

Name: \_\_\_\_\_

# Homeostasis and Response part 2 AQA Triple Biology

Class: \_\_\_\_\_

Date: \_\_\_\_\_

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Time: **77 minutes**

Marks: **73 marks**

Comments:

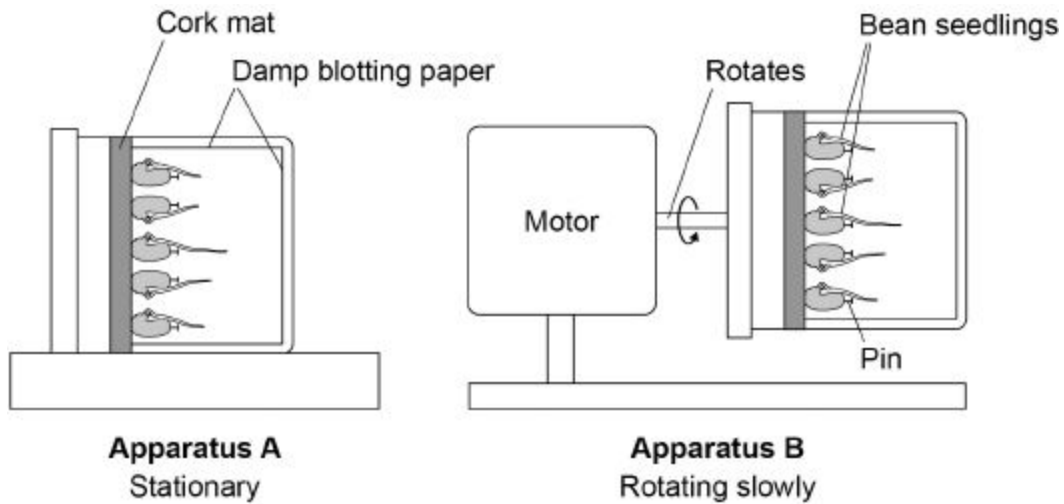
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1.

Some students investigated geotropism in the roots of bean seedlings.

Figure 1 shows the apparatus used.

Figure 1



This is the method used.

1. Measure the length of the root of each of 10 bean seedlings.
2. Pin 5 seedlings to the cork mat in apparatus **A**.
3. Pin 5 seedlings to the cork mat in apparatus **B**.
4. Leave **A** and **B** in a dark cupboard for 2 days.
5. After the 2 days:
  - make a drawing to show the appearance of each seedling
  - measure the length of the root of each seedling.

(a) Why did the students surround the seedlings with damp blotting paper?

Tick **one** box.

To prevent light affecting the direction of root growth

To prevent photosynthesis taking place in the roots

To prevent the growth of mould on the roots

To prevent water affecting the direction of root growth

Apparatus **B** is a control.

Apparatus **B** rotates slowly.

(b) How does apparatus **B** act as a control?

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(1)

The table below shows the students' results.

	Apparatus A					Apparatus B				
Seedling number	1	2	3	4	5	1	2	3	4	5
Length at start in mm	35	41	32	33	39	30	33	29	28	31
Length after 2 days in mm	49	57	43	45	54	45	45	44	29	44
Length change in mm	14	16	11	12	15	15	12	15	1	13
Mean length change in mm	14					11				

(c) One student stated:

'The mean length change for the seedlings in apparatus **B** is **not** valid.'

Suggest the reason for the student's statement.

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(1)



(f) In horticulture plant hormones are used for controlling plant growth.

Draw **one** line from each plant hormone to the correct use of that hormone.

Plant hormone	Use of hormone
Auxin	To reduce the time taken for tomatoes to ripen
Ethene	To slow down the growth of plant stems
Gibberellin	To promote seed germination
	To stimulate root growth in plan cuttings

(3)  
(Total 10 marks)

