

# GCSE BIOLOGY

# H

Higher Tier Paper 2H

Specimen 2018

Time allowed: 1 hour 45 minutes

### Materials

For this paper you must have:

- ruler
- 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 01.3, 02.4, 03.3, 04.2 and 08.2 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, to allow character computer recognition.

Centre number Candidate number

Surname

Forename(s)

Candidate signature

---

0	1
---	---

Charles Darwin proposed the theory of natural selection.

Many people at the time did not accept his theory.

0	1
---	---

 . 

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]

Jean Baptiste Lamarck  
Baptiste

0 1 . 2

Studying fossils helps scientists understand how living things have evolved.

Figure 1 shows a fossilised snake.

Figure 1



Explain how the fossil in Figure 1 may have formed.

[3 marks]



The dead snake was covered in sediment.  
 The soft tissue decays, but bone does not.  
 Therefore the bone is replaced by minerals.  
 Therefore the

Question 1 continues on the next page

There are many types of rat snake in the world.

Table 1 shows two types of rat snake

Table 1

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

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

#level 2:  
detailed + coherent  
logical links

1 natural variation

2 some individuals better adapted

3 better adapted individuals more likely to survive

Some of these colours are closer to the green of the Japanese grass environment so

these colours are better camouflaged and reproduce the Japanese environment so

these snakes will inherit these genes

will inherit these genes

genes

genes

genes

genes

genes

genes

genes

genes

# The rat snakes have evolved to suit their environment. Explain how the Japanese rat snake evolved to be different from the Texas rat snake. [4 marks]

Initially there are lots of different colours of snake. These colours are determined by genes. Some of these colours are closer to the green of the Japanese grass environment, so there are better camouflaged. Green snakes more likely to survive and breed, so the survivors offspring will inherit these genes.

Many species of snake have become extinct.

Give one reason why a species might become extinct. [1 mark]

New predator arriving.

predator arriving

change surroundings

new biotopes

new competitors

catastrophic - drought / eruption etc.

Turn over for brought/or the next question

0 2

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

The gardener wants to make his own compost.

produces methane

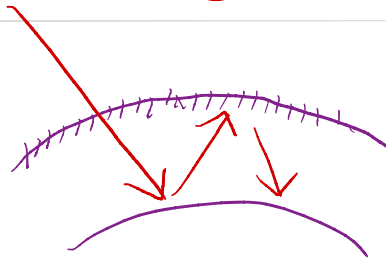
-2 statement + reasoning

1 An airtight compost heap causes anaerobic decay.

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

[2 marks]

Anaerobic decay produces methane, which is a greenhouse gas, which is a greenhouse gas.



The gardener finds this research on the internet:

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

Table 2.  
Look at

Table 2

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

closest to  
25:1

e

↑  
49:1

0 2 . 2 Determine the ratio X in Table 2.

[1 mark]

$$9.8 \div 0.2 = 49$$

Ratio 49:1

0 2 . 3 Which type of material in Table 2 would be best for the gardener to use to make his compost?

Justify your answer.

[1 mark]

Horse manure because carbon to nitrogen ratio closest to 25:1

Question 2 continues on the next page

0 2 . 4

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

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

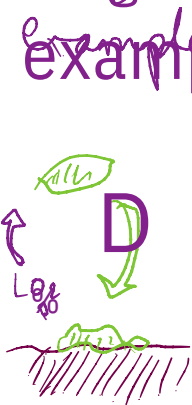
The carbon in the dead leaves is recycled through the carbon cycle.

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

[6 marks]

bespecific  
to the given

coherent  
logical link  
gi



Carbon compounds in dead leaves are broken down by microorganisms.

They release CO<sub>2</sub> into the atmosphere. Plants take up this CO<sub>2</sub> and use it in the process of photosynthesis. Plants convert CO<sub>2</sub> into glucose.

The glucose produced is used to make proteins which are essential for growth of new leaves.

stationer  
explanati



0 2 . 5

Figure 2 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.

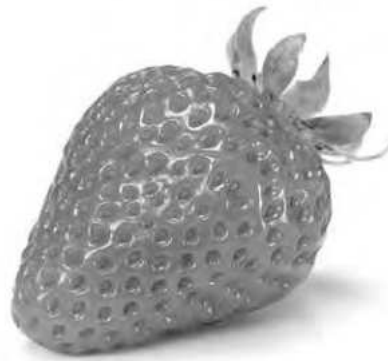
Figure 2

moulds:  
 ↳ requires -  
 microorganisms  
 warmth  
 oxygen  
 moisture.

Strawberry A



Strawberry B



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

[3 marks]

1 Stored at higher temperature

2 stored in conditions with more oxygen.

3 stored in a place with more moisture

+ storage conditions contained more microorganisms that cause decay.

Turn over for the next question

0 | 3

Many different types of animals are produced using selective breeding.

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

to improve quality of life of cat  
OR to improve cat as a pet.

0 | 3

. 1

Suggest two other reasons why people might selectively breed cats.

[2 marks]

1 To eliminate specific genetic defects

2 for aesthetic reasons

4 to make them less aggressive / more docile.

0 | 3

. 2

Selective breeding could cause problems of inbreeding in cats.

Describe one problem inbreeding causes.

[1 mark]

More likely to pass on recessive disorders.  
pass on recessive

OR cats are more susceptible to disease

0 3 . 3  
 Choose  
 best cats  
 for purpose  
 (heart) (F1)  
 Breed  
 to  
 breed offspring  
 with heart  
 tells D1.

