# Plant & Animal responses Model Answers 1

| Level      | A Level                               |
|------------|---------------------------------------|
| Subject    | Biology                               |
| Exam Board | OCR                                   |
| Module     | Communication, homeostasis and energy |
| Торіс      | Plant & animal responses              |
| Booklet    | Model Answers 1                       |

| Time allowed:     | 80 minutes           |
|-------------------|----------------------|
| Score:            | /59                  |
| Percentage:       | /100<br>AISTRYONLINE |
| Grade Boundaries: |                      |

| A*   | А   | В   | С   | D   | E   |
|------|-----|-----|-----|-----|-----|
| >69% | 56% | 50% | 42% | 34% | 26% |

## **Question 1**



The image below is a diagram of the human brain.

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

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

[1]

Learning takes place in the cerebral cortex (Z) but to play the instrument needs

fine manipulative coordination of muscle which takes place in the cerebellum (W)

(a)

[3]

- i. Protein
- ii. Synaptic cleft
- iii. Acetylcholine esterase / ACh esterrase
- (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.

[4]

- Carboxylic should be carbonic
- Vagus should be accelerator or sympathetic
- AVN should be SAN
- Baroreceptors should be chemoreceptors or pH should be pressure
- Smooth muscle should be cardiac muscle

(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. [2]
- It allows the baby to grasp and hold on
- Crying draws attention to the baby

(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.

• Blinking / closing of the eyes

[3]

• This is involuntary / innate / automatic / instinctive



[Total: 12]



Plant hormones affect the growth of plant tissues in different ways.

One such effect is to promote the formation of seedless fruit.

Cytokinins are a group of plant hormones.

A commercial plant hormone firm carried out research into three different cytokinins: kinetin, zeatin and diatin.

The firm investigated the effect of adding different volumes of each cytokinin on the production of seedless fruit.

The cytokinins were sprayed on the flowers of different plants. Over time, the mass of seedless fruits produced by the plants was measured.



Fig. 21

On the basis of these results, the firm decided to use diatin in their new plant spray.

The firm made the following claim on their packaging:

Diatin is scientifically proven to cause production of seedless fruit when applied to flowers.

(a)\* Evaluate the firm's claim, using the evidence in Fig. 21.

- As the volume of diatin increases the mass of seedless fruits increases -
- However, there is no scale or units on the axes
- The labels are the wrong way round
- There are no error bars or statistical tests
- Rather than increase in mass it should be percentage increase in mass \_
- The student concludes that diatin causes the increase in mass when it's actually a correlation
- There is a risk of bias or no objectivity
- No control variables are given, such as concn of hormone
- Temperature and carbon dioxide not specified
- Soil type / water availability / light intensity not specified
- No control groups or repeats

Causation is when a change in one variable is RESPONSIBLE for a change in another variable Correlation is when a change in one variable is REFLECTED by a change in another variable

[6]

This evidence is from the

data

These are control

variables or attempts to

improve reliability (b) Another response affected by plant hormones is phototropism.

A student completed an investigation into phototropism in cress seeds.

This was the method used:

- Place 50 cress seeds (*Lepidium sativum*) on a sterile paper towel in a petri dish.
- Water with 10 cm<sup>3</sup> of distilled water.
- Repeat for 3 different sets of seeds:
  - Set 1 is placed in a box to prevent light shining on the seeds.
  - Set 2 is placed in a box with light from above only.
  - Set 3 is placed in a box with light from the right hand side only.
- Keep all 3 sets at 25°C.
- After 72 hours, remove 20 of the seedlings from each set and count how many have bent.

Identify two limitations of the student's method.

For each limitation, explain how it limits the validity of conclusions that can be drawn **and** suggest an improvement that would improve the validity of conclusions made.

limitation 1: Light intensity

explanation: Light intensity could affect the extent of bending

improvement: Use the same bulb or wattage or keep the distance from the lamp the same

limitation 2: Choosing the seedlings

explanation: This could lead to biased results

improvement: Introduce some element of random selection

limitation 3: Measuring the degree of bending or bending was not quantitative

explanation: Could lead to biased results

improvement: Measure the angle (with any device eg protractor)

limitation 4: There were no repeats

explanation: Anomalies could not have been identified

improvement: Carry out at least 3 trials

[6]

So selecting samples for an investigation must be randomised

Control variables in this investigation were all considered apart from light

Measurement was not considered

Repeats not carried out. In any investigation this must always be your first consideration,

however you must know why they are important

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The peripheral and central nervous systems work together to enable mammals to respond to changes in their external environment.

