Name: _____

Class: _____

Date: _____

Homeostasis and Response part 4 AQA Triple Biology

Time: **69 minutes**

Marks: **69 marks**

Comments:

1. People with type 1 diabetes inject insulin to control their blood glucose level.

A pancreas transplant is another treatment for type 1 diabetes.

One risk of a pancreas transplant is organ rejection.

(a) Explain why a transplanted organ may be rejected.

_____

_____

_____

_____

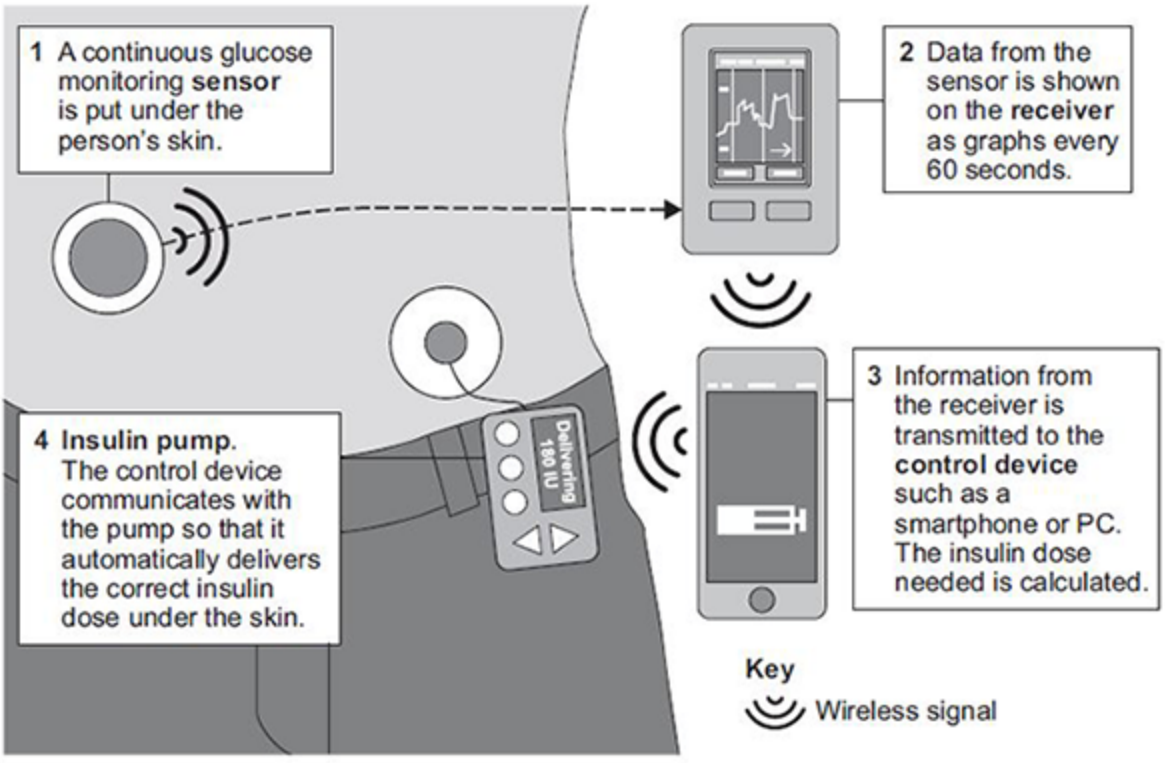
_____

_____

(3)

(b) Scientists have developed an artificial pancreas to treat type 1 diabetes.

The diagram below shows how an artificial pancreas works.



(i) A woman with type 1 diabetes has an artificial pancreas. The woman eats a meal high in sugar. The meal causes her blood glucose level to rise.

Use information from the diagram above to describe what happens to bring the blood glucose level of the woman back to normal.

(4)

(ii) The traditional way of monitoring and treating type 1 diabetes is to take a small sample of blood and put it on a test strip to find out how much insulin to inject.

Suggest **one** possible advantage, other than not having to do blood tests, of the method used in the diagram above.

