SPECIMEN MATERIAL

GCSE
BIOLOGY

Foundation Tier Paper 2F

F

Specimen 2018 Time allowed: 1 hour 45 minutes

Materials
For this paper you must have:
- a ruler
- a calculator.

Instructions
- Answer **all** questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- There are 100 marks available on this paper.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- When answering questions 09.5, 10.3, 11.4 and 12.3 you need to make sure that your answer:
  - is clear, logical, sensibly structured
  - fully meets the requirements of the question
  - shows that each separate point or step supports the overall answer.

Advice
In all calculations, show clearly how you work out your answer.

Please write clearly, in block capitals.

Centre number ☐☐☐☐☐ Candidate number ☐☐☐☐

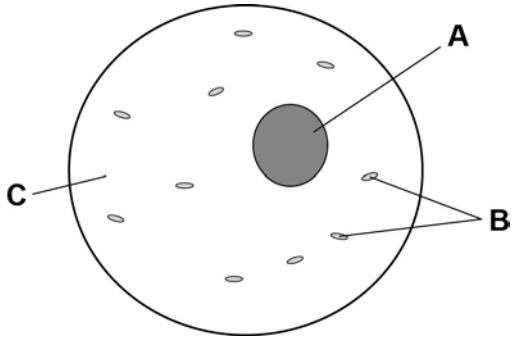
Surname

Forename(s)

Candidate signature _____

0 1 **Figure 1** shows a human body cell.

Figure 1



0 1 . 1 Which part in **Figure 1** contains chromosomes?

[1 mark]

Tick **one** box.

A ☐ **B** ☐ **C** ☐

0 1 . 2 Humans have pairs of chromosomes in their body cells.

Draw **one** line from each type of cell to the number of chromosomes it contains.

[2 marks]

Type of cell	Number of chromosomes
	10
Human body cell	23
	46
Sperm cell	60
	92

Humans have two different sex chromosomes, **X** and **Y**.

Figure 2 shows the inheritance of sex in humans.

Figure 2

		Mother	
		X	X
Father	X	XX	XX
	Y	XY	XY

0 1 . 3 **Circle** a part of **Figure 2** that shows an egg cell.

[1 mark]

0 1 . 4 Give the genotype of male offspring.

[1 mark]

0 1 . 5 A man and a woman have two sons. The woman is pregnant with a third child.

What is the chance that this child will also be a boy?

[1 mark]

Tick **one** box.

0% ☐

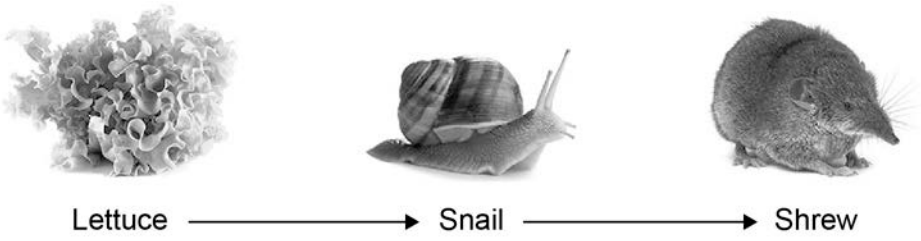
25% ☐

50% ☐

100% ☐

0 2 **Figure 3** shows a food chain in a garden.

Figure 3



0 2 . 1 Name **one consumer** shown in **Figure 3**.

[1 mark]

0 2 . 2 Name **one carnivore** shown in **Figure 3**.

[1 mark]

0 2 . 3 A disease kills most of the shrews in the garden.

Suggest why the number of snails in the garden may then increase.

[1 mark]

0 2 . 4 What is the name given to all the snails in the garden shown in **Figure 3**?

[1 mark]

Tick **one** box.

Community ☐

Ecosystem ☐

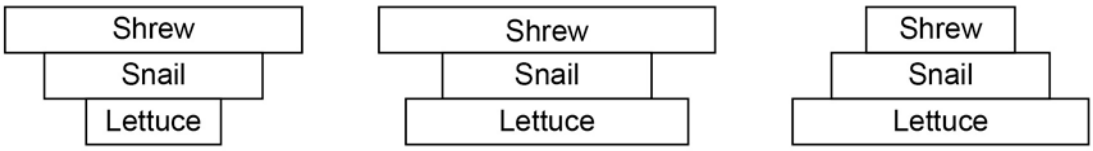
Population ☐

Territory ☐

0 2 . 5 Which pyramid of biomass is correct for the food chain shown in **Figure 3**?

