

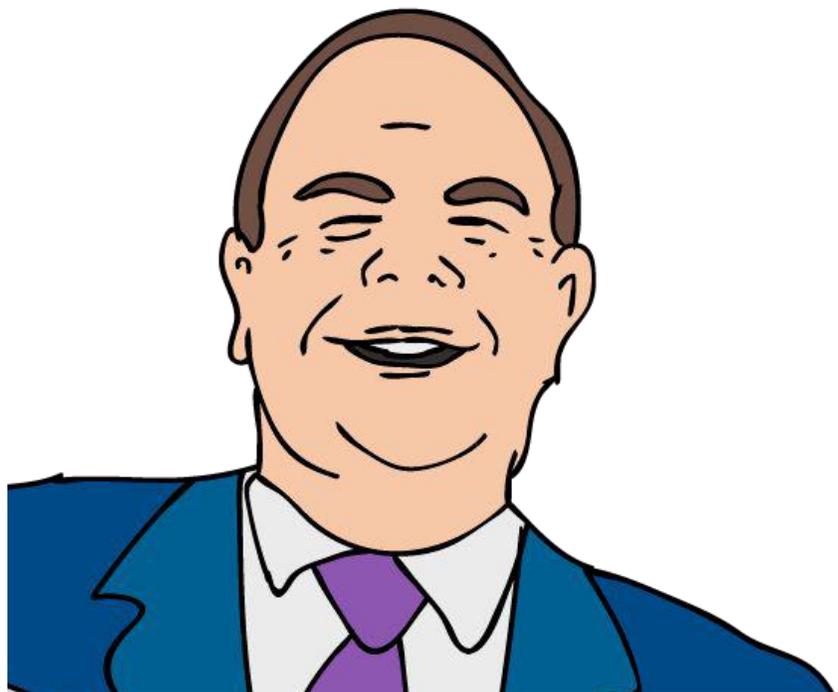
Exam Technique



What are we going to cover?

- **Interpreting questions**
- How to **set out answers**
- Examples of **command words**
- Tried and tested **exam wisdom**

What do the examiners say?



“Many students experienced difficulties by **missing important details** in both questions and their answers.”

“There were a number of questions where it was obvious candidates had **not read the question** properly.”

“The paper is set so that the **questions cover the specification as widely as possible** and **test as many skills** as possible.”

Which information?

Context – this should help you identify the part of the specification that is relevant to the question

Q: There is a debate about the name of a species of snake. Some scientists name it *Liasis papuana* and other scientists name it *Apodora papuana*.

Give the name of the taxon about which the scientists disagree.

Commands – these tell you what form you must write your answer in

Directions – these tell you specifically what information you need to include in your answer

Interpreting Questions

You will find that questions tend to come in 7 different types:

- **Statement Questions** ~1 Mark
- **Simple Explanatory/ Descriptive Questions** ~2 Marks
- **Calculation Questions** ~2 - 3 Marks
- **Explanation/Qualitative Questions** ~3 Marks
- **Experimental & Data Analysis Questions** ~4 Marks
- **Extended Responses** ~5 - 6 Marks
- **Essay-style Questions (AQA only)** ~25 Marks

Statement Questions

- Test of **rote learning** – your ability to **remember facts**
- Questions usually require information from the **specification**
- May have some **context** from which you will need to extract the **subject** of the question

Command Words:

- **State**
- **Define**
- **Name**
- **Give**
- **Which**

Examples:

- Give the two types of...
- Name the...
- Which of the following...
- Define the term...

Statement Questions - Command Words

Name/State: Give a **simple** one word answer or a short sentence.

- **No justification or explanation** is required. You can lose marks for contradictory explanation
- Make sure to use **scientific terminology correctly**

08 . 3

There is a debate about the name of one of these species of snake. Some scientists name it *Liasis papuana* and other scientists name it *Apodora papuana*.

Give the name of the taxon about which the scientists disagree.

[1 mark]

08 . 3

There is a debate about the name of one of these species of snake. Some scientists name it *Liasis papuana* and other scientists name it *Apodora papuana*.

Give the name of the taxon about which the scientists disagree.

[1 mark]

Genus/ Genera

Define/ State what is meant by a term:

Requires a **short sentence** or **bullet-point** answer.

- It's worth **memorising** the **standard wording**
- Be as **specific** as possible – including all necessary **key words**

8 The effects of light intensity and temperature on the net primary productivity (NPP) of young willow trees were investigated.

(a) (i) State what is meant by the term net primary productivity.

(1)

.....

.....

“When asked to explain or define a scientific term do not take words directly from the stem of the question as you have not demonstrated to the examiner any additional knowledge.”



8 The effects of light intensity and temperature on the net primary productivity (NPP) of young willow trees were investigated.

(a) (i) State what is meant by the term net primary productivity.

(1)

Net primary productivity is the rate at which plants convert light energy into the chemical energy stored in biomass in a given area in a given amount of time (gross primary productivity) minus energy lost due to respiration.

Simple Explanatory/Descriptive Questions

- Test your **qualitative understanding** of biological phenomena
- May require you to **recall simple facts** and **link** your **own knowledge** to specific examples within the question
- May be combined with a **statement question**

Command Words:

- **Explain**
- **Describe**
- **Suggest**
- **Give reasons**

Simple Explanatory/Descriptive Questions - Command Words

Explain: Give **step-by-step logical reasoning** to show **how** or **why** a biological **phenomenon** or **effect** occurs.