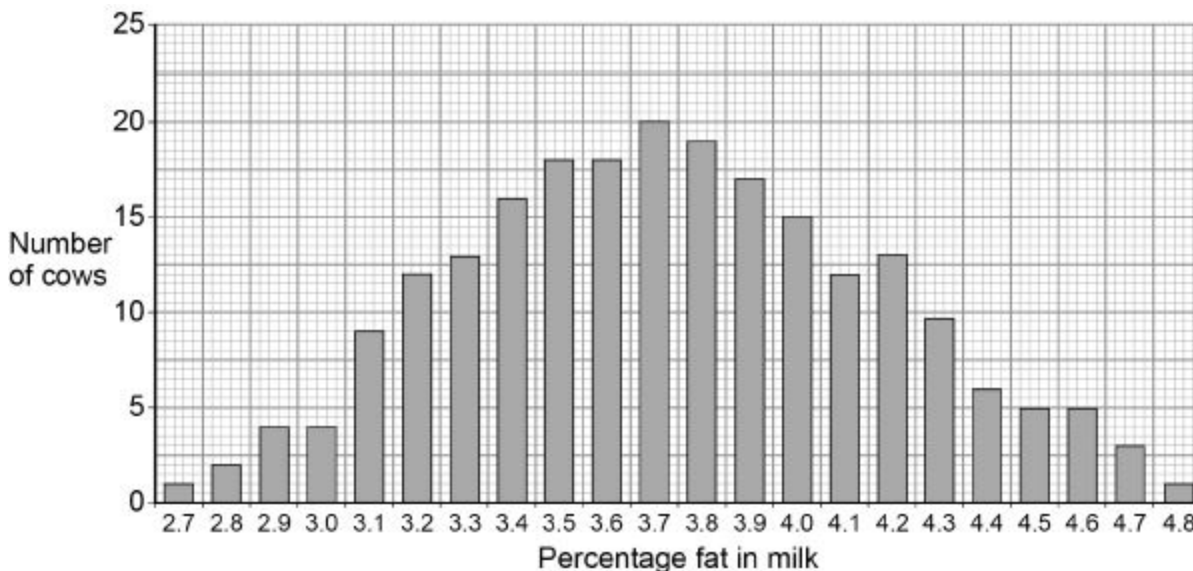
2.

Scientists want to breed cows that produce milk with a low concentration of fat.

**Figure 1** shows information about the milk in one group of cows.

The cows were all the same type.

**Figure 1**



(a) In **Figure 1** the mean percentage of fat in the milk is equal to the modal value.

Give the mean percentage of fat in the milk of these cows.

Mean percentage = \_\_\_\_\_

(1)

(b) A student suggested:

'The percentage of fat in milk is controlled by one dominant allele and one recessive allele.'

How many different phenotypes would this produce?

Tick **one** box.

2	
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3	
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22	
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46	
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(1)

(c) Give the evidence from **Figure 1** which shows the percentage of fat in the milk is controlled by several genes.

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(1)

(d) One of the genes codes for an enzyme used in fat metabolism.

A mutation in this gene causes a reduction in milk fat.

The mutation changes one amino acid in the enzyme molecule.

Explain how a change in one amino acid in an enzyme molecule could stop the enzyme working.