(a) Outline the roles of the peripheral and central nervous systems in responding to changes in the environment.

The names and functions of regions in the brain are **not** required.

• Responding to changes in the environment begins with a receptor detecting a

stimulus

- A sensory neurone then conducts an action potential
- The sensory neurone ends at a synapse in the CNS
- A relay neurone conducts an action potential from a sensory neurone to a

motor neurone

- Chemical transmission across the synapse stimulates a motor neurone
- The brain coordinates a response



[4]

(b) The endocrine system is also involved in responding to changes in the external environment. For example, adrenaline is released in the 'fight or flight' response. When adrenaline arrives at a liver cell membrane, it binds to a receptor. Inside the cell, a cascade of events leads to glycogenolysis.

Explain how this response would be of use to a rabbit that has seen a predator. [3]

- Glycogenolysis is when glycogen is converted to glucose in the liver
- Blood glucose then increases
- More glucose is made available to the cells
- Glucose is needed for respiration which begins with glycolysis
- Respiration releases energy in the form of ATP, this helps with increased

muscle contraction

(c) (i) All three types of muscle in the rabbit's body contribute to the 'fight or flight' response.
Complete the table below by filling in the blank boxes. [3]

| Organ              | Type of muscle       | Action of <u>muscle</u><br>in fight or flight<br>response |  |
|--------------------|----------------------|---|--|
| heart              | Cardiac              | increases pulse rate                                      |  |
| leg muscle         | Voluntary / striated | Contract / movement                                       |  |
| arteriole to liver | smooth               | Contract / relax  |  |

(ii) Muscles in the rabbit's leg are made up of units.

Fig. 5.1 is a diagram of one unit.



The thick lines in the A band represent a protein.

Name this protein.

- Myosin
- (d) Innate behaviour and the capacity to learn are further assets that animals have in avoiding danger.
  - (i) Slugs are active at night. It would be useful to slugs to eat all day. But when dawn comes, they move away from the light.

State one advantage of this innate behaviour.

- Slugs move away from the light to avoid predation of prevent drying out
- (ii) Describe how you could use the slug's response to light to demonstrate habituation.

[2]

[1]

[1]

- Shine a light on the slugs at night and measure the response
- Repeat the stimulus
- See if the response is reduced over time
- (iii) Woodlice also respond to light. When it shines, they tend to move away from it.

What name do biologists give to this behaviour?

[1]

• Taxis or kinesis

(e) Chimpanzees are usually vegetarian. Meat is a dietary supplement for them.

A famous TV wildlife documentary showed a group of chimpanzees trapping colobus monkeys in order to eat them. The colobus sought refuge in trees. They can climb better than chimpanzees. Being much lighter, they can retreat to thinner branches.

(i) Place a tick √ in one box next to the biological name that correctly describes this type of chimpanzee behaviour. [1]

| Classical learning   |
|----------------------|
| Social behaviour     |
| Disruptive behaviour |
| Insight learning     |
| Natural selection    |
|                      |

(ii) Fig. 5.2 shows the arm bones of a chimpanzee and a human, drawn to the same scale.



Fig. 5.2

The muscles of the chimpanzee arms are approximately the same thickness as the arm muscles of an athletic man, yet those of the chimpanzee are stronger than those of most men.

### Suggest why.

[2]

- The bones of the lower arm of the chimp are longer
- If they are longer they must have more muscle
- More muscle means they can contract with more force

Animals and plants respond to changes in their environment.

(a) Plants respond to changes in their environment using chemicals known as plant hormones or plant growth regulators.

A student carried out a two-part experiment to identify the contents of two unlabelled bottles, J and K. One bottle contained auxin and the other contained gibberellin.

In Part 1 of the experiment, 30 seedlings had their shoot tips removed. The 30 seedlings were then divided into three groups of 10 and treated as shown in Table 3.1 and Fig. 3.1.

| Group | Treatment  |  |
|-------|--|--|
| 1     | no treatment applied   |  |
| 2     | solution of <b>J</b> applied to cut stem at apex of seedling |  |
| 3     | solution of <b>K</b> applied to cut stem at apex of seedling |  |



All the seedlings were then exposed to light from **all** directions and left for seven days.

