Extended Response (Component 3): Eduqas A Level Biology Exam Questions

19 questions · 171 marks · about 205 minutes. Answer in the spaces, then check the mark schemes at the end.

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7. **Table 7.1** shows information for several species of fish found in the Amazon River in Brazil.

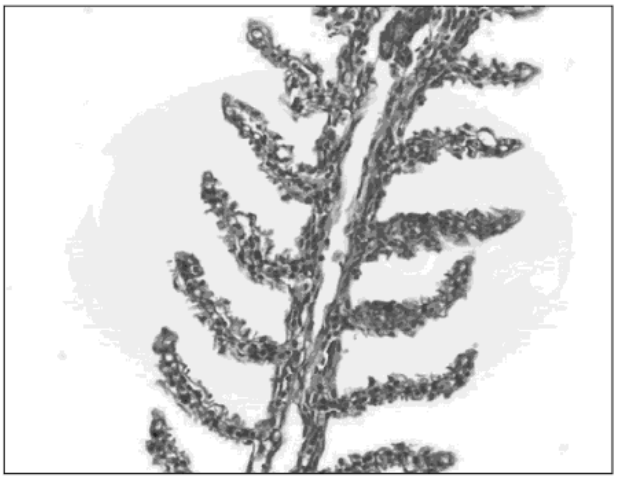
Table 7.1

Genus	Mean Mass / kg	Mean surface area of gills / mm^2kg^{-1}	Behaviour	Habitat
Colossoma	48	1000	fast swimmer	fast moving water
Hydrolycus	30	950	fast swimmer	fast moving water
Electrophorus	20	143	hides on river bed ambushes prey	often buried in mud
Cichla	12	350	swims slowly but will make sudden movements to catch prey	slow moving water

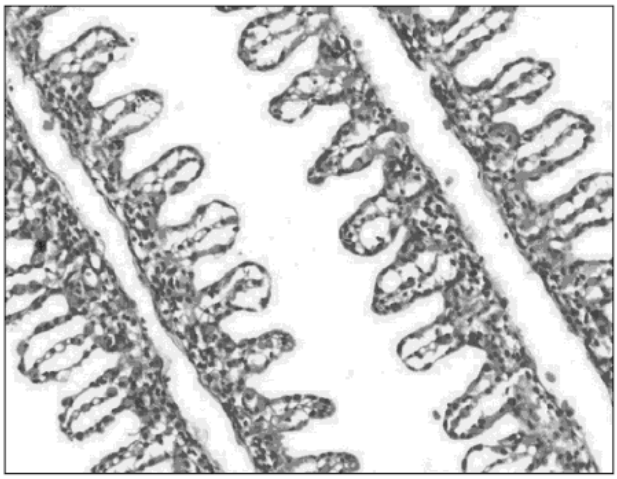
Image 7.2 shows the lamellae from the gills of the *Cichla* from a non-polluted and a polluted area of the Amazon river drawn to the same scale.

Image 7.2

Healthy gill lamellae



Lamellae from fish in a polluted area



With reference to **table 7.1** and **image 7.2** and your own knowledge, describe and explain the general relationship between mass of fish and the surface area of their gills. Describe and explain the relationship between the surface area of gills and their behaviour and habitat. Describe and explain the effect of pollution on the fish gills and how this would affect the fish. [9 QER]

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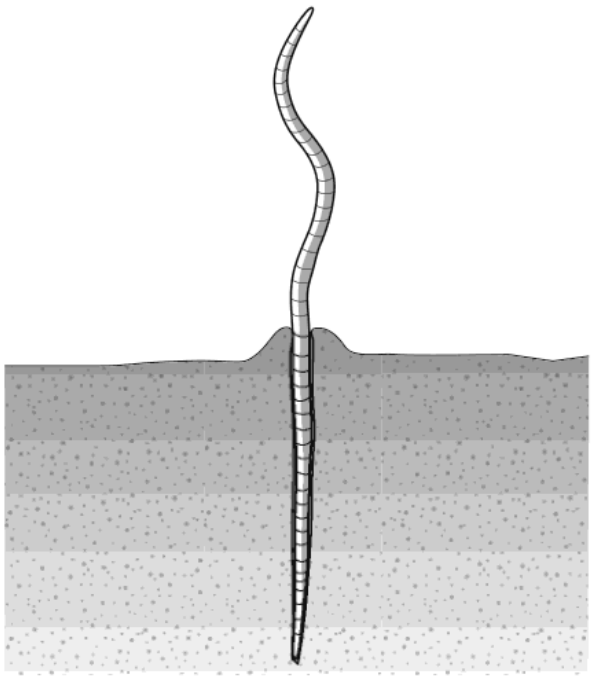
6. *Tubifex* worms have a similar structure to earthworms. They are one of the few multi-cellular organisms that can survive in heavily polluted water which has low oxygen levels. Some of their adaptations to these conditions are described below.

- Diameter of approximately 3 mm, length up to 45 mm.
- Outer body surface is folded.
- Head and front part of body buried in mud – when highly active, less of the body is buried.
- Part of the body exposed to the water moves vigorously.
- Red in colour due to presence of haemoglobin.



Explain how these adaptations enable *Tubifex* worms to survive in water with very low oxygen levels. [9 QER]

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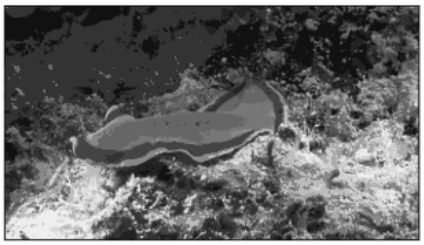
6. Using the information in **Image 6.1** and your knowledge of gas exchange in organisms, explain how *Paramecium caudatum* is adapted for gas exchange. Explain the adaptations shown by *Pseudoceros ferrugineus* and *Eisenia fetida* which have allowed their evolution into larger multicellular organisms. [9 QER]

Image 6.1

Organism	Features
Paramecium caudatum 	• Protoctista • single celled • 0.25 mm length • aquatic environment
Pseudoceros ferrugineus 	• Flatworm • multicellular • 18–48 mm length • thin • aquatic environment
Eisenia fetida 	• Annelid • multicellular • 80 mm length • terrestrial environment • contains haemoglobin • folded body surface

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Question 4 · AS Component 2 · June 2016 · Q7 · 9 marks

7. Axolotls are slow moving animals that live under water. They are sometimes called Mexican Walking Fish, but they are not fish they are amphibians.



Axolotls have external gills which are similar in structure to the internal gills found in bony fish such as goldfish.

Describe how the gills of both bony fish and axolotls are adapted to increase the efficiency of gas exchange and explain how structures in the heads of bony fish enable them to be highly active even when oxygen levels are relatively low but axolotls are slower moving under these conditions. [9 QER]

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6. Multicellular animals have evolved different ways of ventilating their gas exchange surfaces. **Image 6.1** shows the thorax of a human (a mammal), **Image 6.2** shows a cross section through part of the head of a bony fish and **Image 6.3** shows the tracheal system in an insect.

Image 6.1

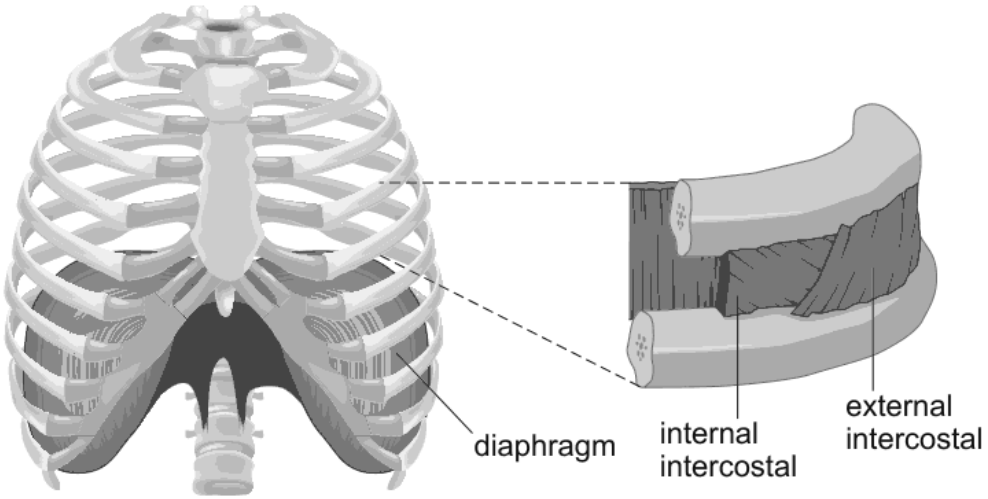


Image 6.2

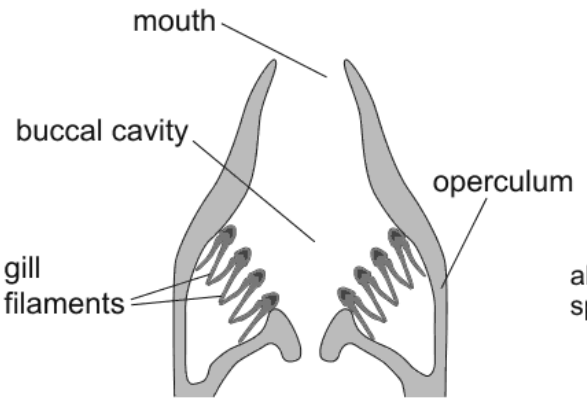
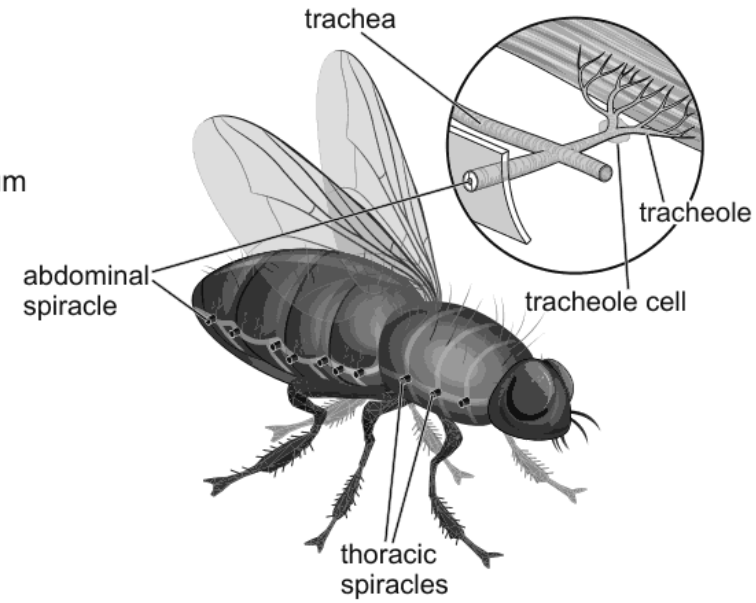


