.
- 3 The effects of isletin are short-lived.

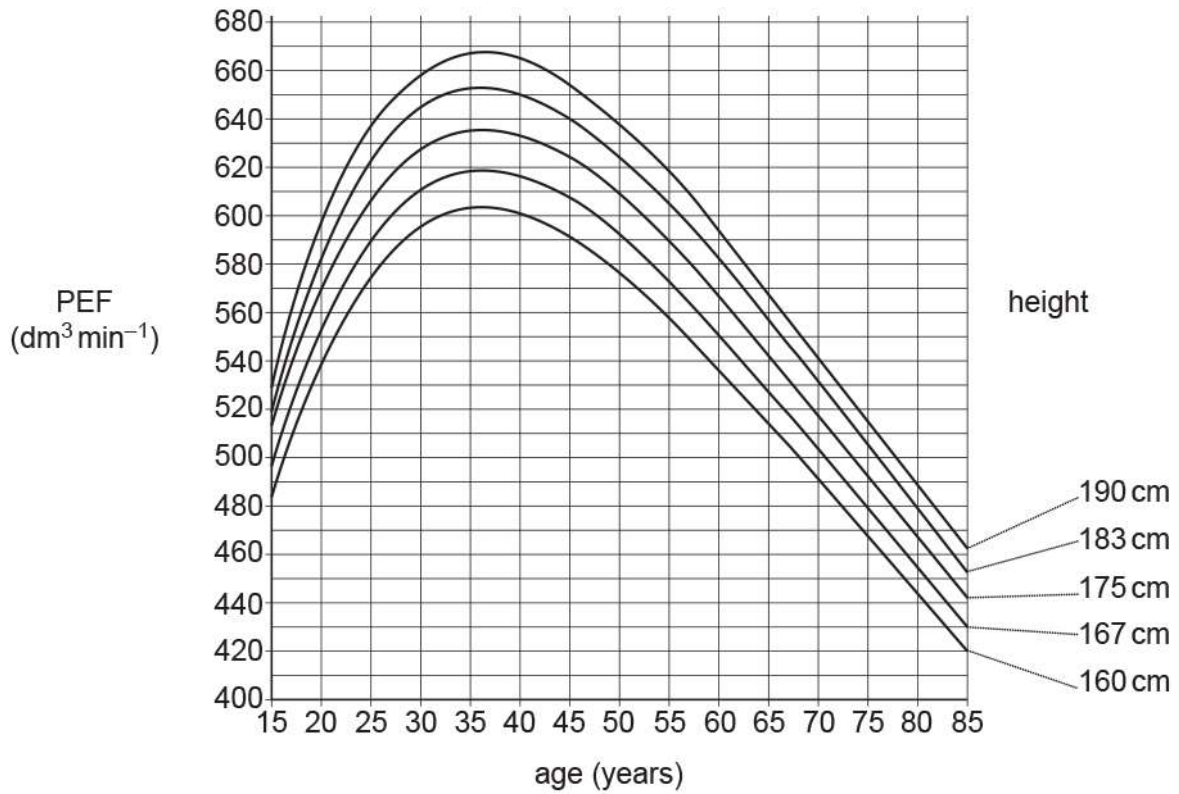
- A** 1, 2 and 3  
**B** Only 1 and 2  
**C** Only 2 and 3  
**D** Only 1

Your answer

[1]

78. Peak expiratory flow (PEF) is a measure of the maximum rate at which a person can exhale.

The graph below shows the typical PEF values for men of different ages and heights.



Which of the following is the percentage increase from the PEF of a 20 year old man of 175 cm to the PEF of a 45 year old man of 183 cm?

- A 19.4%
- B 10.9%
- C 12.3%
- D 8.1%

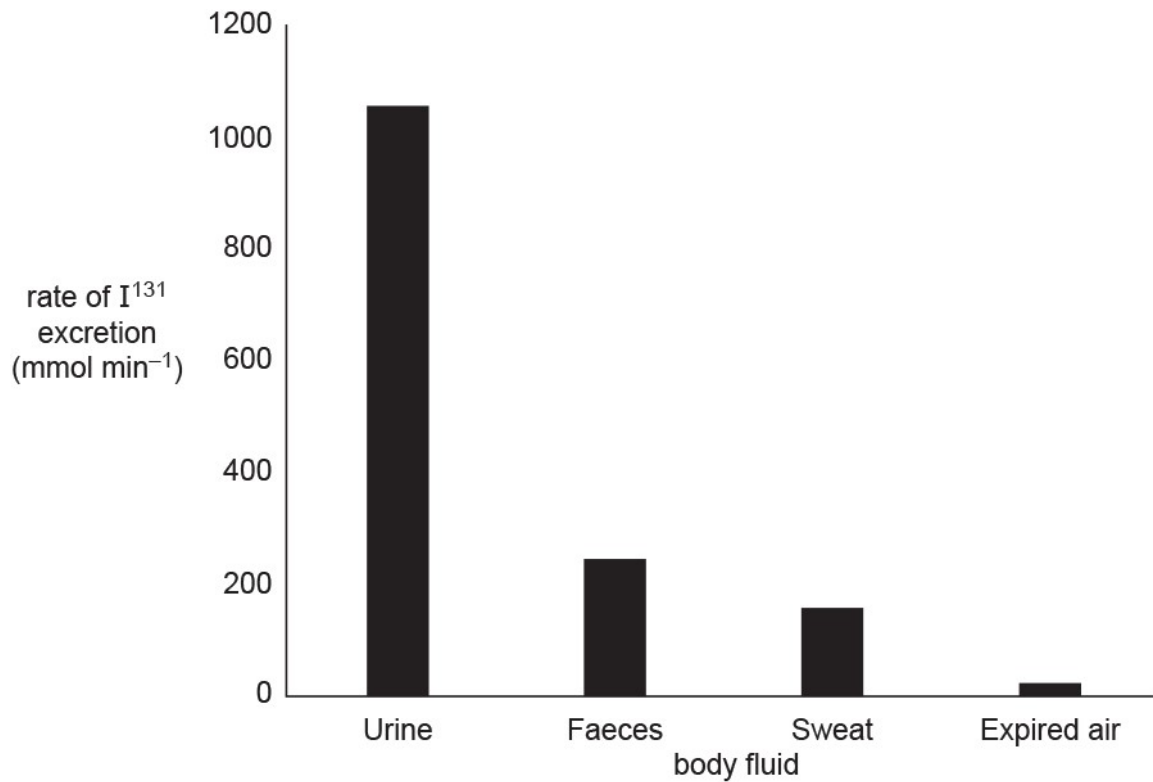
Your answer

[1]

79. One treatment for thyroid cancer is radioactive iodine. The radioisotope  $I^{131}$  is used.

The thyroid gland absorbs any iodine that enters the body, so the radioactive isotope kills the cancerous cells in the thyroid gland. The  $I^{131}$  is then excreted from the body.

Different body fluids excrete different proportions of  $I^{131}$ , as shown in the following graph.



Which of the following, **A** to **D**, correctly explains the different proportions of  $I^{131}$  in each body fluid?

- A**  $I^{131}$  is very soluble in water.
- B**  $I^{131}$  is able to cross capillary walls.
- C** The kidneys are more efficient at excreting  $I^{131}$  than the lungs.
- D** The thyroid gland is well supplied with blood.

Your answer

[1]

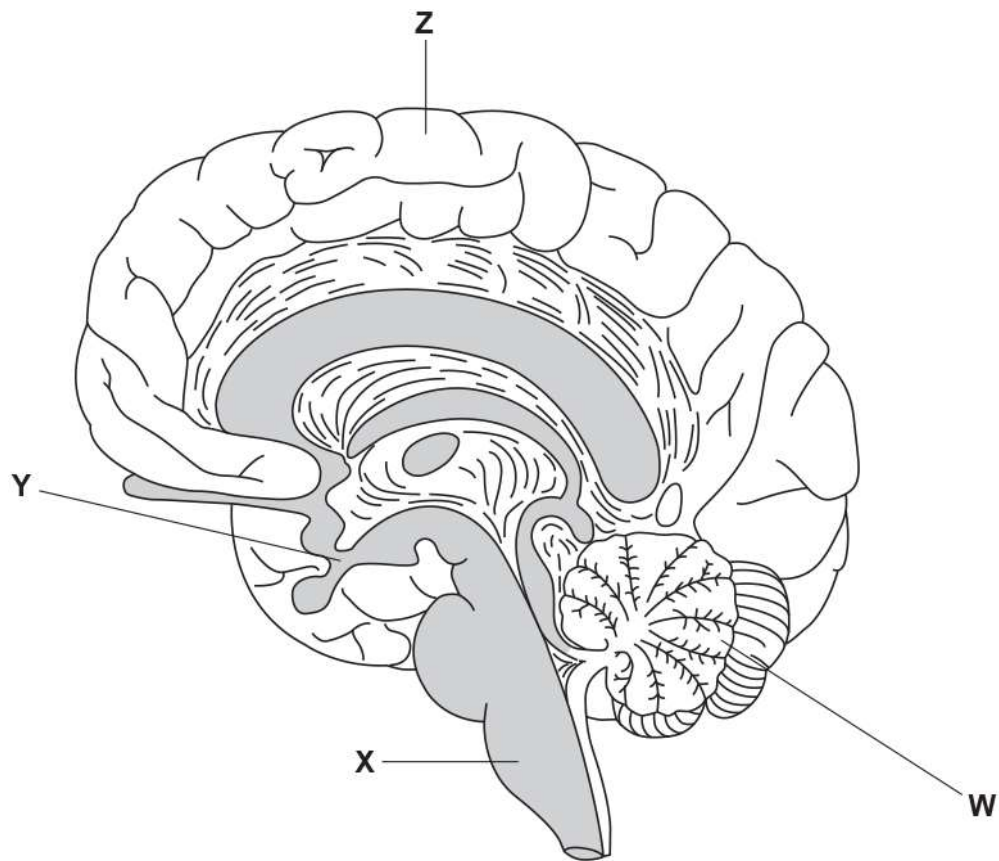
80. Which of the following, **A** to **D**, is a similarity in the way ATP is made in respiration and photosynthesis?

