

Biology paper two

Stretch and challenge booklet



Exam command words

Command words are the words and phrases used in exams that tell students how they should answer a question.

The following command words are taken from Ofqual's official list of command words and their meanings that are relevant to this subject.

Calculate	Use numbers in the question to work these out.	Draw	Produce, or add a diagram.
Choose	Select from a range of alternatives.	Estimate	Give an approximate value.
Compare	Describe similarities/differences.	Use	The answer must include the information in the question.
Define	Specify the meaning of something.	Work out	Students should use numbers in the question.
Describe	Recall facts, events or process in an accurate way.	Write	Short answer, no explanation or description.
Design	Set out how something will be done.	Evaluate	Students should use the information provided as well as their own knowledge and consider evidence for or against.
Determine	Use the data provided to work out your answer.	Explain	Students should make something clear, or state reasons for something happening.
Give	Short answer only.	Identify	Name or characterise.
Label	Add words to complete a diagram, picture or graph	Justify	Use evidence from the information supplied to support your answer.
Measure	Find an item of data for a given quantity.	Name	Single word or phrase.
Plot	Mark on a graph.	Plan	Write a method.
Predict	Give a plausible outcome.	Show	Provide structured evidence to reach a conclusion.
Suggest	Apply your own knowledge.	Sketch	Draw approximately.

Scientific key words

These are keywords often used in questions. You need to be able to recognise and use them in your answers.

Hypothesis	A scientific statement that explains certain facts or observations	Anomaly	A result that does not fit the pattern
Prediction	This describes what you think will happen in an experiment	Accuracy	How close the reading is to the true value
Independent variable	This is the variable that is changed during an investigation. There should only be one of these.	True value	This is the real value of a measurement in an experiment
Dependent variable	This is the variable that changes as a result of a change in the independent variable	Precision	This is determined by the scale on the measuring apparatus e.g. a ruler marked mm is more precise than one in cm
Control variable	Variables that remain constant, to make sure that an investigation is valid	Resolution	The smallest change that can be read from a measuring device for example a ruler measured in mm or cm
Fair test	This is where only the independent variable is changed and the others controlled	Calibration	When we make sure that the measuring apparatus is making correct readings e.g. the temperature of melting ice is 0 degrees Celsius
Valid	The results and conclusions will be this if the variables are correctly controlled	Measurement error	The difference between the real value and the measured value
Categoric variable	A variable that can be described by a label or category such as colour or surface	Random error	This error causes measurements to be spread around the true value – can be reduced by taking repeats and calculating a mean
Continuous variable	A variable which can have any numerical value	Zero error	When a piece of measuring equipment should be reading zero but it doesn't
Interval	This is the difference between the values of your independent variable	Systematic error	This is an error that is always the same for each repeat – usually because of an error in the equipment used
Range	The maximum and minimum values of the independent or dependent variables e.g. 'from 10cm to 50cm'	Uncertainty	When the results obtained are not as accurate as they could be due to the procedure carried out
Data	Information or measurements that you collect	Repeatable	If the same person can get the same reading using the same equipment and method
Datum	One piece of information	Reproducible	If another person can get the same result (trend/specific results) using the same method and equipment or with different method or equipment.

Biology paper 2 checklist

Homeostasis & Response		
Define homeostasis and explain why it is important Give examples of conditions that are maintained in the body		
Name the different types of receptor humans have and describe how they react to a stimulus		
Know what the words receptor, sensory neurone, relay neurone, motor neurone, effector and synapse refer to and use them to describe a response		
Describe how nerve impulses travel and how they cross the synapse		
Explain what a reflex is and be able to label a diagram of a reflex arc		
Describe how the parts of the nervous system are adapted for their function		
Explain the importance of reflexes		
Describe a method to test reaction time, identifying variables and processing data obtained		
Describe the structure and function of the endocrine system, identifying major endocrine glands in the human body		
Describe what a hormone is and explain the main differences between hormonal and nervous responses		
Describe how blood sugar varies and is normally controlled by insulin		
Describe the role of glucagon in maintaining blood sugar levels, including negative feedback		
Describe and compare Type 1 and Type 2 diabetes in terms of the control of sugar and treatments		
Name and describe the effects of the hormones involved in controlling the female menstrual cycle		
Describe the interaction of FSH, LH, oestrogen and progesterone in the menstrual cycle and interpret graphs of hormone levels		
Describe and evaluate forms of contraception (pill, injection, condom, IUD, spermidical agents, sterilisation, diaphragm etc)		
Describe the use of fertility treatments & IVF and evaluate them in terms of cost, ethics, medical/health, success rates, stress on the parents,		
Define negative feedback		
Describe the roles of adrenaline and thyroxine in the body and explain how thyroxine levels are controlled by negative feedback		
Inheritance, Variation & Evolution		
Explain what is meant by the terms 'sexual' and 'asexual' reproduction and the differences between them		
Describe the main stages of the production of gametes by meiosis		
Explain the differences between mitosis and meiosis in terms of daughter cells		
Describe the structure of DNA and define the term genome		
Describe the importance of understanding the genome		
Define key genetic terms – allele, heterozygous, homozygous, dominant, recessive, genotype and phenotype		