Image 6.3



Use the information shown in **Images 6.1 and 6.2** to describe and explain ventilation of the lungs in a human and ventilation of the gills in a bony fish.
Describe the advantages and disadvantages of the insect tracheal system when compared to the gas exchange system of humans. [9 QER]

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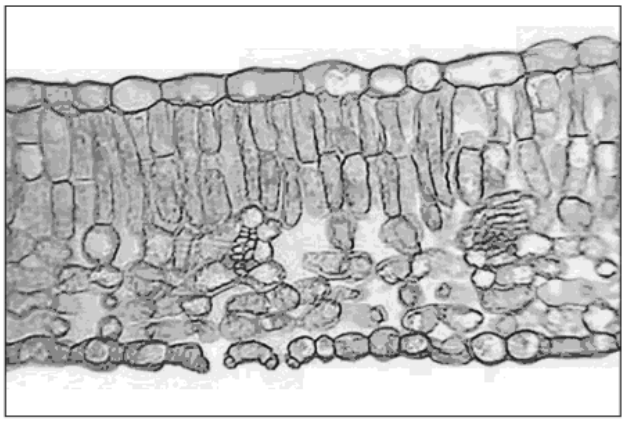
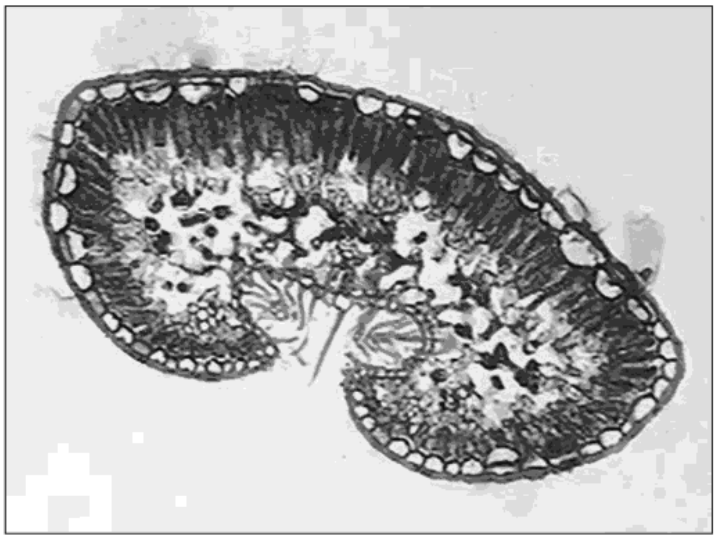
Question 6 · AS Component 2 · June 2019 · Q6 · 9 marks

6. The three photomicrographs below show three types of angiosperm leaf adapted to different environmental conditions.

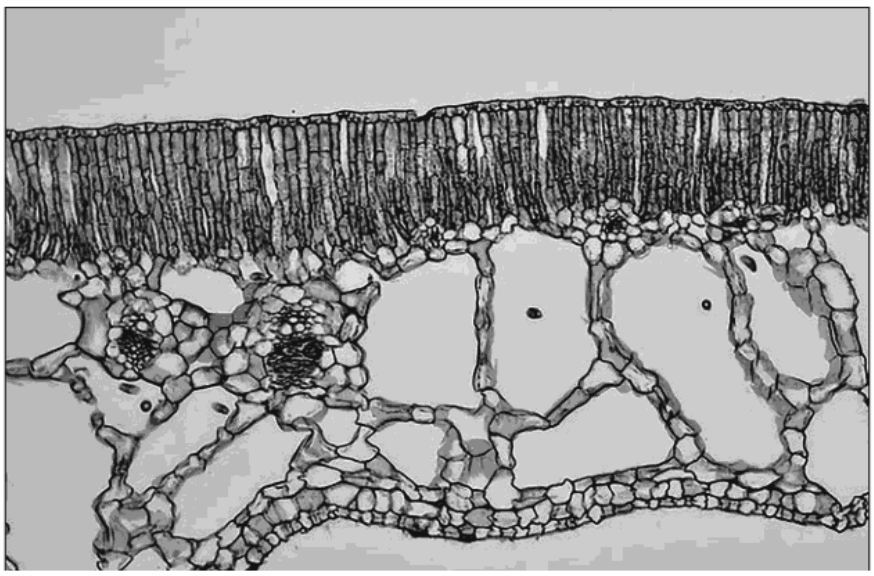
Photomicrograph **A**



Photomicrograph **B**



Photomicrograph **C**



Describe how the structures present in the leaf in photomicrograph **A** allow the plant to carry out photosynthesis and explain how the adaptations in the leaves in photomicrographs **B** and **C** enable the plants to survive in different environmental conditions. [9 QER]

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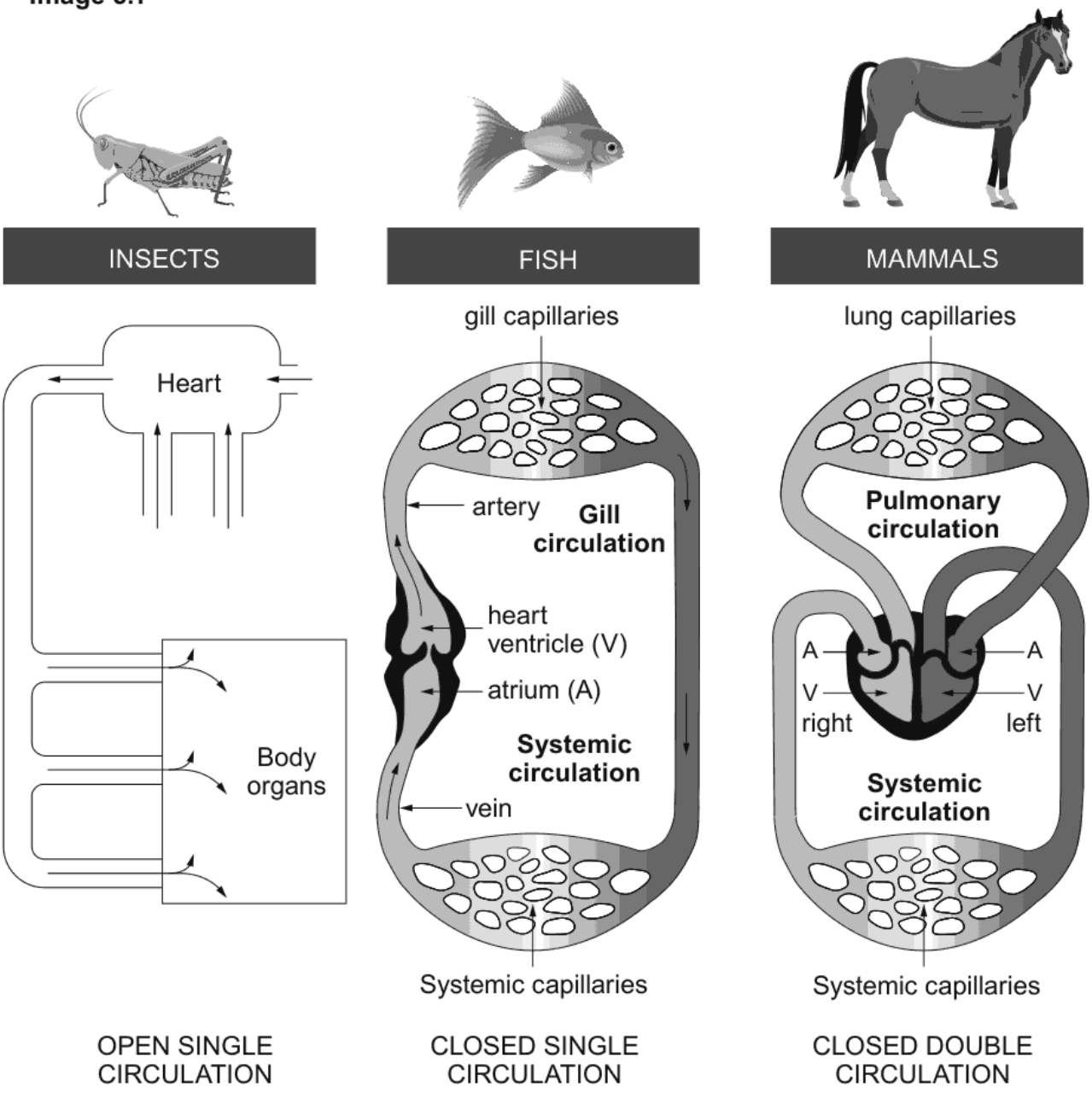
5. Circulatory systems in animals have evolved in different ways.