- A** both involve NAD
- B** both involve substrate level phosphorylation
- C** both involve photons
- D** both involve proton gradients

Your answer

[1]

81. The image below is a diagram of the human brain.



Which of the labelled regions would be directly involved in learning to play a musical instrument?

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

Your answer

[1]

82. Which of the following statements, **A** to **D**, correctly explains a feature of an efficient gaseous exchange surface?

- A The layers are thin for a short diffusion distance.
- B There is a good blood supply, so the system reaches equilibrium quickly.
- C There is an increased surface area to reduce surface area to volume ratio.
- D Ventilation takes place to reduce concentration gradient of dissolved gases.

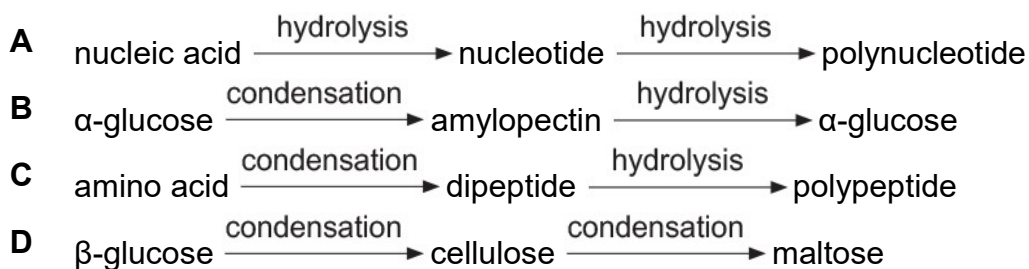
Your answer

[1]



83. The following are a series of organic molecules and the chemical processes that occur to convert them into different molecules.

Which of the rows, **A** to **D**, is correct?



Your answer

[1]

84. The following table describes the approximate percentage mass of different chemical elements in organic polymers.

	Polymer	N (%)	C (%)	O (%)	H (%)	P (%)
<b>A</b>	nucleic acid	20.0	30.0	20.0	10.0	20.0
<b>B</b>	carbohydrate	0.0	33.3	33.3	33.3	33.3
<b>C</b>	protein	30.0	10.0	10.0	0.0	50.0
<b>D</b>	lipid	0.0	50.0	49.0	1.0	0.0

Which of the rows, **A** to **D**, is correct?

Your answer

[1]

85. Bacteria are used in many areas of biotechnology.

In which of the following processes, **A** to **D**, do bacteria **not** play an active role?

- A** bioinformatics
- B** bioremediation
- C** cheese-making
- D** manufacturing human insulin

Your answer

[1]

86. The cell cycle includes a number of checkpoints.

Which of the following statements about the cell cycle is correct?

- A** If damaged DNA is detected at a checkpoint apoptosis is triggered.

- B** If damaged DNA is detected at the G<sub>2</sub> checkpoint the cell cycle is halted and the cell tries to repair the damage.
- C** If a mistake is detected at a checkpoint the cycle reverts to an earlier checkpoint and is repeated.
- D** The G<sub>1</sub> checkpoint checks for mistakes in DNA replication.

Your answer

**[1]**

87. Accurate analysis of an ecosystem's biodiversity requires a detailed classification of organisms.

The spruce pine plant is given the binomial name *Pinus glabra*.

- i. Place a tick (✓) in the box next to the species most closely related to *Pinus glabra*.

*Diplodia pinea*

*Ilex glabra*

*Pinus resinosa*

*Annona glabra*

**[1]**

- ii. Explain why *Pinus glabra* and humans, *Homo sapiens*, are classified in the same domain but in different kingdoms.

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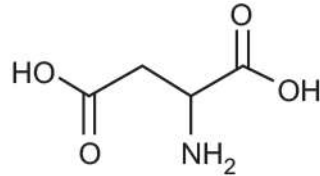
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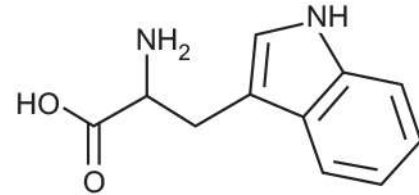
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88. Which of the following could **not** be an amino acid?

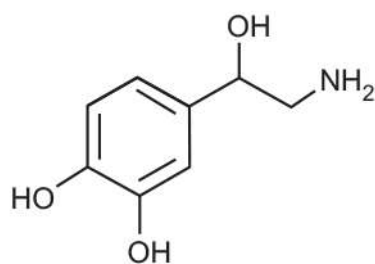
A



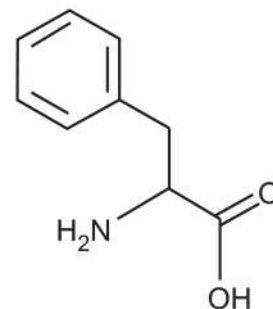
B



C



D



Your answer

[1]

89. Lipids are a diverse group of chemicals that are neither polar nor charged and hence are insoluble in water. The \_\_\_(1)\_\_\_ nature of the heads of phospholipids allows them to form membranes. \_\_\_(2)\_\_\_ also contain fatty acids and form part of the membrane. Lipids can be used for energy storage in the form of \_\_\_(3)\_\_\_. Some hormones are also lipids and they are similar in structure to \_\_\_(4)\_\_\_.

Which row shows the correct sequence of missing words?

	1	2	3	4
A	hydrophilic	glycolipids	triglycerides	cholesterol molecules
B	hydrophilic	triglycerides	cholesterol molecules	glycolipids
C	hydrophobic	cholesterol molecules	triglycerides	bile
D	hydrophobic	cholesterol molecules	triglycerides	glycolipids

Your answer

[1]

90. Which of the following statements about antibiotic resistance is correct?
- A All antibiotics cause mutations in bacterial DNA.
  - B Antibiotic resistance in bacteria is evidence to support Darwin's theory of evolution by natural selection.
  - C The development of antibiotic resistance in bacteria is an example of genetic drift.
  - D The development of antibiotic resistance in bacteria is an example of stabilising selection.

Your answer  [1]

91. Which of the following antibodies increase(s) the phagocytosis of pathogens?

- 1 opsonins
- 2 agglutinins
- 3 anti-toxins

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

Your answer  [1]

92. Which of the following describes an autoimmune disease?

- A a disease in which an individual's own body cells are antigenic
- B a disease in which a pathogen attacks cells of the immune system
- C a disease that prevents production of antibodies
- D a disease to which an individual has developed immunity

Your answer  [1]

93. During which stage of the cell cycle does semi-conservative DNA replication take place?

- A first growth phase
- B prophase
- C second growth phase
- D synthesis phase

Your answer  [1]

94. 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]

95. 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
<b>A</b>	diffusion	facilitated diffusion	diffusion
<b>B</b>	diffusion	active transport	active transport
<b>C</b>	active transport	facilitated diffusion	diffusion
<b>D</b>	active transport	active transport	facilitated diffusion

Your answer

[1]

96. 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]

97. 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?

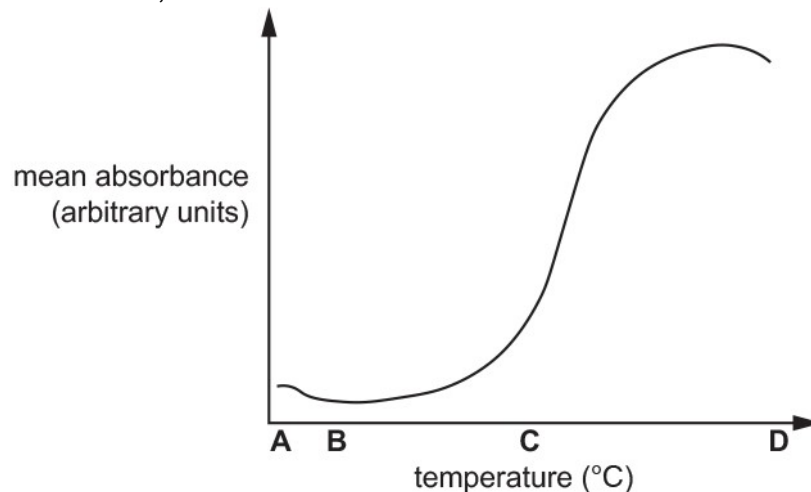
- A callose deposits at sieve tube ends that prevent pathogen movement in phloem
- B hydrolytic enzymes such as chitinase found between cells
- C stomata can be closed by guard cells if pathogens are detected
- D cell walls can be thickened by lignin, making cell entry very difficult for pathogens

Your answer

[1]

98. 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]

99. 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]

100. 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]

101. 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?