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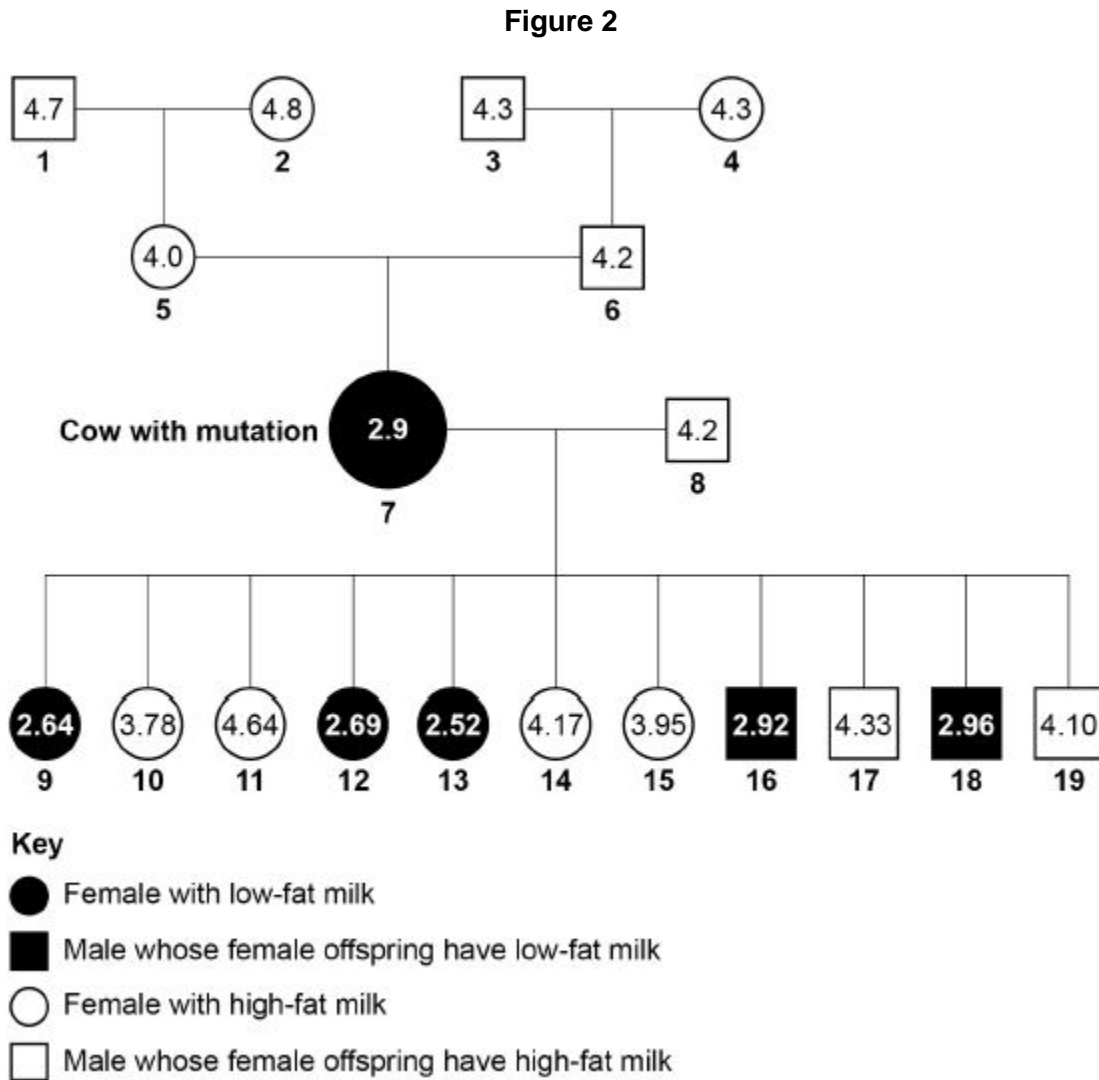
(3)

The scientists found one cow with a mutation.

The cow's milk contained only 2.9% fat.

**Figure 2** shows the percentage of fat in the milk of cattle related to the cow with the mutation.

The values for male cattle are the mean values of their female offspring.



(e) Animal **8** is homozygous.

The mutation in animal **7** produced a dominant allele for making low-fat milk.

Give evidence from **Figure 2** that animal **7** is heterozygous.

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(1)

- (f) Animals **7** and **8** produced 11 offspring. These offspring were produced by in vitro fertilisation (IVF).

The embryos from IVF were transferred into 11 other cows.

Suggest why IVF and embryo transfer were used rather than allowing animals **7** and **8** to mate naturally.

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(1)

- (g) Draw a Punnett square diagram to show a cross between animals **7** and **8**.

Identify which offspring produce low-fat milk and which offspring produce high-fat milk.

Use the following symbols:

**D** = dominant allele for making low-fat milk

**d** = recessive allele for making high-fat milk

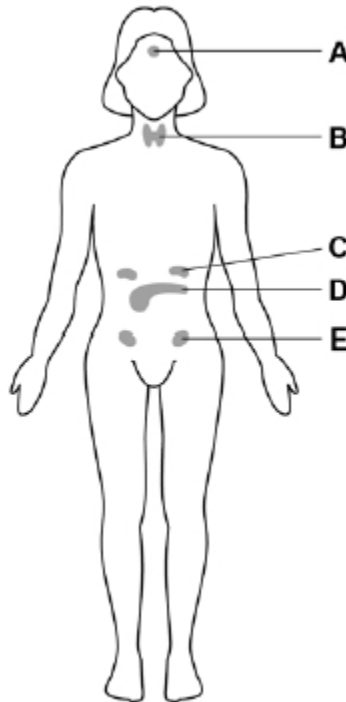
(4)



3.

The menstrual cycle in a woman is controlled by hormones.