- **Look carefully** at the **context** of the question
- Provide **reasons** or **causes** for a biological phenomena

0 2

Dengue is a serious disease that is caused by a virus. The virus is carried from one person to another by a mosquito, *Aedes aegypti*. One method used to try to reduce transmission of this disease is the Sterile Insect Technique (SIT). This involves releasing large numbers of sterile (infertile) male *A. aegypti* into the habitat. These males have been made infertile by using radiation.

0 2 . 1

Explain how using the SIT could reduce transmission of dengue.

[2 marks]

- **Don't repeat content** from the **question** in your answer!

0 2

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0 2 . 1

Explain how using the SIT could reduce transmission of dengue.

[2 marks]

The sterile mosquitoes could compete with fertile ones for

food/resources which is intraspecific competition.

Since the sterile mosquitoes cannot breed, this reduces the

total population of mosquitoes.

Describe: Describe a **process** or **structure** in context of a **specific example**.

- Often involves describing a **process** or **test** then following with the expected **result**
- You do **not need** to **give** a **reason** for why something happens

Describe **two** differences between the two images that could have been used to classify humans and chimpanzees in separate families.

.....

.....

.....

.....

.....

..... [2]

*“When describing a function, you need to describe **what they do** and **how they do it.**”*



- (a) Humans and chimpanzees are currently classified within the same family.

Chimpanzees were once classified separately from humans in the Family Pongidae along with gorillas and orang utans.

Fig. 19.2 shows a human hand and a chimpanzee hand.

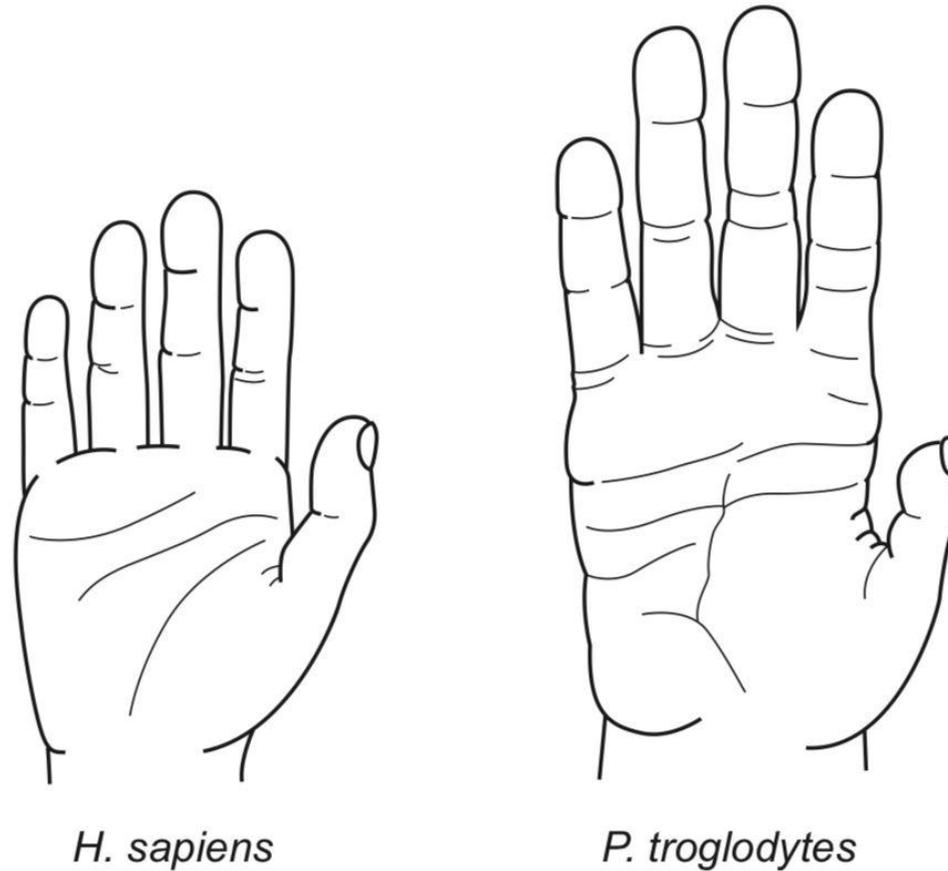


Fig. 19.2

Describe **two** differences between the two images that could have been used to classify humans and chimpanzees in separate families.

The chimpanzee has a relatively shorter thumb.

The chimpanzee has a longer palm.

OR: The chimpanzee has wider fingers

OR: The chimpanzee has wider wrists.

[2]

Suggest: Apply your biological knowledge and understanding to an unseen context

- Refer specifically to the **context** described in the question
- Give **reasons** for your **answer**
- Work out which **concept** is being **applied**

Collagen is a protein produced by cells in joints, such as the knee.

Rheumatoid arthritis (RA) is an auto-immune disease. In an auto-immune disease, a person's immune system attacks their own cells. RA causes pain, swelling and stiffness in the joints.

Scientists have found a virus that produces a protein very similar to human collagen.

Suggest how the immune response to this viral protein can result in the development of RA.

[2 marks]

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Scientists have found a virus that produces a protein very similar to human collagen.