	<b>Most soluble</b>			<b>Least soluble</b>
<b>A</b>	glucose	ribose	amylose	amylopectin
<b>B</b>	amylose	amylopectin	glycogen	ribose
<b>C</b>	glucose	ribose	amylopectin	amylose
<b>D</b>	ribose	amylose	glucose	amylopectin

Your answer

[1]

102. 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
<b>A</b>	<i>S. cellulorum</i> and <i>A. mellea</i>	<i>A. mellea</i>	<i>S. cellulorum</i>	<i>S. cellulorum</i> and <i>A. mellea</i>
<b>B</b>	<i>S. cellulorum</i> and <i>A. mellea</i>	<i>A. mellea</i>	<i>S. cellulorum</i> and <i>A. mellea</i>	<i>S. cellulorum</i> and <i>A. mellea</i>
<b>C</b>	<i>S. cellulorum</i>	<i>S. cellulorum</i> and <i>A. mellea</i>	<i>S. cellulorum</i>	<i>A. mellea</i>
<b>D</b>	<i>A. mellea</i>	<i>S. cellulorum</i>	<i>S. cellulorum</i> and <i>A. mellea</i>	<i>S. cellulorum</i>

Your answer

[1]

103. 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]

104. 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?

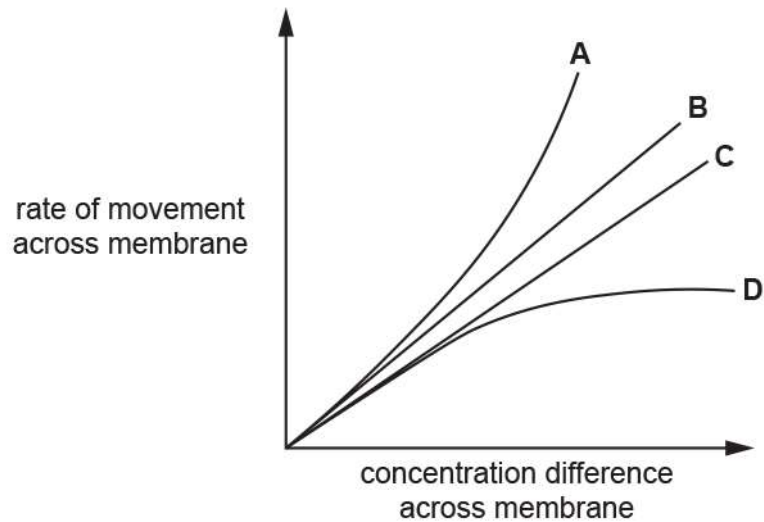
- A** active natural immunity
- B** active artificial immunity
- C** passive natural immunity
- D** passive artificial immunity

Your answer

[1]

105. 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]

106. 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]

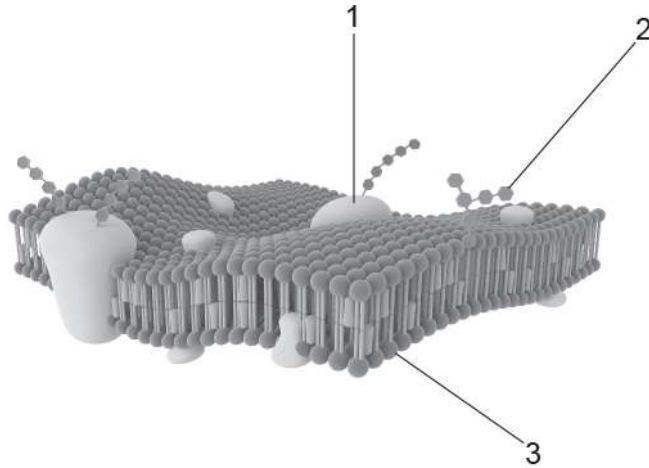
107. Which of the options, **A** to **D**, is a primary defence against pathogens?

- A** antibody production
- B** inflammation
- C** phagocytosis
- D** T-killer

Your answer

[1]

108. The diagram below shows part of a plasma membrane.



Which of the label lines points to a structure that could contain a sulfur atom?

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

Your answer

[1]

109. Which of the following statements about gene therapy is **not** correct?

- A changes resulting from gene therapy cannot be passed on to offspring
- B germ-line gene therapy affects the whole organism
- C gene therapy is a form of genetic engineering
- D somatic cell gene therapy can only affect a limited number of cells

Your answer

[1]

110. Below are three processes that occur within living organisms.

- 1 apoptosis
- 2 mitosis
- 3 meiosis

Which of these processes is important in determining the body plan of an organism?

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

- C Only 2 and 3
- D Only 1

Your answer

[1]

111. Three methods of pathogen transmission between animals or plants are listed below.

- 1 direct contact
- 2 Vectors
- 3 droplets

Which of the methods of pathogen transmission can apply to plants?

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

Your answer

[1]

112. The image below shows a European badger, *Meles meles*, which is a member of the family Mustelidae.



The American badger belongs to a different genus within the same family.

Which of the options, **A to D**, is the correct binomial name for the American badger?

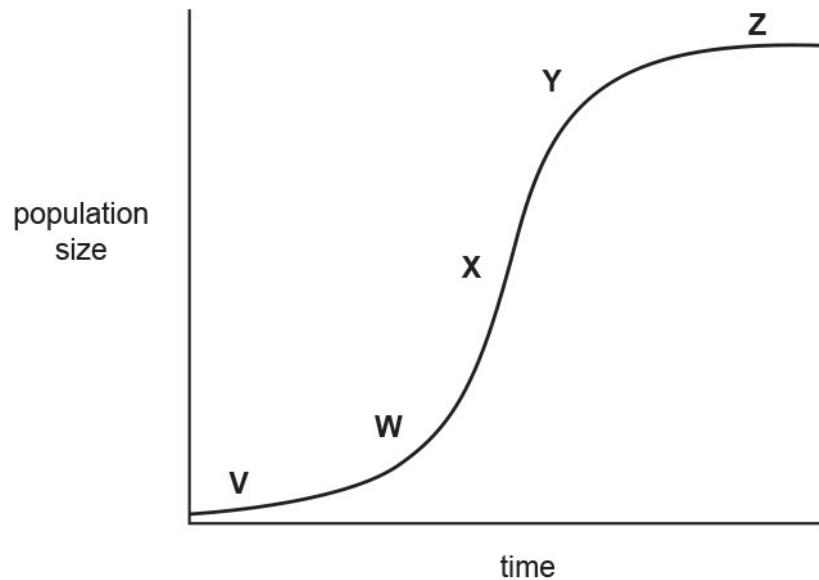
- A *Meles leucurus*

- B *mellivora capensis*
- C *mustelidus Everetti*
- D *Taxidea taxus*

Your answer

[1]

113. The graph shows a typical population growth curve.



Which row correctly describes what is happening at each of stages V to Z ?

	V	W	X	Y	Z
A	reproduction rate is higher than death rate	as time doubles population doubles	population size is proportional to time	population growth is slowing	reproduction rate is similar to death rate
B	reproduction rate is higher than death rate	as time doubles population more than doubles	reproduction rate is much higher than death rate	population growth is slowing	reproduction rate is similar to death rate
C	reproduction rate is higher than death rate	as time doubles population doubles	population size is proportional to time	population growth is decreasing	reproduction rate is similar to death rate
D	reproduction rate is higher than death rate	population is increasing rapidly	reproduction rate is much higher than death rate	population is decreasing	reproduction rate is similar to death rate

Your answer

[1]

114. The first stage of primary succession is the pioneer community.

Which of the following statements about a pioneer community are correct?

- 1 species produce large numbers of wind-carried seeds or spores
- 2 biomass is low
- 3 many species are lichens and mosses

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

Your answer

[1]

115. Which of the statements, **A** to **D**, best defines the term *species evenness*?

- A** the number of species in an area  
**B** the relative abundance of each species in an area  
**C** the relative number of individuals of a species in an area  
**D** the spread of species over an area

Your answer

[1]

116. Which of the statements, **A** to **D**, about amylopectin is correct?

- A** it contains 1-4 and 1-6 glycosidic bonds between  $\alpha$ -glucose monomers  
**B** it is an unbranched chain of  $\alpha$ -glucose monomers  
**C** it contains  $\alpha$  1-4 and  $\beta$  1-6 glycosidic bonds  
**D** it is made up of  $\beta$ -glucose monomers and is uncoiled

Your answer

[1]

117. Bony fish absorb dissolved oxygen from the water using gills. Water is passed through the buccal cavity and over the gill lamellae. The oxygen saturation of the blood and water

changes as the water passes over the gills.

