Plant and Animal Responses (5.1.5): OCR A Level Biology Exam Questio

19 questions · 51 marks · about 61 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · A level Paper 3 · November 2021 · Q3(d) · 1 mark

(d) Many plants have defensive responses to herbivores.

State **one** example of a response that plants use against herbivory.

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..... **[1]**

Question 2 · A level Paper 1 · June 2024 · Q19(a)(i) · 1 mark

19

(a) Plants respond to their environments in different ways.

(i) Describe the meaning of the term **tropism**.

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..... **[1]**

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Question 3 · A level Paper 1 · June 2025 · Q18(a) · 4 marks

18

(a) Describe the role of plant hormones in the control of seed germination.

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..... **[4]**

Question 4 · A level Paper 1 · June 2022 · Q19(a) · 3 marks

19 (a) The table lists structural and functional differences between different types of muscle.

Place a tick (✓) in each box where the structure or function applies to that type of muscle.

The first row has been completed for you.

	Skeletal	Cardiac	Involuntary
Contraction speed is slow			✓
Fibres are multinucleate			
Fibres are branched and interconnected			
Under conscious control			

[3]

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Question 5 · A level Paper 3 · June 2025 · Q3(b) · 3 marks

(b) The table lists events that occur during muscle contraction. Each event is represented by a letter.

Letter	Event
H	ATP binds to myosin, which causes myosin to detach from actin.
I	Troponin changes shape.
J	Myosin binds to actin.
K	ADP is released from myosin.
L	Hydrolysis of ATP causes the myosin head to regain its original position.
M	Ca^{2+} ions bind to troponin.
N	Tropomyosin moves position.

Give the sequence of letters that shows the correct order of events during muscle contraction.

The first letter has been done for you.

M .... **[3]**

Question 6 · A level Paper 1 · June 2025 · Q18(c) · 3 marks

(c) Soybeans are important food crops.

Farmers often grow soybeans with the plants close together but this causes the stems to grow too long so that the plants fall over, which reduces the crop yield.

A scientist suggested that spraying soybean plants with a chemical that inhibits gibberellin production could increase yields.

Explain the scientist's suggestion.

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Question 7 · information from earlier in the question

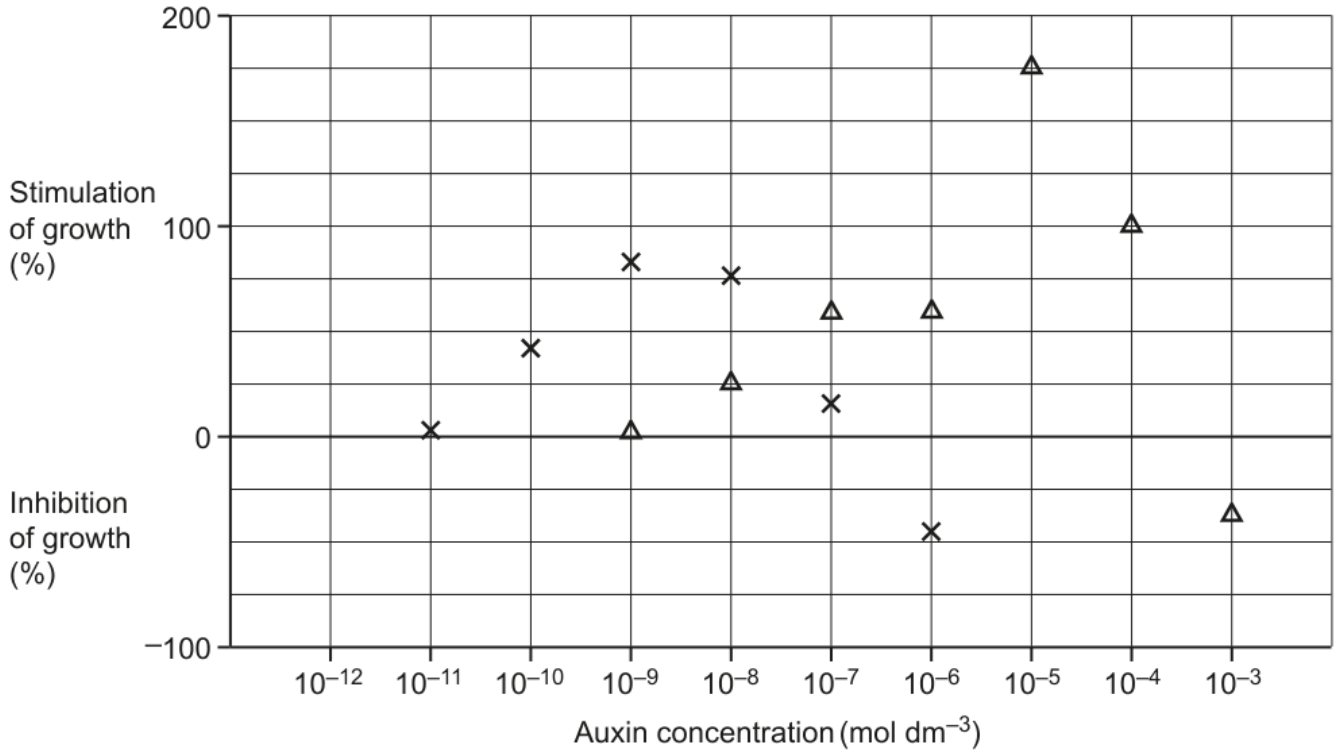
(b) The student investigated the effect of auxin concentration on the growth of shoots.