Suggest how the immune response to this viral protein can result in the development of RA.

[2 marks]

The antibody produced against the viral antigen will also bind to

the collagen present in human joints, resulting in its destruction.

Calculation Questions

- Test **quantitative** understanding
- Sometimes requires recall of the **correct formulae**
- May require **interpreting** data set, figures and graphs to obtain values of variables required for the calculation

Command Words

- **Calculate**
- **Show your working**
- **Determine**

Calculation Questions - Command Words

Calculate: Work out a **numerical** answer **mathematically**, usually using an **equation** provided in the question.

- Include the correct **units** and number of **significant figures** in your answer
- You can also determine **equations** from the **units** used in the **question**

- (a) Different bodily fluids have different concentrations of the different molecules.
- (i) Calculate the order of magnitude by which concentration of copeptin in the **faeces** is higher than the concentration of C-reactive protein in the **saliva**.

Show your working.

Answer = molecules cm^{-3} [2]

17 Cirrhosis of the liver can result from long-term liver damage. Alcohol or other toxins can cause this damage.

Scientists have suggested that cirrhosis can be detected by taking samples of body fluids and testing them for two different molecules: C-reactive protein and copeptin.

The liver produces these two molecules, and increased levels can indicate liver damage due to cirrhosis.

Different bodily fluids from a patient suspected of having cirrhosis were tested for C-reactive protein and copeptin.

Fig. 17.1 is a graph of the results.

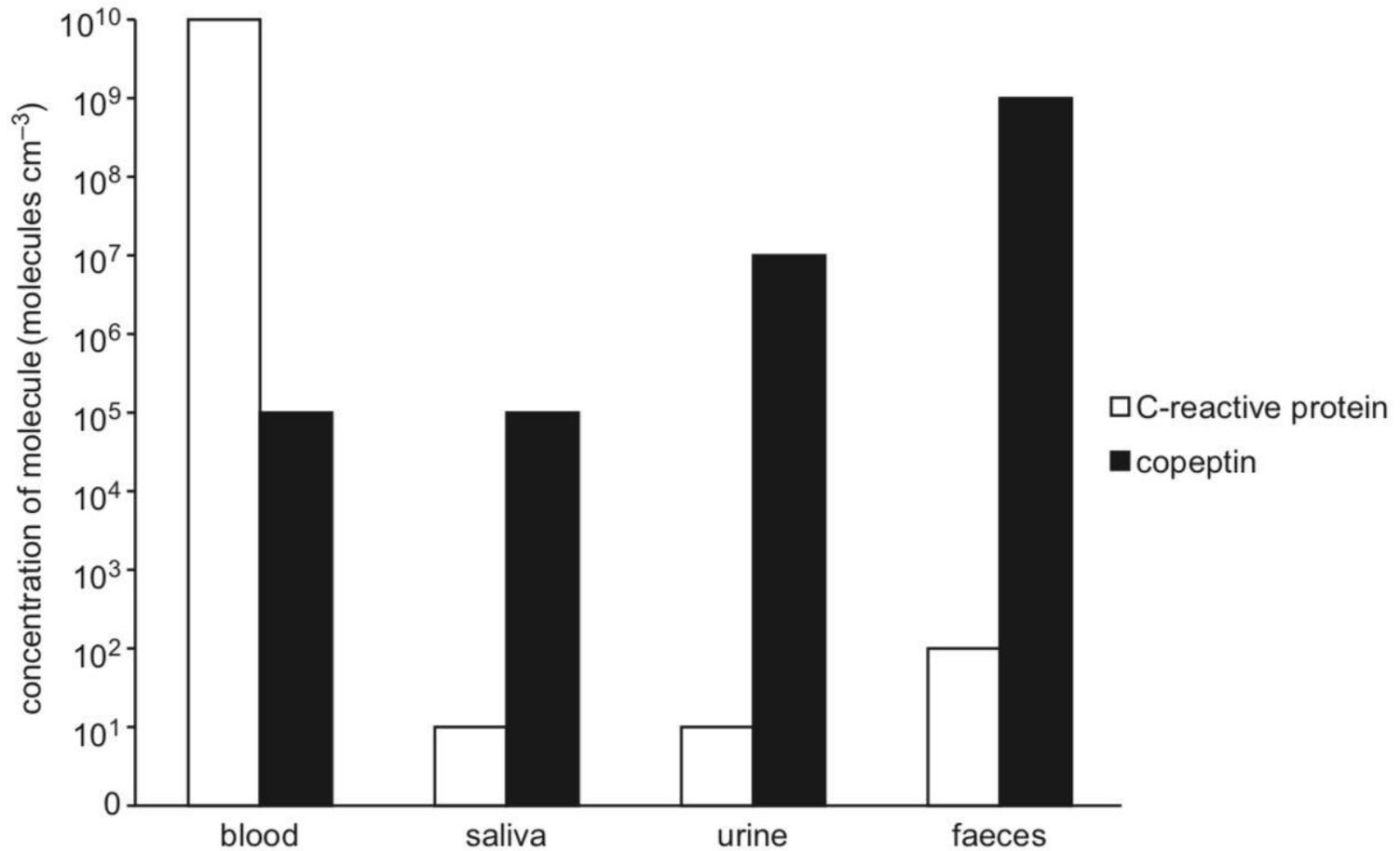


Fig. 17.1

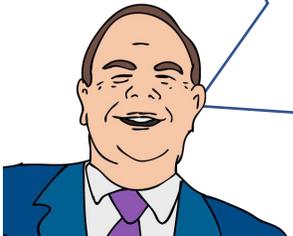
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Show your working.

