

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

# Homeostasis and Response part 8 AQA Triple Biology

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

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

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Time: **84 minutes**

Marks: **78 marks**

Comments:

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1.

Hormones are important for controlling many processes in the human body.

Hormones are produced by glands.

(a) Which organ system has glands that produce hormones?

Tick (✓) **one** box.

The circulatory system

The endocrine system

The nervous system

(1)

(b) How are hormones transported around the body?

Tick (✓) **one** box.

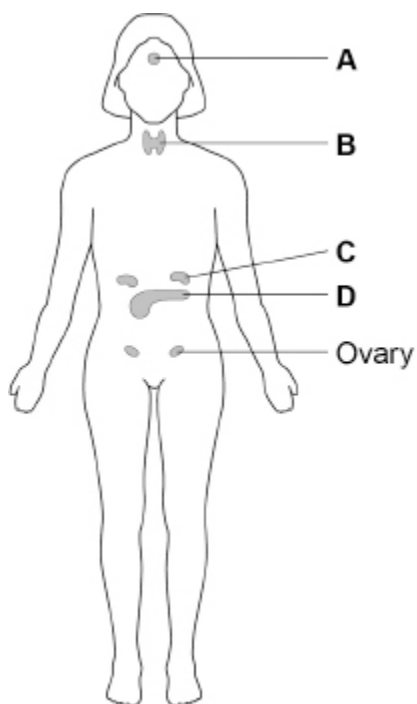
By the blood

By the muscles

By the nerves

(1)

The figure below shows glands in a woman's body.



(c) Draw **one** line from each gland to the name of that gland.

| Gland | Name      |
|-------|-----------|
| A     | Adrenal   |
| B     | Pituitary |
| C     | Testes    |
|       | Thyroid   |

(3)

(d) Which gland in the figure above produces insulin?

Tick (✓) **one** box.

A       B       C       D

(1)

(e) Which organ does insulin mainly affect?

Tick (✓) **one** box.

The brain

The liver

The ovary

(1)

(f) Give **one** effect of insulin.

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(1)

Some hormones control a woman's menstrual cycle.

(g) Which hormone causes an egg to mature in the ovary?

Tick (✓) **one** box.

Adrenaline

Follicle stimulating hormone (FSH)

Testosterone

(1)

(h) Which **two** are hormones that help to maintain the lining of the uterus during pregnancy?

Tick ✓ **two** boxes.

Amylase

Oestrogen

Progesterone

Protease

Thyroxine

**(2)**

(i) Contraception prevents pregnancy.

Give **two** methods of contraception that use hormones.

1 \_\_\_\_\_  
\_\_\_\_\_

2 \_\_\_\_\_  
\_\_\_\_\_

**(2)**

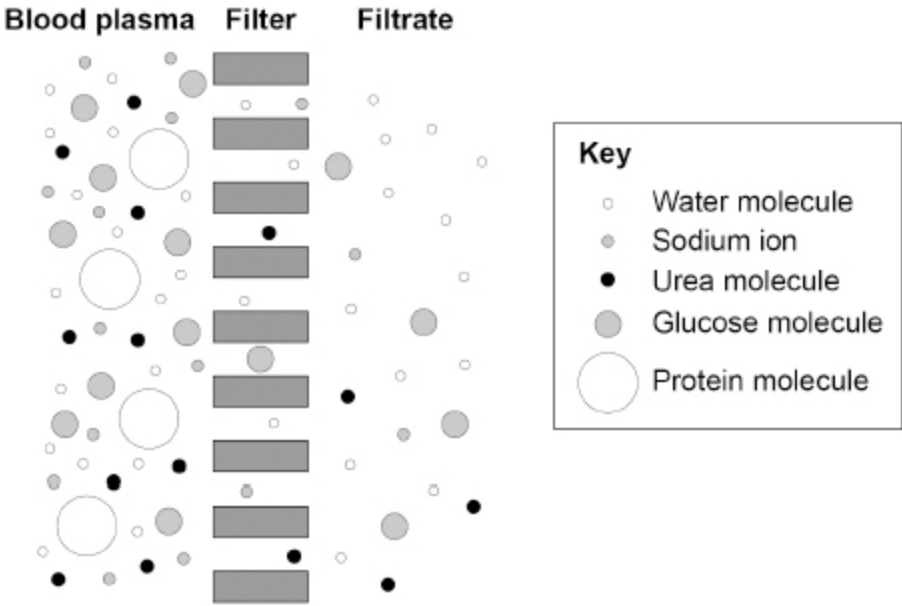
**(Total 13 marks)**

2.