The diagram shows some of the glands in a woman's body that produce hormones.



The hormones that control the menstrual cycle are produced by the pituitary gland and by the ovaries.

(a) Which gland is the pituitary gland?

Tick **one** box.

A  B  C  D  E

(1)

(b) Which gland is the ovary?

Tick **one** box.

A  B  C  D  E

(1)

(c) Complete the sentence.

In the menstrual cycle, one egg is released approximately every \_\_\_\_\_ days.

(1)

(d) Which hormone is used in the oral contraceptive pill?

Tick **one** box.

Adrenaline

Insulin

Progesterone

Testosterone

(1)

(e) Describe how the oral contraceptive pill stops a woman becoming pregnant.

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(2)

(f) Complete the sentences.

Choose the answers from the box.

<b>adrenaline</b>	<b>insulin</b>	<b>oestrogen</b>	<b>progesterone</b>	<b>testosterone</b>
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Development of the female secondary sex characteristics is controlled

by \_\_\_\_\_ .

Sperm production is stimulated by \_\_\_\_\_ .

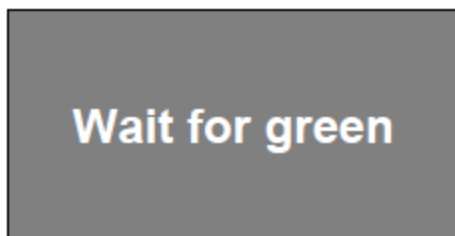
(2)

(Total 8 marks)

4. Three students measured their reaction times.

The students used a computer program.

The image below shows the image displayed on the computer screen.



This is the method used:

1. Sit facing the computer screen.
2. Click the mouse button as quickly as possible when the computer screen turns green.
3. Record the time taken as shown on the computer screen.
4. Repeat steps 2 and 3 a further 9 times.

The table shows the students' results.

Attempt number	Time in milliseconds		
	Student A	Student B	Student C
1	275	260	272
2	259	268	268
3	251	251	275
4	261	256	266
5	260	244	270
6	263	280	283
7	259	468	274
8	256	258	278
9	255	255	286
10	248	277	275
<b>Mean</b>	259	282	275

(1 second = 1000 milliseconds)

- (a) Suggest why measuring reaction time with a computer is more accurate than measuring reaction time with a stopwatch.

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(1)

- (b) The students measured 10 reaction times for each person rather than 3 reaction times. Explain why.

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(2)

- (c) Explain why the mean for student **B** has been calculated incorrectly. Use information from the table.

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(2)

- (d) Calculate the ratio of student **C**'s mean reaction time to student **A**'s mean reaction time. Give your answer to 3 significant figures.

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Ratio student **C** : student **A** = \_\_\_\_\_ : 1

(2)

(e) Student **A** wanted to present his mean result in seconds, in standard form.

What is the correct way of doing this?

Tick **one** box.

$259 \times 10^{-3}$  seconds

$0.259 \times 10^{-3}$  seconds

$2.59 \times 10^{-1}$  seconds

$0.259 \times 10^{-4}$  seconds

(1)

(f) Student **C** said the results from this investigation showed that he had the fastest reactions.

Give **two** reasons why student **C**'s statement is **not** correct.

1. \_\_\_\_\_  
\_\_\_\_\_

2. \_\_\_\_\_  
\_\_\_\_\_

(2)

(g) The reaction the students investigated is **not** a reflex action.

Give the reason why.

\_\_\_\_\_  
\_\_\_\_\_

(1)

(Total 11 marks)

**5.**

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.

(a) Give **two** variables the students controlled in their investigation.