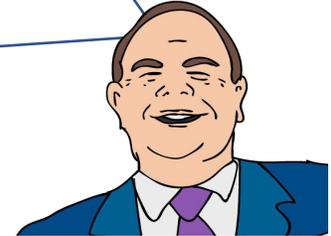
$$\frac{10^9}{10^1} = 10^8$$

Answer = $\frac{10}{8}$ molecules cm^{-3} [2]

Words of Wisdom



*"Candidates should **substitute numerical values** into an equation **before re-arranging**, as this can show a correct use of the equation even if the final answer is incorrect."*



*"If the answer line does not give a unit it is always a good idea to **write the correct units** next to your answer"*

Explanation/Qualitative Questions

- Test of your **qualitative understanding** of biological phenomena
- Test your ability to describe **more complex processes** and **hypothesise** based on provided information
- Include **longer explanations** and **multiple linked** points

Command Words:

- **Explain**
- **Describe**
- **Outline**
- **Comment**

Examples:

- Using your knowledge, explain...
- Explain why...
- Analyse how...
- Comment on...

Explanation/Qualitative Questions - Command Words

Outline: Write about the **main points** in a **topic**.

- Ensure to use **correct terminology**
- **Bullet points** can help you structure your **answers**

Ecologists investigated changes in grassland communities on large islands off the coast of Scotland between 1975 and 2010. On each island, they used data from a number of sites to determine the change in mean species richness and the change in mean index of diversity.

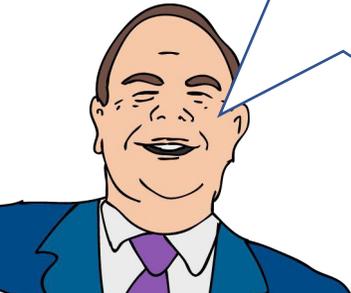
Outline a method the ecologists could have used to determine the plant species richness at one site.

[3 marks]

Ecologists investigated changes in grassland communities on large islands off the coast of Scotland between 1975 and 2010. On each island, they used data from a number of sites to determine the change in mean species richness and the change in mean index of diversity.

Outline a method the ecologists could have used to determine the plant species richness at one site.

[3 marks]



*"Read your answer back and check if it **fully answers** the question asked."*

The ecologist would have selected the various places to sample at random
at the site e.g. a map grid with coordinates selected using a random
number generator. They would have placed a quadrat at these various
randomly selected places. They would have then counted the number of
different plant species present in each of these quadrats.

Data Analysis Questions

- Test **applied** and **experimental skills** in **unseen contexts**
- May ask you to **analyse** and **evaluate** (including **comparison**) data and figures
- **Data** and **information** (including extraneous info) will be provided in the **context** of the question

Command Words:

- **Describe**
- **Explain**
- **Summarise**
- **Analyse**
- **Deduce**
- **Compare/Contrast**

Data Analysis Questions- Command Words

Describe and Explain: Write **what** the **data shows** and **give reasons** for **why** it shows that

- When describing, you **must** present **relevant figures** when describing data
- When explaining, give a well-developed line of **reasoning** which is **clear** and **logically structured**
- Use your **own knowledge and information** from the **context** of the **question** to **back up** your **reasoning**



An investigation was carried out into the effects of two plant growth substances, gibberellins and auxins, on apical dominance. The terminal (apical) buds of a number of pea plants were removed and discarded. The tops of each of the remaining shoots were given one of the following treatments:

- Coated with a paste containing gibberellin.
- Coated with a paste containing auxin (IAA).
- Coated with a paste without any plant growth substance.

In addition, a control group of plants did not have their terminal buds removed and were not coated with paste.

The growth of the side shoots was measured at regular time intervals and a mean value calculated. The results are shown in Fig. 6.1.

Using data from Fig. 6.1 describe **and** explain the effect of auxin (IAA) on the growth of side shoots.