Image 5.1 shows organisms which have different arrangements of their circulatory systems.

Image 5.1



Explain the similarities and differences between the circulatory systems shown in the diagrams.

Outline the advantages and disadvantages of the single and double circulatory systems.

[9 QER]

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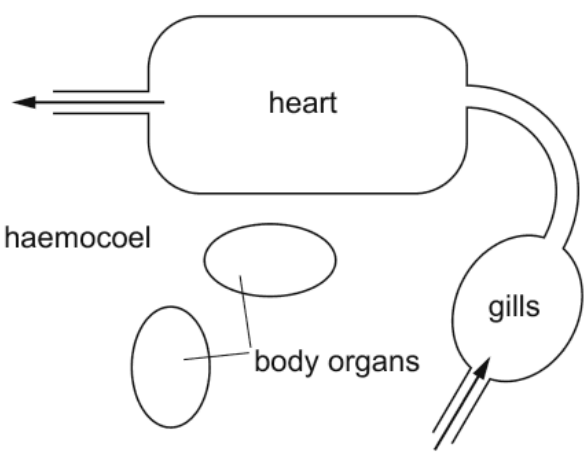
6. Mollusca is a phylum of invertebrate animals that have evolved different types of vascular systems. **Images 6.1** and **6.2** show the generalised circulatory systems of an aquatic snail and a squid (also aquatic). The circulatory system of aquatic snails includes a haemocoel. This is the main body cavity containing circulatory fluid which surrounds the internal organs.

Image 6.1: circulatory system of an aquatic snail



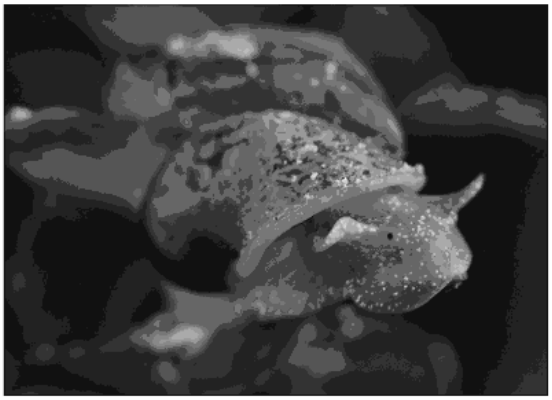
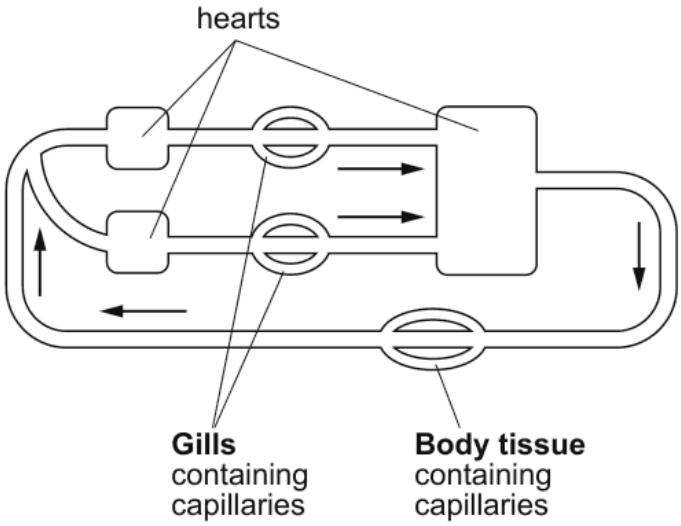


Image 6.2: circulatory system of a squid





Snails are slow-moving animals which feed mainly by grazing on algae and plants.

Squid are fast-moving predatory animals feeding on a wide variety of marine animals.

Describe the key features of the open circulatory system found in aquatic snails (**Image 6.1**) and the closed circulatory system found in squid (**Image 6.2**).
Explain how the circulatory systems of these organisms reflect their lifestyles. [9 QER]

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6. **Image 6.1** is a photomicrograph of human tissue. Two different types of blood vessel, labelled **X** and **Y**, are shown. Sometimes high blood pressure can lead to an aneurysm in a blood vessel. A diagrammatic cross-section of the wall of a vessel with an aneurysm is shown in **Image 6.2**.

Image 6.1

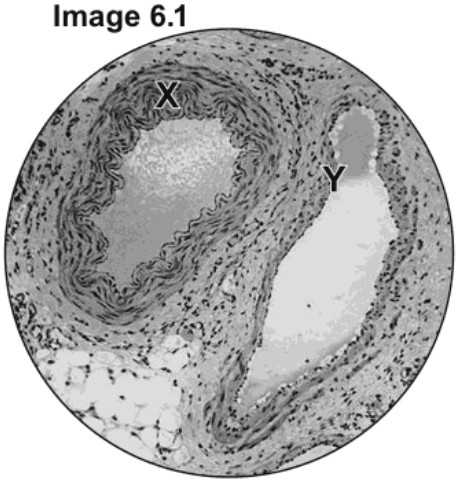
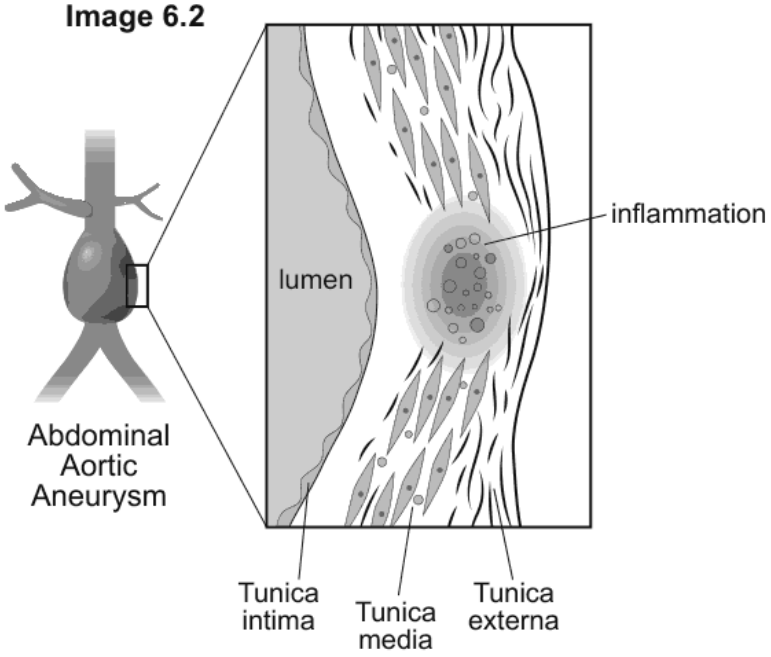


Image 6.2



Identify the two types of blood vessel, labelled **X** and **Y**, shown in **Image 6.1**, giving reasons for your answer.
Describe and explain how the structure of vessels **X** and **Y** is related to their function.
Describe what has happened to the wall of the vessel in **Image 6.2** and suggest possible problems associated with an aneurysm. [9 QER]

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6. The electrical activity of the heart can be measured and analysed using an electrocardiogram (ECG). **Image 6.1** shows an ECG trace from a healthy individual. **Image 6.2** shows an ECG trace from a patient with a heart defect.

Image 6.1 An ECG trace from a healthy individual

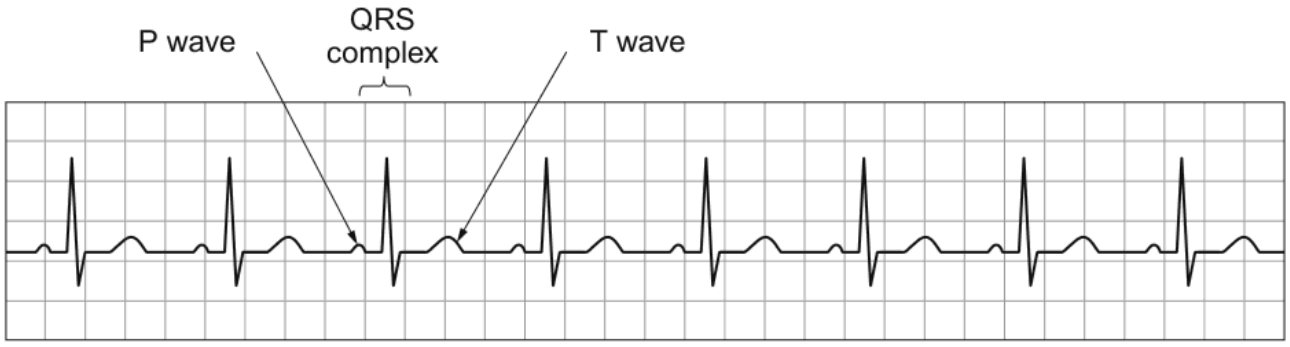
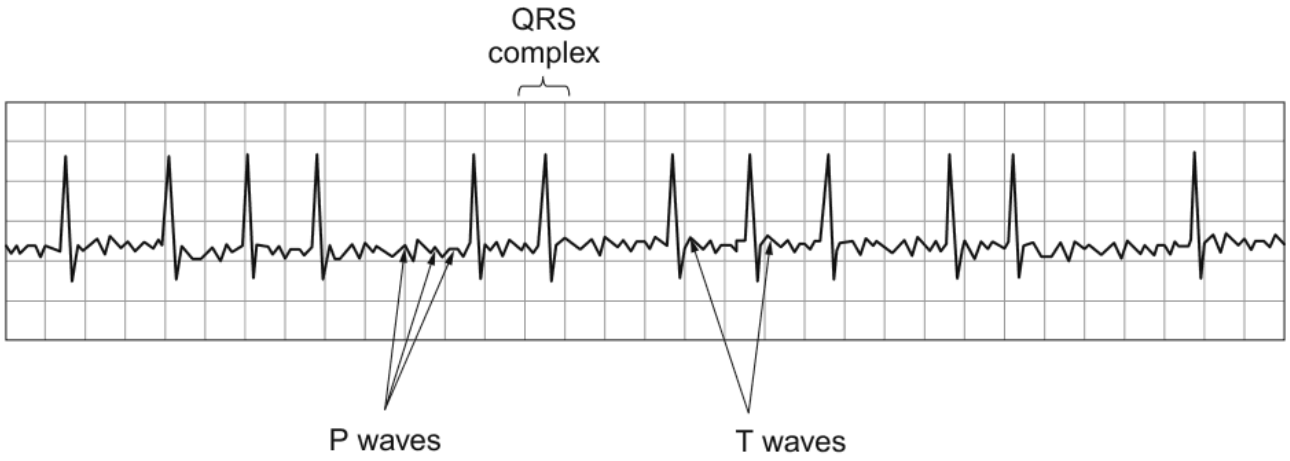