Which of the statements, **A** to **D**, correctly describes the way oxygen is transferred into the blood at the gills?

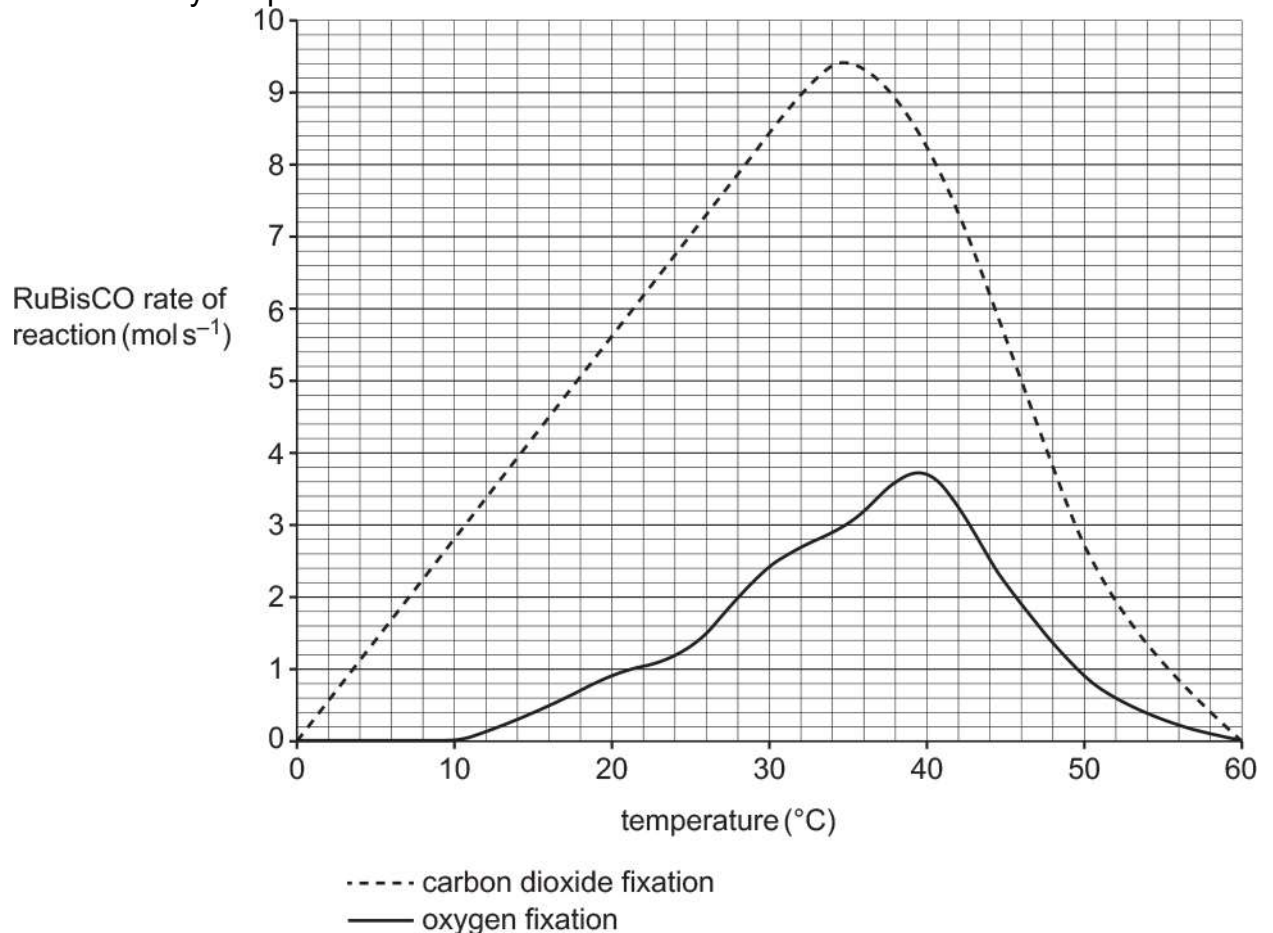
- A** Blood and water flow in a concurrent system with a constant concentration gradient between them.
- B** Blood and water flow in a countercurrent system with a constant concentration gradient between them.
- C** Blood and water flow in a concurrent system with a greater concentration gradient between them at the start of the gill lamella.
- D** Blood and water flow in a countercurrent system with a greater concentration gradient between them at the start of the gill lamella.

Your answer

[1]

118. RuBisCO is an enzyme that fixes carbon dioxide in photosynthesis. In some conditions, RuBisCO also carries out oxygen fixation.

The graph below shows how the carbon dioxide and oxygen fixing activities of RuBisCO are affected by temperature.



What are the correct percentage changes in RuBisCO carbon dioxide and oxygen fixing activities between 30 °C and 40 °C?

- A** carbon dioxide fixation – 12.7%, oxygen fixation 23.3%
- B** carbon dioxide fixation – 14.6%, oxygen fixation 18.9%
- C** carbon dioxide fixation – 2.4%, oxygen fixation 54.2%
- D** carbon dioxide fixation – 3.6%, oxygen fixation 35.1%

Your  
answer

[1]

119. The hormone hCG can be detected in urine using pregnancy tests.

Which of the following properties of the hormone hCG allows it to be detected in urine?

- A** hCG is a polar molecule
- B** hCG has a molecular mass of less than 69,000
- C** hCG is a polypeptide
- D** hCG binds to cells using glycoproteins

Your  
answer

[1]

120. The hormone ecdysone is synthesised in the prothoracic glands found in the upper thorax of some invertebrates and is released into haemolymph. It is then transported to cells near the surface of the body and causes the loss of the exoskeleton so that a new exoskeleton can form.

Which of the following statements explains how ecdysone is able to act on cells near the surface of the body?

- 1 Ecdysone is synthesised by specialised neurosecretory cells.
- 2 Ecdysone is soluble in haemolymph because it is a polar molecule.
- 3 Ecdysone is complementary to cell surface receptors on cells throughout the body of some invertebrates.

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

Your  
answer

[1]

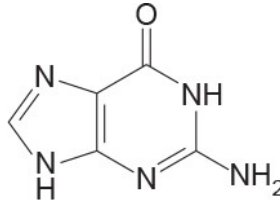
121. Which of the statements, **A** to **D**, correctly describes the process of adhesion?

- A** attraction of water molecules to the impermeable walls of xylem tissue
- B** attraction of water molecules to other water molecules in the xylem tissue
- C** active transport of water molecules into phloem tissue
- D** attraction of water molecules to other water molecules in the phloem tissue

Your  
answer

[1]

122. The image below shows the structure of the nucleotide base guanine.



Bird droppings are known as *guano* because they contain a high proportion of guanine. Unlike mammals, birds excrete nitrogenous waste as guanine instead of urea. Guanine is synthesised from ammonia in the liver.

The following statements relate to guanine:

- 1 ammonia is more toxic than guanine
- 2 urea is more soluble in water than guanine
- 3 guanine has a high proportion of nitrogen

Which of the statements correctly explains why birds excrete guanine?

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

Your  
answer

[1]

123. Which of the options, **A** to **D**, correctly describes how an endotherm would respond to an increase in temperature?

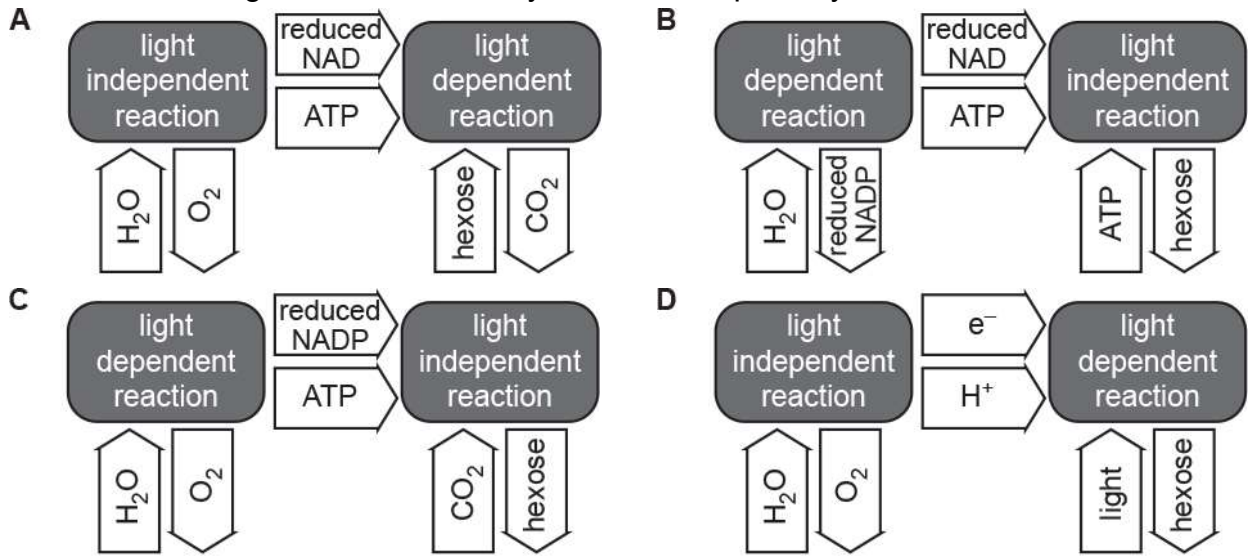
- A** dilation of arterioles near the surface of the skin
- B** erector muscles contract, causing hairs to stand up
- C** rapid contractions of skeletal muscles
- D** sweat glands release less sweat



Your answer

[1]

124. Which of the images, **A** to **D**, correctly summarises photosynthesis?



Your answer

[1]

125. A student counted stomata on a leaf using a light microscope. The image below shows the stomata that were visible.

The image magnification is  $\times 60$ .