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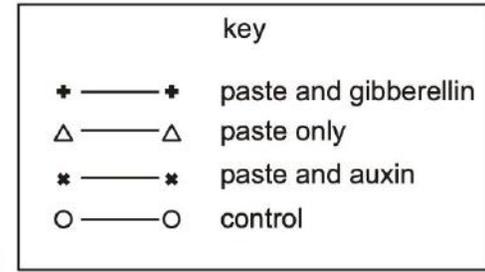
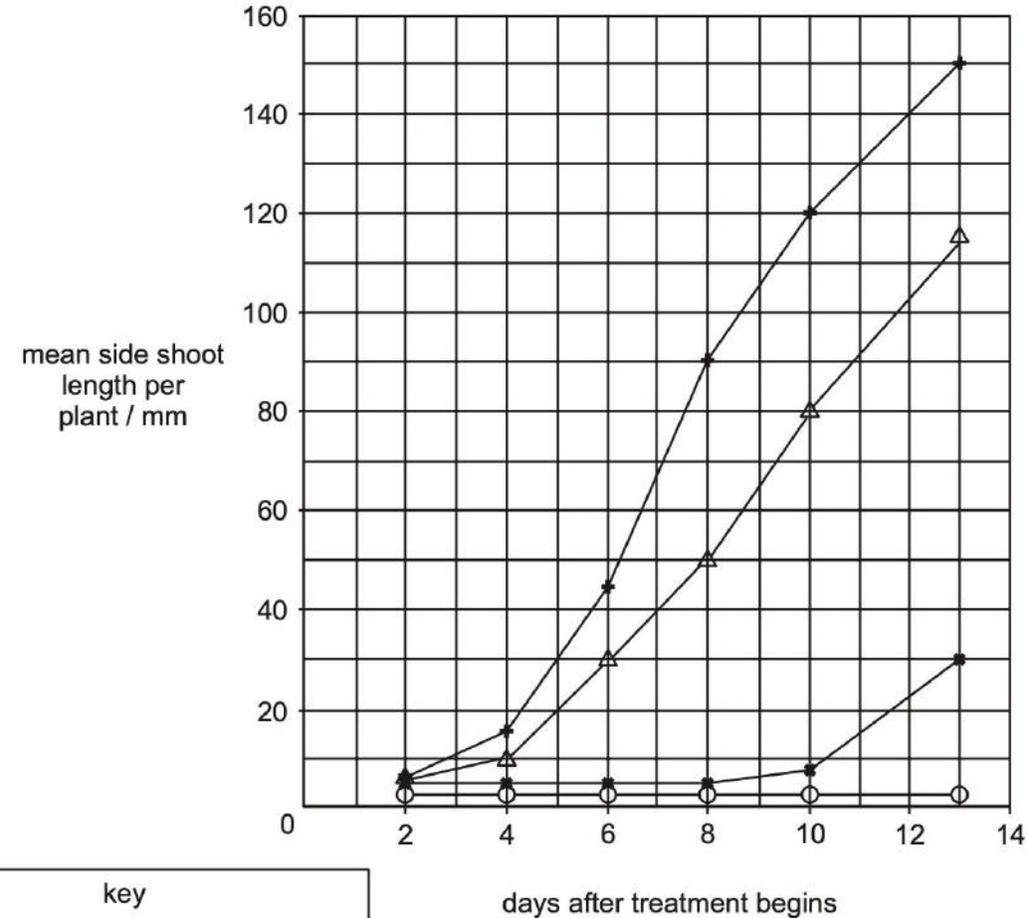
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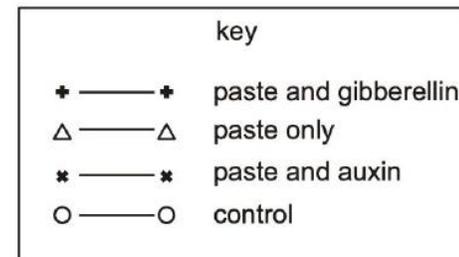
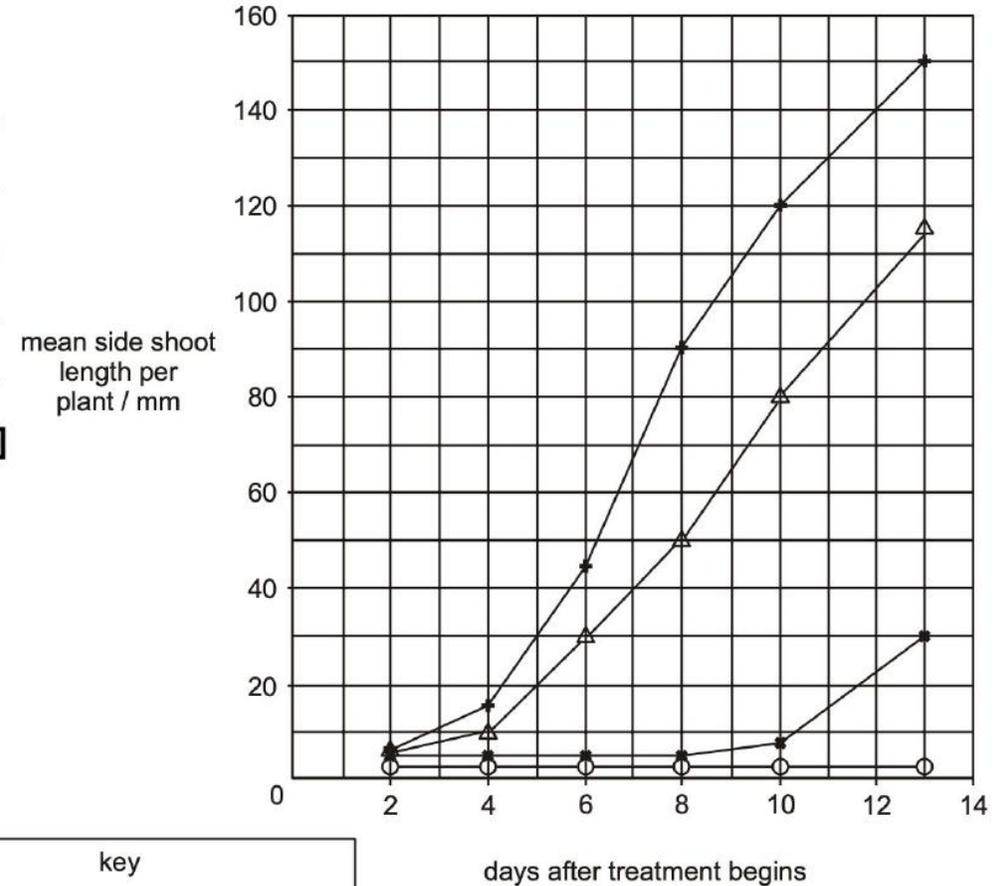
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[3]

Using data from Fig. 6.1 describe **and** explain the effect of auxin (IAA) on the growth of side shoots.