Image 6.2 ECG trace from a patient with a heart defect



Explain how the normal ECG relates to the electrical control of the cardiac cycle. Compare the ECG traces shown in **Images 6.1** and **6.2**. Using **Image 6.2**, suggest how the cardiac cycle would be affected in a patient with this heart defect. [9 QER]

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6. Sunflowers (*Helianthus annuus*) produce large flowers on long stems.

Image 6.1 shows a transverse section of a sunflower stem.

Image 6.2 shows a transverse section of a stem of *Potamogeton*, a hydrophytic plant that grows in freshwater ponds. Roots anchor the plant in the ground below water. A stem connects the roots to the leaves which float on the water surface where there is maximum light.

Image 6.1 – TS *Helianthus* stem

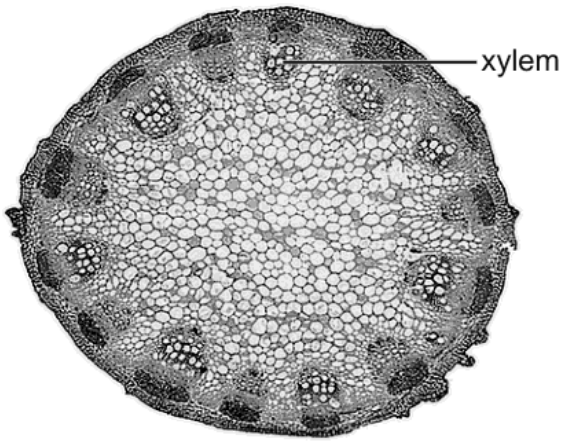
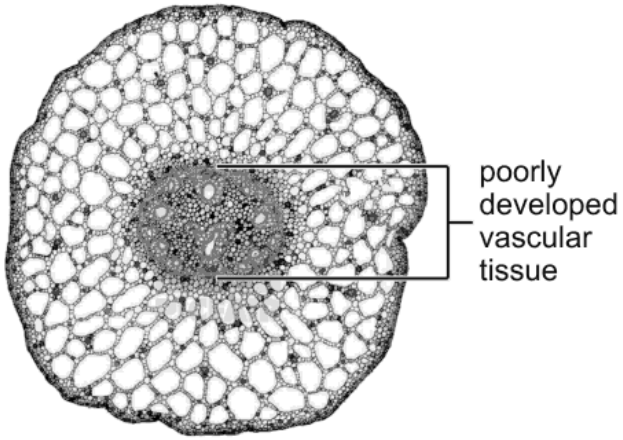


Image 6.2 – TS *Potamogeton* stem



Use **Image 6.1** to describe how the structure and position of xylem tissue contribute to its functions in a sunflower stem.

Use the information in **Images 6.1** and **6.2** together with your knowledge of hydrophytes to describe the differences between the stem structures of *Helianthus* and *Potamogeton*.

Explain how the stem structure of *Potamogeton* is adapted to its aquatic environment.

[9 QER]

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6. All plants and some prokaryotes are autotrophs. All animals are heterotrophs and may exhibit holozoic or parasitic nutrition. Fungi are also heterotrophs but have a different way of obtaining nutrients.

Explain the term 'autotroph' and describe the different categories of autotrophs.

Explain the term 'heterotroph' and state the meanings of holozoic and parasitic nutrition.

Describe how fungi obtain their nutrients. [9 QER]

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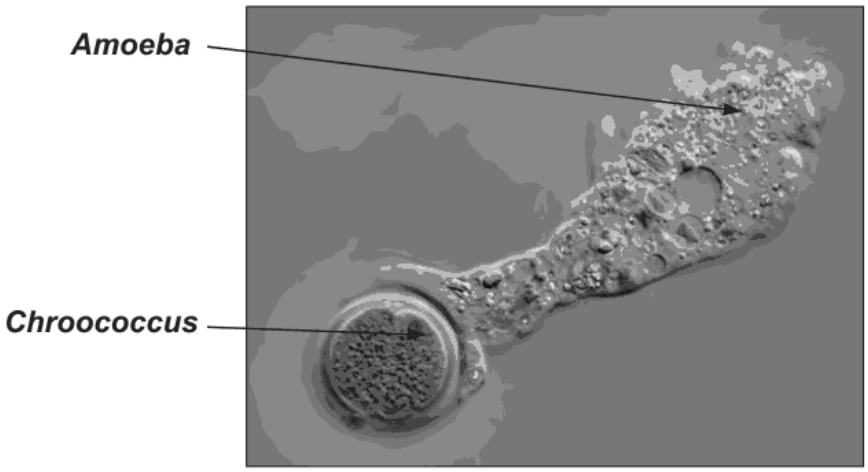
7. All living organisms need to obtain energy and raw materials for growth and survival but do this in different ways. The images below show **four** organisms that have different modes of nutrition.

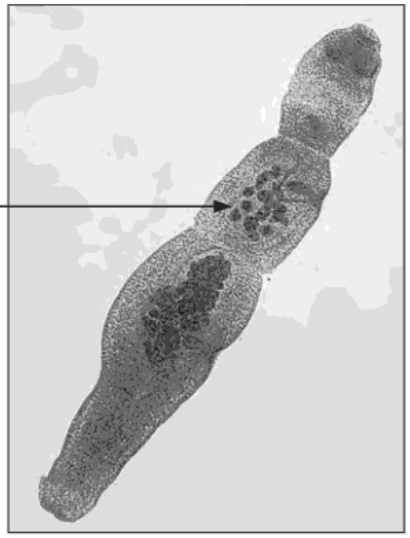
Botrytis cinerea is a fungus that grows on a wide range of fruit causing decay.



Amoeba sp. ingesting a cell of *Chroococcus sp*, an unicellular alga.



Echinococcus granulosus is a small tapeworm (2 – 4 mm long) found in large numbers in intestines of infected dogs.



Using your knowledge of nutrition in different organisms and the information provided, identify the different modes of nutrition in each of the **four labelled** organisms shown in the images.
Describe what is meant by each mode of nutrition you identify.
Explain the adaptations of each of these organisms to their mode of nutrition. [9 QER]

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6. *Amoeba* is a unicellular organism, whilst *Hydra* is an example of a multicellular organism that shows an increased level of adaptation for the digestion and absorption of food material.

Both *Amoeba* and *Hydra* show holozoic nutrition. **Image 6.1** shows the process of holozoic nutrition in *Amoeba*. **Image 6.2A** shows *Hydra* ingesting a worm and **Image 6.2B** is a diagram of its body wall.