Which of the options, **A** to **D**, is the correct stomatal density of this leaf?

- A** 7.50 stomata mm<sup>-2</sup>
- B** 0.13 stomata mm<sup>-2</sup>

- C 2428 stomata  $\text{mm}^{-2}$
- D 0.21 stomata  $\text{mm}^{-2}$

Your answer

[1]

126. Which of the options, **A** to **D**, occurs in the nucleus of a cell?

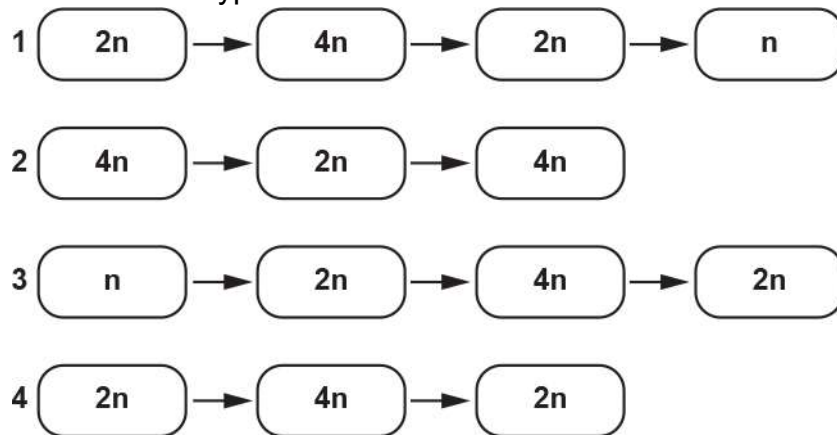
- A synthesis of enzymes
- B synthesis of RNA
- C modification of polypeptides
- D synthesis of carbohydrates

Your answer

[1]

127. During cell division, the chromosome number in the cells changes.

The following sequences describe the chromosome number in cells before, during and after different types of cell division.



Which of the options, **A** to **D**, correctly describes the stages of mitosis and meiosis in human cells?

- A 1 is mitosis, 2 is meiosis
- B 2 is mitosis, 3 is meiosis
- C 3 is mitosis, 4 is meiosis
- D 4 is mitosis, 1 is meiosis

Your answer

[1]

128. Patients with kidney failure can be treated in different ways.

Which of the following statements describes a feature of peritoneal dialysis?

- 1 Urea and mineral ions pass into the tissue fluid.
- 2 Blood is passed over an artificial membrane to remove toxins.
- 3 The patient receives immunosuppressant medication.

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

Your answer

[1]

129. 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]

130. 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]

131. 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]

132. 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]

133. 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]

134. 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]

135. 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.

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

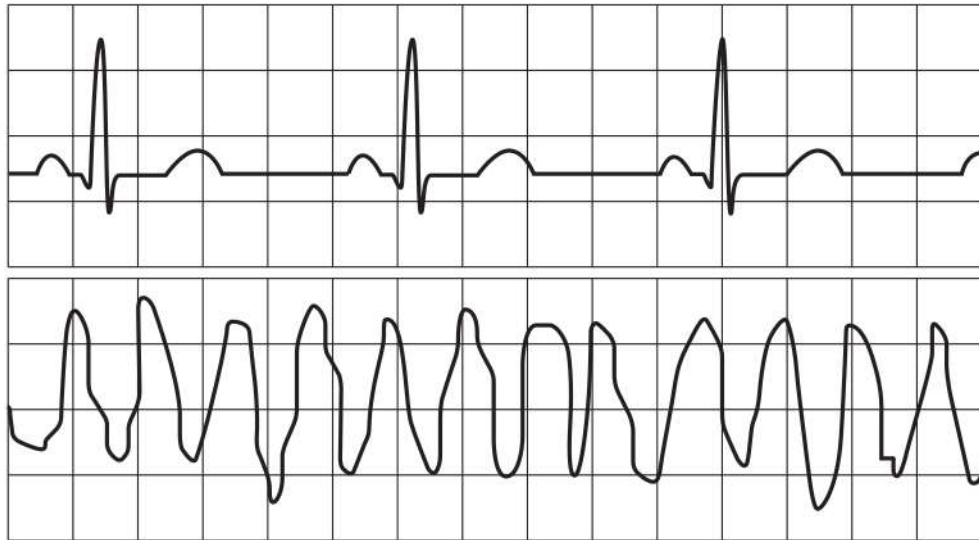
Name the type of enzyme the students used.

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

Your answer

[1]

136. 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]

137. 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]

138. 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]

139. 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]

140. 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]

141. 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]

142. 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]

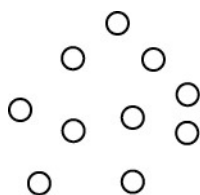
143. Which of the options, **A to D**, is a correct statement about polysaccharides of glucose?

- 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.

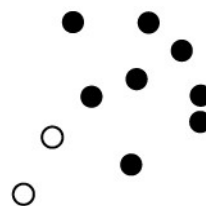
Your answer

[1]

144. Diagrams **X**, **Y** and **Z** represent populations of microorganisms.



**X**



**Y**



**Z**



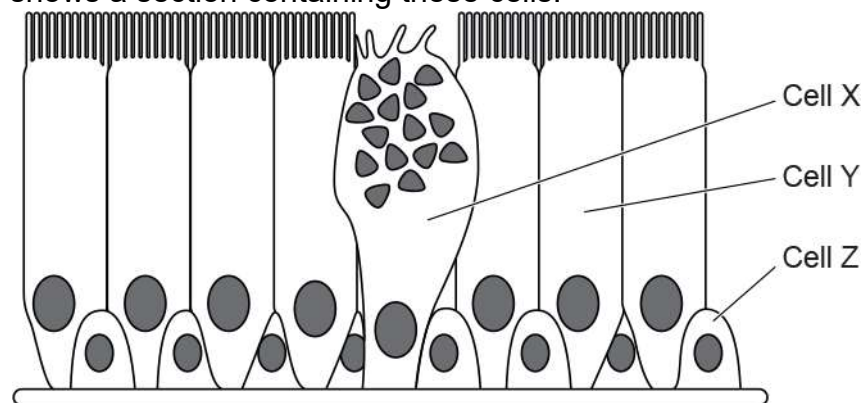
Which of the sequences, **A** to **D**, demonstrates the changes caused by addition of a drug to which some individuals are resistant?

- A** Y, X, Z
- B** Z, Y, X
- C** Z, X, Y
- D** Y, Z, X

Your answer

[1]

145. 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?

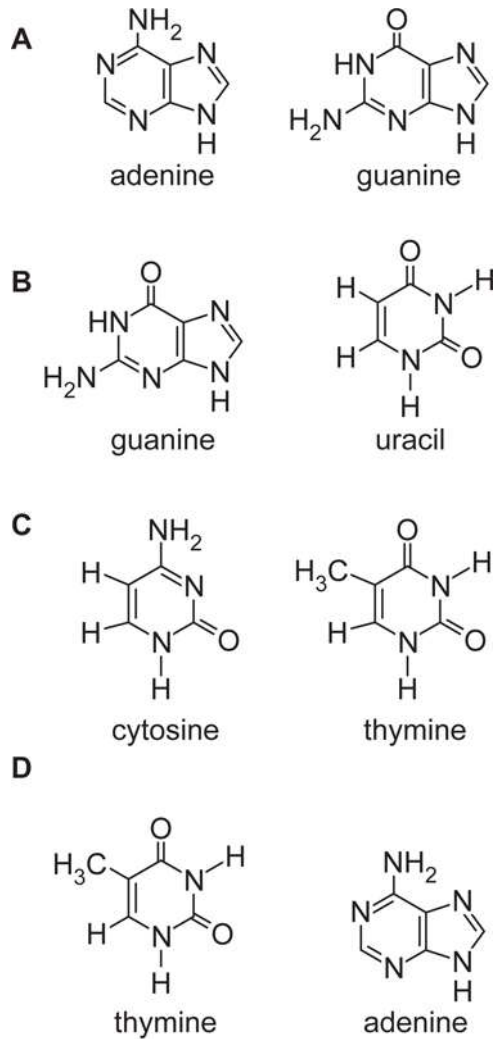
- A** Cells X, Y and Z are all columnar epithelial cells.
- B** Cells X and Y move mucus and trapped bacteria out of the trachea.
- C** Cell X releases mucus into the trachea.
- D** Cell Z is a goblet cell.