Complete punnett squares to show the possibilities for offspring of a genetic cross and interpret them using direct proportion and ratios		
Describe the chromosome make up of men and women and use genetic crosses to show how gender is inherited		
se and interpret family tree diagrams		
Construct genetic diagrams and use theory of probability to interpret results		
Describe the inheritance of the diseases polydactyly and cystic fibrosis		
Evaluate the use of embryo screening to prevent these and other inherited diseases		
Explain why Darwin's theory of natural selection was not well accepted at first and contrast his theory with that of Lamarck		
Define the reasons for variation within a species and across species		
Explain the role of mutations in variation		
Describe the theory of evolution		
Apply the theory of natural selection to explain how organisms have changed over time		
Explain how different species arise over time		
Describe 'selective breeding' and give examples of where it is used		
Give the disadvantages of selective breeding in terms of the gene pool		
Describe how plants, animals and bacteria can be genetically engineered and evaluate this – e.g +/- of genetically modified foods, production of insulin by GM bacteria		
Describe the main steps in genetic engineering of crops and bacteria		
Describe the evidence for evolution – fossils, antibiotic resistant bacteria etc		
Explain what fossils show u, how they were formed and why the fossil record is incomplete		
Interpret evolutionary trees and explain why organisms may go extinct		
Explain how antibiotic resistant bacteria form and how we can try to prevent this		
Describe Linnaeus' classification system		
Describe the more recent 'three-domain' system		
Ecology		
Describe and explain adaptations for animals and plants – especially ones that live in extreme conditions		
Explain what 'extremophiles' are and give examples		
Define biotic and abiotic factors and explain how they can affect the organisms in a community		
Describe the flow of energy through food chains		
Describe methods of determining abundance of organisms within a habitat – using quadrats.		
Name the processes involved in the cycling of carbon and water and describe the importance of this		
Explain how waste, pollution, deforestation and global warming have impacted biodiversity		
Describe some of the biological consequences of global warming		
Describe measures to restore biodiversity and evaluate them		

Required practical activities



Effect of a stimulus on reaction time

What do I need to know?

- Structure of a reflex arc
- How to investigate the effect of caffeine on reaction time
- How to convert between seconds and milliseconds

What can I be asked?

- To label the individual parts of a reflex arc
- How to carry out a practical that affects reaction time
- To evaluate the method carried out by other students
- To calculate mean/mode/median/range

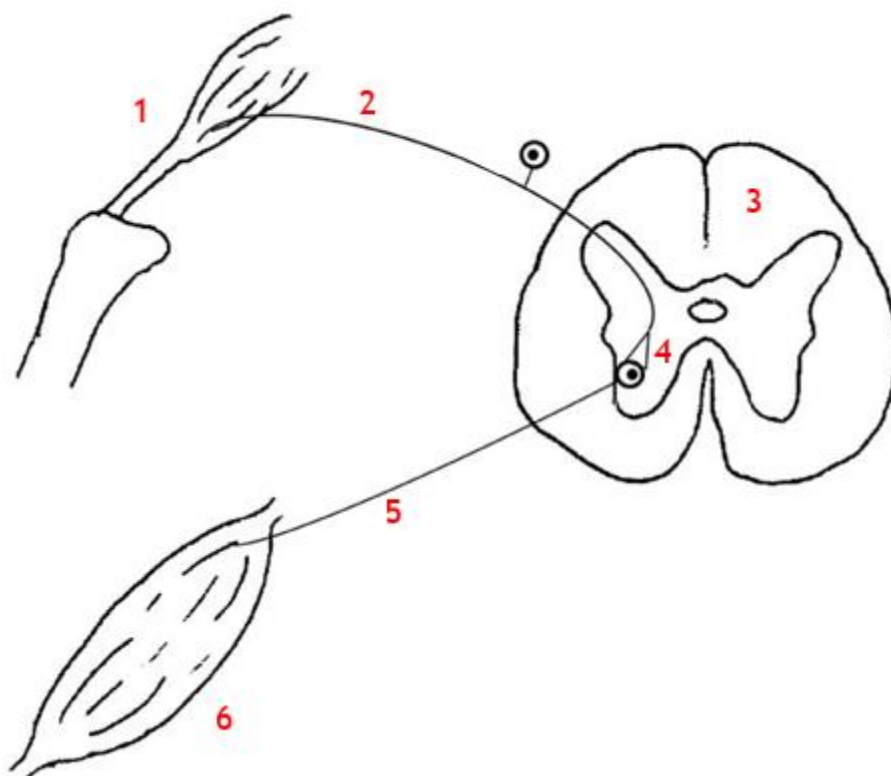
Method

You have an independent variable - what you are investigating the effect of. This could be caffeine or music or gender or anything else!

Reaction time is measured. This can be by catching a ruler, pressing a button or speaking or whatever else the exam question tells you.