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.  
logical

The cat does not cause an allergic reaction.

level 2:  
 detailed, coherent,  
 logical links.

g  
 [4 marks]

Explain how the cat has been produced using selective breeding.

Cats with the desired characteristics the, lowest Fel D1 are allowed to breed. Their offspring will produce a variety of levels of Fel D1. Those with the lowest Fel D1 levels are allowed to breed. This is repeated over many generations so that over time the cats produce less Fel D1 a

Turn over for the next question

There are no questions printed on this page

0 4

A student plans an investigation using mould.

0 4 . 1

Mould spores are hazardous.

Give one safety precaution the student should take when doing this investigation.

[1 mark]

*Wear a mask.*

A student made the following hypothesis about the growth of mould:

'The higher the temperature, the faster the growth of mould'.

The student planned to measure the amount of mould growing on bread.

The student used the following method:

level 2:  
• slices of bread

• sealable plastic bags

• a knife

• a chopping board

• mould spores.

Describe how the materials and equipment could be used to test the hypothesis.

[4 marks]

*level 2 detailed, coherent, logical.*

*results should be quantitative, with a method repeatable.*

*quantitative*

*repeatability*

*detailed*

# *4* slices of bread and cut them into squares of side length 2cm. Add 6 spores to each bag. Place each bag at a different temperature 20, 30, 40 and 50°C. Leave for 4 days. Measure the percentage cover of mould on the surface of bread. Repeat the experiment for 4 days. Measure the percentage cover of mould on the surface of bread.

*control*

*inches*

*month*

0 | 4 | . | 3

Give one variable the student should control in the investigation.

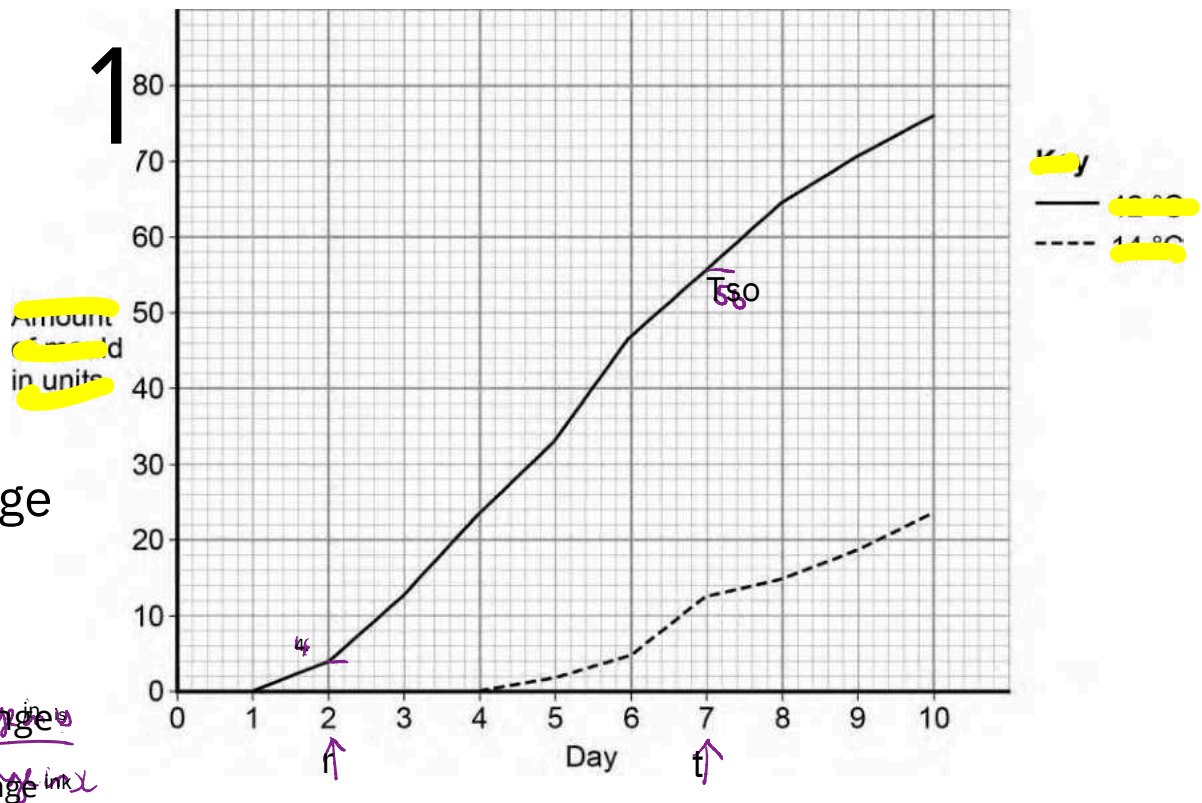
[1 mark]

Amount of mould meant bread piece  
 +  
 + the size of pieces of bread  
 type of mould

& - ¥ - Another student did a similar investigation.

Figure 3 shows the results.

Figure 3



0 | 4 | . | 4

Determine the rate of mould growth at 42 °C between day 2 and day 7.

[2 marks]

$58 - 4 = 54$   $54 \div 5 = 10.8$   $52 \div 5 = 10.4$

Rate of mould growth = 10.4

10.4 units per day

0 4. 5 The growth of mould shows decomposition of the bread.

Give a conclusion about decomposition from the results in Figure 3.