[1 mark]

Tick **one** box.



A ☐ **B** ☐ **C** ☐

0 2 . 6 Some snails ate some lettuces.

The lettuces contained 11 000 kJ of energy.

Only 10% of this energy was transferred to the snails.

Calculate the energy transferred to the snails from the lettuces.

[1 mark]

Energy = _____ kJ

Question 2 continues on the next page

0 2 . 7 Give **one** reason why only 10% of the energy in the lettuces is transferred to the snails.

[1 mark]

Tick **one** box.

- The lettuces carry out photosynthesis ☐
- The snails do not eat the roots of the lettuces ☐
- Not all parts of a snail can be eaten ☐

0 2 . 8 **Abiotic** factors can affect the food chain.

Wind direction is one abiotic factor.

Name **one other** abiotic factor.

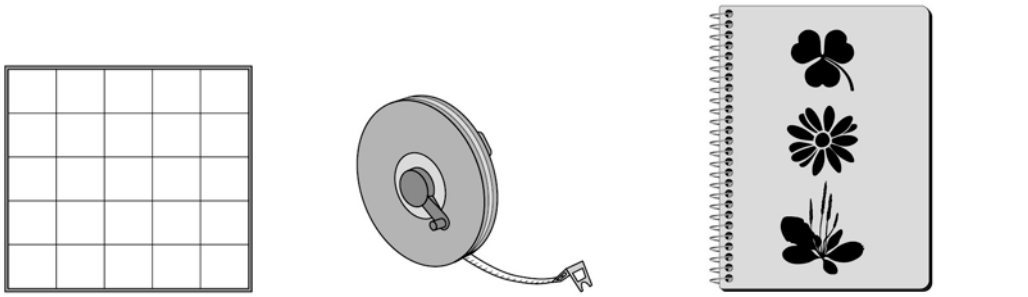
[1 mark]

Turn over for the next question

0 3 A student was asked to estimate how many clover plants there are in the school field.

Figure 4 shows the equipment used.

Figure 4



Not drawn to scale

This is the method used.

1. Throw a quadrat over your shoulder.
2. Count the number of clover plants inside the quadrat.
3. Repeat step **1** and step **2** four more times.
4. Estimate the number of clover plants in the whole field.

0 3 . 1 What is the tape in **Figure 4** used for in this investigation?

[1 mark]

0 3 . 2 The teacher told the student that throwing the quadrat over his shoulder was **not** random.

The method could be improved to make sure the quadrats were placed randomly.

Suggest **one** change the student could make to ensure the quadrats were placed randomly.

[1 mark]

0 3 . 3 How could the student improve the investigation so that a valid estimate can be made?

[2 marks]

Tick **two** boxes.

- Weigh the clover plants ☐
- Compare their results with another student's results ☐
- Count the leaves of the clover plants ☐
- Place more quadrats ☐
- Place the quadrats in a line across the field ☐

Question 3 continues on the next page

Table 1 shows the student's results.

Table 1

Quadrat number	Number of clover plants counted
1	11
2	8
3	11
4	9
5	1
Total	40

0 3 . 4 The area of the school field was 500 m^2.

The quadrat used in **Table 1** had an area of 0.25 m^2.

Calculate the estimated number of clover plants in the school field.

[3 marks]

Estimated number of clover plants = _____

0 3 . 5 What was the mode for the results in **Table 1**?

[1 mark]

Tick **one** box.

1 ☐

8 ☐

11 ☐

40 ☐

0 3 . 6 Suggest which quadrat could have been placed under the shade of a large tree.

Give **one** reason for your answer.

[1 mark]

Quadrat number _____

Reason _____

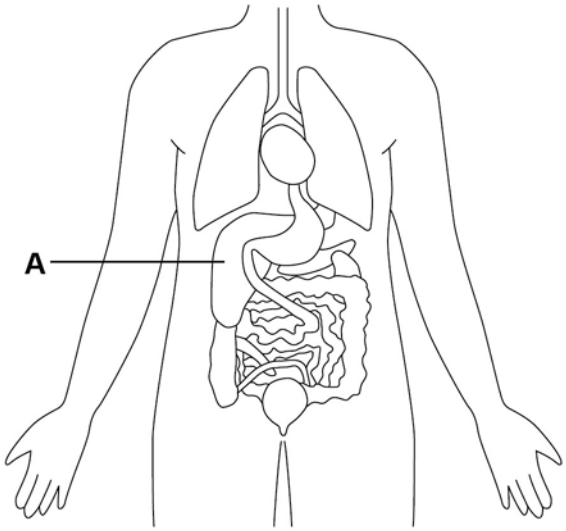
_____

Turn over for the next question

0 4 Humans control their internal environment in many ways.