Remember: Sometimes units need to be converted in to time, e.g. the length of the ruler caught, in order to give a reaction time.

Add labels to the diagram below to show what numbers 1 to 6 are.



A student notices that the length of grass changes the further away the grass is from the tree. He uses a metal 5m x 5m frame and places it on the ground at regular intervals.

Give the name of the frame: _____

Below are the student's results. Calculate the range:

Distance from tree (m)	Height of grass in cm
2	2
4	2
6	3
8	5
10	8

Range of results _____

Give two ways in which he could have improved his experiment:

1.
.....
2.
.....

The student gave the following conclusion:

“As distance away from the tree increased the height of grass also increased. This has to be because the plants are getting more sunlight”

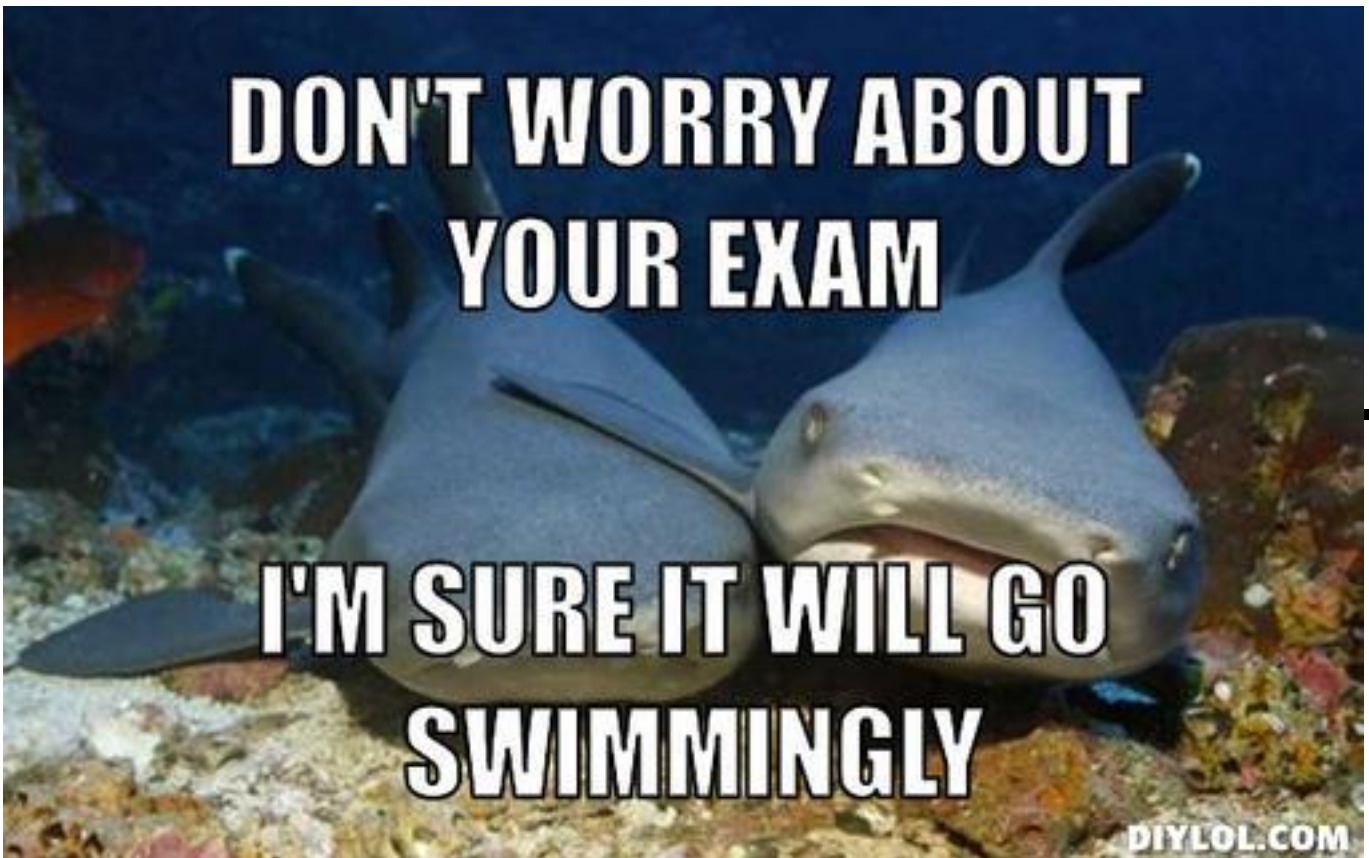
Suggest why the student is correct in his conclusion (2)

.....
.....

Suggest **one** other reason for the results shown above (1)

.....
.....

Exam questions



1.

Caffeine is a drug that decreases reaction time.

A group of sixteen students investigated the effect of caffeine on reaction time.

The students were all 15-year-old girls.

The group was divided into 8 pairs of students.

This is the method used.