The student applied different concentrations of auxin to the apical shoot and the lateral shoots.

The student measured the percentage of growth stimulation or inhibition compared to normal.

Normal growth was represented by 0%.

The student's results are shown in the graph.



Key: × = lateral shoots

Δ = apical shoot

(i) Use the graph to estimate the auxin concentration at which inhibition of lateral shoots is 100%.

Auxin concentration = ... mol dm^{-3} **[1]**

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Question 7 · A level Paper 3 · June 2022 · Q3(b)(iii) · 3 marks

(iii) Using the graph, describe the conclusions that can be drawn about the role of different auxin concentrations in the control of apical dominance.

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Turn over

Questions, mark schemes and examiners' report extracts © OCR.

Question 8 · A level Paper 3 · June 2017 · Q5(b)(i) · 2 marks

(b) Guillain–Barré syndrome is another autoimmune condition in which neurones are damaged and the rate of nervous impulses is reduced.

MS affects the central nervous system.

Guillain–Barré syndrome affects the peripheral nervous system.

(i) Suggest **two** symptoms of MS that might **not** be present in people with Guillain–Barré syndrome.

Explain your answers.

1 .....

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2 .....

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[2]

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Question 9 · A level Paper 1 · June 2018 · Q23(b) · 4 marks

(b) The student wrote the following summary about the control of heart rate.

> When the heart rate is too low the level of carboxylic acid in the blood becomes higher than normal. The vagus nerve sends action potentials to the AVN to increase the contraction rate of the heart muscle. The baroreceptors in the walls of the blood vessels then detect that the pH of the blood is normal, so heart rate can return to resting.
>
> The endocrine system can also change heart rate. Release of the hormone adrenaline from the adrenal medulla causes the smooth muscle of the heart to contract more frequently.

Identify **and** correct any biological errors in the student's summary.

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..... **[4]**

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Question 10 · information from earlier in the question

(c) Reflex actions are rapid responses that protect the body from harm.

The Moro reflex is found in babies up to five months of age, and occurs when the baby feels its head is suddenly no longer supported. The Moro reflex is made up of the following responses:

- The baby spreads out its arms then brings them together rapidly.
- The baby cries.

(i) Suggest how the Moro reflex helps to prevent harm to a newborn baby.

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..... **[2]**

Question 10 · A level Paper 1 · June 2018 · Q23(c)(ii) · 3 marks

(ii) The Moro reflex gradually disappears and usually stops completely after babies reach nine months. Other reflexes develop as children grow older.

Describe a reflex response a 3-year-old child would make to an object moving towards their eyes **and** explain the advantage of this response.