Look at **Figure 5**.

Figure 5



0 4 . 1 Name organ **A**.

[1 mark]

0 4 . 2 Organ **A** stores glucose.

People with Type 1 diabetes cannot effectively control the levels of glucose in their blood.

Name the **hormone** people with **Type 1 diabetes** have to inject to decrease their blood glucose level.

[1 mark]

0 4 . 3 Which organ produces urine?

[1 mark]

Tick **one** box.

Brain ☐

Lungs ☐

Kidney ☐

Thyroid ☐

0 4 . 4 Marathon runners often drink sports drinks during a race.

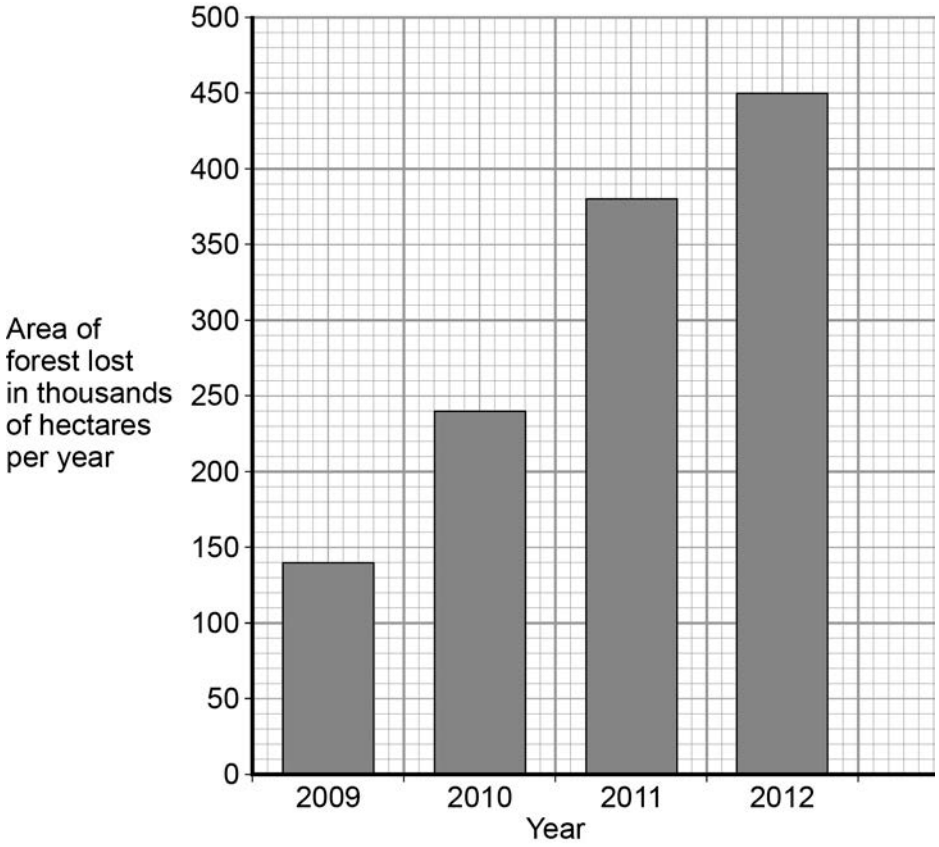
Explain why.

[2 marks]

Turn over for the next question

0 5 **Figure 6** shows the area of forest lost in Madagascar from 2009 to 2012.

Figure 6



0 5 . 1 The area of forest lost each year in Madagascar increased between 2009 and 2012.

Determine the total area of forest lost from the start of 2009 to the end of 2012.

[1 mark]

Total area of forest lost = _____ thousand hectares

0 5 . 2 What are the possible reasons for the change in the area of forest lost per year between 2009 and 2012?

[2 marks]

Tick **two** boxes.

The local people stop growing rice	☐
Fewer new houses are needed for the population	☐
The local people decided to farm cattle	☐
More trees have been planted	☐
A company starts growing plants for biofuels	☐

0 5 . 3 More forest was lost in 2012 than in 2009.