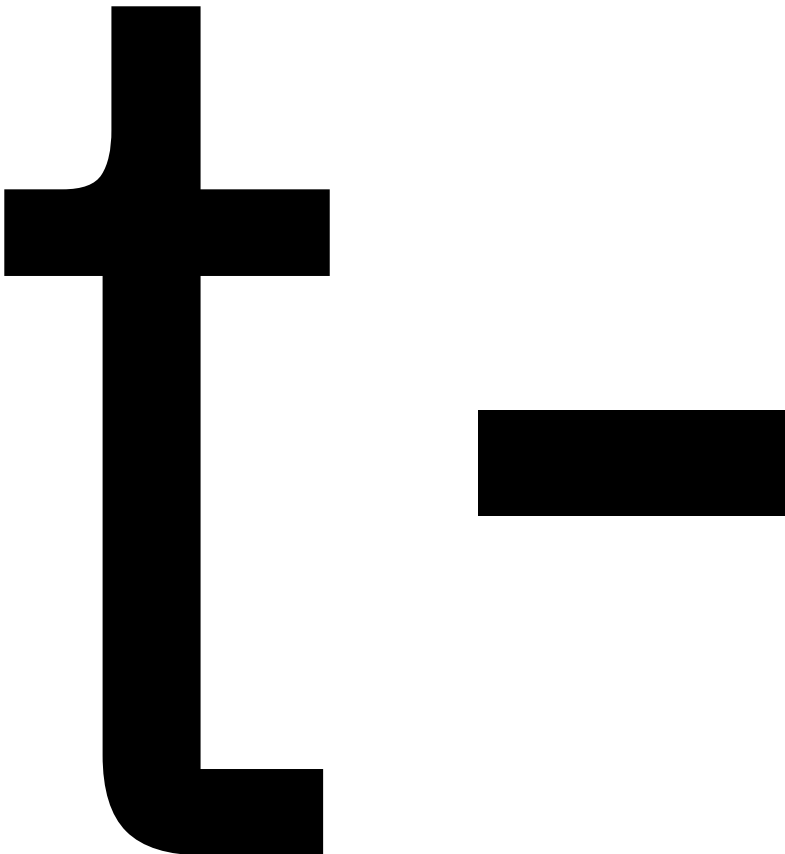
[1 mark]

the ratty decomposition is higher at higher temperatures -

*The rate of decomposition is higher at higher temperatures.*

↑ temperature, ↑ mould  
so, ↑ temperature, ↑ decomposition

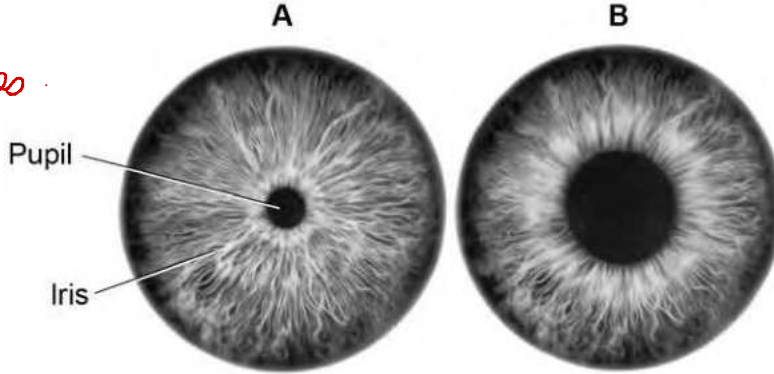
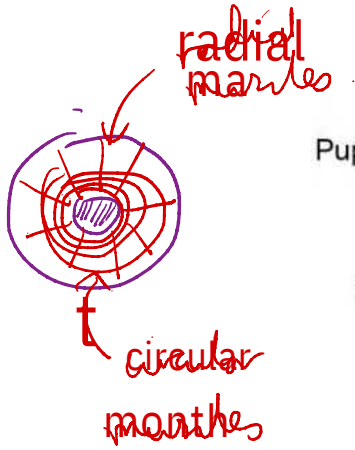
Turn over for the next question



0 | 5

Figure 4 shows a reflex in the iris of the human eye in response to changes in light levels.

Figure 4



radial relaxed  
circular contract

radial contract  
circular relaxed

dilated

2x describe  
2x explain

0 | 5

1

Describe the changes in the pupil and iris going from A to B in Figure 4.

Explain how these changes occur.

Refer to the changes in light level in your answer.

9

[4 marks]

Describe  
Answer  
Pupils dilated at B in low light levels.  
radial muscles contract and circular muscles relax.  
Waxal muscles contraband

✓



0 5 . 2

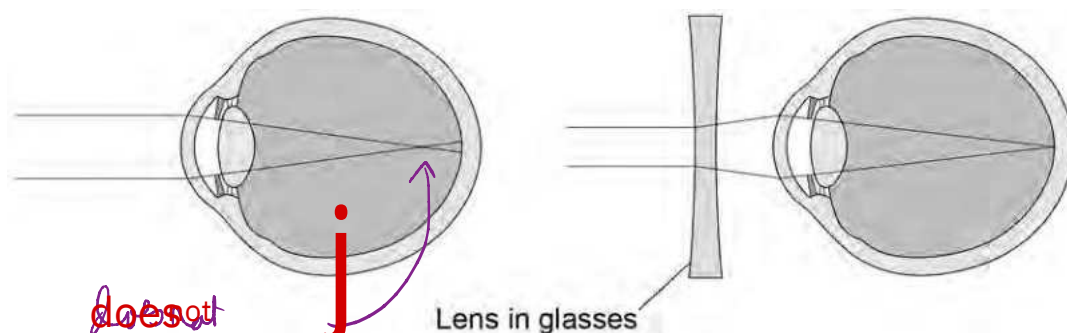
Some people wear glasses to improve their vision.