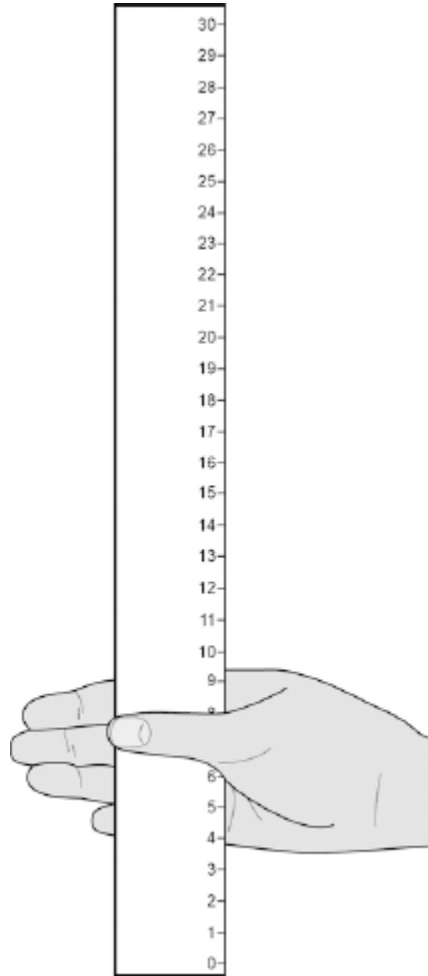
1. \_\_\_\_\_

2. \_\_\_\_\_

**(2)**

(b) **Figure 1** shows one of the results for the Student A.

**Figure 1**



What is the reading shown in **Figure 1**?

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Reading on ruler = \_\_\_\_\_ cm

(1)

(c) **Table 1** shows the students' results.

**Table 1**

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
<b>Mean</b>	<b>7</b>	<b>X</b>

**Circle** the anomalous result in **Table 1** for Student **A**.

(1)

(d) What is the **median** result for Student **B**?

Tick **one** box.

8

11

12

13

(1)

(e) Calculate the value of **X** in **Table 1**.

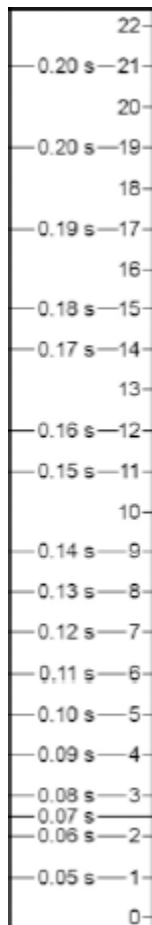
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Mean distance ruler dropped = \_\_\_\_\_ cm

(1)

(f) **Figure 2** shows the scale used to convert distance of the ruler drop to reaction time.

**Figure 2**



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

Use **Figure 2** and **Table 1**.

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Answer = \_\_\_\_\_ s

**(2)**

(g) What improvement could the students make to the method so the results are more valid?

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

(1)

(h) Student **A** carried out a second investigation to see the effect of caffeine on the reflex action.

**Table 2** shows his results.

**Table 2**

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
<b>Mean</b>	<b>8</b>	<b>5</b>

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

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(1)

(Total 10 marks)

6.

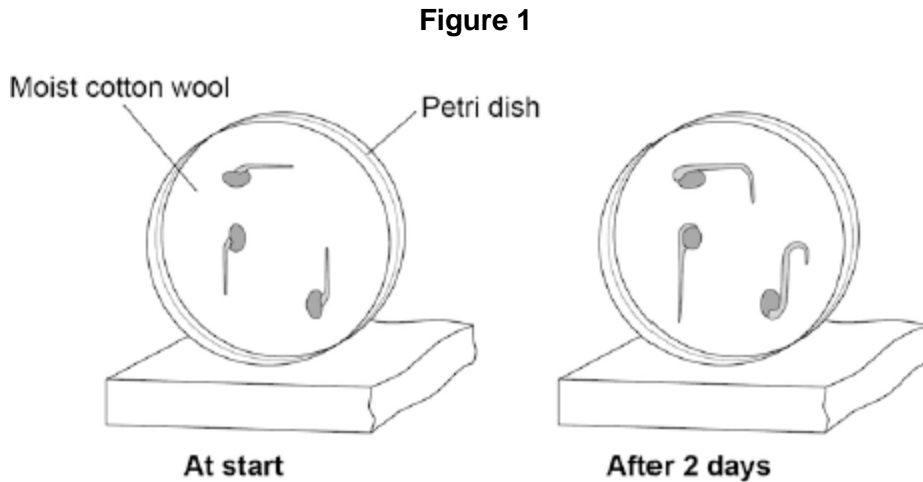
Hormones called auxins control plant growth.

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 1 shows the results.



- (a) Describe the direction of growth of the bean **roots** after 2 days.

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

Direction of root growth \_\_\_\_\_

Reason \_\_\_\_\_

\_\_\_\_\_

(2)

(b) 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.