Use words from the box to complete the sentences.

[2 marks]

carbon dioxide	**excretion**	**nitrogen**
oxygen	**photosynthesis**	**respiration**

The increase in the area of forest lost has caused an increase

in the gas _____ .

The increase of this gas has been caused because less of the gas is being

absorbed by plants for the process of _____ .

Question 5 continues on the next page

0 5 . 4 Deforestation can have negative effects on our ecosystems.

What are the negative effects of deforestation?

[2 marks]

Tick **two** boxes.

Animals and birds migrate because there is less food	☐
More habitats are destroyed	☐
There is less acid rain	☐
There is more biodiversity	☐
The global temperature decreases	☐

0 5 . 5 Scientists try to reduce the negative effects of human activity on our ecosystems.

One way is to protect rare habitats.

Give **one other** way of reducing the negative effects of human activity on our ecosystems.

[1 mark]

Turn over for the next question

0 6 Hormones called auxins control plant growth.

A student investigated plant growth responses in roots.

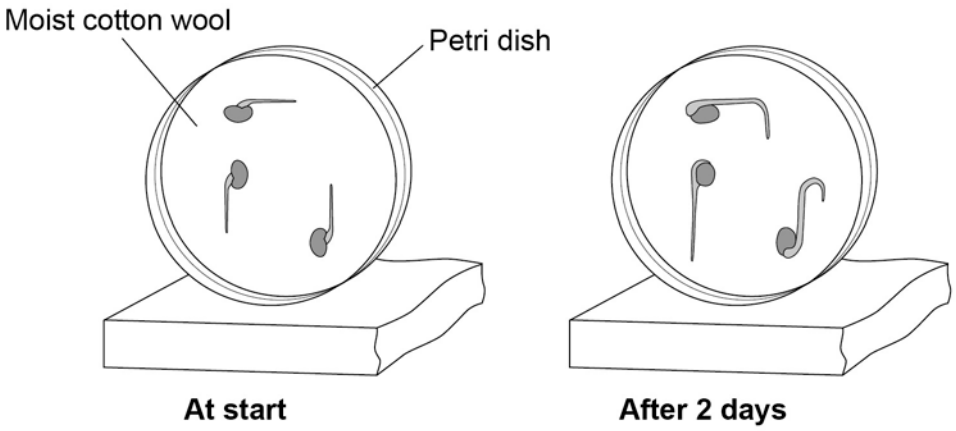
This is the method used.

1. Grow three bean seeds until their roots are 1 cm long.
2. Attach the three bean seeds to moist cotton wool in a Petri dish.

   Each bean seed root should point in a different direction.
3. Fix the Petri dish vertically for 2 days in the dark.

Figure 7 shows the results.

Figure 7



0 6 . 1 Describe the direction of growth of the bean **roots** after 2 days.

Give **one** reason for this growth response.

[2 marks]

Direction of root growth _____

Reason _____

_____

0 6 . 2 The student then noticed the shoots growing from the seeds.

He then:

1. put a light above the Petri dish but did not move the seeds
2. allowed the seeds to grow for 2 **more** days.

Predict the direction of growth of the bean **shoots** after 2 days.

Give **one** reason for your prediction.

[2 marks]

Direction of growth _____

Reason _____

Question 6 continues on the next page

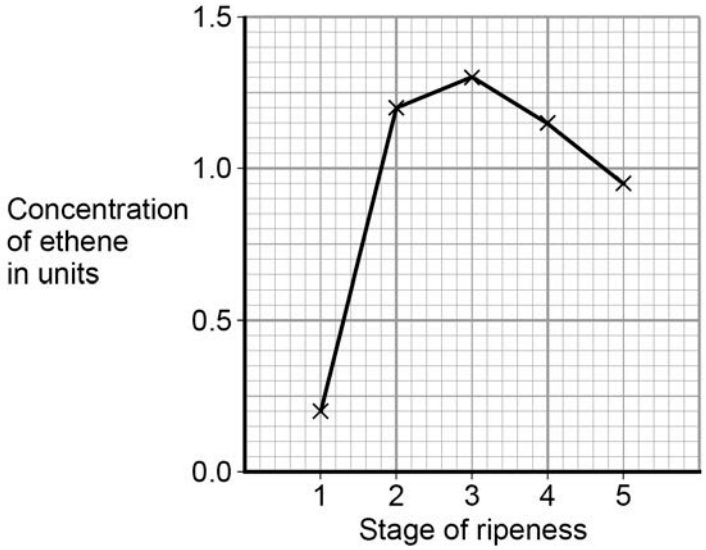
Ethene is a plant hormone.