1. Student **A** starts two stopwatches at the same time.
 2. Student **A** then gives one of the stopwatches to Student **B**.
 3. Student **A** says “stop” at the same time as stopping her stopwatch. Student **B** stops her stopwatch as quickly as possible after Student **A** says “stop”.
 4. The difference in time shown on the two stopwatches is recorded. This is the reaction time of Student **B**.
 5. Student **B** drinks a caffeinated drink.
 6. The students wait 15 minutes and then repeat steps 1 to 4.
- (a) Suggest **one** control variable the students should have used in the investigation.

Do **not** refer to age or sex in your answer.

(1)

(b) Suggest **two** sources of random error when using this method to measure a person's reaction time.

1 _____

2 _____

(2)

The table below shows the results.

Student pair	Decrease in reaction time after drinking the caffeinated drink in seconds
1	0.039
2	0.021
3	0.027
4	0.041
5	0.022
6	0.036
7	0.024
8	0.097

(c) Why can a mode **not** be determined for the data in the table above?

(1)

(d) The students decided the result from pair **8** was anomalous.

The students calculated that the mean decrease in reaction time was 0.030 seconds.

Describe how the students calculated the mean decrease in reaction time.

(1)

(e) Caffeine causes the release of adrenaline.

Adrenaline affects heart rate.

Explain how the effect of adrenaline on heart rate might cause reaction time to decrease.

(4)

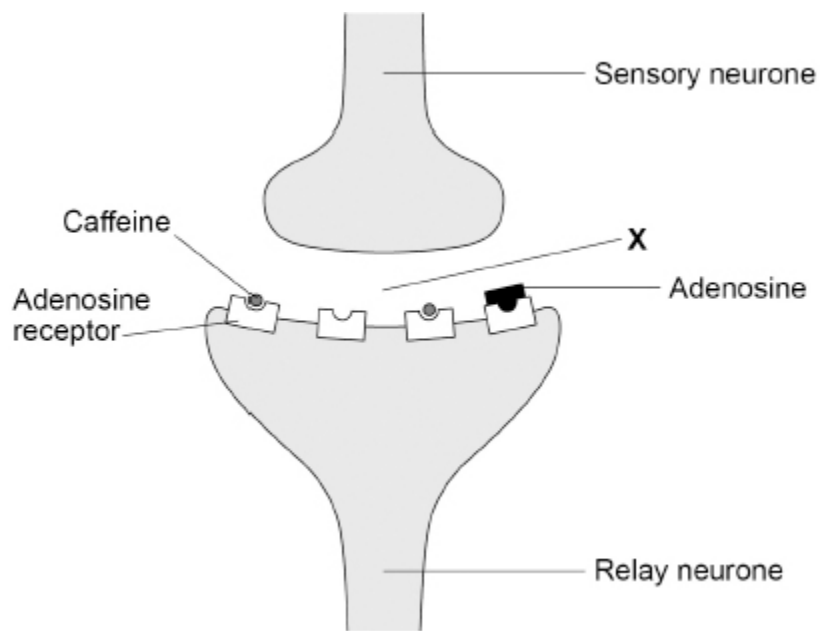
Adenosine is a different chemical made by the body.

Adenosine binds to receptors on relay neurones.

Adenosine decreases the number of impulses in relay neurones.

The figure below shows how caffeine binds to adenosine receptors on a relay neurone.

When caffeine binds to adenosine receptors it blocks the receptor so adenosine cannot bind.



(f) Label **X** shows the gap between the sensory neurone and the relay neurone.

What is the name of the gap labelled **X**?

(1)

(g) Suggest why reaction time decreases when caffeine binds to adenosine receptors.

(2)

(Total 12 marks)

2.

Control of blood glucose concentration is an important aspect of homeostasis.

When the blood glucose concentration is too high the hormone insulin is released.

(a) Name the hormone released when the blood glucose concentration is too low.

(1)

(b) Explain how the **two** hormones keep the blood glucose concentration at the correct level in a healthy human body.

(5)

The two hormones which control blood glucose concentration are proteins.

Proteins are made according to information stored in the DNA structure of genes.

(c) Describe the structure of DNA.

(2)

(d) Describe how DNA controls the structure of a protein.

(2)

- (e) Polydactyly and cystic fibrosis are both inherited disorders caused by faulty DNA.
- Polydactyly is caused by a dominant allele.
 - Cystic fibrosis is caused by a recessive allele.

Mother **A** has polydactyly.

Mother **B** has cystic fibrosis.

Mother **A** is more likely to have a child with polydactyly than Mother **B** having a child with cystic fibrosis.

Explain why.

Assume the fathers of the children have no alleles for polydactyly or cystic fibrosis.

You may use genetic diagrams in your answer.

(3)
(Total 13 marks)

3. **Figure 1** shows one species of bird on a bird feeder.