(1)

(Total 8 marks)

2. This question is about hormones.

(a) (i) Hormones carry messages.

What type of messenger is a hormone?

Draw a ring around the correct answer.

chemical **electrical** **environmental**

(1)

(ii) Which part of the brain secretes hormones?

Draw a ring around the correct answer.

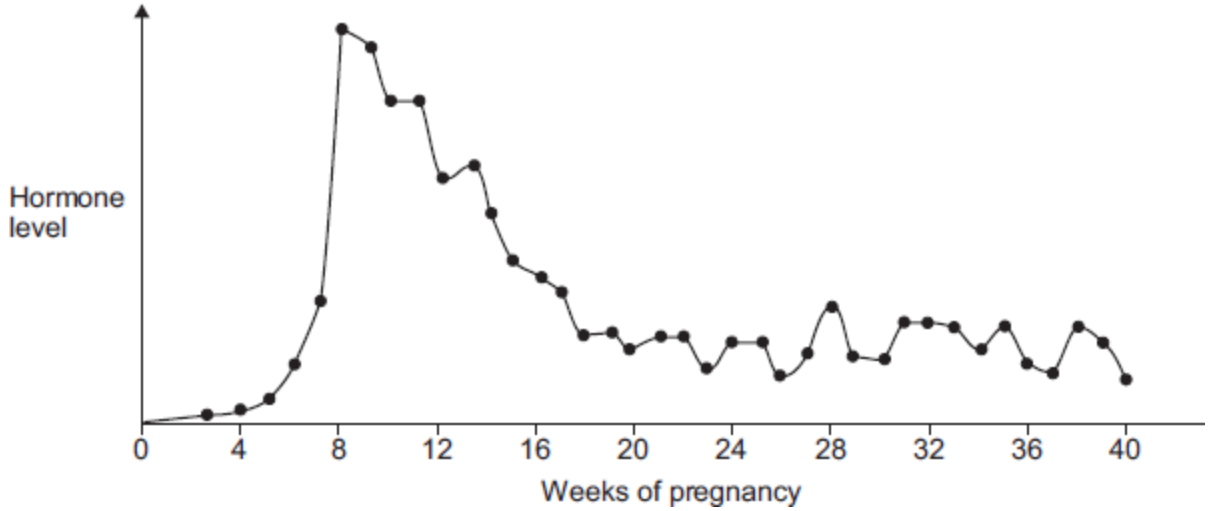
cerebellum **medulla** **pituitary gland**

(1)

(b) **Figure 1** shows the level of a pregnancy hormone over a 40-week pregnancy.

This hormone can be detected in a pregnancy test.

Figure 1



A woman takes a pregnancy test.

In which week of pregnancy is the test most likely to give a positive result?

Use information from **Figure 1**.

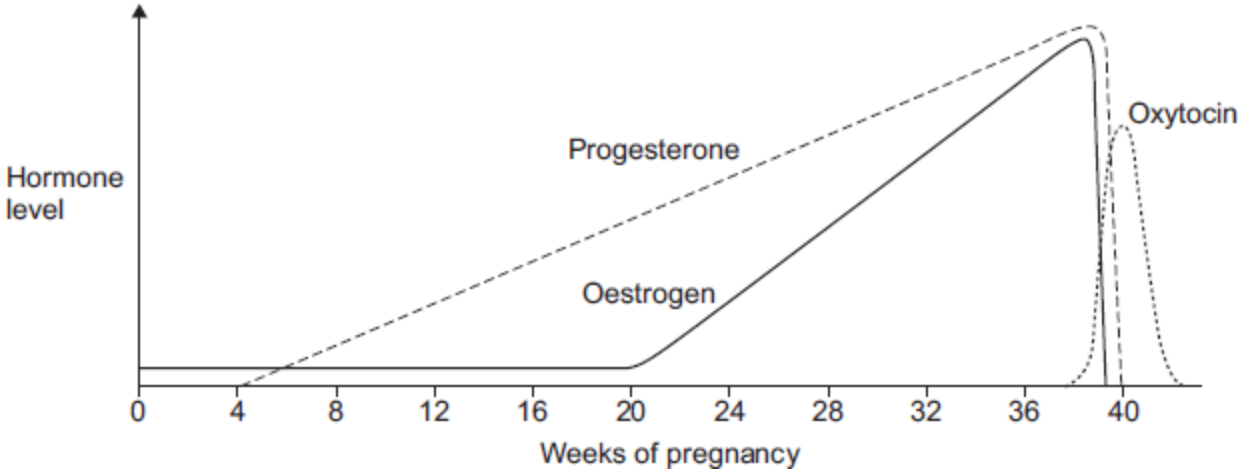
Write the correct answer in the box.