Ethene causes fruit to ripen.

Scientists measured the concentration of ethene found in fruit at different stages of ripeness.

Figure 8 shows the results.

Figure 8



0 6 . 3 At which stage of ripeness is there most ethene?

[1 mark]

Tick **one** box.

Stage **1** ☐

Stage **2** ☐

Stage **3** ☐

Stage **4** ☐

Stage **5** ☐

0 6 . 4 Suggest how the scientists can find out if the result for Stage **1** was an anomaly.

[1 mark]

0 6 . 5 Gibberellins are a different type of plant hormone.

Farmers growing cotton plants in cold climates sometimes soak their seeds in a solution of gibberellins before planting the seeds.

Suggest an advantage of soaking seeds in a gibberellin solution in cold climates.

[1 mark]

Turn over for the next question

0 7 Two students investigated reflex action times.

This is the method used.

1. Student **A** sits with his elbow resting on the edge of a table.
2. Student **B** holds a ruler with the bottom of the ruler level with the thumb of Student **A**.
3. Student **B** drops the ruler.
4. Student **A** catches the ruler and records the distance.
5. Steps **1** to **4** are then repeated.

The same method was also used with Student **A** dropping the ruler and Student **B** catching the ruler.

0 7 . 1 Give **two** variables the students controlled in their investigation.

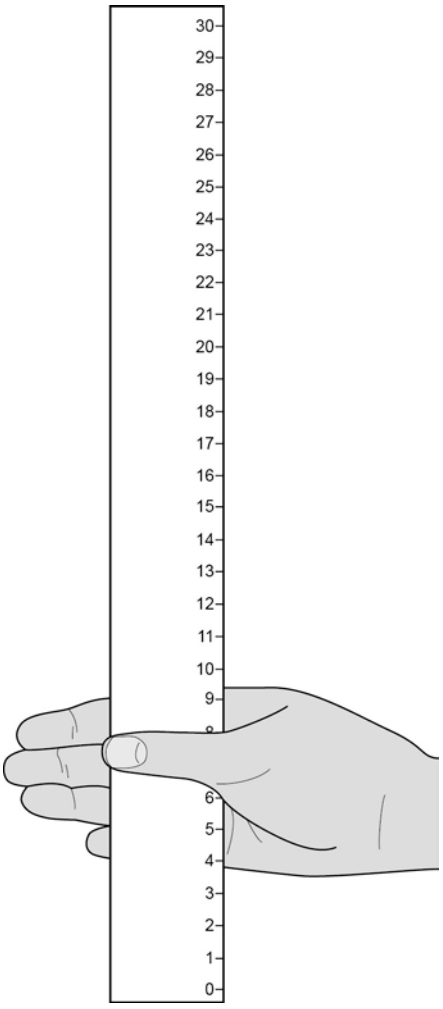
[2 marks]

1 _____

2 _____

Figure 9 shows one of the results for the Student **A**.

Figure 9



0 7 . 2 What is the reading shown in **Figure 9**?

[1 mark]

Reading on ruler = _____ cm

Question 7 continues on the next page

Table 2 shows the students' results.

Table 2

Test number	Distance ruler dropped in cm	
	Student A	**Student B**
1	9	12
2	2	13
3	6	13
4	7	9
5	7	8
Mean	**7**	**X**

0 7 . 3 **Circle** the anomalous result in **Table 2** for Student **A**.

[1 mark]

0 7 . 4 What is the **median** result for Student **B**?

[1 mark]

Tick **one** box.

8 ☐

11 ☐

12 ☐

13 ☐

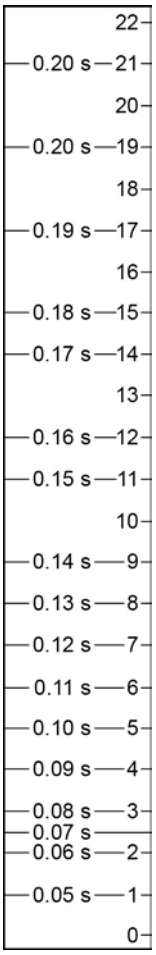
0 7 . 5 Calculate the value of **X** in **Table 2**.