Direction of root growth \_\_\_\_\_

Reason \_\_\_\_\_

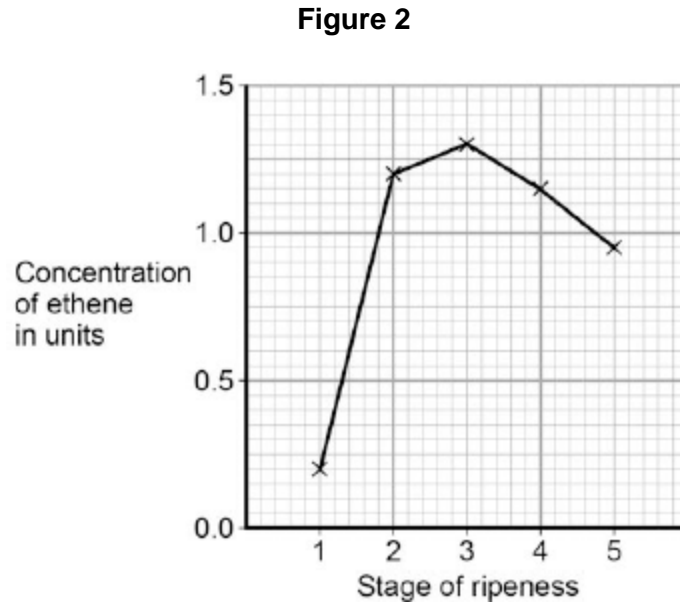
**(2)**

(c) 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 2** shows the results.



At which stage of ripeness is there most ethene?

Tick **one** box.

Stage 1

Stage 2

Stage 3

Stage 4

Stage 5

(1)

(d) Suggest how the scientists can find out if the result for Stage 1 was an anomaly.

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(1)

(e) 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.

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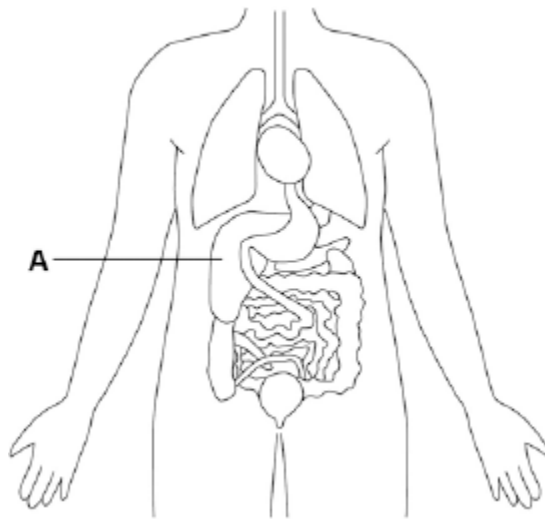
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(1)

(Total 7 marks)

**7.** Humans control their internal environment in many ways.

Look at the diagram below.



(a) Name organ **A**.

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(1)

(b) 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.

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(1)

(c) Which organ produces urine?

Tick **one** box.

Brain

Lungs

Kidney

Thyroid

**(1)**

(d) Marathon runners often drink sports drinks during a race.

Explain why.

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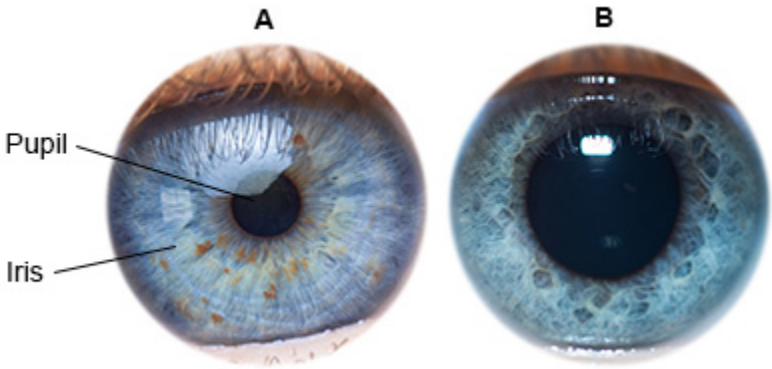
**(2)**

**(Total 5 marks)**

8.

Figure 1 shows a reflex in the iris of the human eye in response to changes in light levels.