Image 6.1

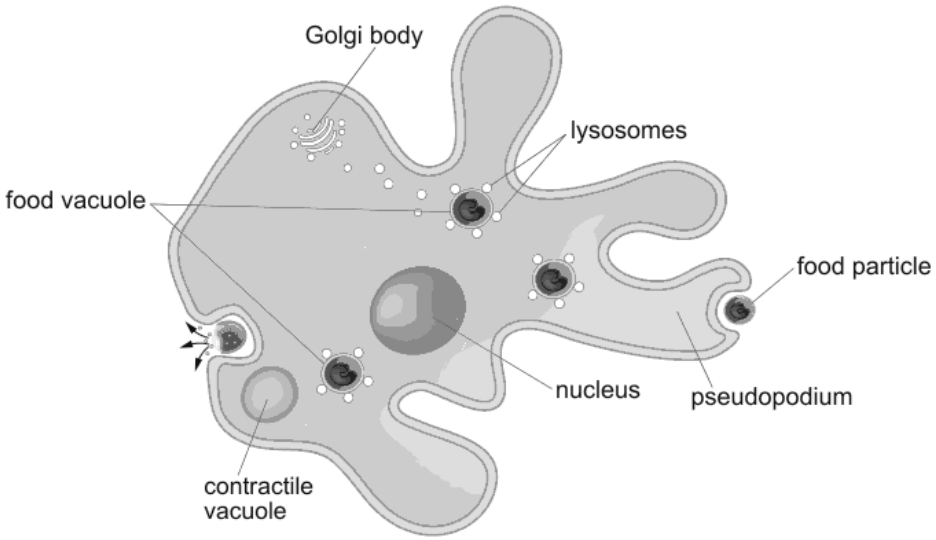


Image 6.2A – *Hydra* ingesting a worm

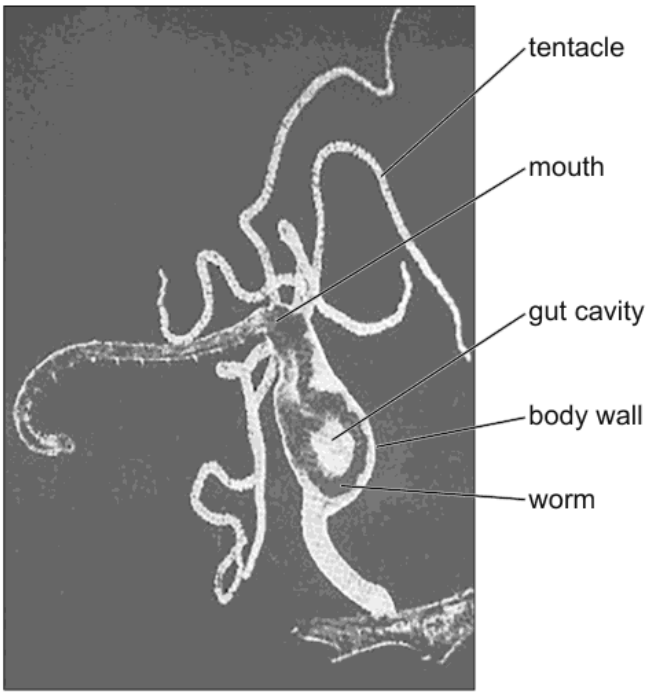
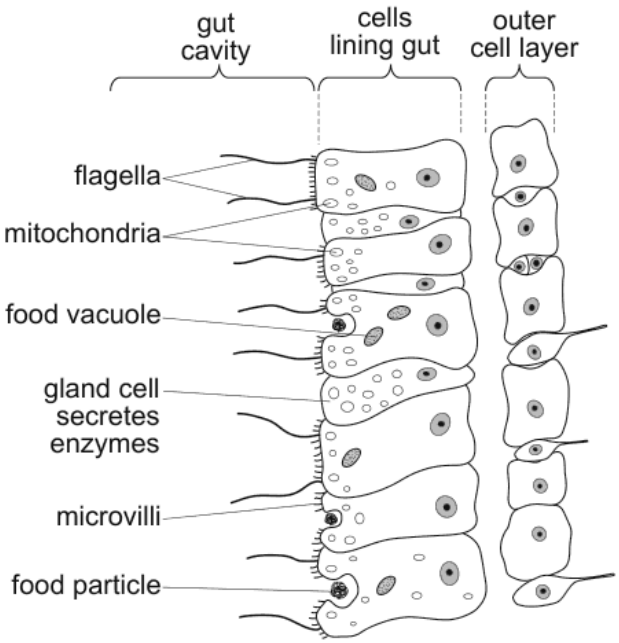


Image 6.2B – Body wall of *Hydra*



Use **Image 6.1** to describe how *Amoeba* ingests, digests and egests food material.

Use **Image 6.2A and Image 6.2B** to describe and explain how *Hydra* is adapted for digestion and absorption.

Humans also show holozoic nutrition and have a tube gut. Describe how the presence of a tube gut enables humans to have a more efficient digestive system. [9 QER]

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Question 15 · AS Component 2 · June 2018 · Q6 · 9 marks

6. Domestic dogs evolved from wolves between 10 000 and 30 000 years ago. Both are adapted to feed mainly on a carnivore diet. Recent studies into dogs and wolves have shown that the ancestors of domesticated dogs produced enzymes involved in starch digestion which are not produced by wolves. It has been proposed that dogs might have developed the ability to digest starch **after** they were domesticated by humans.

Explain how wolves and dogs are both adapted to feed mainly on a carnivore diet. Describe the process of starch digestion and suggest the advantage to domesticated dogs of being able to digest starch. [9 QER]

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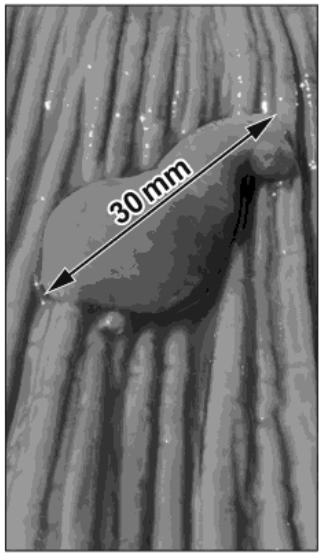
6. **Image 6** is a photograph of an adult endoparasitic worm, *Hirudinella ventricosa*, attached to the folds inside the stomach of its primary host, which is a large fish.

Image 6



Hirudinella's thick body wall has a cuticle covered in mucus. The anterior end has two suckers. It feeds on the host's blood through mouthparts that penetrate the stomach lining.
The parasite is hermaphrodite (has male and female reproductive organs). One adult can release many eggs into the host's digestive tract from which they are egested in faeces.
Eggs hatch into larvae which swim in sea water then penetrate the secondary host, a marine snail. Several larval stages reproduce asexually inside the snail.

Using the above information together with your knowledge of parasitic nutrition, state what is meant by the term 'endoparasite' and distinguish between the terms 'primary host' and 'secondary host'.

Suggest how the features of this parasitic life cycle increase the chance of *Hirudinella* infecting its primary host.

Describe the problems encountered by an adult *Hirudinella* in the stomach of its host and explain how it is adapted to survive in such conditions. [9 QER]

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7. **MDMA** (Ecstasy) is an illegal recreational drug which has side-effects including:

- increased body temperature and sweat production
- increased ADH secretion
- increased thirst
- decreased urine output

Furosemide is a prescription drug used to reduce hypertension (high blood pressure) by lowering blood volume. It acts as an inhibitor of sodium ion transport proteins in the ascending limb of the loop of Henle and increases urine output.

Hyponatraemia (low plasma concentration of Na^+) is a condition where the concentration of sodium ions in the plasma falls below normal levels. This can disrupt the transmission of action potentials and lead to muscle weakness, seizures and even coma.

Using your knowledge of urine production, explain how ecstasy reduces urine output and furosemide increases urine output and how misuse of both drugs can result in hyponatraemia.

[9 QER]

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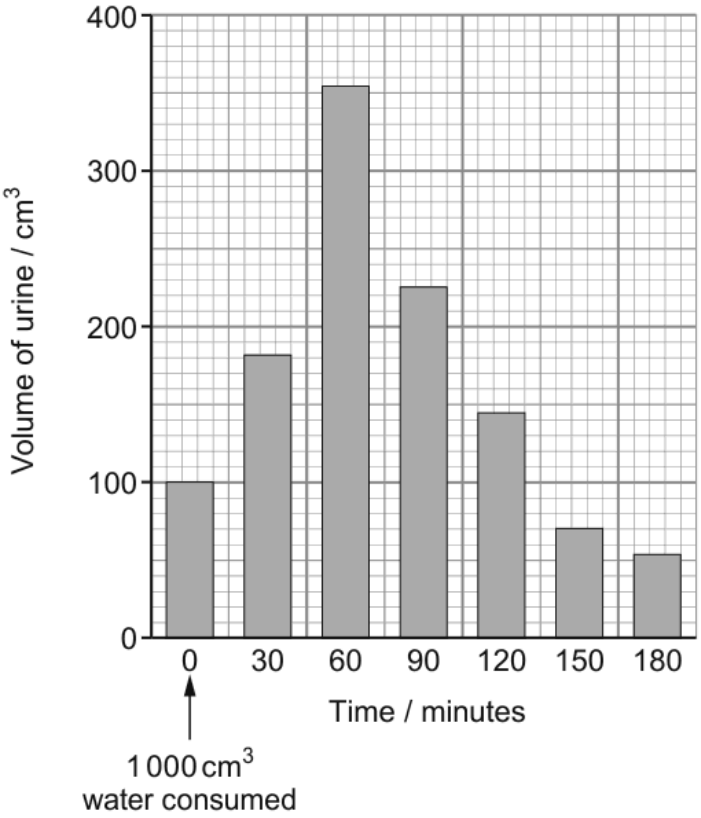
6. A student drank 1 000 cm^3 of distilled water. The student's urine was collected immediately after drinking the water and then at 30-minute intervals for three hours.
The volume of urine collected at each point is shown on **image 6**.

Image 6



Describe the role of antidiuretic hormone (ADH) in osmoregulation.

Using your knowledge of homeostasis, explain the change in volume of urine collected between **0 and 60 minutes** in **image 6**.