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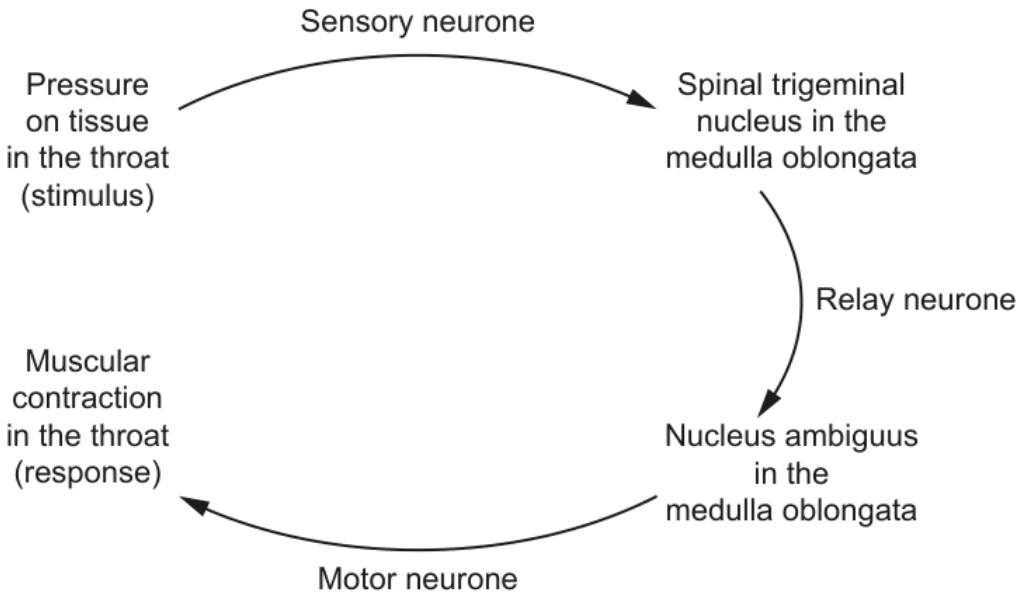
..... **[3]**

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(c) The nervous system of a cat coordinates a response to stop objects becoming stuck in their throat.

Sensory receptors at the back of the throat detect the stimulus of a large piece of food or a ball of hair pressing on the tissue. The response is shown in **Fig. 1.2**.

Fig. 1.2



Explain **two** conclusions that can be drawn from **Fig. 1.2** about the type of nervous response shown.

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..... **[2]**

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Question 12 · information from earlier in the question

2 Adrenaline is a hormone that increases heart rate when it binds to receptors on heart cells.

Beta blockers are drugs that bind to adrenaline receptors on heart cells.

Beta blockers are used to treat tachycardia (fast heart rate) and high blood pressure. They reduce the risk of a heart attack or stroke, which are two examples of cardiovascular diseases.

(a) The conversion of ATP to cyclic AMP (cAMP) in a heart cell is prevented when beta blockers bind to adrenaline receptors on the cell surface membrane.

(i) Describe **one** difference between the structure of ATP and the structure of ADP.

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..... **[1]**

Question 12 · A level Paper 3 · June 2025 · Q2(a)(ii) · 2 marks

(ii) Suggest how the binding of beta blockers to adrenaline receptors prevents the conversion of ATP to cAMP.

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..... **[2]**

Turn over

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Question 13 · A level Paper 3 · June 2025 · Q2(c) · 2 marks

(c) Heart rate is lowered when the heart receives stimulation from the vagus nerve.

Explain why the vagus nerve is considered part of the peripheral nervous system **and** part of the autonomic nervous system.

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..... **[2]**

Turn over

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(b) **Fig. 19.1** and **Fig. 19.2** are transmission electron micrographs (TEMs) of striated muscle.