Figure 1

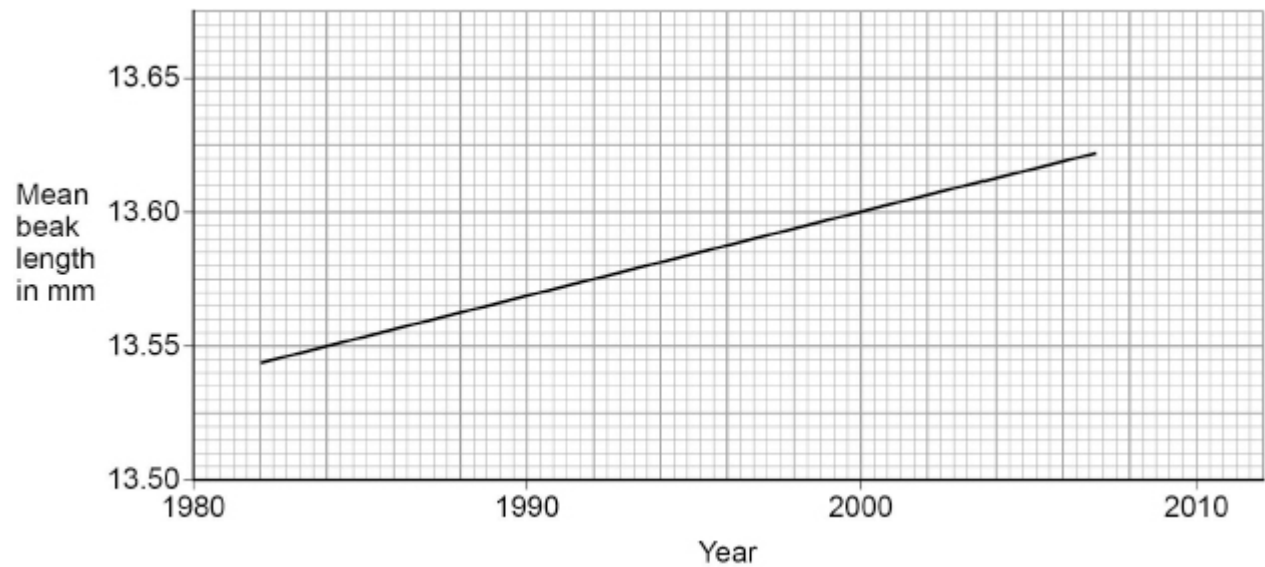


The birds use their beaks to reach nuts inside the bird feeder.

Figure 2 shows the mean beak length of this species of bird in the UK.

This species of bird often visits bird feeders.

Figure 2



- (a) Determine the rate of change in beak length from 1984 to 2000.

Use **Figure 2**.

Rate of change = _____ mm/year

(3)

- (b) Explain the process of evolution that could cause the trend in **Figure 2**.

(6)

(c) Birds of this species:

- live for about 3 years
- produce up to 24 eggs every year.

Explain why evolution is easier to study in this species of bird than in humans.

(3)

(d) Birds of this species are found in different parts of the world.

Describe evidence that would show two individual birds are the same species.

(3)

(Total 15 marks)

4.

(a) In sexual reproduction, cells divide by meiosis to form gametes.

Which **two** statements are true for cell division by meiosis?

Tick (✓) **two** boxes.

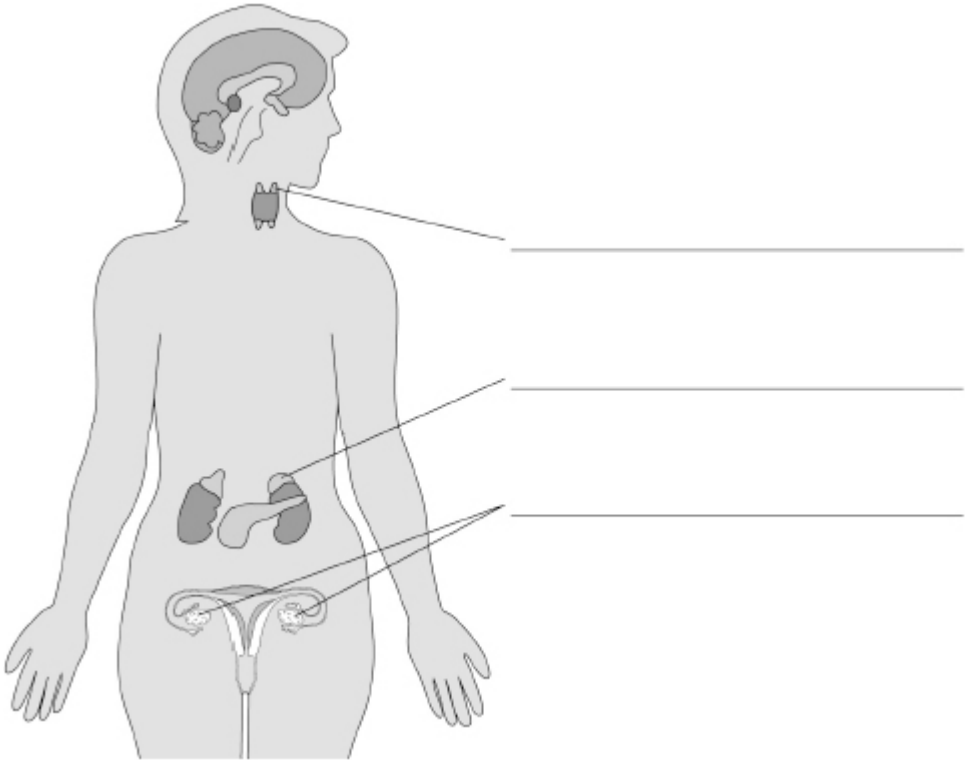
- Daughter cells have two sets of chromosomes.
- Four daughter cells are formed.
- The daughter cells are genetically identical.
- The DNA replicates twice.
- The parent cell divides twice.