The kidneys filter the blood.

Figure 1 shows filtration in the kidney.

Figure 1



(a) Glucose molecules are found in the blood plasma **and** in the filtrate.

Protein molecules are **only** found in the blood plasma.

Draw **one** line from each substance to the reason for where the substance is found.

| Substance | Reason  |
|-----------|---|
| Glucose   | The molecules are too large to pass through the filter    |
| Protein   | The molecules are small enough to pass through the filter |
|           | The molecules are too small to pass through the filter    |

(2)

- (b) The kidneys control the volume of water in the body.

The table below shows information about a person on one day.

|                           | Volume in dm <sup>3</sup> |
|---------------------------|---------------------------|
| Water filtered from blood | 160.0                     |
| Water lost in urine       | 1.9                       |

Calculate the volume of water reabsorbed into the blood.

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Volume = \_\_\_\_\_ dm<sup>3</sup>

(1)

- (c) A person with kidney disease may be treated by dialysis or by having a kidney transplant.

**Figure 2** gives information about dialysis and kidney transplants.

**Figure 2**

**Dialysis**

- A person needs 3 dialysis sessions a week, with each session lasting about 8 hours.
- Most patients have dialysis in hospital.
- Protein and salt levels in food must be kept low.
- Dialysis costs £35 000 per year for each patient.

**Kidney transplant**

- In a surgical operation the use of a general anaesthetic can occasionally cause damage to other organs.
- After a transplant the patient must take drugs for the rest of their life to suppress the immune system.
- A transplant costs £17 000 in the first year and then £5 000 in each of the following years for drugs.
- The transplanted kidney will work well for about 10 years.



- (d) A kidney transplant costs £17 000 in the first year and then £5 000 in each of the following years for drugs.

Calculate the total cost of treatment by kidney transplant over the first 5 years.

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Total cost = £ \_\_\_\_\_

(3)

(Total 12 marks)

3.

A person's eyes can focus on objects at different distances.

A person looks at a distant object.

The person then looks at a near object.

The person's eyes make adjustments so that the near object forms a clear image.

- (a) Which term describes the adjustment of focus from the distant object to the near object?

Tick (✓) **one** box.

Accommodation

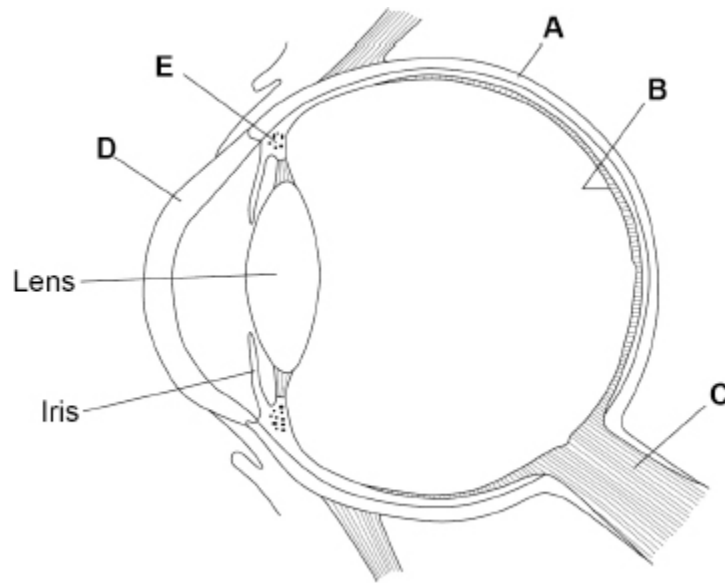
Adaptation

Hyperopia

Myopia

(1)

The figure below shows the eye.



(b) Which structure in the figure above is where the image is focused?

Tick (✓) **one** box.

A       B       C       D       E

(1)

(c) Which structure in the figure above is a muscle that contracts when focusing on a near object?

Tick (✓) **one** box.

A       B       C       D       E

(1)

(d) What happens to the shape of the lens when focusing on a near object?