Figure 5 shows light entering the eye in a person with blurred vision.

Figure 6 shows how this condition is corrected with glasses.

Figure 5

Figure 6



does not  
focus on retina

Lens in glasses

MYOPIA (near sighted)

Compare Figure 5 and Figure 6.

Explain how the blurred vision is corrected.

[2 marks]

Figure 5 shows myopia where light focuses before the retina. In figure 6, the lens bends the light so that it focusses on the retina. ✓ height ✓

Turn over for the next question

Two students investigated reflex action times.

This is the method used.

1. Student A sits with her 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.

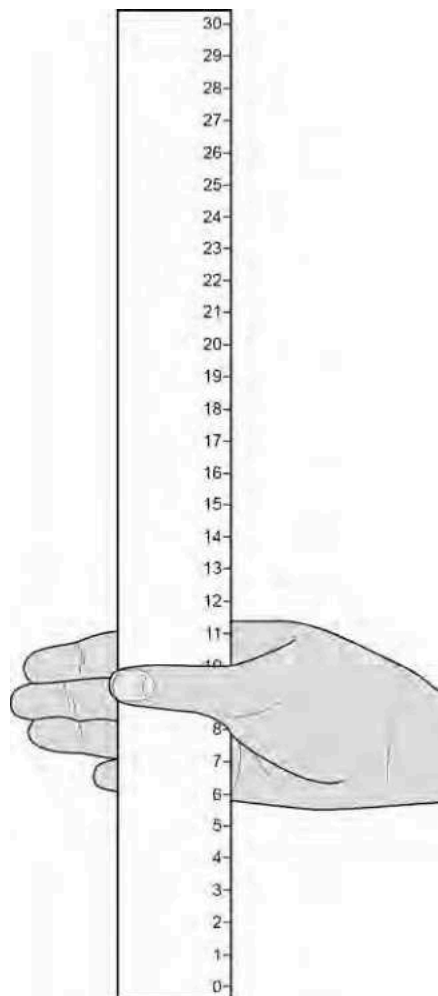
4. Student A catches the ruler and records the distance, as shown in

5. Steps 1 to 4 were then repeated.

*dropped with no force*  
*→ X drop*  
*drop from same height*  
*same ruler*  
*same hand*

Figure 7.

Figure 7



19 (I

of pealahk (control variables)

0 6 . 1

Suggest two ways the student

would give valid results.

[2 marks]

1 Drop from same height

2 Use the same type of ruler.

Question 6 continues on the next page

Table 3 shows Student A's results.

Table 3

Test Number	Distance ruler dropped in mm
1	117
2	120
3	115
4	106
5	123
6	125
7	106

median -  
middle  
of ordered  
data  
bit.

④

⑤

③

①

⑥

⑦

②

7 tests, so  $n \div 2 = 4^{\text{th}}$  is middle.

0 6 . 2

What is the median result?

[1 mark]

Tick one box.

106

115

116

117

123

06 . 3

The mean distance the ruler was dropped is 116 mm.

Calculate the mean reaction time.

Use the equation:

[3 marks]

$$10 \text{ mm} = 1 \text{ cm}$$

$$\text{reaction time in s} = \sqrt{\frac{\text{mean drop distance in cm}}{490}}$$

Give your answer to 3 significant figures

$$\mu = 116 \text{ mm} = 11.6 \text{ cm}$$

$$\sqrt{\frac{11.6}{490}} = 0.1539$$

Mean reaction time =

0.154 s

06 . 4

The students then measured Student A's reaction time using a computer program.

This is the method used.

1. The computer shows a red box at the start.
2. As soon as the box turns green the student has to press a key on the keyboard as fast as possible.
3. The test is repeated five times and a mean reaction time is displayed.

Student A's mean reaction time was 110 ms.

Using a computer program to measure reaction times is likely to be more valid than the method using a dropped ruler.

Give two reasons why.

[2 marks]

1. You might be able to tell when the other person is about to drop the ruler.
2. Measurement of time more precise using computer.

Question 6 continues on the next page

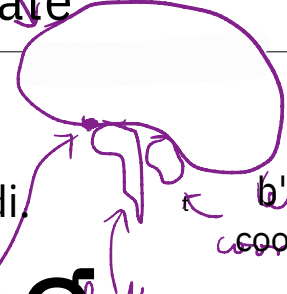
m  
↳

cerebrum

↳ outer layer = Cerebrate

↳ cortex: i memory,

intelligence,  
language etc.



cerebellum;  
coordination / movement  
medulla; unconscious

0 | 6 | . | 5

A woman has a head injury.

witethjemei

Her symptoms include: languagedi.

- finding it difficult to name familiar objects

• **not being able to remember recent events.**

hypothalamus: temp / Hz levels

Cerebral cortex

[1 mark]

0 | 6 | . | 6

A man has a head injury.

He suggests that his **temp medulla./Hz levels;**

Suggest which part of her brain has been

damaged activity **brain has been** damaged.