Your answer

[1]

146. 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]

147. What is the main advantage of the polymerase chain reaction (PCR) when it is used as part of the process to sequence the genome of an endangered species?

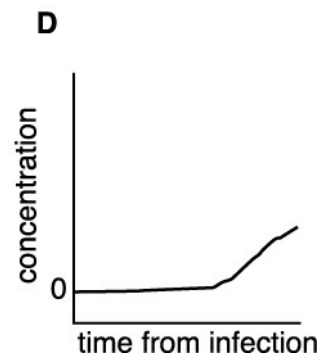
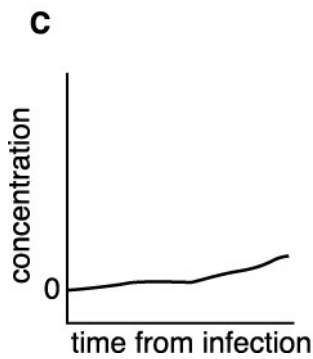
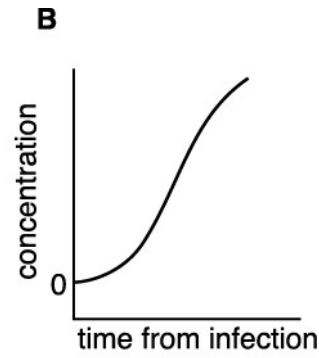
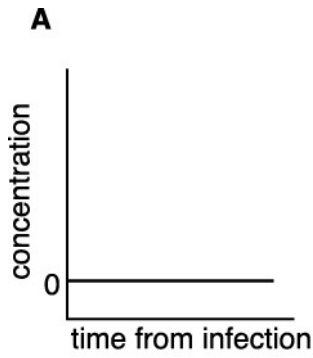
- A** it is cheaper than rearing animals
- B** it never makes mistakes
- C** it reproduces DNA rapidly
- D** only a small sample of DNA is required

Your answer

[1]

148. The graphs below show the concentration of antibodies in the blood of four people after a first natural exposure to an antigen. One of the people had been vaccinated against this antigen previously.

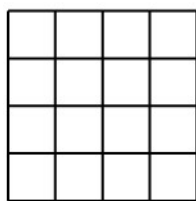
Which of the graphs, **A** to **D**, represents the person who had been vaccinated?



Your answer

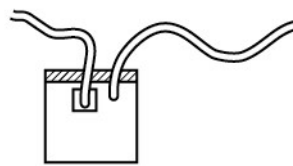
[1]

149. The images show four pieces of apparatus that could be used to collect data about biodiversity in the field.



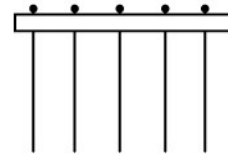
frame quadrant

**P**



potter

**Q**



point quadrant

**R**



sweep net

**S**

Which row, **A** to **D**, describes when each piece of apparatus would be used to measure species evenness and richness in a meadow?

Row	Measuring species richness	Measuring species evenness
<b>A</b>	Q, S	R
<b>B</b>	P	P, R

<b>C</b>	P, Q, R, S	P, Q, R, S
<b>D</b>	P, Q, R, S	P, Q, S

Your answer

[1]

150. The list below describes some types of plant found during primary succession on a sand dune.

- i. a legume that contains nitrogen fixing bacteria
- ii. hardy grasses that can resist desiccation
- iii. large mature trees
- iv. small herbs that can tolerate salty spray
- v. small trees and bushes

In which order are these plants most likely to grow successfully?

- A** i – ii – iii – iv – v
- B** ii – v – iv – i – iii
- C** ii – iv – i – v – iii
- D** ii – iv – iii – v – i

Your answer

[1]

**END OF QUESTION paper**

# Mark scheme

Question			Answer/Indicative content	Marks	Guidance
1			C	1	
			<b>Total</b>	<b>1</b>	
2			D	1	
			<b>Total</b>	<b>1</b>	
3			D	1	
			<b>Total</b>	<b>1</b>	
4			A	1	
			<b>Total</b>	<b>1</b>	
5			A	1	
			<b>Total</b>	<b>1</b>	
6			A	1	
			<b>Total</b>	<b>1</b>	
7			D	1	
			<b>Total</b>	<b>1</b>	
8			D	1	
			<b>Total</b>	<b>1</b>	
9			B	1	
			<b>Total</b>	<b>1</b>	
10			C	1	
			<b>Total</b>	<b>1</b>	
11			A	1	
			<b>Total</b>	<b>1</b>	
12			A	1	
			<b>Total</b>	<b>1</b>	
13			C	1	
			<b>Total</b>	<b>1</b>	
14			A	1	

			<b>Total</b>	<b>1</b>	
15			D	1	
			<b>Total</b>	<b>1</b>	
16			D	1	
			<b>Total</b>	<b>1</b>	
17			D	1	
			<b>Total</b>	<b>1</b>	
18			D	1	
			<b>Total</b>	<b>1</b>	
19			C	1	
			<b>Total</b>	<b>1</b>	
20			C	1	
			<b>Total</b>	<b>1</b>	
21			D	1	
			<b>Total</b>	<b>1</b>	
22			B	1	
			<b>Total</b>	<b>1</b>	
23			A	1	
			<b>Total</b>	<b>1</b>	
24			C	1	
			<b>Total</b>	<b>1</b>	
25			D	1	
			<b>Total</b>	<b>1</b>	
26			D	1	
			<b>Total</b>	<b>1</b>	
27			D	1	
			<b>Total</b>	<b>1</b>	
28			B	1	
			<b>Total</b>	<b>1</b>	
29			B	1	

			<b>Total</b>	<b>1</b>	
30			D	1	
			<b>Total</b>	<b>1</b>	
31			B	1	
			<b>Total</b>	<b>1</b>	
32			C	1	
			<b>Total</b>	<b>1</b>	
33			D	1	
			<b>Total</b>	<b>1</b>	
34			B	1	
			<b>Total</b>	<b>1</b>	
35			B	1	
			<b>Total</b>	<b>1</b>	
36			B	1	
			<b>Total</b>	<b>1</b>	
37			D	1	
			<b>Total</b>	<b>1</b>	
38			D	1	
			<b>Total</b>	<b>1</b>	
39			C	1	
			<b>Total</b>	<b>1</b>	
40			B	1	
			<b>Total</b>	<b>1</b>	
41			B	1	
			<b>Total</b>	<b>1</b>	
42			A	1	
			<b>Total</b>	<b>1</b>	
43			C	1	
			<b>Total</b>	<b>1</b>	
44			A	1	

			<b>Total</b>	<b>1</b>	
45			D	1	
			<b>Total</b>	<b>1</b>	
46			A	1	
			<b>Total</b>	<b>1</b>	
47			B	1	
			<b>Total</b>	<b>1</b>	
48			A	1	
			<b>Total</b>	<b>1</b>	
49			C	1	
			<b>Total</b>	<b>1</b>	
50			A	1	
			<b>Total</b>	<b>1</b>	
51			B	1	
			<b>Total</b>	<b>1</b>	
52			A	1	
			<b>Total</b>	<b>1</b>	
53			C	1	
			<b>Total</b>	<b>1</b>	
54			B	1	
			<b>Total</b>	<b>1</b>	
55			C	1	
			<b>Total</b>	<b>1</b>	
56			D	1	
			<b>Total</b>	<b>1</b>	
57			A	1	
			<b>Total</b>	<b>1</b>	
58			D	1	
			<b>Total</b>	<b>1</b>	
59			A	1	



			<b>Total</b>	<b>1</b>	
60			D	1	
			<b>Total</b>	<b>1</b>	
61			A	1	
			<b>Total</b>	<b>1</b>	
62			C	1	
			<b>Total</b>	<b>1</b>	
63			B	1	
			<b>Total</b>	<b>1</b>	
64			C	1	
			<b>Total</b>	<b>1</b>	
65			B	1	
			<b>Total</b>	<b>1</b>	
66			A	1	
			<b>Total</b>	<b>1</b>	
67			B	1	
			<b>Total</b>	<b>1</b>	
68			B	1	
			<b>Total</b>	<b>1</b>	
69			B	1	
			<b>Total</b>	<b>1</b>	
70			D	1	
			<b>Total</b>	<b>1</b>	
71			B	1	
			<b>Total</b>	<b>1</b>	
72			C	1	
			<b>Total</b>	<b>1</b>	
73			D ✓	1	
			<b>Total</b>	<b>1</b>	
74			C ✓	1	<u>Examiner's Comments</u>