(2)

Hormones are released from endocrine glands.

Each hormone travels in the bloodstream to a target organ.

The diagram below shows the position of endocrine glands in a female.



(b) Label the endocrine glands on the diagram above.

(3)

(c) Complete the table below.

Hormone	Name of gland which releases hormone	Target organ of hormone
Luteinising hormone (LH)	Pituitary gland	
	Adrenal gland	
Glucagon		

(3)

Millions of geranium plants are sold each year in garden centres.

Geraniums can be reproduced asexually or sexually.

The image below shows a potted geranium plant.



Garden centres usually grow new geranium plants by asexual reproduction.

(d) Suggest **two** advantages for garden centres of growing geraniums by asexual reproduction compared with sexual reproduction.

1. _____

2. _____

(2)

(e) Suggest **two** disadvantages for garden centres of growing geraniums by asexual reproduction compared with sexual reproduction.

1. _____

2. _____

(2)

(Total 12 marks)

5.

(a) Vectors are used in the process of genetic engineering.

Which **two** statements are correct?

Tick (✓) **two** boxes.

Vectors are enzymes used to 'cut open' the DNA molecule.

Vectors are used to insert genes into cells.

Vectors are used to isolate the required gene.

Vectors are used to stimulate cell division.

Vectors are usually plasmids or viruses.

(2)

(b) Scientists have genetically engineered a variety of wheat to be resistant to herbicides.

The herbicide resistant variety of wheat will give a higher yield than the non-herbicide resistant variety.

Explain why.

(3)

(c) Give **two** examples of genetic engineering in use today.

Do **not** refer to herbicide resistance in your answer.

1 _____

2 _____

(2)

(d) Scientists working on the 'Human Genome Project' have now mapped the entire genetic code of humans.

Explain **one** way this could be important for people in the future.

(2)

(Total 9 marks)

6.

Animals have adaptations to survive in their environment.

These adaptations may be structural, behavioural or functional.

(a) Draw **one** line from each animal adaptation to the type of adaptation it is.

Animal adaptation

Type of adaptation



Male palm cockatoos use sticks to beat on hollow branches to attract females.

Structural



The harmless hornet moth has black and yellow stripes to look like a bee or wasp.

Behavioural



Sea spiders have automatic muscle contractions that move oxygen around their bodies.

Functional

(2)

Plants also have adaptations.

There are more than 28 000 known species of orchid plants.

(b) Many orchid plants:

- grow attached to other types of plants
- have brightly coloured flowers
- produce large quantities of pollen
- produce thousands of tiny, light seeds.

Describe how these adaptations help orchid plants to survive and compete.

(4)

A rare orchid has been found in the mountains in China.

The orchid has pale yellow flowers.

DNA analysis of the genome shows that it is an ancestral species.

All other present day orchids evolved from this ancestral species millions of years ago.

(c) One present day species has bright purple flowers.

Describe how an orchid with bright purple flowers may have evolved from the ancestral species which has pale yellow flowers.

(4)

(d) The DNA code determines the sequence of amino acids which are joined together to form a specific protein.

The table shows part of the amino acid sequence for the colour pigment protein in five orchid species.

The rest of the amino acid sequence is the same for all the species.

Species	Amino acid sequence	Flower colour
Ancestral species	ala-leu-gly-isoleu-tyr-gly-ala-leu-gly-ala	pale yellow
Species A	ala-isoleu-gly-ala-tyr-gly-ala-tyr-gly-ala	pale yellow
Species B	ala-leu-ala-isoleu-tyr-gly-ala-tyr-gly-ala	pink
Species C	ala-isoleu-gly-ala-gly-tyr-gly-leu-gly-ala	pale yellow
Species D	ala-leu-gly-isoleu-tyr-tyr-ala-leu-gly-ala	purple

Key:

ala = alanine

gly = glycine

isoleu = isoleucine

leu = leucine

tyr = tyrosine

Suggest which orchid species is most closely related to the ancestral species.

Give a reason for your answer.

Species _____

Reason _____

(2)

(Total 12 marks)

7.

Human activities affect the environment.

- (a) Describe the reasons why deforestation takes place and the effects deforestation has on the environment.

(6)

Forests have been called:

'The lungs of the planet.'

- (b) Describe **one** way forests being called 'The lungs of the planet' can be considered to be a **correct** statement.

(1)

- (c) Trees do **not** have lungs.

Describe **one** other way forests being called 'The lungs of the planet' is an **incorrect** statement.