(1)

(c) **Figure 2** shows the levels of three other hormones during pregnancy.

The baby is usually born at about 40 weeks.

Figure 2



Adaptation by kind permission of Biozone International

(i) Describe the patterns in the levels of oestrogen and progesterone from 0 to 36 weeks.

(4)

(ii) Which hormone is likely to stimulate contractions of the uterus (womb) when the baby is born?

Use information from **Figure 2** to give a reason for your answer.

(2)

(Total 9 marks)

3. (a) Control systems help to keep conditions in the human body relatively constant.

What is the general name for the processes that keep body conditions relatively constant?

Draw a ring around the correct answer.

eutrophication **homeostasis** **hydrotropism**

(1)

(b) The concentration of glucose in the blood is controlled by hormones.

Use the correct answer from the box to complete each sentence.

glucagon	**glycerol**	**glycogen**
kidney	**liver**	**pancreas**

When the blood glucose concentration increases, an organ called the _____ releases the hormone insulin.

Insulin causes glucose to move from the blood into the cells of the muscles and the _____ .

Inside these organs, the glucose is changed into a carbohydrate called _____ , which can be stored.

When the blood glucose concentration falls, another hormone is released, which causes the storage carbohydrate to break down into glucose again.

This hormone is called _____ .

(4)

(c) A person with Type 1 diabetes does not make enough insulin.

The person needs to test their blood at intervals throughout the day.

If the concentration of glucose in their blood is too high, the diabetic person needs to inject insulin.

(i) Insulin is a protein.

It must be injected and cannot be taken by mouth.

Explain why.

_____

_____

_____

_____

(2)

(ii) Apart from injecting insulin, give **one other** way that a diabetic person could help to control the concentration of glucose in their blood.

_____

_____

(1)

(d) Pet dogs have been trained to detect if the concentration of glucose in the blood of their diabetic owners is outside the normal healthy range. These dogs are called 'medical response dogs'.
The dogs respond in different ways. They may bark, jump up, or stare at their owners. They may even fetch a blood-testing kit.

(i) Suggest what stimulus the dogs might be responding to when they behave like this.

_____

_____

(1)

(ii) **Table 1** shows how the concentration of glucose varied in blood samples from five diabetic people. Measurements were made both before and after getting a medical response dog.

Table 1

		Mean percentage of blood samples with different concentrations of glucose from the five diabetic people		
	Number of blood samples measured	**Low glucose**	**Within normal range of glucose**	**High glucose**
Before getting a dog	1704	32.6	54.8	12.6
After getting a dog	1724	18.6	61.6	19.8

A survey was made of the effect of a medical response dog on the lives of 16 diabetic people.

Table 2 shows how well these diabetic people agreed with each statement in the survey.

Table 2

Statement in survey	**Totally agree**	**Somewhat agree**	**Neither agree nor disagree**	**Somewhat disagree**	**Totally disagree**
I am more independent since getting my dog.	12	2	2	0	0
There are disadvantages to having a medical response dog.	0	0	4	4	8
I trust my dog to alert me when my sugar levels are low.	11	3	1	0	1
I trust my dog to alert me when my sugar levels are high.	6	7	0	1	2

Evaluate how useful medical response dogs are for warning diabetic people that the concentration of glucose in their blood is outside the normal range.