The graph shows that there is no growth of side shoots up to day 8. Between day 8 and day 10, growth of side shoots occurs slowly, and then grows faster up to day 13. The period of no growth occurs because auxin moves out of the paste and inhibits growth of the shoots. After 10 days, the auxin is all used up so side shoots start growing again. [3]



Summarise: Present **only** the **main points/trends**.

- Does **not** require reasoning behind **conclusions**
- Use all the **information provided** in the **data set**

State **three** conclusions that you can draw from the data in the table.

1

.....

2

.....

3

.....

[Total 3 marks]

Small soil animals of two arthropod orders – **mites** and **springtails** – were studied in several areas of forest on Vancouver Island. Each of the areas was similar in slope and soil type.

The study areas had different stages of tree growth. In each area, mites and springtails were extracted from soil samples and counted. The species of springtail in each sample were identified. The species of mite were not identified.

Some of the data from the investigation are shown in the table below.

	numbers per 100 g of soil		
stage of tree growth	mean number of individuals of all types of mite	mean number of individuals of all types of springtail	mean number of species of springtail
tree seedlings	1375	125	9
young trees	2564	300	13
mature trees	1981	312	11
climax forest, not cut or burned since records began	2890	715	16

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tree seedlings	1375	125	9
young trees	2564	300	13
mature trees	1981	312	11
climax forest, not cut or burned since records began	2890	715	16

State **three** conclusions that you can draw from the data in the table.

- 1
 The population of mites and springtails is much greater in the climax forest than in tree seedlings, young trees or mature trees.

- 2
 The number of species of springtail is the greatest in the climax community.

- 3
 There is a greater population of mites than springtails in each sample.

Scientists have investigated the effect of UV-B on both chlorophyll and flavonoid

A group of plants was exposed to UV-B for 20 minutes per day for one month. The chlorophyll and flavonoid content of each plant were then determined and the means calculated.

This was repeated for three more groups of plants. Each group was exposed to UV-B for different lengths of time. All other variables were kept constant.

The results are shown in the table.

Length of time exposed to UV-B / minutes	Mean chlorophyll content / arbitrary units	Mean flavonoid content / arbitrary units
0	32	25
20	30	24
40	27	39
60	24	40

- (i) Compare and contrast the effect of length of exposure to UV-B on the chlorophyll and flavonoid content of these plants.

(3)

Exposure to UV-B for 20 mins decreases both the mean chlorophyll content and the mean flavonoid content.

Exposure to UV-B for longer than 20 min causes the mean chlorophyll content to decrease and the mean flavonoid content to increase.

Exposure to UV-B results in a greater change in the mean flavonoid content compared to the mean chlorophyll content.

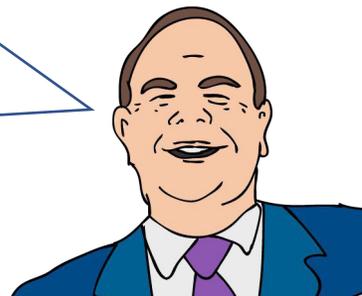
Extended Answer Questions

- Test ability to **write** and structure **longer answers**
- Marks available for **structure** and **coherence** of arguments, along with **relevant points**
- Longer questions can also ask you to **plan** and describe your own experiment, including by **drawing diagrams**

Command Words:

- **Evaluate/Discuss**
- **Compare/Contrast**
- **Explain**
- **Describe**
- **Devise/Design**

*"Many students **struggled** with answers that required **extended writing**, particularly those involving some **reasoning**."*



Evaluate/Discuss: Present **key points** from a **range** of **arguments** or the **strengths** and **weaknesses** of an **argument**.

- Be sure to consider **more than one side** of the argument
- Provide a **detailed** account of the arguments

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

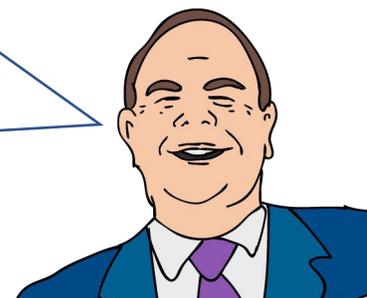
The firm made the following claim on their packaging:

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.

.....

*"If the question asks for risks and benefits to be evaluated, make sure that the **risks** are **not just disadvantages** – there is a difference."*



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.

