

Plant & Animal responses

Model Answers 2

Level	A Level
Subject	Biology
Exam Board	OCR
Module	Communication, homeostasis and energy
Topic	Plant & animal responses
Booklet	Model Answers 2

Time allowed: 82 minutes

Score: /61

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E
>69%	56%	50%	42%	34%	26%

Question 1

A student who was interested in animal behaviour did a day's work experience at a zoo. He made these notes about some examples of animal behaviour that he observed.

A When I approached the otter enclosure tapping a bucket of food, the otters made rapid squeaking noises and ran to the door to meet me!

B A mother duck escaped from her enclosure and all her baby ducklings followed her through a hole in the wire.

C I moved a log in one enclosure and noticed that the woodlice, which had been resting underneath the log, began to move around quickly once the log was lifted.

D A banana had fallen a short distance away from the chimpanzee pen. A chimpanzee used a stick to reach out and drag the banana towards her.

E The ring-tailed lemurs showed mutual grooming behaviour, taking it in turns to search through another lemur's fur for parasites.

F Cockroaches living in the dark in the house for nocturnal animals ran away from the light of my torch.

G Zoo deer are free to roam amongst the visitors. Although deer usually run away from humans, the zoo deer do not.

H When a chimpanzee threw an apple at the keeper, the keeper ducked his head very fast.

Match the examples **A–H** to the names of different **types of behaviour** by writing the correct letter beside the name. One has been done for you. [7]

1 social behaviour

E

2 kinesis

C

3 imprinting

B

4 escape reflex

H

5 taxis

F

6 operant conditioning

A

7 habituation

G

8 insight learning

D

[Total: 7]

Question 2

Fig. 2.1 is an electron micrograph showing a longitudinal section of contracted striated muscle.

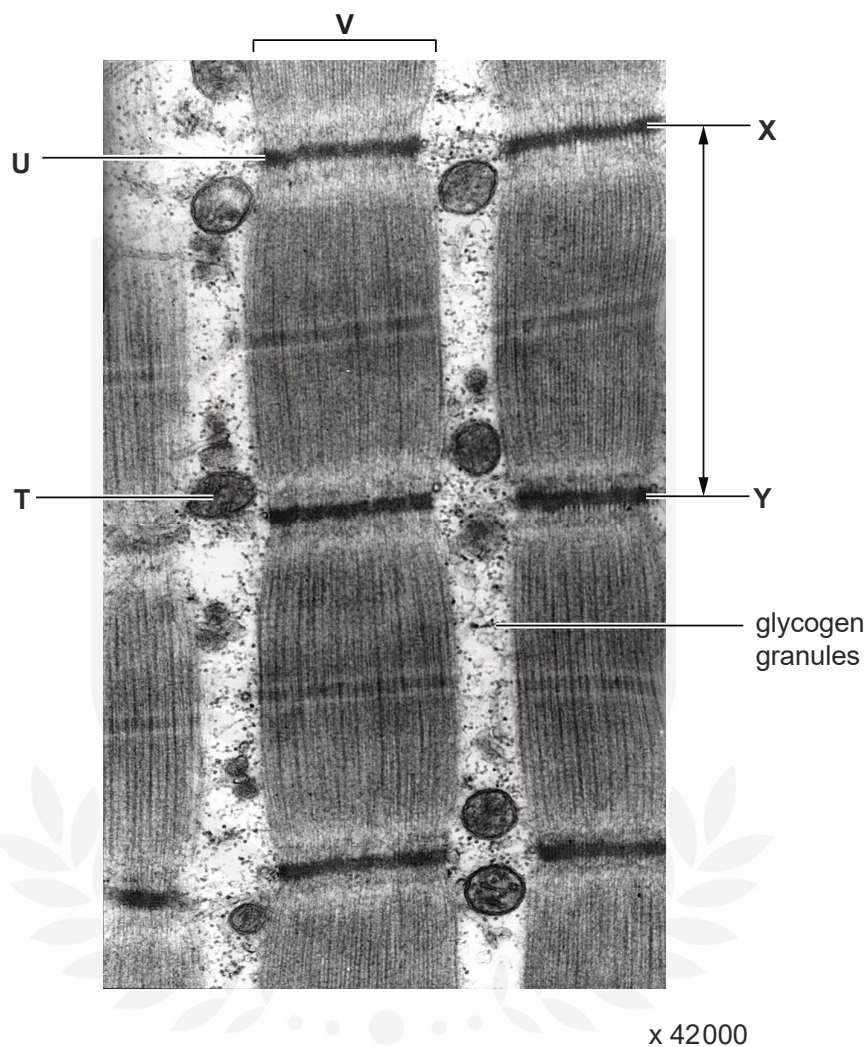


Fig. 2.1

(a) (i) Using Fig. 2.1, identify T, U and V. [3]

T mitochondria

U Z line

V myofibril

(ii) Using Fig. 2.1, name the structure between positions X and Y. [1]

- A sarcomere is the distance between two Z lines

(iii) Explain why glycogen granules are present in striated muscle.