Use information from **Tables 1** and **2**.

(5)

(e) **Table 3** shows the concentrations of some substances in the urine of a non-diabetic person and in the urine of a diabetic person.

Table 3

	Concentration of substance in urine in g per dm^3	
Substance	**Non-diabetic person**	**Diabetic person**
Protein	0	0
Glucose	0	2.0
Urea	20.0	19.5
Sodium ions	6.0	5.8

Compare the results for the non-diabetic person and the diabetic person.
Give reasons for any differences.

Use your knowledge of how the kidney works.

(5)

(Total 19 marks)

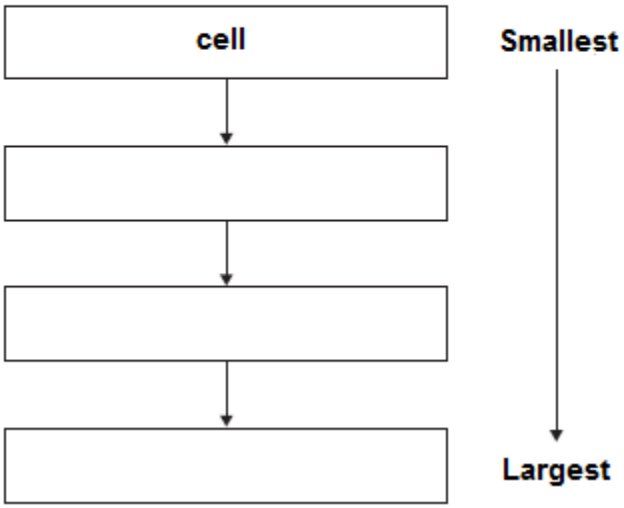
4. The human body is organised to carry out many different functions.

(a) Use words from the box to complete **Figure 1** by putting the parts of the body in order of size from smallest to largest.

The smallest one has been done for you.

cell	organ system	organ	tissue

Figure 1



(2)

(b) The stomach is made of different types of tissue.

Draw **one** line from each type of stomach tissue to the correct description.

Epithelial tissue	Allows food to be churned around the stomach
Glandular tissue	Covers the outside and the inside of the stomach
Muscular tissue	Produces digestive juices
	Coordinates nerve impulses

(3)

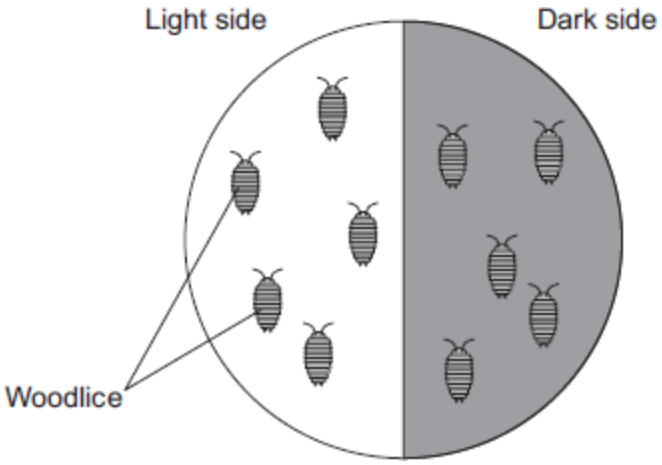
(c) Animals can react to their surroundings because they have nervous systems.

A student investigated the behaviour of small animals called woodlice.

The student set up the investigation as shown in **Figure 2.**

- The student covered one half of a Petri dish with black paper to make that side of the Petri dish dark.
- The other side had no cover.
- The student put five woodlice into each side of the dish and then put the clear Petri dish lid back on the dish.

Figure 2



After 30 minutes, all the woodlice had moved to the dark side of the Petri dish.

(i) In this investigation, what is the **stimulus** that the woodlice responded to?

_____

(1)

(ii) In this investigation, what is the **response** that the woodlice made?

_____

(1)

(iii) The student concluded that woodlice prefer dark conditions.

Give **two** ways in which the student could improve the investigation to be sure that his conclusion was correct.