[1 mark]

Mean distance ruler dropped = _____ cm

0 7 . 6 **Figure 10** shows the scale used to convert distance of the ruler drop to reaction time.

Figure 10



Calculate how much faster the reaction time of Student **A** was compared to Student **B**.

Use **Figure 10** and **Table 2**.

[2 marks]

Answer = _____ s

Question 7 continues on the next page

0 7 . 7 What improvement could the students make to the method so the results are more valid?

[1 mark]

Tick **one** box.

Use alternate hands when catching the ruler ☐

Carry out more repeats ☐

Use a longer ruler for catching ☐

Use more than two students to collect results ☐

0 7 . 8 Student **A** carried out a second investigation to see the effect of caffeine on the reflex action.

Table 3 shows his results.

Table 3

Test number	Distance ruler dropped in cm	
	Without caffeine	**With caffeine**
1	9	5
2	6	5
3	9	4
4	6	7
5	10	4
Mean	**8**	**5**

Give **one** conclusion about the effect of caffeine on reflex actions.

[1 mark]

Turn over for the next question

0 8 Our understanding of genetics and inheritance has improved due to the work of many scientists.

0 8 . 1 Draw **one** line from each scientist to the description of their significant work.

[3 marks]

Scientist	Description of significant work
Charles Darwin	Carried out breeding experiments on pea plants.
Alfred Russel Wallace	Wrote 'On the origin of species'.
Gregor Mendel	Worked on plant defence systems.
	Worked on warning colouration in animals.

0 8 . 2 In the mid-20th century the structure of DNA was discovered.

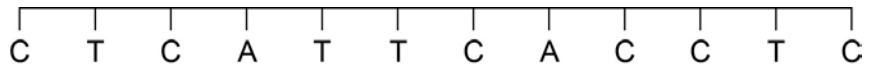
What is a section of DNA which codes for one specific protein called?

[1 mark]

Figure 11 shows one strand of DNA.

The strand has a sequence of bases (A, C, G and T).

Figure 11



0 8 . 3 How many amino acids does the strand of DNA in **Figure 11** code for?

[1 mark]

Tick **one** box.

2 ☐

3 ☐

4 ☐

6 ☐

Question 8 continues on the next page

Mutations of DNA cause some inherited disorders.

One inherited disorder is cystic fibrosis (CF).

A recessive allele causes CF.

0 8 . 4 Complete the genetic diagram in **Figure 12**.

- Identify any children with CF.
- Give the probability of any children having CF.

[3 marks]

Each parent does not have CF.

The following symbols have been used:
D = dominant allele for **not** having CF
d = recessive allele for having CF

Figure 12

		Mother	
		D	d
Father	D	DD	
	d		

Probability of a child with CF = _____

0 8 . 5 What is the genotype of the mother shown in **Figure 12**?

[1 mark]

Tick **one** box.

Heterozygous ☐

Homozygous dominant ☐

Homozygous recessive ☐

Turn over for the next question

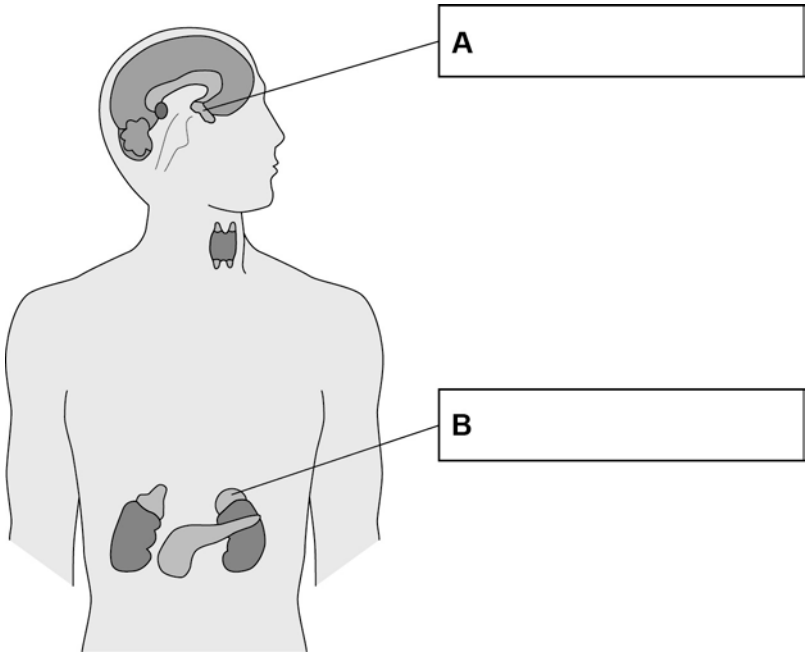
0 9 Glands in the body produce hormones.