(1)

(Total 8 marks)

Mark schemes

1.

(a) any **one** from:

- previous intake of caffeine that day
- usual intake of caffeine (on previous days)
- concentration of caffeine
- volume of caffeine

allow named caffeinated drink for caffeine

allow amount / mass / type of caffeine for 1 mark

- time of day
- amount of sleep
- body mass
- previous experience of the test
- which hand (of student **B**) holds the stopwatch

allow fatigue

allow (body) weight / BMI

1

(b) any **two** from:

- (student **A**) does not press both start buttons simultaneously
- (student **A**) may not say stop and press button simultaneously
- student **B** could be distracted
- idea that student **B**

anticipated student **A**

stopping the stopwatch

- stopwatch malfunction

allow (stop)watches may not be accurate

2

(c) no value / result / number occurs more than once

or

all the values / results / numbers are different

1

(d) add(ed) the other (7) results and divide(d) by 7

allow correctly shown calculation

ignore leave out the result for pair 8

1

(e) (adrenaline) increases heart rate
allow increases blood flow 1

(which) increases oxygen / glucose to brain / muscle (cells) 1

(which) increases rate of respiration 1

(so) releasing more energy for (faster / more) muscle contraction
allow (so) releasing more ATP for (faster / more) muscle
contraction
*do **not** accept energy produced / made / created* 1

(f) synapse
allow synaptic cleft 1

(g) fewer adenosine (molecules) can bind to the receptors
or
adenosine has no / less effect on the (relay) neurone 1

therefore impulses in relay neurone are more frequent
allow impulses in relay neurone are faster
allow there are more impulses in relay neurone
allow impulses in relay neurone not delayed / reduced
(in number)
ignore caffeine binds to adenosine receptors 1

[12]

2. (a) glucagon
correct spelling only 1

- (b) if glucose too high (insulin causes) glucose to enter liver / muscle cells
or
 glucose to be converted to glycogen 1
- so blood glucose levels fall 1
- when glucose gets too low (glucagon causes) glycogen breakdown in liver / muscle cells
allow ecf from part (a) 1
- so glucose enters blood and raises level again 1
- this is called negative feedback 1
- (c) any **two** from:
- polymer
 - made of two strands
 - (twisted) in a double helix
- allow:*
- *backbone of strands contains sugar and phosphate groups*
 - *(cross) linked by pairs of bases*
 - *correct names of four bases or base pairs*
- 2
- (d) contains a code 1
- for a sequence of amino acids which forms a specific protein 1
- (e) mother **A** (polydactyly)
- 50% / half of children will have polydactyly if parent is heterozygous as it only takes one allele to show the disorder and half the sperm / ova / gametes will have faulty allele. 1
- (and) all / 100% will have polydactyly if parent is homozygous as faulty gene will always be passed on 1
- (but) for mother **B** (cystic fibrosis) none / 0% of children will have cystic fibrosis as it would need a second allele from the other parent before the disorder would be present
- allow genetic diagram(s) if correct and offspring ratio clearly indicated.*
- 1

[13]

3.

(a) 13.55 (mm) **and** 13.60 (mm)

1

$$\frac{13.60 \text{ (mm)} - 13.55 \text{ (mm)}}{2000 - 1984}$$

allow

0.05

16

allow correct working from other pairs of readings

1

0.003125 (mm/year)

or

3.125×10^{-3} (mm/year)

allow correct answer from other pairs of readings

allow a correct answer given to any number of significant figures

1

(b) **Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.

5-6

Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.

3-4

Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.

1-2

No relevant content

0

Indicative content

- there is variation in beak length (in this bird population)
- variation is due to mutations
- beak length is controlled by gene(s)
- birds with longer beaks can reach more nuts / food **or** birds with longer beaks can fight with **or** outcompete birds with shorter beaks
- therefore have more energy from food
- so can produce more offspring **or** reproduce more
- those offspring that inherit the long beak allele more likely to survive
- which is natural selection
- pass allele / gene (for long beak) on
- repeated over many generations
- birds are evolving to have longer beaks

For **Level 3** detail of process of evolution must be linked to beak length **and** implication of several generations is required.

(c) shorter life cycle / span

allow converse if clearly referring to human evolution

ignore shorter life

1

more offspring

1

(so) the genetics of the population changes faster

*allow effect of mutations seen sooner / faster **or***

humans can see evolution in birds during the course of a human life(time)

allow more fossil evidence

1

(d) similar / same phenotype

1

similar genotype / DNA (profile)

1

(can reproduce / breed and) produce fertile offspring

1

[15]

4.