[2]

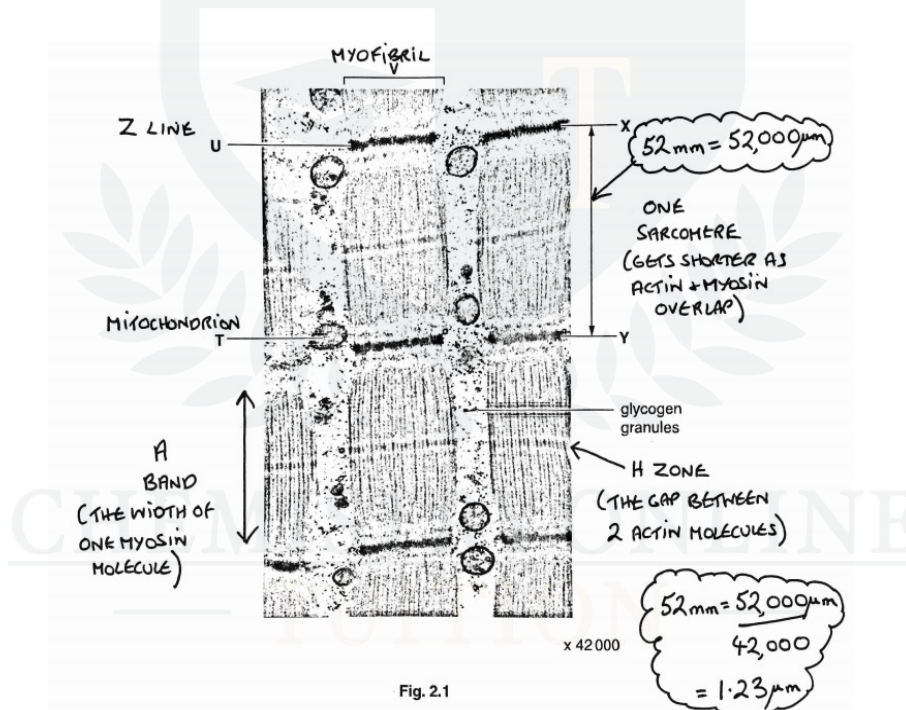
- Glycogen is used to store energy
- It can easily be hydrolysed to glucose
- Glucose is needed for aerobic respiration to make ATP
- As glycogen is insoluble it does not lower the water potential of the cell and exerts no osmotic effect

(iv) Calculate the actual distance between positions X and Y on Fig. 2.1.

Show your working. Give your answer to the nearest 0.1 of a micrometre (μm).

[2]

- Between 1.2 and 1.3



(b) Fig. 2.2 below shows the arrangement of thick and thin filaments in striated muscle.

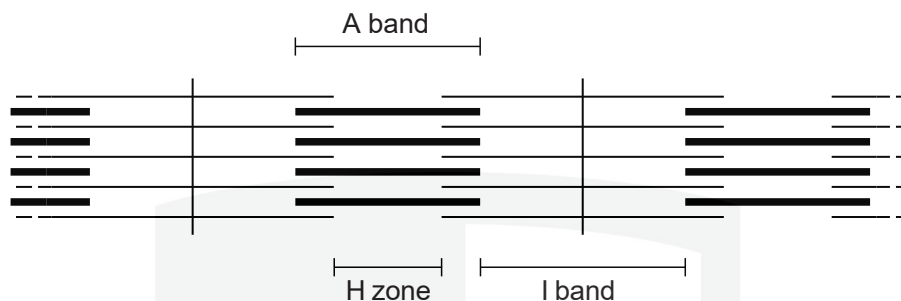


Fig. 2.2

State what happens to the lengths of the following when muscle contracts:

[3]

- A band stays the same this is the width of a myosin molecule so it cannot change
- H zone gets narrower this is the gap between two actins which get closer together
- I band gets shorter this the gap between two myosins which get closer together (

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- (c) During strenuous exercise, the concentration of hydrogen ions in muscle tissue increases. A high concentration of hydrogen ions reduces the ability of calcium ions to bind to proteins in the myofibrils. This reduces the force with which a muscle can contract.