					Many candidates who noted that data from both pre and post-synaptic neurones had been included in the table and were able to apply their knowledge of membrane potentials to this information went on to choose C as the correct option.
			<b>Total</b>	<b>1</b>	
75			C ✓	1	<b><u>Examiner's Comments</u></b> There were many correct responses to this question with candidates recognising the sympathetic nervous system prompt and its association with heart rate and blood pressure.
			<b>Total</b>	<b>1</b>	
76			B ✓	1	
			<b>Total</b>	<b>1</b>	
77			C ✓	1	<b><u>Examiner's Comments</u></b> This question provided significant challenge to candidates. Only statements 2 and 3 were correct thereby giving option C as the correct response.
			<b>Total</b>	<b>1</b>	
78			C ✓	1	<b><u>Examiner's Comments</u></b> Candidates had to process the information in the graph of PEF data and choose the appropriate values to perform their calculation. Candidates often struggle with such percentage calculations in section B, but this posed little problem for the majority of candidates who were able to perform the calculation and identify C as the correct option.
			<b>Total</b>	<b>1</b>	
79			C ✓	1	<b><u>Examiner's Comments</u></b> This question proved challenging for some and required skills in applying knowledge to novel context to choose the most appropriate response.
			<b>Total</b>	<b>1</b>	
80			D ✓	1	<b><u>Examiner's Comments</u></b> Option A provided a distractor and common incorrect response to the correct option, C in this question as statement 1, whilst correct, was irrelevant to the question being asked about ecdysone.  Option B provided a distractor and common incorrect

					response to the correct option, D, in this question. This is possibly due to misconceptions surrounding the synthesis of ATP by different methods of phosphorylation.
			<b>Total</b>	<b>1</b>	
81			C ✓	1	
			<b>Total</b>	<b>1</b>	
82			A ✓	1	
			<b>Total</b>	<b>1</b>	
83			B ✓	1	
			<b>Total</b>	<b>1</b>	
84			A ✓	1	<p><b><u>Examiner's Comments</u></b></p> <p>Many candidates were able to correctly identify nucleic acids (option A) here, demonstrating knowledge of the composition of some organic polymers. Some candidates opted for B which, although providing the correct elements present in carbohydrates, the approximate percentage mass for each of these elements could not be true for carbohydrates.</p>
			<b>Total</b>	<b>1</b>	
85			A ✓	1 (AO1.1)	<p><b><u>Examiner's Comments</u></b></p> <p>Three quarters of candidates got this right.</p>
			<b>Total</b>	<b>1</b>	
86			B ✓	1 (AO1.2)	<p><b><u>Examiner's Comments</u></b></p> <p>Although on the same topic as Q10, fewer candidates were clear about what happens if damaged DNA is detected and A was a common incorrect response.</p>
			<b>Total</b>	<b>1</b>	
87		i	<i>Pinus resinosa</i> ✓	1	<p><b><u>Examiner's Comments</u></b></p> <p>This was generally well answered. Most candidates understood that organisms in the same genus were more closely related than those in different genera that had the same species name.</p>
		ii	<p><i>In the same domain because</i></p> <p>(plants / pines, and, animals / humans) are both eukaryotes</p>	2	<p><b>ALLOW</b> 'they are both eukaryotic'</p> <p><b>ALLOW</b> 'all eukaryotes are classified in the same domain'</p>

			<p><b>or</b></p> <p>description of similarity between plant and animal (eukaryotic) cells ✓</p> <p><i>In different kingdoms because</i></p> <p>description of difference between plants and animals ✓</p>		<p>e.g. 'both the pine and humans have cells with membrane-bound organelles'</p> <p>e.g. 'pines carry out photosynthesis but humans do not'</p> <p>'plant cells have permanent vacuole but animal cells do not'</p> <p>'difference is animal cells do not have cell wall'</p> <p><b><u>Examiner's Comments</u></b></p> <p>The majority of candidates gained credit for stating that <i>Pinus glabra</i> and <i>Homo sapiens</i> are both eukaryotes. Many candidates described similarities in cell structure to justify this statement. Most candidates recognised that <i>Pinus glabra</i> are plants and <i>Homo sapiens</i> are animals but many did not gain credit by explaining why they are classified in this way. Many candidates who attempted to describe a difference between the two kingdoms did not make a comparative statement and so did not gain the mark.</p>
			<b>Total</b>	<b>3</b>	
88			C ✓	1 (AO2.1)	<p><b><u>Examiner's Comments</u></b></p> <p>Most candidates were able to correctly spot that C did not have a terminal -COOH group.</p>
			<b>Total</b>	<b>1</b>	
89			A ✓	1 (AO1.1)	<p><b><u>Examiner's Comments</u></b></p> <p>The most common answer was the correct one, but many candidates answered D, which suggests a misunderstanding about the structure of cholesterol.</p>
			<b>Total</b>	<b>1</b>	
90			B ✓	1 (AO1.2)	<p><b><u>Examiner's Comments</u></b></p> <p>Most responses were correct. The most common misconception was that antibiotic resistance is an example of genetic drift.</p>
			<b>Total</b>	<b>1</b>	
91			B ✓	1 (AO1.1)	<p><b><u>Examiner's Comments</u></b></p> <p>This was correctly answered by most.</p>
			<b>Total</b>	<b>1</b>	
92			A ✓	1 (AO1.1)	<p><b><u>Examiner's Comments</u></b></p>

					This was correctly answered on most scripts but a sizeable minority put B.
			<b>Total</b>	<b>1</b>	
93			D ✓	1 (AO1.1)	<b><u>Examiner's Comments</u></b> Most candidates were able to answer this correctly.
			<b>Total</b>	<b>1</b>	
94			D ✓	1	<b><u>Examiner's Comments</u></b> This question tests understanding of the Bohr effect. Candidates find this a difficult topic and many link more hydrogen ions to higher pH. Those that understand the pH scale then incorrectly link a fall in pH to a rise in affinity of haemoglobin for oxygen. Only the most able candidates reliably got this correct.
			<b>Total</b>	<b>1</b>	
95			C ✓	1	<b><u>Examiner's Comments</u></b> This question tests detail of how sucrose is actively loaded into sieve tube elements. Candidates need to recall the process and apply what they know about how substances cross membranes. This enables them to work out that C is the correct response. Only the more able candidates could achieve this.
			<b>Total</b>	<b>1</b>	
96			C ✓	1	<b><u>Examiner's Comments</u></b> Most candidates gave the correct response to this question testing the meaning of in-situ and ex-situ conservation techniques.
			<b>Total</b>	<b>1</b>	
97			B ✓	1	<b><u>Examiner's Comments</u></b> The key to answering this question correctly was spotting that the question asks for a chemical defence rather than a barrier type response. Those candidates who read the question carefully could provide the correct response.
			<b>Total</b>	<b>1</b>	

98			C ✓	1	<p><b><u>Examiner's Comments</u></b></p> <p>This question about the effect of temperature change on membrane structure proved tricky for many candidates who did not think about the process carefully. Almost all the incorrect responses were D. These candidates obviously linked the graph to enzyme activity. In the same way that rising temperature affects enzyme structure, the proteins here are denatured. The difference is that once the membrane proteins are denatured they allow leakage of the betaxanthins. This occurs at point C.</p>
			<b>Total</b>	<b>1</b>	
99			D ✓	1	<p><b><u>Examiner's Comments</u></b></p> <p>This questions tests understanding of osmosis. Most candidates gave either C or D as their response. More able candidates realised that there may be some movement of water molecules and that the movement would be equal in both directions – response D.</p>
			<b>Total</b>	<b>1</b>	
100			A ✓	1	<p><b><u>Examiner's Comments</u></b></p> <p>Candidates who read the question carefully spotted that it is asking for an adaptation to reduce water loss. Roots have nothing to do with water loss, they are involved in uptake. The other three adaptations refer to leaves where the majority of water loss occurs.</p>
			<b>Total</b>	<b>1</b>	
101			A ✓	1	<p><b><u>Examiner's Comments</u></b></p> <p>This question tests knowledge of carbohydrate structure and how candidates apply their knowledge to solubility. Most candidates apparently knew that glucose and ribose are the most soluble. Many candidates found it difficult to assess whether amylose or amylopectin is the least soluble.</p>
			<b>Total</b>	<b>1</b>	
102			A ✓	1	<p><b><u>Examiner's Comments</u></b></p>

					This question tests knowledge of differences between prokaryote and eukaryote cell structure. The correct response is A. However, many candidates believe that prokaryotes do not have ribosomes. They do not appear to distinguish between ribosomes and membrane bound organelles.
			<b>Total</b>	<b>1</b>	
103			<b>C ✓</b>	1	<b><u>Examiner's Comments</u></b>  This question tested knowledge about the function of different organelles. Many candidates were successful but some had forgotten that vesicles are used to transport the enzymes to the cell surface membrane and for exocytosis.
			<b>Total</b>	<b>1</b>	
104			<b>D ✓</b>	1	<b><u>Examiner's Comments</u></b>  This question tested candidate knowledge about types of immunity. It is clear that many candidates have not focused on what is meant by active immunity. Active immunity is when the specific immune system is activated and produces its own antibodies. Many candidates gave B as an incorrect response.
			<b>Total</b>	<b>1</b>	
105			<b>D ✓</b>	1	<b><u>Examiner's Comments</u></b>  This question tests understanding of how substances pass through cell membranes. The more able candidates appreciated that sodium ions would pass through channel proteins. If the number of channel proteins in the membrane is limited then this will eventually limit the rate of movement of the ions.
			<b>Total</b>	<b>1</b>	
106			<b>B ✓</b>	1	<b><u>Examiner's Comments</u></b>  Candidates should be well aware that insects have a single open circulatory system. <i>Daphnia</i> are small crustaceans closely related to insects. Most candidates were able to spot this link and give the correct response.