(a) four daughter cells are formed

1

the parent cell divides twice

1

(b) thyroid (gland)

in this order only

1

adrenal (gland)

1

ovary / ovaries

1

(c)

Hormone	Name of gland which releases hormone	Target organ of hormone
Luteinising hormone (LH)	Pituitary gland	Ovary
Adrenaline	Adrenal gland	Heart / lungs / liver
Glucagon	Pancreas	Liver / muscle

1

1

1

(d) only need 1 parent plant

1

will produce (many genetically) identical plants

allow for 1 mark it is a faster process

allow for 1 mark will produce a large number of plants at one time

ignore clones unqualified

1

(e) any **two** from:

- genetically identical so will all be susceptible to same diseases / pathogens
- no genetic variety for new colours / characteristics to offer customers
- no genetic variety leads to weaker / unhealthy plants (due to lack of evolution)

2

[12]

5.

(a) vectors are used to insert genes into cells

1

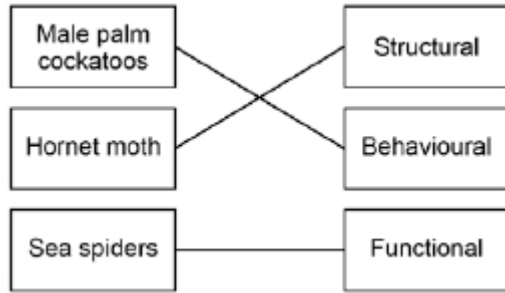
vectors are usually plasmids or viruses

1

- (b) wheat not affected by spraying / herbicide
allow only weeds affected / killed by spraying / herbicide 1
- (so) wheat gets more light / water / nitrates / ions / minerals
allow less competition for light / water / nitrates / ions / minerals
ignore nutrients
ignore carbon dioxide
ignore space 1
- (so) more photosynthesis / glucose / proteins (for more yield) 1
idea of more needed at least once for mp 2 and 3
- (c) any **two** from:
- production of human insulin / medicines
 - crops resistant to diseases / pests
allow examples such as potatoes resistant to blight
 - crops resistant to frost
 - crops resistant to drought
 - crops / foods with added nutrients
allow examples such as golden rice with vitamin A gene
 - plants / crops with more / bigger fruits **or** higher yield
allow examples such as larger tomatoes
 - crops with improved taste
 - crops with improved shelf life
- 2
- (d) identify genes linked to (certain) disease
allow correctly named diseases such as cancer / diabetes 1
- so can lead to better prevention / treatment of that disease
- or**
- identify genes causing inherited disorders (1)
- so may prevent children being born with the disorder by using IVF **or** gene therapy (1)
- or**
- tracing human migration patterns from the past **or** evolution of humans (1)
- so to better understand the ancient history of humans (1)
- 1

6.

(a)



all correct for 2 marks

allow 1 mark for one or two correct line(s)

additional lines from a box on the left negates the mark for that box

2

(b) any **four** from:

- growing on other plants means support to absorb more light (for photosynthesis)

allow to obtain water / minerals / ions / glucose from the other plant

ignore nutrients

- bright colours attract pollinators

or

bright colours attract insects to transfer pollen

allow fertilisation for transfer of pollen

- large quantities of pollen (increases the likelihood of pollen transfer) and so more seeds / reproduction
- tiny / light seeds will travel long distances to grow in new areas
allow tiny / light seeds will travel away from competitors
- many seeds mean many new plants so will out-compete other species
allow many seeds so more (orchids) will survive

4

(c) any **four** from:

- mutations for purple flower (in ancestral species)
allow genetic variation gives purple flowers
- isolation **or** change in environment e.g. area had more insects
allow purple orchid more suited to a new environment
- (plants with purple flowers) survive and breed
- (plants with purple flowers) pass on allele / gene / DNA / mutation
allow genetic material for allele
- until they were so different they could no longer interbreed (with the ancestral species)
allow breed successfully for interbreed

4

(d) species **D**

must be an attempt at an explanation to gain this mark

1

because it has the lowest number of amino acids different (in the sequence)

allow because it has the highest number of amino acids which are the same (in the sequence)

1

or

because it has the lowest number of differences in the sequence

allow because it has only one difference in the sequence

or

only one / sixth amino acid is different

allow only the glycine / gly has been changed to tyrosine / tyr

[12]

7.

- (a) **Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.

4–6

Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.

1–3

No relevant content

0

Indicative content

Reasons

- tropical rainforests cleared for land
- that land used to raise cattle, plant rice or plant crops such as coffee
- land cleared for mining
- that land used to grow biofuels or palm oil
- (temperate) forests cut down for wood for building / paper
- (temperate) forests cleared for farming (wheat / sheep)

Effects

- less trees to take in carbon dioxide for photosynthesis
- decay by microorganisms respiring releases carbon dioxide
- burning waste wood releases carbon dioxide
- build-up of carbon dioxide in atmosphere leads to greenhouse effect
- build-up of carbon dioxide in atmosphere leads to global warming
- consequences of global warming
- habitat loss
- leading to reduced biodiversity
- leading to soil erosion

Must consider both reasons and effects for Level 2.

- (b) (forests) involve gas exchange with the atmosphere

1

- (c) (in forests) carbon dioxide is used and oxygen is released whereas in lungs it is oxygen used and carbon dioxide is released

allow gas exchange occurs by diffusion in the leaves of trees, but involves ventilation / breathing in the lungs of animals

1

[8]