Use this information and your own knowledge of the proteins in muscle cells to explain how an increased concentration of hydrogen ions leads to a reduction in the force of contraction of a muscle.



In your answer you should make clear the link between the increased concentration of hydrogen ions and the reduction in the force of contraction of a muscle.

[6]

- If hydrogen ion concentration increases and fewer calcium ions bind to proteins then:
- Fewer calcium ions will bind to troponin
- Instead of changing shape when calcium ions bind they will stay the same
- Tropomyosin molecules fail to move to the side
- Binding sites on the actin are less available
- So fewer actin / myosin cross bridges are formed
- The power stroke is reduced
- Extremely low pH will denature proteins

[Total: 17]

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Question 3

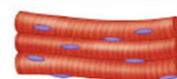
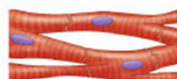
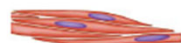
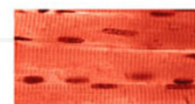
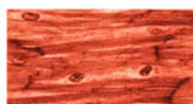
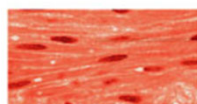
This question is about types of muscle and how the nervous system and hormones control their activity.

- (a) There are three types of muscle within the human body. These differ in their cellular structure and in their function.

Complete Table 2.1 to show how each type of muscle **differs from the other two** types. [6]

Table 2.1

	voluntary (skeletal) muscle	involuntary (smooth) muscle	cardiac muscle
cellular structure	<ul style="list-style-type: none"> • Striated (striped) • Cylindrical shaped • Multi nucleate (many nuclei) 	<ul style="list-style-type: none"> • Unstriated (not striped) • Spindle shaped • Uninucleate (single nucleus) 	<ul style="list-style-type: none"> • Striated (striped) • Branched shape • Uninucleate • Intercalated discs
function	<ul style="list-style-type: none"> • To move bones and joints 	<ul style="list-style-type: none"> • To control the diameter of arteries and bronchioles 	<ul style="list-style-type: none"> • To pump blood



Smooth muscle

- has spindle-shaped, nonstriated uninucleated fibers.
- occurs in walls of internal organs.
- is involuntary.

Cardiac muscle

- has striated, branched, uninucleated fibers.
- occurs in walls of heart.
- is involuntary.

Skeletal muscle

- has striated, tubular, multinucleated fibers.
- is usually attached to skeleton.
- is voluntary.

- (b) The human thorax is the area between the base of the neck and the base of the rib cage. All three types of muscle can be found within this area.

For each type of muscle, identify where **in the thorax** this type of muscle may be found.

[3]

voluntary	intercostal muscle or diaphragm
involuntary	bronchioles, arterioles, aorta and oesophagus
cardiac	heart

- (c) Fig. 2.1 shows a vertical section through the human brain.

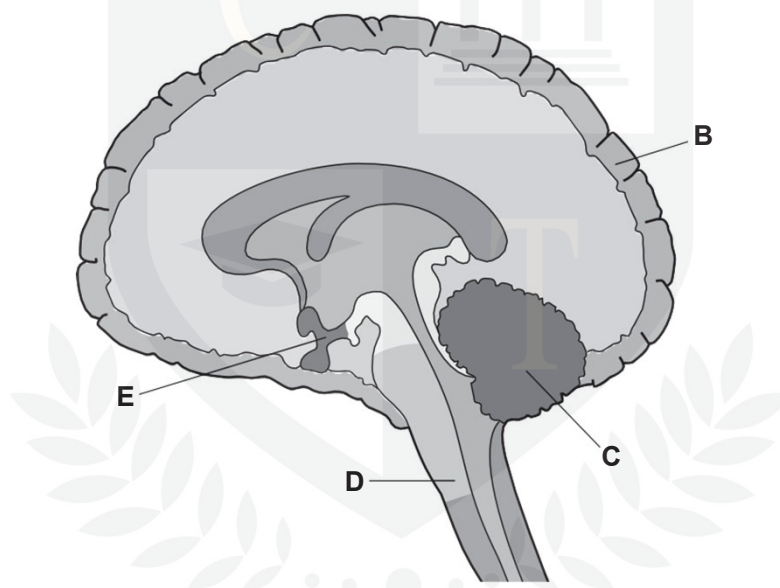
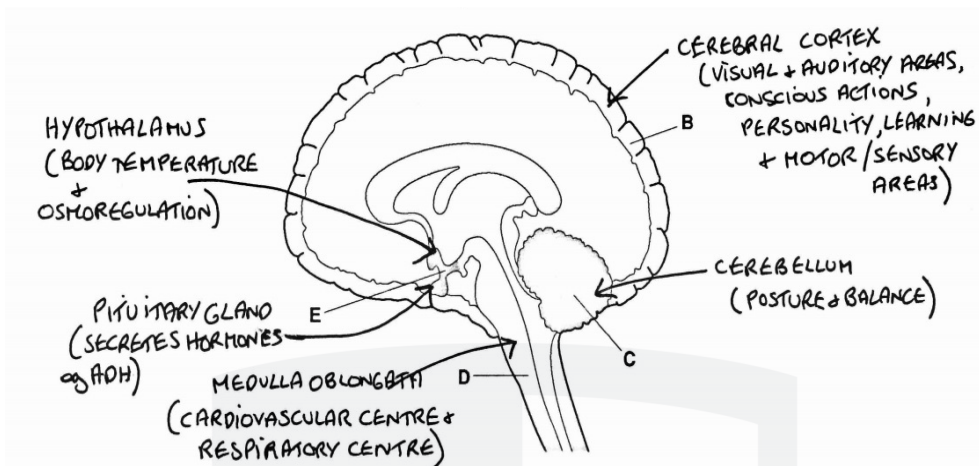