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(1)



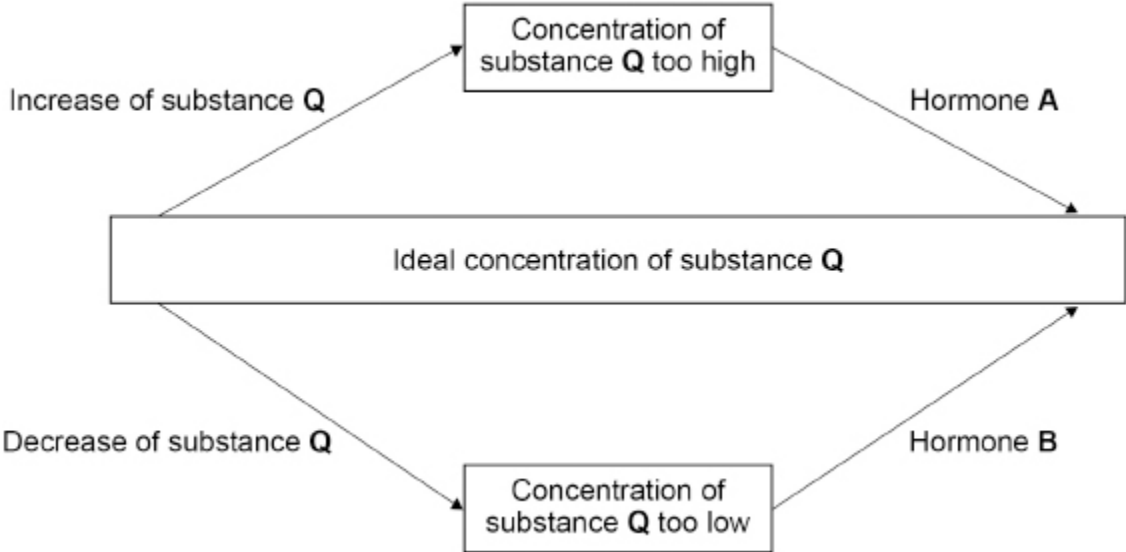
4.

Homeostasis is the regulation of the body's internal conditions.

Many internal conditions are controlled by hormones.

Homeostasis works by negative feedback control.

(a) The figure below shows how the concentration of substance Q in the blood is controlled by negative feedback.



Explain how the concentration of substance Q in the blood is controlled by negative feedback.

Use information from the figure above.

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(3)

(b) Thyroxine is a hormone produced by the thyroid gland.

A decrease in body temperature causes an increase in thyroxine production.

Explain how the production of thyroxine causes an **increase** in body temperature.

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(2)

(c) ADH is a hormone made by the pituitary gland.

ADH controls how much water is reabsorbed from the kidney tubules.

The table below shows effects of ADH.

| Concentration of ADH in the blood in nanograms/dm <sup>3</sup> | Concentration of dissolved substances in urine in arbitrary units | Rate of urine production in cm <sup>3</sup> /minute |
|--|---|---|
| 0.0  | 50  | 20.0  |
| 1.25   | 700   | 8.8   |
| 2.50   | 980   | 3.9   |
| 3.75   | 1110  | 1.8   |
| 5.00   | 1170  | 0.9   |

The concentration of ADH in a man's blood was 3.75 nanograms/dm<sup>3</sup>.

The concentration of ADH in his blood decreased to 1.25 nanograms/dm<sup>3</sup>.

Explain how the decrease in the concentration of ADH would cause the changes to the urine shown in the table above.

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(4)  
(Total 9 marks)

5.

Hormones are important for regulating the menstrual cycle.

During the menstrual cycle, eggs mature inside follicles in the ovaries.

A 27-year-old woman was infertile.

A doctor tested a sample of the woman's blood.