1. _____

_____

2. _____

_____

(2)

(Total 9 marks)

5. Gardeners sometimes use weed killers to control the growth of plants.

(a) A gardener wanted to get rid of daisy plants growing in a lawn.

The gardener investigated the use of a weed killer.

The gardener:

- recorded the number of daisy plants growing in different 10 m^2 areas of the lawn
- made solutions of the weed killer (each solution had a different concentration)
- put 5 dm^3 of each solution on different 10 m^2 areas of the lawn
- recorded the number of daisy plants growing in each area after 2 weeks.

The table shows the results.

Concentration of weed killer in arbitrary units	**Number of daisy plants per 10 m^2**	
	Before using weed killer	**2 weeks after using weed killer**
0 (water)	8	8
20	6	8
40	9	6
60	5	2
80	4	0
100	8	0

(i) To make the investigation fair, the gardener controlled some variables.

Give **one** variable the gardener controlled in the investigation.

_____

_____

(1)

(ii) The gardener decided that the result for a concentration of 20 arbitrary units of weed killer was anomalous.

Suggest why the gardener decided this result was anomalous.

_____

_____

(1)

(iii) Why did the gardener put 0 arbitrary units of weed killer on one area of the lawn?

_____

_____

(1)

(iv) The gardener concluded that the best concentration of weed killer to use all over a lawn is 100 arbitrary units.

Suggest why the gardener cannot be sure about this conclusion.

_____

_____

(1)

(b) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Plants respond to different environmental factors.

Describe how different environmental factors affect:

- the direction of growth of roots
- the direction of growth of shoots.

In your answer you should refer to the role of plant hormones.

Do **not** refer to the artificial use of plant hormones by gardeners or scientists.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(6)

(Total 10 marks)

6. Humans use the nervous system to react to changes in the environment.

(a) (i) Which word means a change in the environment?

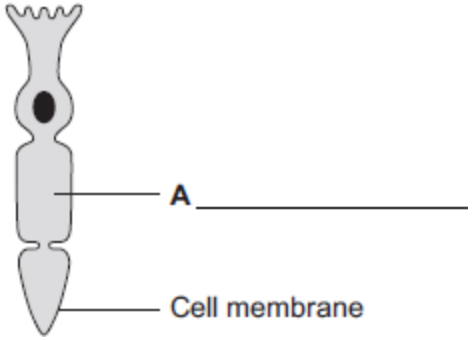
Draw a ring around the correct answer.

neurone **reflex** **stimulus**

(1)

(ii) **Figure 1** shows a light receptor cell.

Figure 1



Use the correct answer from the box to label part **A** on **Figure 1**.

chloroplast	**cytoplasm**	**vacuole**

(1)

(b) **Figure 2** shows a boy riding a bicycle on a sunny day.

Figure 2

© Stockbyte/Thinkstock

(i) Receptors in the boy's body detect changes in the environment.

Complete the table to show which organ of the body contains the receptors for each change in the environment.

Change in the environment	**Organ that contains the receptors**
Sound of traffic from behind him	
Flashing blue lights of a police car	
Cooler air temperature in the shadows	

(3)

(ii) The boy's response to danger is to pull on the bicycle brakes.

Which type of effector causes this response?

Tick (✓) **one** box.

A gland ☐

A muscle ☐

A synapse ☐

(1)

(Total 6 marks)

7. (a) Humans need to remove waste products from their bodies.

Which organ removes waste carbon dioxide from the body?

Tick (✓) **one** box.

Liver ☐

Lung ☐

Skin ☐

(1)

(b) Kidneys make urine. Urine is stored in the bladder.

Which **one** of the following stages is involved in making urine in a healthy kidney?

Tick (✓) **one** box.

Filtering the blood ☐

Reabsorbing **all** of the ions ☐

Reabsorbing **all** of the water ☐

(1)

(c) A healthy kidney keeps the correct amount of water in the blood.

If there is too much water in the blood, what might happen to the blood cells?

Tick (✓) **one** box.