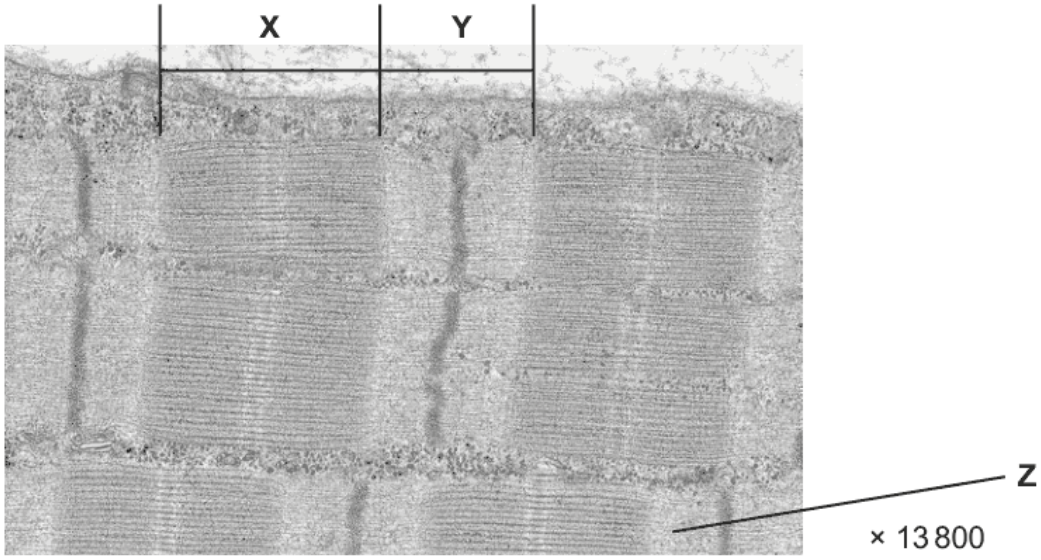


Fig. 19.1

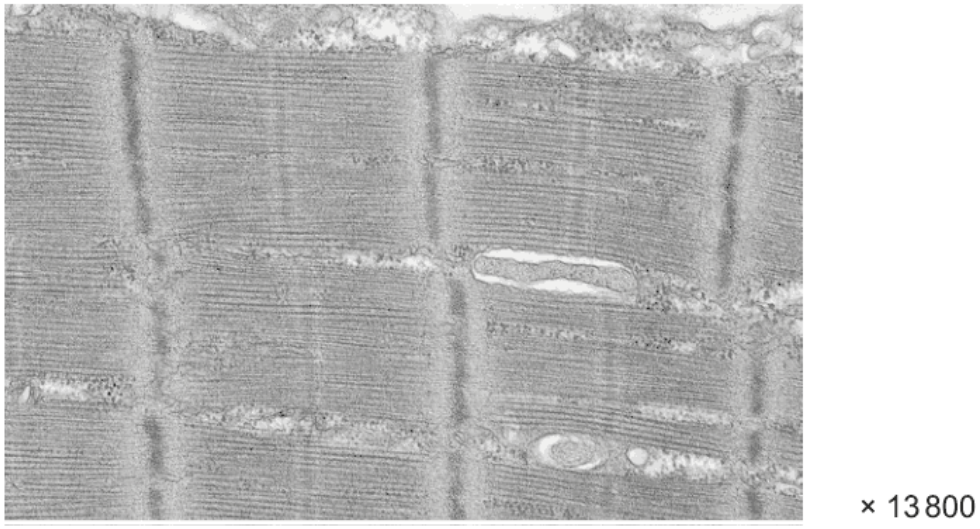


Fig. 19.2

17

(i) Identify **three** proteins that make up the filaments labelled **Z** on **Fig. 19.1**.

1 .....

2 .....

3 .....

[3]

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Question 14 · A level Paper 1 · June 2022 · Q19(b)(iii) · 3 marks

(iii) Use your knowledge of the sliding filament model of muscle contraction to explain why **Fig. 19.2** represents contracted muscle.

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..... **[3]**

Turn over

Question 15 · A level Paper 1 · June 2022 · Q19(c) · 2 marks

(c) After death, the concentration of ATP in muscle cells decreases. During this time, the muscles become rigid in a process called rigor mortis.

Suggest why a lack of ATP leads to muscle rigidity.

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..... **[2]**

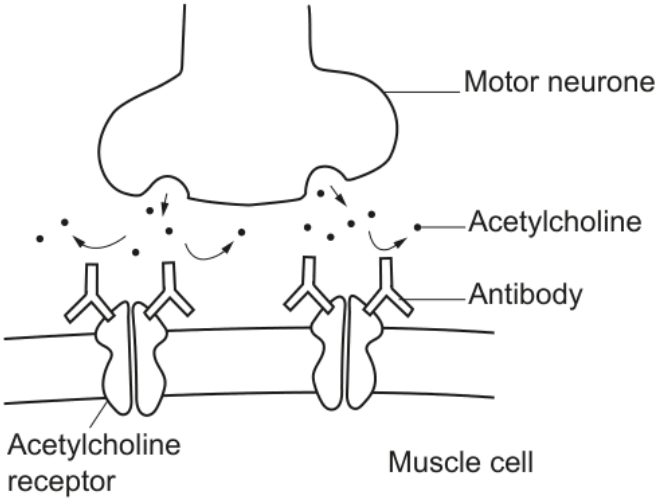
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Question 16 · information from earlier in the question

(c) Myasthenia gravis (MG) is a disease that causes muscle weakness.

In MG, antibodies bind to acetylcholine receptors in neuromuscular junctions which prevents acetylcholine from binding to the receptors.

The diagram shows this process.



(i) State the name given to diseases such as MG.

..... **[1]**

Question 16 · A level Paper 3 · June 2025 · Q3(c)(ii) · 2 marks

(ii) Explain how the binding of antibodies to acetylcholine receptors in the neuromuscular junction reduces the rate at which Ca^{2+} ions bind to troponin.