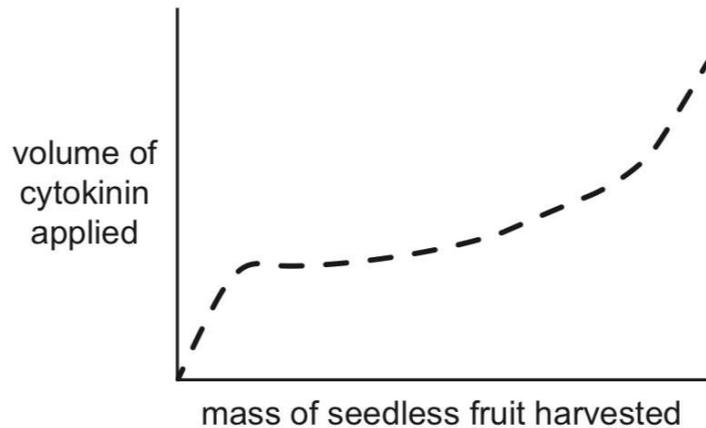
The firm investigated the effect of adding different volumes of each cytokinin on the production of seedless fruit.

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

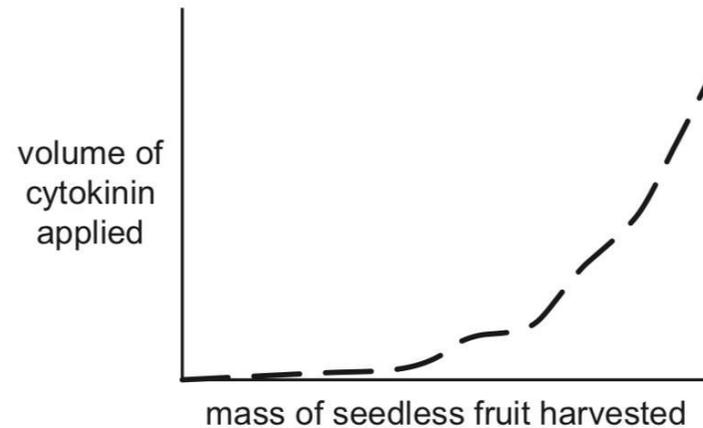
Fig. 21 is a summary of their results.

Fig. 21

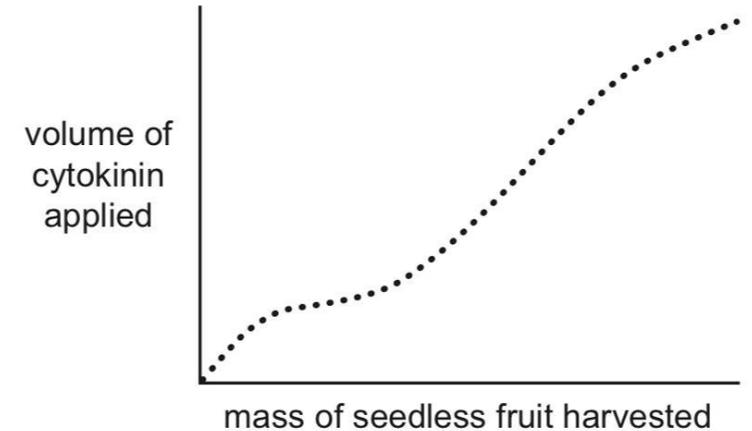
A – kinetin



B – zeatin



C – diatin



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

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

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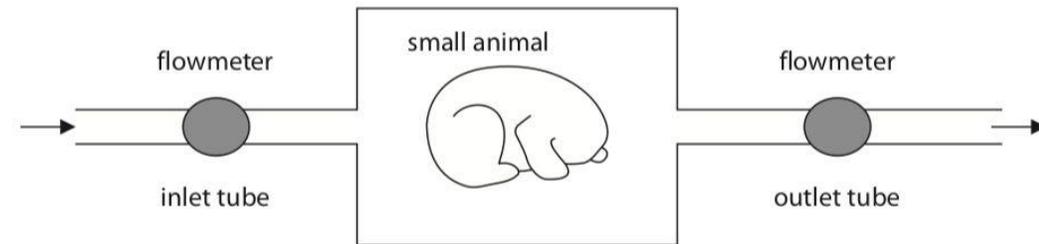
The graph shows that the mass of the harvested seedless fruit increases as the volume of diatin applied is also increased. However, no error bars or statistical tests for the data have been provided, which means that the significance of the correlation cannot be quantified. Correlation also does not equal causation. Furthermore, the lack of units and wrong labelling on the axes, call the results into question. The species of plant studied and the concentration of diatin used are also not specified, no control variables (e.g. temperature, CO₂ concentration, etc.) are indicated, no control group is mentioned and no repeats are shown. All of these factors mean that the claim made by the firm is largely scientifically invalid and unreliable.

Devise: Clearly describe and explain how to **conduct an experiment**. Discuss any **uncertainty** in your method.

- Use **experimental terminology**, (e.g: the names of pieces of **apparatus**)
- You may need to draw a **diagram** to illustrate your answer or **plot a graph** and **line of best fit** to determine a **variable** from **data**

(iii) The data for calculating metabolic rate are collected using a respirometer.

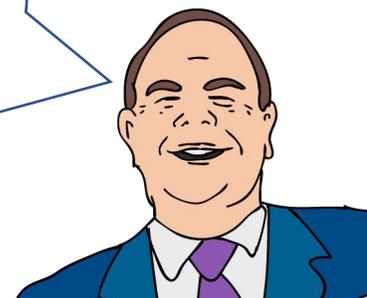
The rate of respiration for small mammals can be measured using a continuous flow respirometer. A continuous flow respirometer circulates air through a chamber containing the animal. The rate of air flow can be measured using flowmeters on the inlet and outlet tubes.



Devise a procedure using a continuous flow respirometer to collect the data required to calculate the metabolic rate of an arctic ground squirrel.