If the student had exercised for ten minutes before drinking 1 000 cm^3 of distilled water, describe how **and** explain why the results would differ. [9 QER]

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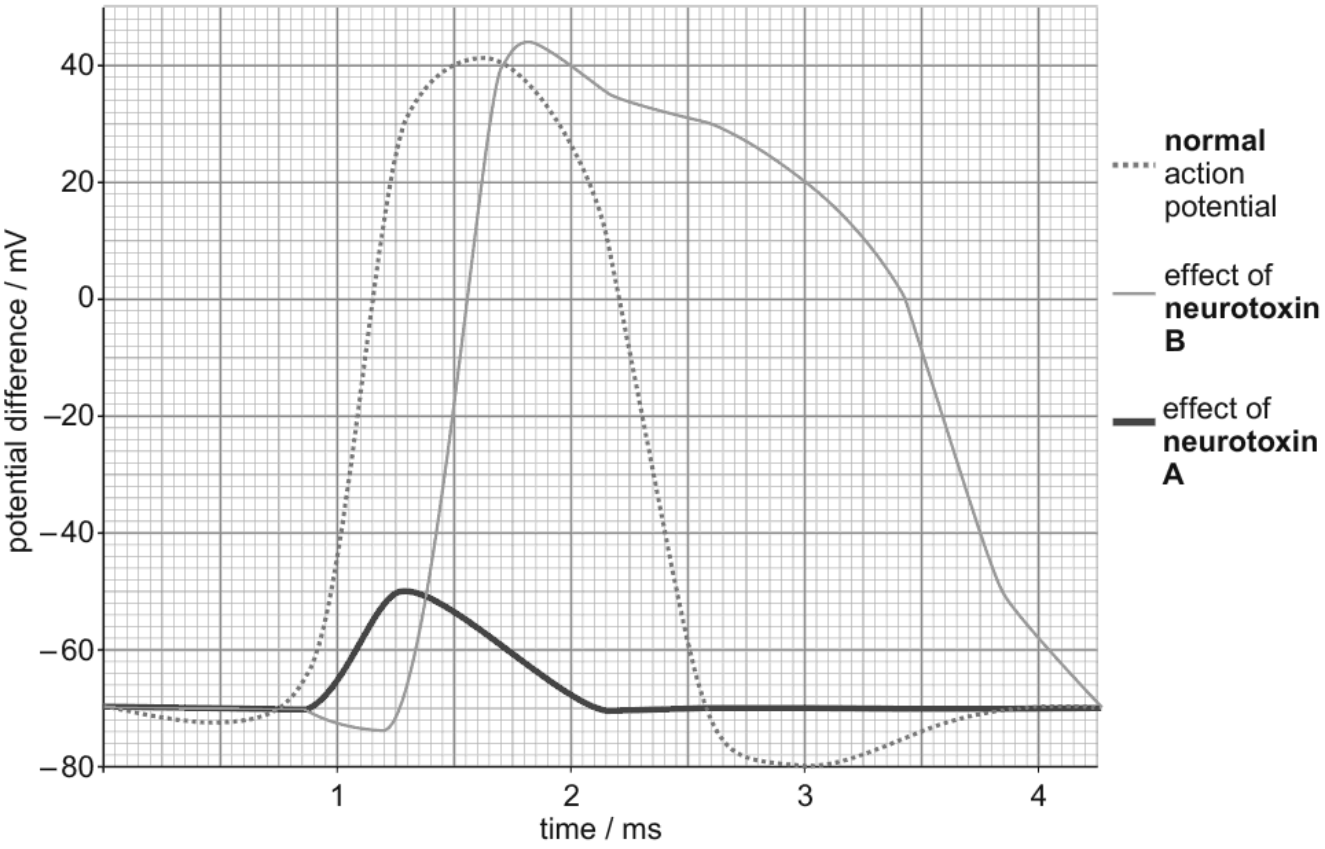
6. Neurotoxins are chemicals produced by many organisms as a defence against predators. Most neurotoxins cause paralysis of muscles and eventually death. Different neurotoxins affect the transmission of a nervous impulse from the central nervous system to muscles in different ways.

Effect of neurotoxins A and B on an action potential



Effect of neurotoxin C:
Neurotoxin C has **no effect** on the generation or transmission of an action potential in an axon but prevents the generation of an action potential in a post-synaptic membrane.

	Ion concentration in the terminal of a presynaptic neurone / mmol dm^{-3}					
	At rest		**Immediately after stimulation**			
			Without neurotoxin C		**With neurotoxin C**	
Ion	**Inside neurone**	**Outside neurone**	**Inside neurone**	**Outside neurone**	**Inside neurone**	**Outside neurone**
Na^+	14	145	130	15	125	25
K^+	155	5	15	145	20	135
Ca^{2+}	0.001	5	3.9	1.1	0.008	4.9

Using the information provided and your knowledge and understanding of the transmission of nervous impulses, explain how each of the neurotoxins **A**, **B** and **C** could cause muscle paralysis. [9 QER]

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Mark schemes

Questions, mark schemes and examiners' report extracts © WJEC CBAC Ltd (Eduqas).

Question 1 · A level Component 3 · Autumn 2020 · Q7 · 9 marks

7	**Indicative content** **Mass and Surface area** • Larger mass means more cells/tissues to supply with oxygen • Large surface area of gills to absorb more oxygen/ greater rate of oxygen absorption • Increased surface area to volume ratio • More oxygen in the blood/ more aerobic respiration • Cichla does not fit this trend • Use of data **Behaviour and habitat** • Larger surface area of gills = faster swimmers • To gain enough oxygen for their needs. • Fast swimming fish require a higher rate of respiration/ metabolic rate (or converse) • *Electrophorus* lies on river bed so low level of activity. Only low levels of respiration needed. • *Cichla* larger SA as it needs to move to catch fish. • *Cichla* water not moving fast so does not maintain concentration gradient. • Use of data **Pollution:** • Lamellae thickens / shortens lamellae/ lamellae fused • Smaller surface area for gas exchange • Larger diffusion distance • This means the fish will not gain as much oxygen in their blood • So will move more slowly/ have a higher ventilation rate	1	5	3	9
	7-9 marks Indicative content of this level is IDENTIFY AND EXPLAIN All 3 areas *The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.* **4-6 marks** Indicative content of this level is 2 of the 3 areas covered *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.* **1-3 marks** Indicative content of this level is 1 of the areas covered *The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate has limited use of scientific conventions and vocabulary.* **0 marks** *The candidate does not make any attempt or give a relevant answer worthy of credit.*				

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6	**Indicative content** **Gas exchange adaptations** • {Skin/ body surface} is gas exchange surface • Outer body surfaces folded – further increases surface area for diffusion • Diameter of approximately 3 mm, length up to 45mm - narrow diameter gives short diffusion pathway • Cylindrical shape - high surface area to volume ratio **Behaviour adaptations** • Head and front part of body buried in mud – when highly active, less of the body is buried – more surface in contact with gas exchange medium • Part of the body exposed to the water moves vigorously - maintains steep concentration gradient **Haemoglobin** • Red in colour due to presence of haemoglobin – presence of respiratory pigment increases ability to absorb oxygen • Presence of blood vessels to transport oxygen/ maintain diffusion gradient • Haemoglobin may have higher affinity for oxygen	6	3				
	7-9 marks Indicative content of this level is… Detailed explanation of gas exchange adaptations Detailed explanation of behavioural adaptations Detailed explanation of role of haemoglobin To award 9 marks a comment linking adaptations to survival in a low oxygen environment is required *The candidates constructs an articulate, integrated account. which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.* **4-6 marks** Indicative content of this level is… Any two from: Explanation of gas exchange adaptations Explanation of behavioural adaptations Explanation of role of haemoglobin *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.*						
	1-3 marks Indicative content of this level is… Brief explanation of gas exchange adaptations OR Brief explanation of behavioural adaptations OR Brief explanation of role of haemoglobin *The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate has limited use of scientific conventions and*						

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Question 3 · AS Component 2 · Autumn 2021 · Q6 · 9 marks

6				*Paramecium* adaptations • diffusion over cell membrane/external surface/ diffusion over body surface • high sa:vol • short diffusion path • low metabolic demand • Lower oxygen in water than on land • Diffusion rate sufficient to meet needs Flatworm and annelid adaptations for larger size *Pseudoceros ferrugineus* Flat worm • External surface for diffusion • Lower sa:vol as multicellular • Flat shape to increase sa:vol • Thin so short diffusion path • Higher metabolic demand as more cells *Eisenia fetida* Annelid • External surface for diffusion • Lower sa:vol as multicellular/cylindrical • Cylindrical shape to increase sa:vol • Mucus layer for diffusion of gases/ oxygen dissolving in mucus • High metabolic demand as more cells • ref to Haemoglobin binding to and transporting oxygen • ref to blood vessels to transport of oxygen to cells far from body surface	0	9	0	9	0	0
				7-9 marks Indicative content of this level is… *The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.* **4-6 marks** Indicative content of this level is… *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.* **1-3 marks** Indicative content of this level is… *The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate has limited use of scientific conventions and vocabulary.* **0 marks** *The candidate does not make any attempt or give a relevant answer worthy of credit.*						

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7			I	• large surface area due to presence of gill filaments/ plates/ lamellae • permeable • rich blood supply to maintain concentration gradient between water and blood • reduced diffusion distance • ventilation mechanism	5	4	9
			II	• separate buccal and opercular/gill cavities • operculum/bony plates can close gill cavity • lowering floor of buccal cavity increases volume and decreases pressure in buccal cavity • mouth opens and water enters • mouth closes floor of buccal cavity is raised • increased pressure forces water over the gills			
				• water and blood flow in opposite direction – countercurrent flow • maintain a concentration gradient for O_2 across whole of gill surface • O_2 absorption is more efficient/ blood and water do not reach equilibrium/more O_2 is absorbed			
			III	• Axolotls have external gills so no ventilation mechanism/rely on water currents/whole body movements to ventilate gills • Reference to parallel flow • Cannot absorb as much / less efficient at O_2 absorption which is needed for aerobic respiration			

7-9 marks
Detailed explanation of properties of gas exchange surfaces.
Detailed explanation of ventilation including reference to pressure/ volume **and** counter current mechanism in fish.
Explanation of slower movement in axolotl.

The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.

4-6 marks
Any two from:

Explanation of properties of gas exchange surfaces
Explanation of ventilation and counter current mechanism in fish
Explanation of slower movement in axolotl

The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.