			<b>Total</b>	<b>1</b>	
107			B \	1	<b>ALLOW C</b> <b>Examiner's Comments</b> Almost all candidates achieved this mark.
			<b>Total</b>	<b>1</b>	
108			D \	1	<b>Examiner's Comments</b> Around half of candidates were able to successfully apply their knowledge of biochemistry to the context of a plasma membrane.
			<b>Total</b>	<b>1</b>	
109			A \	1	<b>Examiner's Comments</b> A little over half of candidates achieved this mark.
			<b>Total</b>	<b>1</b>	
110			B \	1	<b>Examiner's Comments</b> Around two thirds of candidates understood that meiosis was not involved in body plan development.
			<b>Total</b>	<b>1</b>	
111			B \	1	<b>Examiner's Comments</b> A little over a third of candidates achieved this mark.
			<b>Total</b>	<b>1</b>	
112			D \	1	<b>Examiner's Comments</b> Around a third of candidates achieved this mark. All possible answers were seen, in almost equal proportions.
			<b>Total</b>	<b>1</b>	
113			B \	1	<b>Examiner's Comments</b> Around two thirds of candidates also achieved this mark. The most common incorrect response was A, suggesting that some candidates are unclear about how exponential growth (stage W) can be described.
			<b>Total</b>	<b>1</b>	
114			A \	1	<b>ALLOW B</b> <b>Examiner's Comments</b> Almost two-thirds of candidates were correct about pioneer communities.
			<b>Total</b>	<b>1</b>	



115			B \	1	<b>Examiner's Comments</b> A clear majority of candidates had either successfully learned the definition of species evenness or realised that one species cannot have a relative number of individuals.
			<b>Total</b>	<b>1</b>	
116			A \	1	<b>Examiner's Comments</b> A large majority of candidates achieved the mark.
			<b>Total</b>	<b>1</b>	
117			B ✓	1	<b>Examiner's Comments</b> This question was generally answered well, with candidates being able to discern the difference between correct and incorrect descriptions of the countercurrent process.
			<b>Total</b>	<b>1</b>	
118			C ✓	1	<b>Examiner's Comments</b> Candidates did have to process some information from a graph in this question and choose appropriate values to perform a percentage change calculation. Whilst candidates often struggle with such calculations in the question styles of section B, this posed little problem for nearly 80% of candidates who identified option C as the correct response.
			<b>Total</b>	<b>1</b>	
119			B ✓	1	<b>Examiner's Comments</b> This question proved challenging for some candidates with option D being the most commonly seen incorrect response.
			<b>Total</b>	<b>1</b>	
120			C ✓	1	<b>Examiner's Comments</b> Option A provided a distractor and common incorrect response to the correct option C in this question, as statement 1 relating to the cells synthesising ecdysone, would not form part of an explanation for the site of action of the hormone.
			<b>Total</b>	<b>1</b>	
121			A ✓	1	<b>Examiner's Comments</b> The majority of candidates chose the correct option for this question.
			<b>Total</b>	<b>1</b>	
122			A ✓	1	<b>Examiner's Comments</b> This question provided significant challenge to

					candidates. All three statements were correct thereby giving option <b>A</b> as the correct response.
			<b>Total</b>	<b>1</b>	
123			A ✓	<b>1</b>	<b>Examiner's Comments</b> A straightforward recall question to start the paper was accessible to all candidates across the ability range, demonstrating a clear grasp of the processes involved in endothermic responses.
			<b>Total</b>	<b>1</b>	
124			C ✓	<b>1</b>	<b>Examiner's Comments</b> Despite the novel approach, few were significantly challenged by this question which was answered correctly by a high proportion of candidates. However, some candidates were caught out by the presence of NAD in options <b>A</b> and <b>B</b> as opposed to NADP needed for the correct response, option <b>C</b> .
			<b>Total</b>	<b>1</b>	
125			A ✓	<b>1</b>	<b>Examiner's Comments</b> This question proved challenging and was poorly answered by many candidates who struggled with the multiple stages of the calculation. Option <b>B</b> was the most common incorrect response, reached by failing to factor in the 2-dimensional nature of the image.
			<b>Total</b>	<b>1</b>	
126			B ✓	<b>1</b>	<b>Examiner's Comments</b> This question was straightforward recall and the majority of candidates chose the correct response.
			<b>Total</b>	<b>1</b>	
127			D ✓	<b>1</b>	<b>Examiner's Comments</b> There were many correct responses to this question with candidates recognising the use of chromosome number to indicate the doubling and halving of DNA proportion in mitosis and meiosis.
			<b>Total</b>	<b>1</b>	
128			D ✓	<b>1</b>	<b>Examiner's Comments</b> Only stronger candidates appeared to understand the processes involved in peritoneal dialysis. Many candidates were challenged by the nature of the question requiring them to rule out the incorrect statements.
			<b>Total</b>	<b>1</b>	

129			<b>B ✓</b>	1	<b>Examiner's Comments</b> Candidates found this question straightforward.
			<b>Total</b>	<b>1</b>	
130			<b>C ✓</b>	1	<b>Examiner's Comments</b> Candidates found this difficult which was surprising considering that it is a clear learning outcome and that the question set out a scenario that would definitively indicate a particular type of immunity provided.
			<b>Total</b>	<b>1</b>	
131			<b>A ✓</b>	1	<b>Examiner's Comments</b> This was well answered. It was, however, surprising the number of candidates who thought that the vessel described was a capillary.
			<b>Total</b>	<b>1</b>	
132			<b>D ✓</b>	1	<b>ACCEPT A</b> <b>Examiner's Comments</b> Candidates could reasonably suggest either <b>A</b> or <b>D</b> as correct answers and both were credited in order to be fair to candidates.
			<b>Total</b>	<b>1</b>	
133			<b>C ✓</b>	1	<b>Examiner's Comments</b> This was well answered, with many candidates being confident about the definition.
			<b>Total</b>	<b>1</b>	
134			<b>B ✓</b>	1	<b>Examiner's Comments</b> This question was challenging. Those who answered incorrectly predominantly suggested <b>A</b> .
			<b>Total</b>	<b>1</b>	
135			<b>B ✓</b>	1	<b>Examiner's Comments</b> Many candidates got this one wrong with all distractors proving tempting.
			<b>Total</b>	<b>1</b>	
136			<b>A ✓</b>	1	<b>ACCEPT B</b> <b>Examiner's Comments</b> Candidates could reasonably suggest either <b>A</b> or <b>B</b> as

					correct answers and both were credited in order to be fair to candidates.
			<b>Total</b>	<b>1</b>	
137			<b>C ✓</b>	<b>1</b>	<b>Examiner's Comments</b> This was correctly answered by many candidates.
			<b>Total</b>	<b>1</b>	
138			<b>A ✓</b>	<b>1</b>	<b>Examiner's Comments</b> Given that this was a question requiring application of candidates' knowledge, it was one of the harder questions. <b>B</b> was rarely seen as an incorrect suggestion.
			<b>Total</b>	<b>1</b>	
139			<b>C ✓</b>	<b>1</b>	<b>Examiner's Comments</b> <b>D</b> was a common incorrect answer provided by a significant proportion of candidates.
			<b>Total</b>	<b>1</b>	
140			<b>B ✓</b>	<b>1</b>	<b>Examiner's Comments</b> Most candidates answered this correctly, many with evidence that they had performed the calculation for each population.
			<b>Total</b>	<b>1</b>	
141			<b>C ✓</b>	<b>1</b>	<b>Examiner's Comments</b> This was correctly answered by many candidates.
			<b>Total</b>	<b>1</b>	
142			<b>A ✓</b>	<b>1</b>	<b>Examiner's Comments</b> This was the most challenging question for candidates, with the fewest number of correct answers. There was no pattern in the incorrect answers supplied.
			<b>Total</b>	<b>1</b>	
143			<b>C ✓</b>	<b>1</b>	<b>Examiner's Comments</b> This was fairly well answered.
			<b>Total</b>	<b>1</b>	
144			<b>D ✓</b>	<b>1</b>	

			<b>Total</b>	<b>1</b>	
145			<b>C ✓</b>	<b>1</b>	<b>Examiner's Comments</b> This was answered quite well, the more common incorrect answers being <b>B</b> and <b>D</b> .
			<b>Total</b>	<b>1</b>	
146			<b>A ✓</b>	<b>1</b>	<b>Examiner's Comments</b> Most candidates answered this correctly. The most common incorrect answer was not, as anticipated, the distractor <b>C</b> but <b>D</b> .
			<b>Total</b>	<b>1</b>	
147			<b>D ✓</b>	<b>1</b>	
			<b>Total</b>	<b>1</b>	
148			<b>B ✓</b>	<b>1</b>	
			<b>Total</b>	<b>1</b>	
149			<b>C ✓</b>	<b>1</b>	
			<b>Total</b>	<b>1</b>	
150			<b>C ✓</b>	<b>1</b>	
			<b>Total</b>	<b>1</b>	