In Part 2 of the experiment, 30 coleoptiles had their tips removed. They were then divided into three groups of 10 coleoptiles and treated as shown in Table 3.2 and Fig. 3.2.

| Group | Treatment   |  |
|-------|---|--|
| 4     | no treatment applied                                  |  |
| 5     | solution of <b>J</b> applied to cut tip of coleoptile |  |
| 6     | solution of <b>K</b> applied to cut tip of coleoptile |  |





Fig. 3.2

The coleoptiles in groups **4**, **5** and **6** were then exposed to light from **one direction**, as shown in Fig. 3.2, and left to grow for two days.

(i) Identify three variables that must be controlled in this experiment to produce valid results.

Control variables are what needs to be kept constant so that they do not

affect the dependent variable:

• Seedlings have the same genotype/ size/ age/ height/ mass and are

the same **species** 

[3]

Different types of seedlings may have different responses to the hormones.

- The **same volume of solution** has to be consistently applied in the procedure.
- The routine of watering the seedlings must be maintained and consistent for all seedlings.
- The light intensity must be kept constant

As this will affect the rate of photosynthesis, which in turn will

affect growth rate.

The temperature must be kept constant,

As temperature affects the kinetic energy of molecules, and

reactions can work faster at higher temperatures.

(ii) Groups 1 and 4 were controls in this experiment.

Explain why these controls were necessary.

• Control tests are necessary for this experiment because they allow an

observation of the response of seedlings without the treatment.

• Controls allows the effect of the treatment to be **compared**.

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[1]

The observations at the end of each part of the experiment are shown in Table 3.3.

| Group | Treatment               | Observations  |
|-------|-------------------------|---|
| 1     | none                    | increase in stem length of 10 mm and growth of lateral buds |
| 2     | J on cut stem apex      | no growth of lateral buds                                   |
| 3     | K on cut stem apex      | increase in stem length of 40 mm and growth of lateral buds |
| 4     | none                    | vertical growth of the coleoptiles                          |
| 5     | J on cut coleoptile tip | growth of the coleoptiles towards the light source          |
| 6     | K on cut coleoptile tip | vertical growth of the coleoptiles                          |

## Table 3.3

(iii) Using the information from Table 3.3, identify the contents of bottles **J** and **K and** give reasons for your answer.

[3]

• J must be auxin because of the growth of group 5 towards the light source

which is evidence of **positive phototropism** (growth towards light).

• It also shows **inhibition of lateral buds** in group 2.

This is **apical dominance**, which is controlled by auxin.

• K is gibberellin because there is a greater increase in stem length in group 3.

• It also causes growth of lateral buds in group 3.

- axon myelin sheath mitochondrion vesicle containing acetylcholine
- (b) Fig. 3.3 is a diagram representing the neuromuscular junction in mammals.



- (i) What type of molecule forms ion channels W and X?
  - Protein

Ion channels are pore-forming membrane proteins that allow ions to

pass through the channel pore.

- (ii) Identify region Y.
  - Synaptic cleft

The synaptic cleft is the region between the **presynaptic** cell and the

postsynaptic cell across which neurotransmitters diffuse.

(iii) Name the enzyme found in region Y.

• Acetylcholine esterase

Presynaptic vesicles release **acetylcholine** into the synaptic cleft, where it binds to its **receptor**. Next to the receptor is **acetylcholine esterase**, the enzyme which breaks up acetylcholine into **acetate** and **choline**. This can then be **re-packaged** into the pre-synaptic cleft, ready to be release upon another action potential.

[1]

[1]

[1]

(c) As mammalian muscle uses energy to contract, it needs an energy supply.

Complete the following passage by choosing the best term to fill each gap.

Most ATP for muscle contraction is generated by aerobic respiration in organelles called aerobic respiration called Oxidative phosphorylation If the oxygen supply is insufficient, ATP can also be obtained from anaerobic respiration, in which pyruvate is converted to the toxic product .... Lactate A third source of ATP in muscle involves the transfer of a phosphate group to ADP from a substance called ..... creatine phosphate During the contraction of skeletal muscle, energy from ATP is used to break the Cross-bridge Myosin head

..... that hold the actin and ......

together.

[Total: 16]

[6]