1-3 marks
Any one from:

Description of properties of gas exchange surfaces
Description of ventilation **or** counter current mechanism in fish
Attempt at explanation of slower movement in axolotl

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6	Humans. A1 (External) intercostal muscles contract **and** rib cage moves {upwards / outwards} A2 Diaphragm contracts **and** flattens A3 pleural membranes are pulled out A4 Volume thoracic cavity increases **and** pressure decreases A5 causes alveoli to expand / air {pulled / moves} into the lungs A6 description of expiration Fish. B1 Mouth open **and** floor of buccal cavity lowers B2 Increases volume of buccal cavity **and** pressure decreased B3 so water enters (buccal cavity) B4 mouth closed **and** floor of buccal cavity raised B5 water {forced/ moves} over {gills / gill filaments} B6 water leaves through the (open) operculum Tracheal system Advantage. C1 <u>Oxygen</u> {diffuses / passes} directly to {cells / tissues} C2 no (need to produce) respiratory pigment / owtte C3 Spiracles can be closed to reduce water loss. C4 Ref to impermeable tracheole reducing water loss / Hairs in spiracles to trap moisture / owtte Disadvantage. C5 {Rate of diffusion / mass of chitin} limits size and shape of insect	4	5
	7-9 marks Indicative content of this level is detailed content from all three areas. *The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.* **4-6 marks** Indicative content of this level is detailed content from two areas. *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.* **1-3 marks** Indicative content of this level is any correct statement from the indicative content. *The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate has limited use of scientific conventions and vocabulary*		

6	Photomicrograph A • Upper epidermis clear to allow light to penetrate • Palisade mesophyll with many chloroplasts • Spongy mesophyll with air spaces for gas exchange • Lower epidermis has stomata to allow gases to diffuse into leaf. • Orientation of palisade cells • Xylem transports water for photosynthesis Photomicrograph B • Xerophyte • Lives in a dry conditions Adaptations to reduce water loss include • Leaf rolled to reduce air movement • Hairs trap moist air around stomata • Thick waxy cuticle reduces water loss through evaporation • Sunken stomata Photomicrograph C • Hydrophyte • Lives in water • Large air spaces in spongy mesophyll for buoyancy • Stomata on upper surface {to allow gases to diffuse from air/ lower surface is immersed in water} • Waxy cuticle is thin/ absent as water loss not an issue				
	7-9 marks Indicative content of this level is… Detailed description of the structural features of the A in relation to photosynthesis Detailed explanation of xerophytic adaptations of leaf B Detailed explanation of hydrophytic adaptations of leaf C *The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.* **4-6 marks** Indicative content of this level is… Any two from: Description of leaf structure Explanation of adaptations of xerophyte Explanation of adaptations of hydrophyte *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and*				

5	**Indicative content** A. Similarities • Contain blood/ transport medium • Contain heart to generate pressure/ maintain flow Open vs closed • No blood vessels vs blood vessels Single vs double • Single through heart once in each circulation, double through heart twice in each circulation • Higher pressure in double circulation • More complex heart in double B. Advantages • Single - lower pressure (as low activity level) – less energy needed to power the heart • Single - high pressure to gills • Double - generates higher pressure to body cells • Double - allow lower pressure at alveoli • Double - separation of oxygenated and deoxygenated blood is possible for more efficient • Double - higher rate of blood flow C. Disadvantages • Single - oxygenated blood at lower pressure, • Single - slower rate of blood flow to body organs • Double - greater pressure greater risk of problems – damage to heart • Double - greater complexity – greater risk of problems, heart structure/ valve issues	5 4 0 9 0 0
	7-9 marks Indicative content of this level is… Detailed explanation of similarities and differences Detailed explanation of advantages Detailed explanation of disadvantages *The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.* **4-6 marks** Indicative content of this level is… Any two from explanation of similarities and differences explanation of advantages explanation of disadvantages *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses*	

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Question 8 · A level Component 3 · June 2025 · Q6 · 9 marks

6				**Indicative content** **Snail** A1 {Circulatory fluid/ haemolymph/ blood} not in vessels A2 {Circulatory fluid/ haemolymph/ blood} flows {around/in contact with/ bathe} the {cells/ tissues/ organs} A3 single heart A4 Low pressure (from heart) A5 Slow flow / flow not {controlled/ Directed} **Squid** B1 (all) blood contained in blood vessels B2 {Circulatory fluid/ haemolymph/ blood} not {around/in contact with} the {cells/ tissues/ organs} B3 {More than one/ three} heart B4 {High/ more} pressure (from heart)/ pressure maintained B5 Fast flowing blood/ flow {controlled/ directed} **Lifestyle** Squid - C1 (fast moving predator) has to hunt prey/ move away from own predators/ owtte C2 requiring rapid muscle contraction/ owtte C3 High demand for oxygen/ High rate of {respiration / metabolism} Snail C4 (slow moving herbivore) does not need to hunt / owtte C5 Low demand for oxygen/ low rate of {respiration / metabolism}	6	3	9	
				7-9 marks Indicative content of this level is…detailed description of all three areas of indicative content *The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.* **4-6 marks** Indicative content of this level is…description of at least two areas of indicative content *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.* **1-3 marks** Indicative content of this level is… description of at least one area of indicative content *The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate has limited use of scientific conventions and vocabulary.* **0 marks** *The candidate does not make any attempt or give a relevant answer worthy of credit.*				

Question 9 · A level Component 3 · June 2022 · Q6 · 9 marks

6	**X** Artery: Thicker {wall/ muscle layer} To {withstand/ maintain} high pressure (due to ventricular contraction) Thicker elastic tissue Evens out flow/ recoils when lower pressure Muscle layer contracts to give smaller lumen diameter Alters blood supply to different organs **Y** Vein: Thinner {wall/ muscle layer} Allows skeletal muscle to increase pressure in lumen {large/ wide} lumen to reduce resistance to flow Backflow of blood prevented By the presence of valves Aneurysm: Wall stretched/ bulging/ or description of Outer layer not broken {Smooth muscle/ wall} “torn”/ damaged/ inflammation of tunica media May break (and bleed out)/ owtte Less {blood/ oxygen} to destination. Blood pools
	7-9 marks Indicative content of this level is…detailed description of all three areas of indicative content *The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.* **4-6 marks** Indicative content of this level is…description of at least two areas of indicative content or less detail of three *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.* **1-3 marks** Indicative content of this level is… description of at least one area of indicative content *The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses*

6

ECG

- P wave – Atria {stimulated/depolarisation} to contract/atrial systole
- Pacemaker/ SAN send {impulse/wave of excitation} across the atria
- Impulse passes to AVN – delayed
- Impulse down bundle of His fibres (and to apex)
- QRS – Depolarisation throughout the ventricles/ (before) ventricular systole
- impulses travel up Purkinje fibres and cause ventricles {to contract /systole} (from base upwards)
- T repolarisation of the ventricles/ T wave corresponds to diastole

Comparison of the normal ECG and the Patient A

Normal	Patient
One P wave	Many P waves
QRS is the same	
T wave same	
QRS regular intervals	Irregular intervals
fewer cycles /beats per minute in normal ECG	More cycles/more QRS spikes/more beats per minute/faster heart rate

Possible problems

- SAN firing too rapidly
- Atria not contracting normally /
- ref to arrhythmia/ atrial fibrillation
- Atria not able to empty/ fill fully
- Not enough blood to ventricles

4 | 5 | 9

7-9 marks
Indicative content of this level is a
detailed description of all three areas of indicative content
The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.

4-6 marks
Indicative content of this level is a
detailed description of two areas of indicative content
The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.

1-3 marks
Indicative content of this level is
any correct statement from the indicative content
The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate has limited use of scientific conventions and vocabulary.

0 marks
The candidate does not make any attempt or give a relevant answer worthy of credit.

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6

A1 {xylem / vascular tissue} arranged in a ring around the periphery / close to the epidermis
A2 Lignified so {resists bending / is strong / provides support}
A3 Many {tubes / vessels} / vascular tissue arranged in a ring provide {rigidity / strength / support}.
A4 Water transport
A5 Ref: Adhesion / cohesion / capillarity

Differences;

Potamogeton	Helianthus
B1 Vascular tissue central	Vascular tissue on periphery (OWTTE)
B2 Vascular tissue / xylem poorly developed	Vascular tissue / xylem well developed / well structured / description of.
B3 Aerenchyma / air spaces in cortex.	No aerenchyma / air spaces or tissue / cells tightly packed.
B4 Less lignification / fewer lignified tissues	(More) lignin in xylem / other tissues.
B5 Single bundle	Many bundles

Potamogeton stem –
C1 Vascular tissue is central so allows flexibility in water / resists pulling (from water currents).
C2 Poorly developed xylem.
C3 Little need for water transport as leaves are in / on water.
C4 (very little lignin for support) Supported by {water / leaves floating on surface}.
C5 Air spaces / aerenchyma (in cortex) - Allows (faster) diffusion of O2 / CO2 to / from leaves / forms a reservoir of gases / buoyancy.

7-9 marks
Indicative content of this level is detailed content from all three areas.

The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.

4-6 marks
Indicative content of this level is detailed content from two areas.

The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.

1-3 marks
Indicative content of this level is any correct statement.