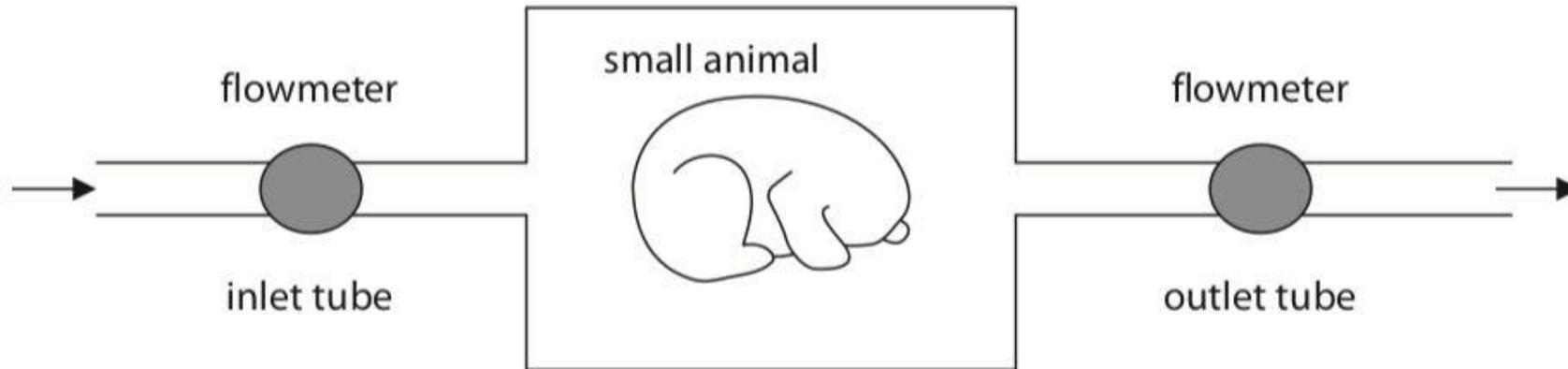
(4)

*"Describe the **independent variable** and how it will be applied, the **dependent variable** and how it will be **measured**. Then try to describe valid variables that will need to be **controlled**. Repeats on its own is not worthy of a mark – link to specific situations "*



(iii) The data for calculating metabolic rate are collected using a respirometer.

The rate of respiration for small mammals can be measured using a continuous flow respirometer. A continuous flow respirometer circulates air through a chamber containing the animal. The rate of air flow can be measured using flowmeters on the inlet and outlet tubes.



Devise a procedure using a continuous flow respirometer to collect the data required to calculate the metabolic rate of an arctic ground squirrel.

(4)

A solution of potassium hydroxide must be used to absorb the carbon dioxide produced by respiration. The volume of air entering and leaving the chamber through the inlet and the outlet tubes has to be measured. Any decrease in the volume of air represents the oxygen taken up by the squirrel for respiration. Environmental variables such as temperature of the chamber need to be controlled using water baths . The measurements need to be taken for a few minutes. The metabolic rate can be calculated by dividing the volume of oxygen used in a unit of time by the measured body mass of the squirrel.

Essay-style Questions (AQA only)

- Test **understanding** and **application** – holistic approach
- **Structured** - select **five** or **six** examples (four is the minimum) and **write a paragraph** about each, **linking** it back to the key theme or idea
- You don't need to write an **introduction** or a **conclusion**
- Use **A-Level terminology** throughout

Command Words:

- **Evaluate/Contrast**
- **Explain/Discuss**
- **Describe**
- **Devise**

10(a) The importance of the specific shapes of molecules in organisms.

Question	Marking Guidance	Mark	Comments
10(a)		25	
P	3.1.2 Proteins and enzymes		
C	3.1.2 and 3.2.4 . Glucose, starch, cellulose		
T	3.1.3 Plasma membranes and transport across and absorption		
I	3.1.6 Immune response		
D	3.2.2 and 3.5.6 DNA, genes and polypeptide synthesis		
M	3.2.5 and 3.2.10 and 3.5.6 Replication of DNA and mutations		
H	3.2.4 . Haemoglobin		
Pr	3.4.3 and 3.4.4 Photosynthesis and respiration		
R	2.5.1 and 3.5.4 Receptors (and specificity)		
N	2.5.2 Nerve impulses and synapses		
Mc	2.5.3 Muscle contraction		
Hf	3.5.4 and 3.5.5 Hormones and feedback systems		
Ge	3.5.7 Gene expression		
Gt	3.5.8 Gene therapy and medical diagnosis		

Top Tips

Use the right words...

Avoid saying...

Smaller structures have a larger surface area.

Instead say...

Smaller structures have a **larger surface area to volume ratio** than bigger structures.

Top Tips

Use the right words...

Avoid saying...

“Energy is **produced** in respiration”

Instead say...

“Energy is **released** in respiration”

Top Tips

Use the right words...

Avoid saying...

“oxygen is breathed in,
carbon dioxide is breathed
out”

Instead say...

“exhaled air contains a
**lower concentration of
oxygen** and a **higher
concentration of carbon
dioxide** than inhaled air”

Top Tips

Use the right words...

Avoid saying...

“the cell membrane is
semi-permeable”
(sometimes still accepted)

Instead say...

“the cell membrane is
partially permeable”