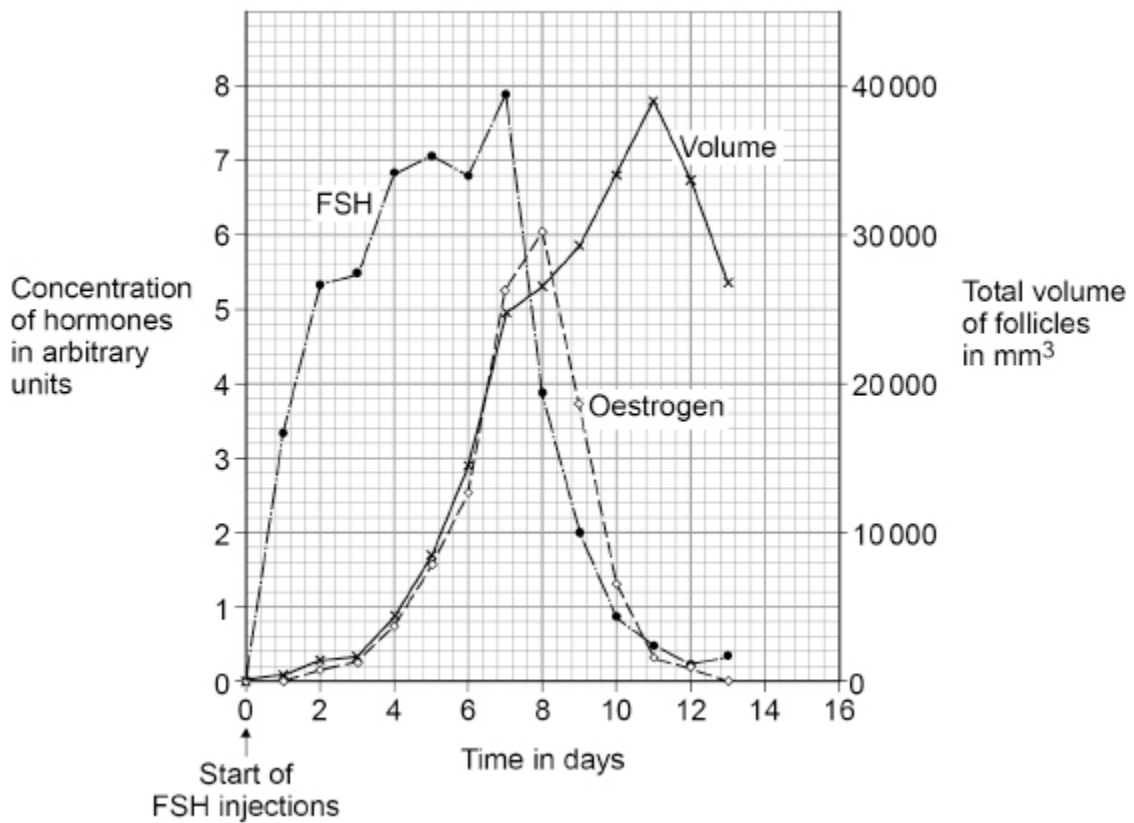
The test did **not** detect any follicle stimulating hormone (FSH) in the woman's blood.

The doctor gave the woman daily injections of FSH for 7 days.

The doctor measured:

- the concentration of FSH in the woman's blood
- the concentration of oestrogen in the woman's blood
- the volumes of developing follicles in the ovaries.

The figure below shows the results.



- (a) Give evidence from the figure that the follicles in the ovaries release oestrogen.

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(1)

- (b) Injection of FSH caused the development of a number of follicles.

The mean diameter of the follicles on day 11 was 22 millimetres.

Calculate the number of follicles in the woman's ovaries on day 11.

Assume each follicle is a sphere.

$$\text{Volume of a sphere} = \frac{4}{3} \pi r^3$$

r = radius

$\pi = 3.14$



(e) The woman continues to have injections of FSH.

The woman has a child with a man who is heterozygous for the FSH gene.

Explain why the probability that the child will be able to produce FSH is 0.5.

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(3)  
(Total 14 marks)

**6.** Many human actions are reflexes.

(a) Which statement describes a reflex action?

Tick (✓) **one** box.

A reflex action does not need a sense organ.