Fig. 2.1

Use Fig. 2.1 to state the letter (B to E) of the part of the brain that would be involved in the following:

[3]

adjusting the rate of contraction of cardiac muscleD.....
clapping the hands togetherB.....
automatically correcting balance when riding a bicycleC.....



- (d) Movement disorders are conditions in which people lose the ability to control their body movements.

Scientists have discovered that inserting electrodes to stimulate parts of the brain can help to cure some movement disorders. This discovery has resulted from experimental work with monkeys, which has made the research controversial.

Suggest why monkeys rather than other laboratory animals, such as rats, were used for this work **and** comment on whether their use in this way is justified or not.

[3]

- Monkeys were used rather than because they are more closely related and share a common ancestor
- Both humans and monkeys are primates
- Humans and monkeys have a similar brain structure and physiology
- Monkey's brains are larger than rats
- The medical importance of the research is justified to alleviate human suffering
- However the investigation may cause pain and distress to the monkeys

Exam tip: Ethical use of organisms. If an investigation uses living organisms the first consideration is whether the cruelty or risks involved outweigh the medical importance of the research. The organism should not be away from its natural environment for too long and any feeling of pain should be avoided. For this reason, invertebrates are preferred as they don't have well developed nervous systems and might not feel pain. Another consideration is whether or not the organism is endangered and how quickly they reproduce. The use of vertebrates can be justified however if the drug being tested is eventually for use in humans. Vertebrates have a similar physiology and biochemistry so if a drug is effective in mice for example, it is more likely to be effective in humans.

- (e) The 'fight or flight' response to threatening environmental stimuli is coordinated by the nervous and endocrine systems.

Describe and explain how the activation of the 'fight or flight' response affects voluntary, involuntary and cardiac muscle.



In your answer, for each type of muscle, you should give a named structure in which it is found and explain how the nervous and endocrine systems affect its response.

[9]

- When the fight or flight reflex is activated the sympathetic motor neurones are stimulated
- Noradrenaline is released at the neuromuscular junction
- Adrenaline is released into the bloodstream
- Adrenaline is secreted by the adrenal medulla
- When the adrenaline and noradrenaline are released they bind to receptors on the target tissue
- The effect on cardiac muscle is to make the heart beat faster
- The heart also beats with more force
- This increases blood pressure
- Blood is diverted from the gut to the muscles
- Gut secretions are reduced and lack of blood flow to the skin makes the skin pale
- The smooth-muscle in the gut relaxes and peristalsis slows down
- Smooth muscle in the airways relaxes and makes the lumen of the airways wider
- The radial muscles in the iris contract and the pupil dilates
- Breathing muscles are stimulated to contract, as is the diaphragm which also contracts faster
- More blood flows to the skeletal muscles
- The liver is also stimulated to convert glycogen to glucose

During the flight or fight response changes in blood flow are brought about. These are designed to increase blood flow to skeletal muscle which needs extra oxygen and glucose for aerobic respiration, this is in case the person has to fight or literally run away. Airways widened in the lungs to allow air to flow in and out more easily. The heart rate increases and blood pressure increases to increase blood flow to the skeletal muscles, again to provide for aerobic respiration. The sympathetic nervous system slows down digestive processes and peristalsis and makes the body concentrate blood towards areas where it is needed most.