0 9 . 1 Use words from the box to label gland **A** and gland **B** on **Figure 13**.

[2 marks]

Adrenal	**Pancreas**	**Pituitary**	**Testis**	**Thyroid**

Figure 13



0 9 . 2 Which gland produces oestrogen?

[1 mark]

Tick **one** box.

- Ovary ☐
- Pancreas ☐
- Testis ☐
- Thyroid ☐

Table 4 shows some methods of contraception.

Table 4

Type of contraception	Percentage (%) of pregnancies prevented
Oral pill	>99
Implant	99
Condom	98
Diaphragm	<96

0 9 . 3 Which method of contraception in **Table 4** is **least** effective at preventing pregnancy?

[1 mark]

0 9 . 4 Which method of contraception in **Table 4** will protect against sexually transmitted diseases like HIV?

[1 mark]

Question 9 continues on the next page

Another method of contraception is called the intrauterine device (IUD).

There are two main types of IUD:

- copper
- plastic.

Both types of IUD are more than 99% effective.

Look at **Table 5**.

Table 5

	Copper IUD	**Plastic IUD**
How the IUD works	• releases copper • copper changes the fluids in the uterus to kill sperm	• releases a hormone • hormone thickens mucus from the cervix so the sperm have more difficulty swimming to the egg
Benefits	• prevents pregnancy for up to 10 years • can be removed at any time • can be used as emergency contraception	• prevents pregnancy for up to 5 years • can be removed at any time
Possible side effects	• very painful periods • heavy periods or periods which last for a long time • feeling sick, back pain	• painful periods • light periods or no periods • feeling sick, headaches, breast pain, acne • hormones may affect mood • ovarian cysts

0 9 . 5 Evaluate the use of the plastic IUD as a contraceptive compared to the copper IUD.

Use the information in **Table 5**.

[4 marks]

Turn over for the next question

1 0 Charles Darwin proposed the theory of natural selection.

Many people at the time did not accept his theory.

1 0 . 1 There was a different theory at the same time as Darwin's theory.

The different theory said that changes in an organism during its life could be inherited.

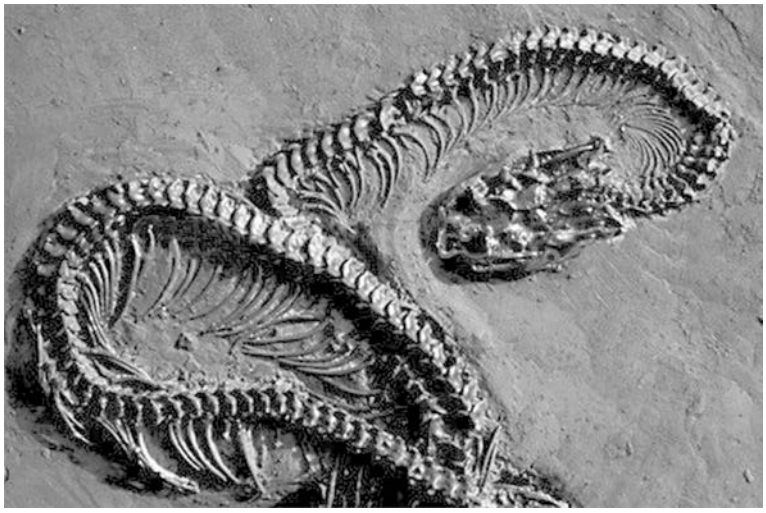
Who proposed this theory?

[1 mark]

1 0 . 2 Studying fossils helps scientists understand how living things have evolved.

Figure 14 shows a fossilised snake.

Figure 14



Explain how the fossil in **Figure 14** may have formed.

[3 marks]

Question 10 continues on the next page

There are many types of rat snake in the world.

Table 6 shows two types of rat snake.

Table 6

Type of snake	Japanese rat snake	Texas rat snake
Colour of snake	Green	Pale brown
Type of environment	Grass	Dry and dusty

1 0 . 3 The different types of rat snake have evolved from similar ancestors.