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Question 12 · AS Component 2 · June 2025 · Q6 · 9 marks

6	A1. Autotrophs convert an external energy source into chemical energy / make their own {food / energy-containing compounds / glucose} / A2. make complex / large organic molecules from simple / small inorganic molecules A3. Photoautotrophs use light as an energy source; A4. Chemoautotrophs use energy released from chemical reactions as an energy source; B1. Heterotrophs cannot convert external energy source / light into chemical energy / B2. rely on autotrophs or other heterotrophs for {energy-containing compounds / food / biological compounds} B3. Heterotrophs convert the chemical energy in food into chemical energy in their cells; B4. 'Holozoic' refers to digesting food internally / ingestion, digestion and egestion B5. Parasitic – living in or on another organism gaining nutrition at the expense of the host / owtte. C1. Saprotrophs / saprobionts; C2. digest dead / decaying organic material C3. {External / extracellular} digestion / secrete enzymes on to substrate; C4. absorb digested nutrients	9
	7-9 marks *The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.* **4-6 marks** *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.* **1-3 marks** *The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate has limited use of scientific conventions and vocabulary.* **0 marks** *The candidate does not make any attempt or give a relevant answer worthy of credit.*	

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Question 13 · A level Component 3 · June 2019 · Q7 · 9 marks

7		2	6	1	9	0	0

Organism	A: Mode of nutrition	B: Description of Nutrition Type	C: Adaptations to mode of nutrition
Chroococcus	• autotrophic	**autotrophic** • uses energy from the Sun / light • to combine inorganic compounds • to produce its own organic compounds/ photosynthesis	• has chloroplasts / chlorophyll (for photosynthesis)
		heterotrophic • uses organic compounds from other organisms • as a source of raw materials / energy • to produce its own organic compounds	
Botrytis	• Heterotrophic • saprotrophic	**saprotrophic** • extracellular digestion of food substances • absorption of the products of digestion	• {hyphae / mycelium} which grow {over / through} the food it lives on • secretes enzymes • digest the food outside the body
Amoeba	• Heterotrophic • holozoic	**holozoic** • digests it internally /intracellularly • involves ingestion, digestion and egestion	• {Ingests/ engulfs} prey / endocytosis • Exocytosis of waste • Contains digestive enzymes
Echinococcus	• heterotrophic • parasitic	**parasitic** • obtaining nutrients from a host organism	• no digestive system • does not secrete digestive enzymes/ food has already been digested by its host; • {thin/flattened} (proglottids) increasing surface area / reducing diffusion distance

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6	**Amoeba.** A1 Phagocytosis/ endocytosis/ description of formation food vacuole. A2 Golgi body producing lysosomes A3 lysosomes fuse with food vacuole/ lysosomes contain enzymes A4 ref to: intracellular digestion/ digestion inside vacuole A5 Products of digestion absorbed/ owtte A6 Exocytosis/ or description of **Hydra** B1 Can ingest {large organisms/ prey/ food}/ or description of B2 Enzymes produced by gland cells/ extracellular digestion B3 {Food/ waste} {mixed/ moved} by flagella B4 intracellular digestion in the food vacuole B5 Microvilli to increase SA. for absorption B6 large numbers of mitochondria for {ATP/energy} for {absorption/ active transport/ AVP} **Further adaptations mammals.** C1 Mechanical digestion/ teeth/ churning C2 Peristalsis/ or description of C3 Long gut allows time for {digestion/ absorption} C4 Different regions modified to digest specific nutrients /given examples of at least two regions/ owtte C5 Reference to region with adaptation for {absorption/ owtte} e.g. microvilli/ folding/ C6 Mammals gut ingestion mouth + egestion from anus/ owtte	3	6	9
	7-9 marks Indicative content of this level is detailed explanation of all three sections *The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.* **4-6 marks** Indicative content of this level is detailed explanation of two sections or less detail of three sections *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.* **1-3 marks** Indicative content of this level is any comment from the indicative content. *The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate has limited use of scientific conventions and vocabulary.*	3	6	9

6	Indicative content • Wolves and dogs have carnivore dentition • Sharp incisors and long pointed canines Carnassial teeth for shearing through bone, ligaments and tendons • (Relatively) short gut adapted for protein digestion • Salivary amylase hydrolyses starch to maltose • Optimum pH maintained by mineral salts/buffers in saliva • Starch digestion resumes in duodenum with pancreatic amylase • Maltose digested to glucose by maltase in small intestine • Domestic dogs fed on human food waste containing large amounts of starch • Some dogs better at digesting starch than others • Dogs that could digest starch well more likely to survive and breed/can live on human food waste • Wolves/wild dogs cannot digest starch as there is no selective advantage/wolves cannot produce amylase **7-9 marks** Detailed explanation of carnivore dentition Detailed account of starch digestion Logical explanation of advantage of starch digestion in domesticated dogs *The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.*	3 4 2 9
	4-6 marks Any two from: Explanation of carnivore dentition An account of starch digestion Attempt to account for advantage of starch digestion in early dogs *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.* **1-3 marks** Any one from: Brief explanation of carnivore dentition Brief account of starch digestion Attempt to give an advantage for starch digestion in early dogs *The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The*	

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6	**Section A** • Endo(parasite)– parasite that lives, feeds and reproduces inside its host. • (Endo)parasite –causing harm to the host. • Primary host is where parasite undergoes sexual reproduction/adult form exists • Secondary host is where parasite undergoes asexual reproduction/only larval forms exist. **Section B** • Large numbers of eggs produced in primary host increase the number of larvae to infect more secondary host organisms/snails. • Relevant/correct reference to being hermaphrodite. Reject if linked to asexual reproduction • Secondary host/snail ingested/eaten/consumed by primary host/fish • Large numbers of larvae produced in secondary host (at intermediate stages of life cycle) increase probability of infecting/surviving in (primary) host **Section C** • Peristalsis/stomach muscle contractions could detach parasite from stomach wall • Suckers for attachment prevent detachment of parasite • Low pH/stomach enzymes/host immune response damages parasite cells/tissue/could kill parasite • Thick cuticle/mucus protects parasite (tissues) from low pH/enzymes/immune response of host; • Sharp mouthparts to enable feeding through stomach wall.	2 4 3 9
	7-9 marks Indicative content of this level is detailed content from all three sections *The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.* **4-6 marks** Indicative content of this level is detail from two sections or less detail from three *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.* **1-3 marks** Indicative content of this level is any indicative content statement *The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer*	

Question 17 · A level Component 3 · June 2018 · Q7 · 9 marks

7.			**Indicative content** **Ecstasy** • ADH increases permeability of {DCT /collecting duct} to water • more aquaporins added into the cell membrane • more water reabsorbed (and lower volume of urine produced) • increases sweat production so reduces {urine volume/ water potential of plasma} **Furosemide** • ions transported out of ascending limb of Loop of Henle into tissue fluid of medulla • lower solute/water potential of tissue fluid/ creates a water potential gradient in medulla • Water moves out of {descending limb/ collecting duct} by osmosis • this reduces volume of {filtrate/ urine} • fewer ions into medulla reduces water potential gradient so less water reabsorbed from {descending limb/collecting duct} • {filtrate /urine} volume remain high **Hyponatraemia** • **ecstasy** causes increased body temperature – body reacts by sweating resulting in increased loss of Na^+ • **ecstasy** causes increased thirst – blood is diluted • **ecstasy** too much water reabsorbed dilutes the blood • **(furosemide** inhibits transport of Na^+ out of filtrate) so more Na^+ are passed out in urine • **furosemide** also increases urine volume so more Na^+ lost from body	3	3	3	9	
			7-9 marks A clear account of the role of the loop of Henle and ADH/collecting duct interaction is given. This is related in detail to the action of MDMA in increasing permeability of the collecting duct to water through the incorporation of more aquaporins and also how furosemide decreases the reabsorption of water by decreasing the water potential gradient between the filtrate and the tissue fluid in the medulla. A detailed explanation is given of how both drugs can lead to low blood Na^+ levels. *The candidate constructs an articulate, integrated account, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.* **4-6 marks** The involvement of the loop of Henle and the collecting duct, together with the role of ADH is described. The effects of MDMA and/or furosemide are linked to these structures and their effect on the volume of urine is explained. A sound attempt is made to explain how both drugs can result in hyponatraemia. *The candidate constructs an account correctly linking*					

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6			***Indicative content*** **Role of ADH** • Water potential of blood detected by osmoreceptors in hypothalamus • Pituitary release more/less ADH • Travels in blood to collecting ducts • Makes collecting duct more/less permeable to water • Reference to aquaporins **Graph** • Water enters the blood and water potential of the blood increases. • less ADH/ ADH release Inhibited • less permeable to water • Less water reabsorbed into the blood. • Therefore larger volumes (of dilute) urine are produced • NEGATIVE FEEDBACK. **EXERCISE:** • Student has lost water by sweating/exhaling more • To cool the body. • Water potential of the blood already very low' • So less water is lost in order to keep water potential of blood correct. • Less urine formed.
			7-9 marks Detailed content from all three areas *The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.* **4-6 marks** Detailed content from two areas or less detail from three areas *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.* **1-3 marks** Content from one area *The candidate makes some relevant points, such as those in the*

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6	**Indicative content** **Neurotoxin A** • must block the voltage gated Na^+ channels • Na^+ ions cannot flood into the axon • so depolarisation is small • does not exceed threshold potential • no action potential is generated/ all or nothing • impulse cannot reach muscles • muscles won't contract **Neurotoxin B** • allows an action potential to be generated • delay in depolarisation/ Na^+ cannot flood in as quickly • repolarisation takes too long • blocking the K^+ channels • preventing K^+ from flooding out of the axon • restoring the negative charge inside. • neurone does not / takes too long to return to resting potential • impulse takes too long to / does not reach muscles • delay in generating the next action potential/ next impulse **Neurotoxin C** • does not affect the generation of an action potential so does not affect the axon. • blocking the Ca^{2+} channels • prevents Ca^{2+} from entering the neurone. • neurosecretory vesicles do not fuse with the presynaptic membrane • or release neurotransmitter into the synapse. • preventing synaptic transmission • stopping an impulse reaching a muscle					
	7-9 marks Detailed explanation of modes of action of Neurotoxin **A** Detailed explanation of modes of action of Neurotoxin **B** Detailed explanation of modes of action of Neurotoxin **C** *The candidate constructs an articulate, integrated account, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.* **4-6 marks** Any two from Explanation of modes of action of Neurotoxin **A** Explanation of modes of action of Neurotoxin **B** Explanation of modes of action of Neurotoxin **C** *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content.*					

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