Make sure in this question that you answer each type of muscle, that is voluntary which is the skeletal muscle, involuntary which is found in the airways and gut, and cardiac muscle which is obviously found in the heart.

[Total: 24]

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Question 4

- (a) Plant responses to environmental changes are co-ordinated by plant growth substances (plant hormones).

Explain why plants need to be able to respond to their environment.

[2]

- Plants need to be able to respond to their environment to avoid abiotic stress
- It's enables plants to cope with change in conditions
- It helps them to grow towards the light to maximise photosynthesis
- Being able to respond enables them to avoid grazing by primary producers
- It makes sure that they can germinate in suitable conditions and disperse their seeds and pollen at the right times of year

- (b) The following investigation was carried out into the effects of plant growth substances on germination:

- a large number of lettuce seeds was divided into eight equal batches
- each batch of seeds was placed on moist filter paper in a Petri dish and given a different treatment.

The different treatments are shown in Table 6.1. Each tick represents one of the eight batches of seeds.

Table 6.1

	treatment	concentration of gibberellin (mol dm^{-3})			
		0.00	0.05	0.50	5.00
A	water	✓	✓	✓	✓
B	abscisic acid	✓	✓	✓	✓

The batches of seeds were left to germinate at 25 °C in identical conditions and the percentage germination was calculated.

Fig. 6.1 shows the results of this investigation.

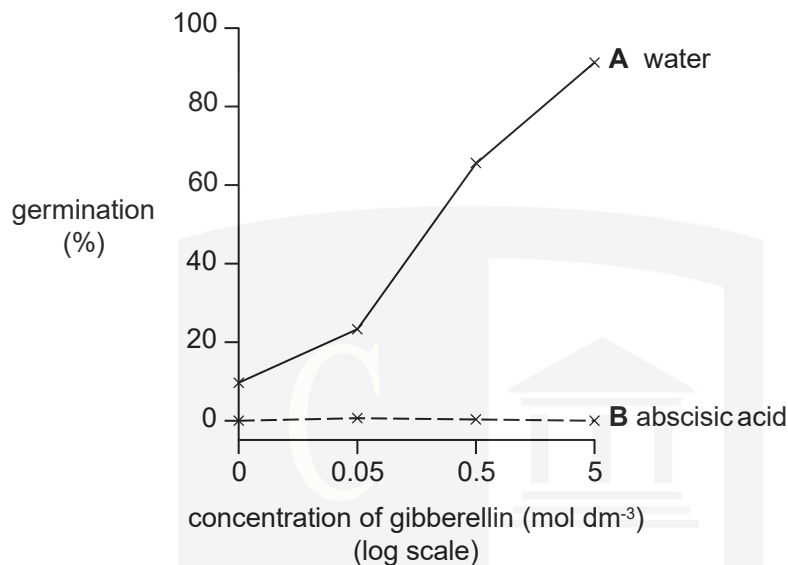


Fig. 6.1

(i) Describe, with reference to Fig. 6.1, the effects of the plant growth substances on the germination of lettuce seeds.

[4]

- In water with no abscisic acid the germination increases as GA increases
- When abscisic acid is present there is no germination
- The maximum germination was 90% at 5 mol dm³ without abscisic acid
- Use of figures such as: when GA increases from 0.5 to 5 the percentage germination increases from 22% to 64%

(ii) Explain why all the lettuce seeds were kept at 25 °C.

[2]

- The lettuce seeds were kept at 25° C so that temperature didn't affect the results and only the independent variable was changed
- Temperature affects enzyme activity
- 25° C could be the optimum temperature for lettuce seed germination

- (iii) State **three** variables, **other than temperature**, that needed to be controlled in the investigation.

[3]

Variables other than temperature that need to be controlled include

- The volume of liquids
- Absciscic acid concentration
- Oxygen availability
- The age of the seeds
- The previous storage of the seeds and the viability
- The variety of seeds
- The size and type of petri dish and filter paper
- The length of time the experiment is left before recording results

- (c) State **two** commercial uses of plant growth substances.

[2]

Commercial uses of plant growth substances include

- Seedless grapes and fruit
- Weedkillers
- Rooting powder to grow cuttings
- To control fruit ripening
- To preserve cut flowers and green vegetables

[Total: 13]