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..... **[2]**

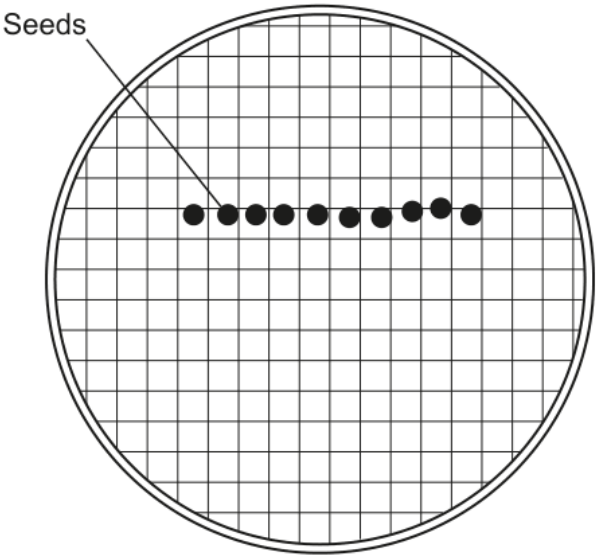
Turn over

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17 Some students investigate the effect of IAA (auxin) concentration on the growth of roots and shoots in mustard seedlings.

This is the method that they use with 8 different concentrations of IAA:

- Place a filter paper on a bed of cotton wool in the Petri dish and soak it with IAA solution.
- Place 10 seeds in a horizontal line on the damp filter paper.
- Cover with a lid that has a grid marked on it, as shown in the diagram.
- Repeat this process with each different concentration of IAA.
- Add distilled water to one Petri dish in place of IAA solution.
- Place the Petri dishes vertically in a warm dark place for 2 to 3 days until the seeds have germinated and the roots and shoots have started to grow.
- Measure the length of the shoots and roots by counting the number of grid squares the shoot or root covers.



(a) (i) Explain why the Petri dishes were placed vertically and in the dark.

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..... **[2]**

Turn over

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Question 18 · information from earlier in the question

(c) Another student plans to investigate the effect of gibberellin concentration on the rate of stem elongation in the pea plant, *Pisum sativum*.

(i) Suggest appropriate units for the dependent variable in this investigation.

..... **[1]**

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Question 18 · A level Paper 3 · June 2022 · Q3(c)(ii) · 6 marks

(ii)* The student has access to standard laboratory equipment and planting materials.

Outline a method that the student could use to investigate the effect of gibberellin concentration on stem elongation in *P. sativum*.

In your answer, you should include details of an appropriate statistical test for this investigation.

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Additional answer space if required.

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Question 19 · A level Paper 3 · June 2022 · Q3(d) · 3 marks

(d) A friend of the student had an apple tree in their garden. The friend asked the student if there was a way to ripen the fruit on the apple tree more quickly so that it would be ready to eat within a few days.

The student gave this advice:

'You should spray the tree with ethene.'

Evaluate whether acting on the student's advice would produce fruit that was ready to eat within a few days.

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..... **[3]**

Turn over

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Mark schemes

Question 1 · A level Paper 3 · November 2021 · Q3(d) · 1 mark

d	example of chemical defence ✓ example of physical defence ✓	**1 max**	1.1

e.g. (production of) pheromones / poisons / toxic compounds / named examples (phenols, tannins, alkaloids, Bt toxin) e.g. folding in response to touch / thorns / spines

Question 2 · A level Paper 1 · June 2024 · Q19(a)(i) · 1 mark

19	**(a)**	**(i)**	directional growth in response to a stimulus ✓	**1**

ALLOW grows towards / away from a stimulus **DO NOT ALLOW** 'growth' unqualified – it must have the sense of being directional

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Question 3 · A level Paper 1 · June 2025 · Q18(a) · 4 marks

Question			Answer	Marks	Element
18	(a)			max 4	1.2
		1.	water, is absorbed by seed/ activates embryo ✓		
		2.	(embryo releases), gibberellin / GA ✓		
		3.	production / gene expression, of digestive enzymes ✓		
		4.	enzymes , digest / break down , (named) food / energy, stores ✓		
		5.	product / glucose, used, in respiration / to produce ATP ✓		
		6.	abscisic acid / ABA , inhibits germination / causes dormancy ✓		