Figure 1



(a) Describe the changes in the pupil and iris going from A to B in Figure 1.

Explain how these changes occur.

Refer to the changes in light level in your answer.

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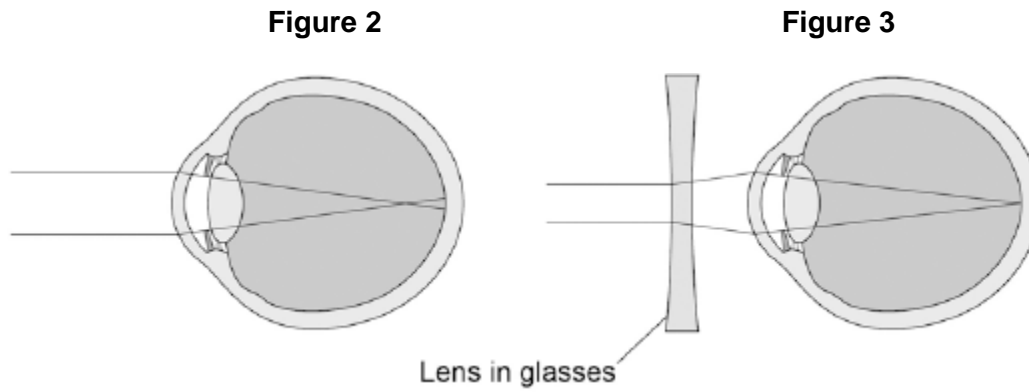
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(4)

(b) Some people wear glasses to improve their vision.

**Figure 2** shows light entering the eye in a person with blurred vision.

**Figure 3** shows how this condition is corrected with glasses.



Compare **Figure 2** and **Figure 3**.

Explain how the blurred vision is corrected.

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(2)  
(Total 6 marks)

## Mark schemes

1.

(a) to prevent water affecting the direction of root growth

1

(b) gravity acts evenly on all sides

*allow cancel out the effect of gravity*  
*do **not** accept there is no gravity*

1

(c) (mean) includes the (anomalous) result for seedling 4

*allow (mean) includes the (anomalous) result which only grew 1 mm*

1

(d) calculate (mean) from just seedlings 1, 2, 3 and 5

**or**

repeat the investigation **and** recalculate (a new mean)

*allow omit seedling 4 from (mean) calculation*

1

(e) uneven distribution of hormone in (root / seedling of) A

*allow reference to auxin*  
*allow more hormone at bottom*  
*do **not** accept more hormone at the top*

1

even distribution of hormone in B

*allow B does not have an uneven distribution of hormone*

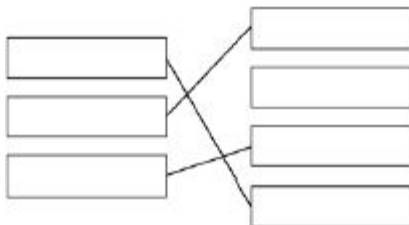
1

(so) top grows fast(er) (than bottom) in (root / seedling of) A (and equal growth in B)

*allow (more) cell elongation or cell division on top of A*  
*allow converse for lower surface*

1

(f)



*extra line for a hormone cancels mark for that hormone*

1

1

1

[10]

2.

(a) 3.7

1

- (b) 2 1
- (c) (different combinations of alleles cause) many / 22 values  
*allow continuous variation*
- or**  
in-between values  
**or**  
large range of values  
**or**  
there are not only two values  
*allow there are not only 3 values if 3 is given in part (b)* 1
- (d) different protein made  
*allow change in shape (of enzyme) or change in 3-D structure*  
*ignore denature* 1
- active site changed 1
- so substrate does not fit / bind  
*allow description of substrate*  
*allow cannot form E-S complex*  
*ignore lock and key description* 1
- (e) produces (some) offspring with high-fat milk  
**or**  
not all offspring have low-fat milk  
*ignore reference to alleles* 1
- (f) takes less time (to obtain results)  
**or**  
more offspring at the same time  
*allow other sensible suggestion – e.g. allows screening*  
**or** *allow cow 7 to continue to produce eggs* **or** *avoid injury to cow 7 during mating or giving birth* 1