They will take in water and burst. ☐

There will be no change. ☐

They will lose water and shrink. ☐

(1)

(d) A child has kidney failure.

A doctor recommends dialysis to treat the kidney failure.

Before dialysis starts, the doctor measures the concentration of glucose and of urea in the child's blood.

The concentration of glucose in the dialysis fluid is 6 mmol per dm^3.

The results are shown below in the table.

	Concentration in the blood before dialysis starts in mmol per dm^3
Glucose	6
Urea	28

(i) Suggest what the concentration of glucose in the blood will be **after** the dialysis treatment.

Draw a ring around the correct answer.

less than 6 **6** **more than 6**

(1)

(ii) Suggest what the concentration of urea in the blood will be **after** the dialysis treatment.

Draw a ring around the correct answer.

less than 28 **28** **more than 28**

(1)

(iii) Give a reason for your answer to part **(d)(ii)**.

_____

_____

(1)

(e) (i) Some patients have kidney transplants. Transplanted kidneys may be rejected by the body.

Use the correct answer from the box to complete the sentence.

antibodies	**hormones**	**tissues**

Transplanted kidneys have proteins on the surface of the cells. These proteins may be attacked by the patient's _____ .

(1)

(ii) It is important to prevent rejection of a new kidney.

Which **one** of the following helps to prevent the kidney from being rejected?

Tick (✓) **one** box.

Giving the patient antibodies ☐

Giving the patient painkillers ☐

Tissue typing the donor kidney ☐

(1)

(Total 8 marks)

1. (a) immune system

allow white blood cells / lymphocytes

ignore phagocytes

1

produces antibodies

1

(which) attack the antigens on the transplanted organ / pancreas

*allow transplanted organs have foreign antigens at start of explanation **and** linked to attacking the organ*

1

(b) (i) change / rise detected by the sensor

1

information used to calculate how much insulin she is going to need (bring her blood glucose back to normal)

1

(pump delivers) insulin into the blood

1

(causing) glucose to move into cells

allow (liver) converts glucose to glycogen

1

max 2 if no ref. to artificial pancreas

(ii) any **one** from:

- it is more accurate **or** less chance of human error
- (glucose) level will remain more stable **or** no big rises and falls in blood sugar levels
- you don't forget to test and / or inject insulin
- if ill or in coma insulin is still injected

ignore continuous and automatic unqualified

1

[8]

2. (a) (i) chemical

1

(ii) pituitary gland

1

(b) 8

allow 9 or 10

1

(c) (i) any **four** from:

- progesterone starts being produced at 4 weeks / no progesterone before 4 weeks
- and then / from 4 weeks increases
- oestrogen at constant / low level (from 0) to 20 weeks
- and then / from 20 weeks increases
- from 20 − 36 weeks level of O rises more steeply than that of P

or

- P is always higher than 0 from 6 to 36 weeks

*if no other marks awarded, allow progesterone and oestrogen both increase / rise for **1** mark.*

4

(ii) oxytocin

1

level of oxytocin increases just before birth

1

[9]

3. (a) homeostasis

1

(b) in sequence:

pancreas

1

liver

1

glycogen

correct spelling only

1

glucagon

correct spelling only

1

(c) (i) broken down / digested

1

further detail eg into amino acids / by enzymes / by proteases

1

(ii) diet / eating less sugar / less fat

ignore balanced diet

or

ignore 'dieting' / slimming diet

exercise

accept pancreas transplant

1

(d) (i) sensible suggestion
eg (owner's) smell / sweating / change in owner's behaviour / dizziness / tiredness

1

(ii) any **five** from:

*allow **1** mark for justified conclusion*

*do not allow full marks unless at least **1** pro and **1** con.*

Pro:
- % below normal decreases
- % in normal increases
- reliable / repeatable / valid data as large number of samples

do not allow accurate / precise
- patients express satisfaction.

Con:
- may not be reliable as blood glucose measurements for only 5 patients / survey of only 16 (dog owners)
- % above normal increases / dogs are less good at detecting high glucose.