Guidance

1 IGNORE GA causes water uptake

2 DO NOT ALLOW gibberellin and ABA (causing germination)

3&4 ALLOW named enzymes
e.g. lipase/ amylase/ protease/ maltase

3 ALLOW 'gene activation' for 'gene expression'

3 IGNORE (named) enzymes, activated / released

5 DO NOT ALLOW ref to, photosynthesis/ plant respiring

6 ALLOW cytokinins / ethene, promote germination

6 ALLOW ABA is antagonistic to gibberellins

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Question 4 · A level Paper 1 · June 2022 · Q19(a) · 3 marks

19 (a)

	skeletal	cardiac	involuntary	
contraction speed is slow			✓	
fibres are multinucleated	✓			✓
fibres are branched and interconnected		✓		✓
under conscious control	✓			✓

3 1.1

IGNORE use of crosses / hybrid ticks
DO NOT ALLOW more than 1 tick per row

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Question 5 · A level Paper 3 · June 2025 · Q3(b) · 3 marks

3	(b)	(M) **I N J K H L**	✓✓✓	3	1.1

If the order is incorrect, award:
one mark for I first (second after M) **and** L last
one mark for N, J, and K in the correct order (but not necessarily listed together).
e.g. I N J H K L = 2 marks
I J N K H L = 1 mark
I N J H L K = 1 mark

Question 6 · A level Paper 1 · June 2025 · Q18(c) · 3 marks

18	(c)			**max 3**	3.2
		1	the chemical reduced gibberellin <u>concentration</u> ✓		
		2	(plants) shorter / reduced stem size so, do not fall over / stay upright ✓		
		3	plants are less damaged / more can be harvested (to increase yield). ✓		
		4	plants use less (named) resources for growth of stem so can increase yield ✓		

IGNORE ref to other uses of GA

1 ALLOW GA, gibberellic acid
1 ALLOW chemical causes zero gibberellin concentration

2 ALLOW 'less' for 'do not'
2 ALLOW 'stems are not elongated' for 'shorter'
2 IGNORE 'smaller' for 'shorter'

3 ALLOW 'more viable/ lost less' for 'less damaged'

4 ALLOW protein/lipid/glucose/carbohydrate/energy for 'resources'

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Question 7 · A level Paper 3 · June 2022 · Q3(b)(iii) · 3 marks

3 (b)	**(iii)**	*Apical shoots* **at** high(er) auxin concentrations / from 10^{-9} (to 10^{-4} mol dm^{-3}) , apical growth / apical dominance is, stimulated / increased ✓ (apical shoot growth) peaks at 10^{-5} (mol dm^{-3}) ✓ *Idea of* very high concentrations of auxin inhibit apical (shoot) growth ✓ *lateral shoots* **at** low(er) auxin concentrations / from 10^{-11} (to 10^{-7} mol dm^{-3}), lateral (shoot) growth is , stimulated / increased ✓ **at** high(er) auxin concentrations / above 3 x 10^{-7} (mol dm^{-3}), lateral (shoot) growth is inhibited ✓

3 max	3.1	**IGNORE** units throughout **ALLOW** any value within this range. **IGNORE** 'as auxin concentration increases apical growth increases' **without ref** to 'high / higher auxin concentration' **or** correct data quote e.g. apical (shoot) growth is inhibited at 10^{-3} (mol dm^{-3}) **ALLOW** any value within this range. 'at high auxin concentrations, apical dominance is greatest and lateral shoot growth is inhibited' = 2 marks (mp1 and 5)

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Question 8 · A level Paper 3 · June 2017 · Q5(b)(i) · 2 marks

b	i	(greater loss of) memory / thinking / cognition / speech / smell / sight / hearing **AND** (due to damage to) cerebrum / cerebral cortex ✓ (greater loss of) balance / coordination **AND** (due to damage to) cerebellum ✓ (greater loss of) feeding / sleeping patterns / temperature control / water balance **AND** (due to damage to) hypothalamus ✓ (greater loss of)swallowing / bladder control / bowel movement / control of, heart rate / breathing rate **AND** (due to damage to) medulla oblongata / brain stem ✓	2

Mark as prose. Mark first two symptoms given only

ACCEPT visual /olfactory / auditory (cortex) if linked to correct loss of speech /smell /sight
ACCEPT corpus callosum if linked to loss of cognition / balance / memory / thinking

ACCEPT (due to damage to) motor cortex

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Question 9 · A level Paper 1 · June 2018 · Q23(b) · 4 marks

(b)		**max 4**
		carboxylic acid should be <u>carbonic</u> acid / H_2CO_3 ✓ *vagus* (nerve) should be , <u>accelerator</u> / <u>sympathetic</u> / <u>accelerans</u> , (nerve) ✓ *AVN* should be , <u>SAN</u> / <u>sinoatrial node</u> ✓ *baroreceptors* should be <u>chemoreceptors</u> **OR** *pH* should be <u>pressure</u> ✓ *smooth muscle* should be <u>cardiac</u> muscle ✓