- (g) male gametes correct: d (and d) 1
- female gametes correct: D and d 1
- allow 1 mark if gametes are correct but gender not identified*
- correct derivation of offspring genotypes from given gametes 1
- allow 2 x 2 or 2 x 1 derivation*
- Dd identified as low-fat **and** dd identified as high-fat in offspring 1
- if DD offspring are produced, must also identify as low-fat*
- (h) find female with low(est) fat in milk **and** high(est) milk yield 1
- allow choose from 7, 9, 12, 13 which has the highest yield*
- find male whose female offspring have high(est) milk yield **and** low(est) fat in milk 1
- allow choose from 16 or 18 whose female offspring has the highest yield*
- or**
- find female with lowest fat in milk
- or** cow 13 (1)\*
- \*or**
- allow female with high(est) milk yield*
- find male whose female offspring have high(est) milk yield (1)\*
- \*or**
- allow male whose female offspring have lowest fat in milk / male 16*
- cross the best (for both features) female with the best male 1
- select best offspring (for both features) from each generation and repeat for several generations 1

[16]

3.

- (a) A 1
- (b) E 1

(c)	28				
		<i>allow 27–29</i>			1
(d)	progesterone				1
(e)	any <b>two</b> from:				
	•	inhibits FSH production / release			
	•	prevents egg maturation			
		<i>allow prevents egg growth</i>			
	•	prevents ovulation			
		<i>allow prevents egg release</i>			
		<i>ignore prevents egg production</i>			2
(f)	oestrogen				1
	testosterone				
		<i>allow in this order only</i>			1
					<b>[8]</b>
<b>4.</b>	(a)	times are very short / in milliseconds			
		<b>or</b>			
		milliseconds cannot be measured with a stopwatch			1
	(b)	to increase validity / repeatability			
		<b>or</b>			
		to get representative results			
		<i>allow to give a more reliable mean value</i>			1
		because of variation in results			
		<i>allow to identify any anomalies</i>			1
	(c)	(they have included) 468 / the 7th result			
		<i>allow identification of anomaly in the table</i>			1
		(which) is anomalous / is a much higher value (than the others)			1

- (d)  $\frac{275}{259}$   
 1.06 (: 1)  
*an answer of 1.06 (: 1) scores 2 marks*  
*allow max 1 mark if wrong number of sig. figs.* 1
- (e)  $2.59 \times 10^{-1}$  seconds 1
- (f) any **two** from:  
 • cannot compare mean to **B** as it has been incorrectly calculated  
 • **C**'s mean reaction time is the longest, not the shortest  
 • only measured one type of reaction  
**or**  
 cannot generalise to all reaction types  
 • other factors can influence reaction time  
*allow examples* 2
- (g) involves (the conscious part of) the brain  
*allow voluntary (re)action* 1
- 5.** (a) any **two** from:  
 • drop the ruler from the same height  
 • use the same / dominant hand each time  
 • thumb same distance from ruler at the start  
 • use same type / weight of ruler  
 • drop the ruler without any force each time  
 • keep arm resting on the edge of the table 2
- (b) 8  
*allow 8.0* 1
- (c) 2 (in test number 2) 1
- (d) 12 1
- (e)  $(12 + 13 + 13 + 9 + 8 / 5 =) 11$  1
- (f)  $0.15 - 0.12$  (s)  
 0.03 (s)  
*allow 0.03 (s) with no working shown for 2 marks* 1

[11]

- (g) carry out more repeats 1
- (h) caffeine speeds up reflex actions 1  
**or**  
 reduces reaction time 1

**[10]**

- 6.** (a) grown down 1  
*allow longer*

towards gravity / gravitropism  
*allow geotropism* 1

- (b) grow up 1

towards the light  
*allow phototropism* 1

- (c) 3 1

- (d) repeat the experiment 1

- (e) seeds germinate sooner so growing season is longer 1

**[7]**

- 7.** (a) liver 1

- (b) insulin 1  
*do not accept glucagon*

- (c) kidney 1

- (d) to replace water / ions / salt 1  
 (that is) lost in sweat 1

**[5]**

- 8.** (a) pupils dilated (at **B**) 1  
*allow converse for A*

in dim light / low light levels

1

because circular muscles (in iris) relax

1

(and) radial muscles contract

1

(b) figure 2 shows myopia where light does not focus on the retina  
*allow refraction*

1

in figure 3 the lens bends the light so that light focuses on the retina

1

**[6]**