5

(e) glucose in urine of diabetic (and not in the non-diabetic)

1

urea and Na+ ions are similar in each / slightly lower in diabetic

1

+ any **three** from:
- no protein in either urine sample because protein too large / does not pass through filter
- glucose passes through filter in kidney

ignore glucose is reabsorbed
- non-diabetic: the / all glucose is reabsorbed / taken back into blood
- diabetic: (too much glucose so) cannot all be reabsorbed
- because diabetic has high concentration of glucose in blood
- urea and Na+ lower in diabetic because less water is reabsorbed (due to extra glucose in filtrate).

3

[19]

4. (a) tissue → organ → organ system

*one right for **1** mark*

*three right for **2** marks*

2

(b) **Epithelial tissue** → covers the outside and the inside of the stomach

more than one line from a tissue = no mark

1

Glandular tissue → produces digestive juices

1

Muscular tissue → allows food to be churned around the stomach

1

(c) (i) light

ignore dark

1

(ii) moving (to the dark)

1

(iii) any **two** from:

- use more woodlice
- repeat the experiment
- run for a longer time

2

[9]

5. (a) (i) any **one** from:

ignore references to same lawn / weather / soil, which are not given in the question.

- (same) (type of) weed killer
- (same) volume / 5dm ^{3} of solution used (on each area)

allow amount of solution used

*do **not** allow amount / volume / concentration of weed killer*

*do **not** allow number of daisy plants*

- effect on daisies (not other weeds / plants)
- (same) area / 10m ^{2}
- (same) time **or** (effect after) two weeks.

1

(ii) more (daisies) growing after use of weed killer **or** after two weeks

allow it does not fit pattern (of other results)

1

(iii) any **one** from:

ignore to see if it / water has an effect

- as a control

*do **not** allow as a control variable*

- to compare (to the other areas)
- to check other factor(s) are not affecting the results / daisies.

1

(iv) 80 (arbitrary units of weed killer) also killed all the daisies

allow ref to possible experimental design flaws such as 'only tested once' or 'not repeated' or 'different number of daisies in each area at first'

allow idea that other weed species may not respond in the same way as daisies

allow idea that 100 (units) may also kill wanted species / grass

1

(b) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information in the Marking Guidance and apply a 'best-fit' approach to the marking.

0 marks
No relevant content.

Level 1 (1−2 marks)
Reference to at least one environmental factor plants respond to
or
at least one response
or
a named hormone

Level 2 (3−4 marks)
Reference to at least one environmental factor plants respond to
and
at least one associated response
or
reference to a named hormone
and
at least one associated response

Level 3 (5−6 marks)
Reference to at least one environmental factor plants respond to
and
at least one associated response
and
reference to a named hormone

Examples of biology points made in the response:

environmental factors

- light

  allow phototropism
- (direction of the force of) gravity

  allow gravi / geotropism
- moisture / water.

  allow hydrotropism

effects on direction of growth

- shoots grow upwards
- shoots grow towards light
- shoots grow against (the force of) gravity
- roots grow downwards
- roots grow towards moisture
- roots grow towards (the force of) gravity.

  allow reference to 'positive' and 'negative' in terms of tropisms as indicating direction of growth

hormone

- reference to auxin

  allow other named hormone(s)
- unequal distribution of hormone causes unequal growth (rates).

  allow higher concentration of hormone causes faster growth in shoots

  allow higher concentration of hormone causes slower growth in roots

6

[10]

6. (a) (i) stimulus

1

(ii) cytoplasm

1

(b) (i) ear(s)

in this order only

1

eye(s)

accept retina

1

skin

ignore extra detail

1

(ii) A muscle

1

[6]

7. (a) Lung

1

(b) Filtering the blood

1

(c) They will take in water and burst

1

(d) (i) 6

1

(ii) less than 28

1

(iii) urea not reabsorbed
or
dialysis (fluid) has removed urea

1

(e) (i) antibodies

1

(ii) Tissue typing the donor kidney

1

[8]