Cerebellum  
cortex

lack of coordination

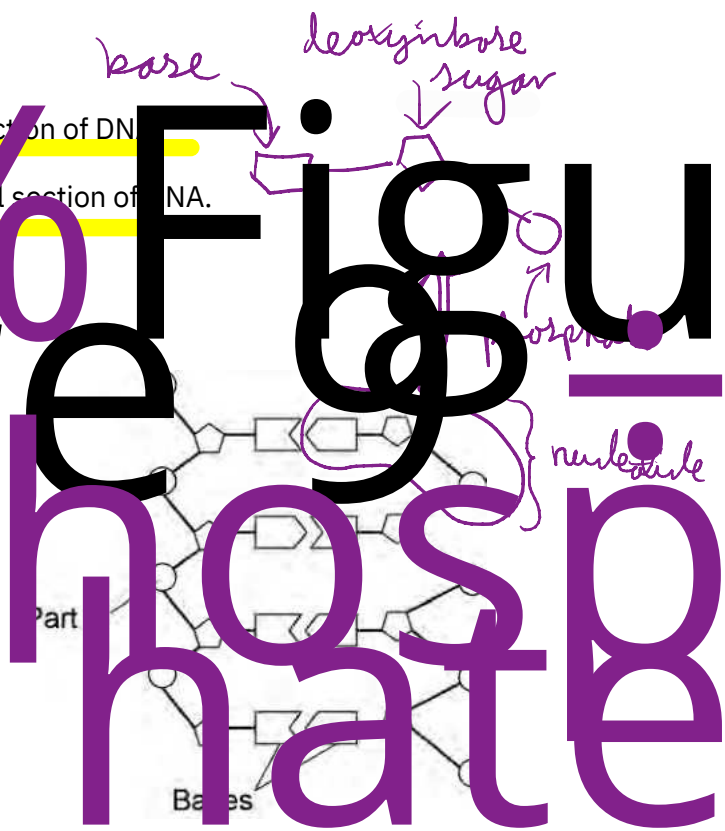
[1 mark]

0 7

Figure 8 shows an image of a small section of DNA.

Figure 9 shows the structure of a small section of DNA.

Figure 8



neukoliik.

0 7 . 1

What is Part B?

[1 mark]

Phosphate group.

0 7 . 2

In Figure 8 the structure of DNA shows four different bases.

There are four different bases and they always pair up in the same pairs.

Which bases pair up together?

[1 mark]

Adenine with Thymine, Cytosine with Guanine

OR Adenine with Thymine, C with G

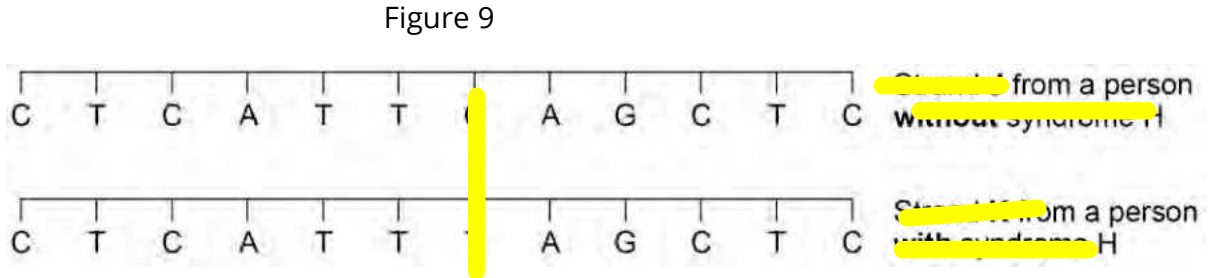
Question 7 continues on the next page

f-

Syndrome H is an inherited condition.

People with syndrome H do not produce the enzyme IDUA.

Figure 9 shows part of the gene coding for the enzyme IDUA.



Strand K shows a mutation in the DNA which has caused syndrome H.

The enzyme IDUA helps to break down a carbohydrate in the human body.

The enzyme IDUA produced from Strand K will not work.

Explain how the mutation could cause the enzyme not to work.

[5 marks]

The mutation has changed one base of DNA from C to T. This changes the amino acid coded for in the sequence. This could change the shape of the protein formed so that the enzyme's active site was a different shape. The enzyme is no longer complementary to the substrate. or say carbohydrate.

or  
t  
say carbohydrate .

DNA

Amino Acids

Protein

Enzyme

substrate



what's sprints state happening what it causes

ger



A recessive allele causes syndrome H.

A heterozygous woman and a homozygous recessive man want to have a child.

Draw a Punnett square diagram to determine the probability of the child having syndrome H.

Identify any children with syndrome H.

[5 marks]

Use the following symbols:

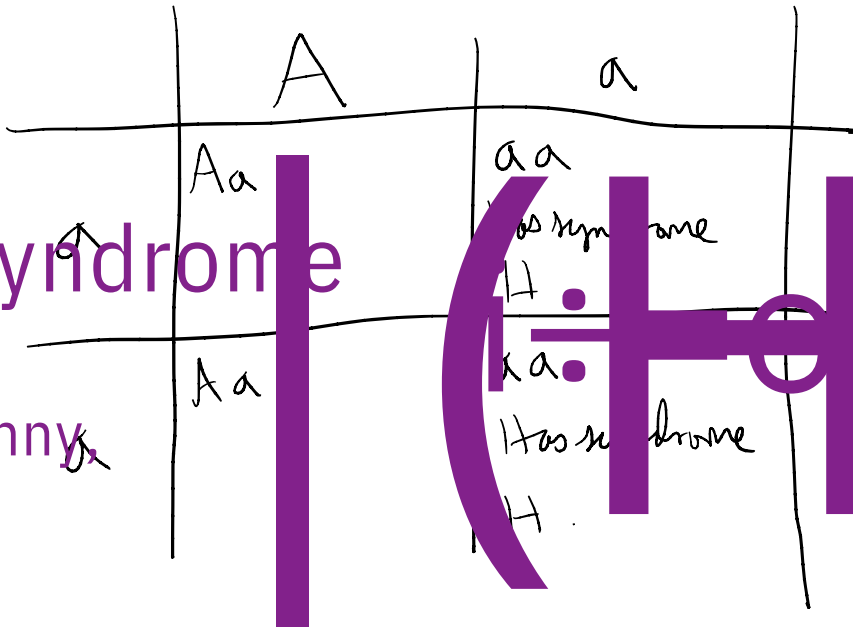
A = dominant allele

a = recessive allele



woman = Aa

man = aa



probability =  $\frac{2}{4} = 0.5$

Probability = 0.5

Turn over for the next question

0 | 8

Food security is when a population has enough food to stay healthy.

Lack of food security is a global problem.

One way to maintain food security is to increase the efficiency of food production.

Figure 10 shows how some pigs are farmed using intensive methods.

Figure 10



0 | 8

. 1

Some people think the farming methods shown in Figure 10 are unethical.

Suggest two other possible disadvantages of intensive farming methods.

[2 marks]

1 Diseases spread more rapidly

2 Heating requires an increased use of fuels

\* overpopulation (this would be a rehitant)

37

linkedo } x2 irrelevant

level 2; clear statements } x2  
linked to next part }  
explorations }

0 8 . 2

Explain how the intensive farming of pigs increases the efficiency of food production.

4 marks

£ { Kept in a temperature controlled environment ✓  
Kept in a

statement



so less energy required to maintain body temperature, and less energy transferred to the environment ✓

explanation

energy required to maintain body temperature and less energy transferred to the environment ✓  
kept in cages. therefore, less energy is required for movement and more energy is available for growth. ✓  
kept in cages. therefore less energy is required for movement and more energy is available for growth.

Question 8 continues on the next page

A newspaper reported that:

'Food security is a serious problem in remote communities in Canada. This is because Aboriginal communities are eating fewer traditional foods.'

One traditional food eaten by Aboriginal communities in Canada is seal.

Look at Table 4.

Table 4

Year	Number of seals caught in thousands
2004	362
2005	316
2006	348
2007	224
2008	215
2009	91
2010	67

% change  

$$= \frac{\text{final} - \text{initial}}{\text{initial}} \times 100$$

b-be safe

assume 3 s.f. to be safe

08 . 3

Calculate the percentage (%) decrease in the number of seals caught from 2004 to 2010.

due decrease.

[2 marks]

$$\frac{67 - 362}{362} \times 100 = \frac{-295}{362} \times 100 = -81.49\% \approx -81.5\%$$

↓ due to decrease

Decrease in seals: 81.5%

81.5

0 8 . 4

The conclusion in the newspaper might not be correct.

Suggest two reasons why.

[2 marks]

- 1 They may eat other goods unclear if they are food insecure.
- 2 We do not know if other traditional foods have declined.

Turn over for the next question

Homeostasis controls the internal conditions of the body.



Explain how blood glucose levels are controlled in the body of someone who does not have diabetes.

[4 marks]

If they are too high, insulin is released from the pancreas so glucose moves into cells.

If too low, glucagon is released from the pancreas from glycogen converted into glucose and released into blood.

If too low, glucagon is released from

glycogen converted into glucose and released into blood.

Comparative language suggests how each type of diabetes can be treated.

In type 1, not enough insulin is produced.

Whereas in type 2, cells do not respond to insulin.

Type 1 is treated with insulin injections.

Type 2 is treated with diet and exercise.

09 . 3 Look at Table 5.

Table 5

Population of UK in 2015	$6.5 \times 10^7$
Number of people diagnosed with diabetes	$3.45 \times 10^6$
Estimated number of people with undiagnosed diabetes	$5.49 \times 10^5$

Calculate the percentage (%) of the UK population estimated to have diabetes.

You should include both diagnosed and undiagnosed people in your calculation.

Give your answer to 2 significant figures.

[3 marks]

$$3.45 \times 10^6 + 5.49 \times 10^5 = 3,999,000$$

$$\frac{3,999,000}{65,000,000} \times 100 = 6.15$$

round up)  $\rightarrow$  (round up)

2 Estimated percentage of population with diabetes = 6.2 %

Question 9 continues on the next page

09 . 4

A urine test can be used to check for the presence of glucose in the urine.

Diabetes can also be diagnosed with a blood test to measure the concentration of blood glucose.

Suggest why a blood test is more reliable than a urine test.

[1 mark]

Blood test

Blood test gives current result urine levels may be hours old.

\* not always glucose in urine

a0w 9w.w5

A blood test called the glucose tolerance test checks how well the body processes glucose.

Concentrations of glucose in the blood are measured before and after drinking a glucose drink.

Patients are not allowed to eat food for 8 hours before the glucose tolerance test.

Suggest why patients are not allowed to eat for 8 hours before the test.