The rat snakes have evolved to to suit their environments.

Explain how the Japanese rat snake evolved to be different from the Texas rat snake.

[4 marks]

1 0 . 4 Many species of snake have become extinct.

Give **one** reason why a species might become extinct.

[1 mark]

Turn over for the next question

1 1 A gardener wants to add compost to the soil to increase his yield of strawberries.

The gardener wants to make his own compost.

1 1 . 1 An airtight compost heap causes anaerobic decay.

Explain why the gardener might be against producing compost using this method.

[2 marks]

The gardener finds this research on the Internet:

'A carbon to nitrogen ratio of 25:1 will produce fertile compost.'

Look at **Table 7**.

Table 7

Type of material to compost	Mass of carbon in sample in g	Mass of nitrogen in sample in g	Carbon:nitrogen ratio
Chicken manure	8.75	1.25	7:1
Horse manure	10.00	0.50	20:1
Peat moss	9.80	0.20	**X**

1 1 . 2 Determine the ratio **X** in **Table 7**.

[1 mark]

Ratio _____

1 1 . 3 Which type of material in **Table 7** would be **best** for the gardener to use to make his compost?

Justify your answer.

[1 mark]

Question 11 continues on the next page

1 1 . 4 Some of the leaves from the gardener's strawberry plant die.

The dead leaves fall off the strawberry plant onto the ground.

The carbon in the dead leaves is recycled through the carbon cycle.

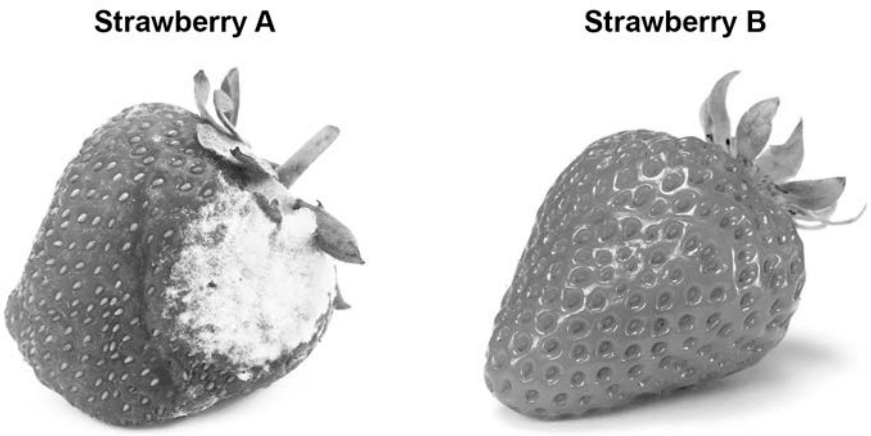
Explain how the carbon is recycled into the growth of new leaves.

[6 marks]

1 1 . 5 **Figure 15** shows two strawberries.

- Both strawberries were picked from the same strawberry plant.
- Both strawberries were picked 3 days ago.
- The strawberries were stored in different conditions.

Figure 15



Give **three** possible reasons that may have caused strawberry **A** to decay.

[3 marks]

1 _____

_____

2 _____

_____

3 _____

_____

Turn over for the next question

1 2 Many different types of animals are produced using selective breeding.

Some cats are selectively bred so that they do not cause allergies in people.

1 2 . 1 Suggest **two other** reasons why people might selectively breed cats.

[2 marks]

1 _____

_____

2 _____

_____

1 2 . 2 Selective breeding could cause problems of inbreeding in cats.

Describe **one** problem inbreeding causes.

[1 mark]

_____

1 2 . 3 Many people have breathing problems because they are allergic to cats.

The allergy is caused by a chemical called Fel D1.

Different cats produce different amounts of Fel D1.

A cat has been bred so that it does not produce Fel D1.

The cat does **not** cause an allergic reaction.

Explain how the cat has been produced using selective breeding.

[4 marks]

END OF QUESTIONS

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Figure 3: Shrew © GlobalP/Thinkstock
Figure 14: Fossilised snake © Peter Menzel/Science Photo Library
Table 6: Japanese rat snake © Kazzpix/Thinkstock
Table 6: Texas rat snake © Alexey Kuznetsov/Thinkstock
Figure 15: Decaying strawberry © sarahdoow/Thinkstock
Figure 15: Strawberry © Mariusz Blach/Thinkstock