Error and correct term must be clearly identified.
ALLOW copied statements where correct terms replace errors.
IGNORE carbon dioxide
ALLOW specialised striated

Question 10 · A level Paper 1 · June 2018 · Q23(c)(ii) · 3 marks

	(ii)	*description:* (rapid) blinking / shutting / closing (of eyes) ✓ *explanation:* involuntary ✓ prevents , damage to / objects entering , eyes ✓
		Total

3	**ALLOW** references to , ducking / raising hands / flinching **ALLOW** unconscious / automatic / innate / instinctive **ALLOW** protects the eyes
12	

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Question 11 · A level Paper 3 · June 2023 · Q1(c) · 2 marks

1	(c)		involuntary **AND** does not use, the cerebrum / somatic nervous system **or** coordinated by the medulla (oblongata) /AW **or** does not use , decision-making /AW ✓ reflex / fast (response) **AND** involves, (only) three (named) neurones / few neurones **or** coordinated by , brainstem / medulla (oblongata) ✓

Question	Answer

2	3.1 3.2	**ALLOW** autonomic **IGNORE** automatic / unconscious e.g. 'involves the medulla (oblongata)' e.g. 'does not require conscious thought / happens without thinking about it' **IGNORE** 'involves minimal number of neurones' **ALLOW** '(only) involves, two / few, synapses' **ALLOW** 'passes through , brainstem / medulla' **IGNORE** 'spinal / cranial' 'it is involuntary and fast because it involves the medulla (oblongata)' = 2 marks

Mark	AO Element	Guidance

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2	**(a)**	**(ii)**	adrenaline cannot bind to receptor ✓ adenylyl cyclase , remains inactive / not stimulated / AW ✓ adenylyl cyclase cannot , catalyse / convert , ATP to cAMP ✓ AVP ✓
Question			**Answer**

2 max	2.5	**ALLOW** 'adenyl' and 'adenylate' for 'adenylyl' throughout **CON** if context is 'change of shape of the receptor / allosteric effect' **ALLOW** adenylyl cyclase is not activated **NOTE**: 'adenyl cyclase is not triggered to convert ATP to cAMP' scores **MP2 and MP3** e.g. G-protein , is not activated / does not work / is not switched on / does not split **NOTE**: 'G-protein does not activate adenyl cyclase' scores **MP2 and MP4** **NOTE** 'adrenaline (normally) binds to receptors to stimulate adenylyl cyclase. This **cannot happen** when the receptors are blocked' scores **2 marks**
Mark	**AO Element**	**Guidance**

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Question 13 · A level Paper 3 · June 2025 · Q2(c) · 2 marks

2	**(c)**		**2**	2.1

peripheral because…

connects , CNS / brain / spinal cord , to,
the heart / rest of body / effector

OR

it is (largely) outside / not part of , CNS / brain / spinal cord

OR

it contains, sensory / motor , neurones ✓

autonomic because…

(control of heart rate is / it controls responses that are)
involuntary

or

connected to / AW , medulla oblongata ✓

NOTE: award marking points even when 'peripheral' and 'autonomic' are not mentioned

IGNORE 'spine' alone

CON relay neurones / interneurones
ALLOW *idea of* transmits impulses , from receptors / to (named) effectors
ALLOW 'nerve cells' for 'neurones'

ALLOW 'unconscious / not conscious / needs no thought / requires no decision-making' for 'involuntary'
IGNORE 'have no control over / automatic / subconscious'

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Question 14 · A level Paper 1 · June 2022 · Q19(b)(iii) · 3 marks

19	**(b)**	**(iii)**	light / I , band is smaller ✓ dark / A , band remains the same ✓ sarcomeres are shorter ✓ H zone becomes smaller ✓ there is greater overlap between actin and myosin (filaments) ✓

max 3	2.7, 3.2	**ALLOW** band Y (as labelled on diagram) **ALLOW** band X (as labelled on diagram) **ALLOW** Z lines closer together

Question 15 · A level Paper 1 · June 2022 · Q19(c) · 2 marks

19	**(c)**	**Any two from:** ATP , is required to , break cross-bridges / detach myosin from actin ✓ actin and myosin (filaments) remain cross-linked / AW ✓ prevents relaxation of muscle / muscle stays contracted ✓