[1 mark]

8 hours is time insulin

8 hours is time insulin given so sufficient time for insulin to act on glucose from the food

OR low starting point to show effects

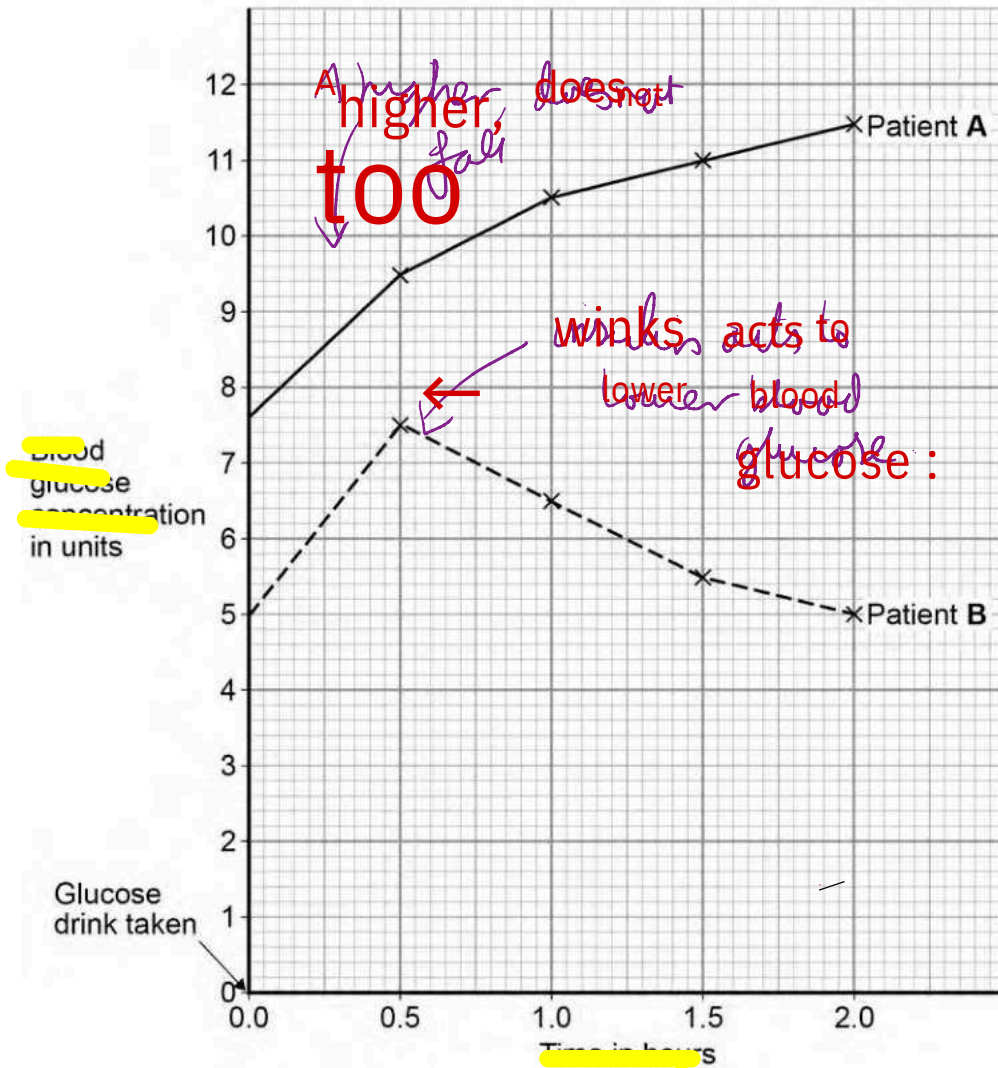
OR so results not affected by glucose from food



09.6

Figure 11 shows the results of a glucose tolerance test for two patients, A and B.

Figure 11



Which patient has diabetes?

Justify your answer.

[2 marks]

Patient A

Justification Patient A's glucose levels are much higher and remain high. Patient B's glucose levels are much lower and remain low.

1 0

Endocrine glands produce hormones.

physiological processes

produces thyroxine

not symptomatic

metabolic rate

1 0 . 1

Hyperthyroidism is caused by an overactive thyroid gland.

Suggest what would happen in the body of a person with hyperthyroidism.

[3 marks]

Basal metabolic rate (BMR) is the rate of energy expenditure while at rest. It is the minimum amount of energy required to maintain basic physiological functions. BMR is measured in kilocalories per day (kcal/day) or kilojoules per day (kJ/day). BMR is influenced by age, sex, body composition, and thyroid hormone levels. An increase in BMR is associated with hyperthyroidism, while a decrease is associated with hypothyroidism.

Increased production of thyroxine therefore leads to an increased rate of respiration and any metabolic processes e.g. increased rate of protein formation.

OR

g. universal procreator of protein

1 0 . 2

Describe the roles of FSH and LH in the menstrual cycle.

[2 marks]

FSH causes the eggs to mature and stimulates ovaries to produce oestrogen.

LH stimulates ovaries to release the egg at ovulation.

causes the release the

FSH = follicle stimulating hormone.

↳ produced pituitary

↳ causes eggs mature

↳ stimulates production oestrogen

LH = luteinizing hormone

↳ also produced pituitary

↳ results in release of egg

The combined pill is a contraceptive that contains progesterone and oestrogen.

The 'mini-pill': *inhibits FSH and LH*

• is a contraceptive that only contains the progesterone hormone

→ C • **has to be taken at the same**

The success rate of the mini-pill in preventing pregnancy is lower than that of the combined pill.

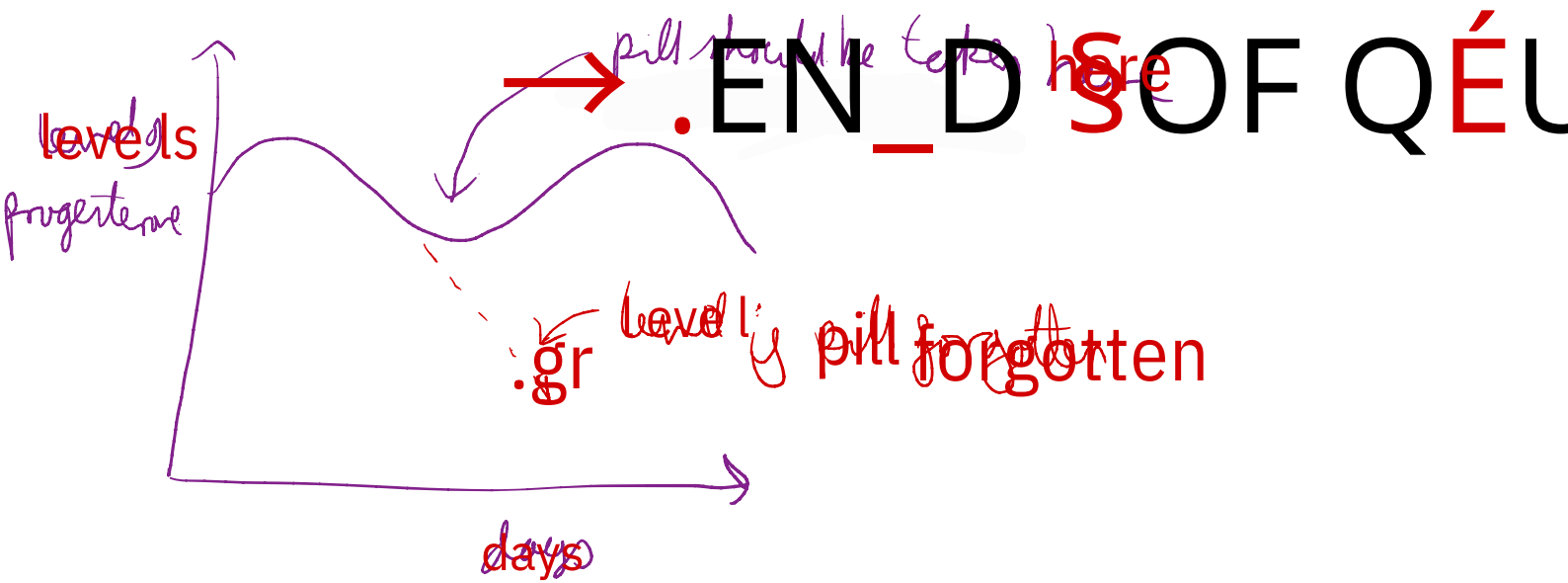
*maintains constant level in bloodstream.*

Explain why missing a dose of the mini-pill would reduce the success rate of the mini-pill.

[4 marks]

**Missing a dose causes a drop in**

*Missing a dose causes a drop in progesterone levels ✓ FSH no longer inhibited Drop means that LH also no longer inhibited / consequently an egg may be matured and released ✓*



---

There are no questions printed on this page

#### Copyright information

Permission to reproduce all copyright material has been applied for. In some cases, efforts to contact copyright-holders may have been unsuccessful and AQA will be happy to rectify any omissions of acknowledgements in future papers if notified. If you have any queries please contact the Copyright Team, AQA, Stag Hill House, Guildford, GU2 7XJ.

Copyright © 2016 AQA and its licensors. All rights reserved.

Figure 1: Fossilised snake © Peter Menzel/Science Photo Library

Table 1: Japanese rat snake © Kazzpix/Thinkstock

Table 1: Texas rat snake © Alexey Kuznetsov/Thinkstock

Figure 2: Decaying strawberry © sarahdoow/Thinkstock

Figure 2: Strawberry © Mariusz Blach/Thinkstock

Figure 4: Dilating iris © Gandee Vasan/Getty Images

Figure 8: DNA computer-generated image © Svisio/Thinkstock

Figure 10: Intensively farmed pigs © Ingram Publishing/Thinkstock

---

There are no questions printed on this page

#### Copyright information

Permission to reproduce all copyright material has been applied for. In some cases, efforts to contact copyright-holders may have been unsuccessful and AQA will be happy to rectify any omissions of acknowledgements in future papers if notified. If you have any queries please contact the Copyright Team, AQA, Stag Hill House, Guildford, GU2 7XJ.

Copyright © 2016 AQA and its licensors. All rights reserved.

Figure 1: Fossilised snake © Peter Menzel/Science Photo Library

Table 1: Japanese rat snake © Kazzpix/Thinkstock

Table 1: Texas rat snake © Alexey Kuznetsov/Thinkstock

Figure 2: Decaying strawberry © sarahdoow/Thinkstock

Figure 2: Strawberry © Mariusz Blach/Thinkstock

Figure 4: Dilating iris © Gandee Vasan/Getty Images

Figure 8: DNA computer-generated image © Svisio/Thinkstock

Figure 10: Intensively farmed pigs © Ingram Publishing/Thinkstock