2	2.5	**ALLOW** e.g. ATP is needed to break the links between myosin and actin so they remain attached = 2 marks

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Question 16 · A level Paper 3 · June 2025 · Q3(c)(ii) · 2 marks

3	**(c)**	**(ii)**	no / few(er) , Na^+ ions enter , sarcoplasm / muscle cell ✓ less / no , depolarisation of , sarcolemma / muscle cell membrane / T-tubules / sarcoplasmic reticulum / SR ✓ no / few(er) , Ca^{2+} released from , sarcoplasmic reticulum / SR ✓

Question	**Answer**
2 max	2.5

IGNORE sodium / Na / calcium / Ca / Ca^+

ALLOW no / fewer , Na^+ channels open in , sarcolemma / muscle cell membrane

ALLOW 'action potential in' for 'depolarisation of'

NOTE 'normally, the T-tubules are depolarised, which causes the SR to release calcium ions. This **cannot happen** when the receptors are blocked' scores **2 marks** (MP2 and MP3)

Mark	**AO Element**	**Guidance**

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Question 17 · A level Paper 1 · June 2023 · Q17(a)(i) · 2 marks

17	(a)	(i)	placed vertically so that , roots grow downwards / shoots grow upwards ✓ in dark so that light does not affect , results / growth **OR** in dark to prevent phototropism ✓

2	2.7	**DO NOT ALLOW** trophism / trophic **ALLOW** roots are positively geotropic / shoots are negatively geotropic **ALLOW** gravitropic for geotropic **ALLOW** roots grow towards gravity / shoots grow away from gravity **ALLOW** absence of light / darkness , is a control variable

Question 18 · A level Paper 3 · June 2022 · Q3(c)(ii) · 6 marks

3	(c)	(ii)	***Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.*** ***In summary:*** *Read through the whole answer. (Be prepared to recognise and credit unexpected approaches where they show relevance.)* *Using a 'best-fit' approach based on the science content of the answer, first decide which of the level descriptors, **Level 1**, **Level 2** or **Level 3**, best describes the overall quality of the answer.* *Then, award the higher or lower mark within the level, according to the **Communication Statement** (shown in italics):* ○ *award the higher mark where the Communication Statement has been met.* ○ *award the lower mark where aspects of the Communication Statement have been missed.* • ***The science content determines the level.*** • ***The Communication Statement determines the mark within a level.***				
			Level 3 (5-6 marks) Comprehensive outline of a valid experimental method, including details of all three types of variable, **and** statistical analysis for the investigation. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3-4 marks)** The answer contains detailed reference to variables **and** statistical analysis for the investigation. *There is a line of reasoning with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1-2 marks)** The answer contains brief reference to a variable **or** statistical analysis for the investigation. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** No response or no response worthy of credit.	**6**	3.3 3.4	**Indicative scientific points may include (but are not limited to):** *AO3: To develop and refine practical design and procedures* *Experimental method* Validity • Details of sample sizes and repeats • Details of group design (e.g. two groups: one without additional gibberellin, or several groups receiving different gibberellin concentrations, plus a control group) • Details of gibberellin application Variables • Details of control variables (e.g. plant/seedling size, water availability, light, temperature) • Details of the independent variable (varying gibberellin concentrations) • Details of the measurement of the dependent variable (measurement of stem length)
						Statistical analysis • Idea of identifying anomalies • Mean calculations • Standard deviation • Statistical testing (e.g. t-test if two groups are used, or Spearman's rank/Pearson correlation test if a range of concentrations are used)

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Question 19 · A level Paper 3 · June 2022 · Q3(d) · 3 marks

3	**(d)**	ethene , promotes / AW , fruit ripening ✓ concentration of ethene / stage of apple development , needs to be known ✓ *idea that* use of ethene to ripen fruit (normally) needs controlled conditions ✓ ethene is a gas **AND** *idea that* it will not be effective outside ✓ ethene promotes fruit dropping (therefore apples may fall to the ground and be damaged) ✓	**3 max**

3.2	**ALLOW** ethene promotes fruit maturing **ALLOW** using too much ethene may make the apples too ripe / ethene will affect different fruits at different rates (due to varying stages of development or time of year used) e.g. ethene is usually applied at a particular temperature e.g. ethene should be applied in closed conditions e.g. ethene should be released gradually e.g. ethene gas would diffuse away in the air and not land on the fruit **IGNORE** ' spraying a gas would be ineffective' **ALLOW** ethene promotes (fruit) abscission **IGNORE** leaf abscission

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