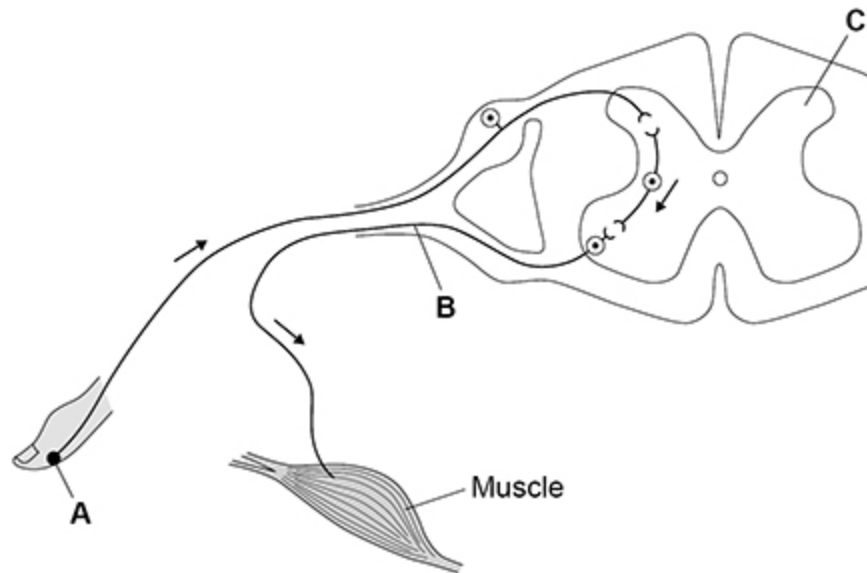
A reflex action is a slow action.

A reflex action is automatic.

**Figure 1** shows the nerve pathway for a reflex action.

The arrows show the direction of the nerve impulse.

**Figure 1**



(1)

(b) Draw **one** line from each part of the nerve pathway to the name of that part.

Use **Figure 1**.

| Part of nerve pathway | Name of part  |
|-----------------------|---------------|
| A                     | Motor neurone |
| B                     | Receptor      |
| C                     | Relay neurone |
|                       | Spinal cord   |

(3)

(c) Which **two** human actions are reflexes?

Tick (✓) **two** boxes.

Blinking when an insect flies into the eye

Catching a ball in a playground game

Playing a musical instrument

Removing the hand from a hot object

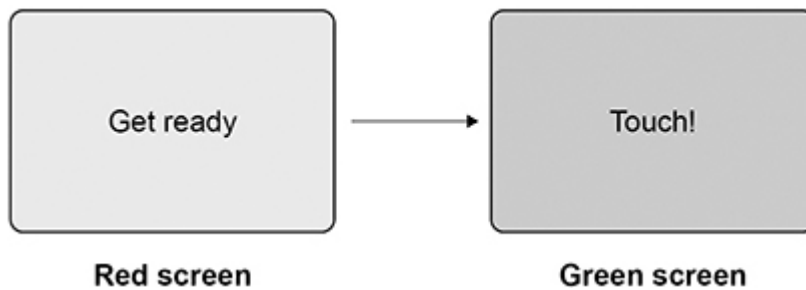
Writing a message to a friend

(2)

Students investigated their reaction times using a computer program.

**Figure 2** shows a sequence of two screens in the computer program.

**Figure 2**



This is the method used.

1. Open the reaction time program.
2. When the screen turns from red to green, touch the screen as quickly as possible.
3. Record the reaction time shown on the screen.
4. Re-set to the red screen.
5. Repeat steps 2 to 4 four more times.
6. Repeat steps 1 to 5 for each student.

The table below shows the results.

| Test | Reaction time in milliseconds |           |           |           |
|------|-------------------------------|-----------|-----------|-----------|
|      | Student P                     | Student Q | Student R | Student S |
| 1    | 317                           | 310       | 367       | 320       |
| 2    | 309                           | 293       | 352       | 304       |
| 3    | 290                           | 312       | 350       | 315       |
| 4    | 333                           | 307       | 359       | 308       |
| 5    | 328                           | 312       | 635       | 313       |
| Mean | 315                           | 307       | 357       | X         |

(d) Calculate mean value **X** in above table.

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**X** = \_\_\_\_\_ milliseconds

(2)

(e) There is an anomalous result for student **R**.

Draw a ring around the anomalous result in the table above.

(1)

(f) Give **two** factors that might affect a person's reaction time.

1 \_\_\_\_\_  
\_\_\_\_\_  
2 \_\_\_\_\_  
\_\_\_\_\_

(2)  
(Total 11 marks)

**7.**

A plant shoot responds to the stimulus of light shining on it from one side.

(a) What name is given to the type of response shown by the plant shoot?

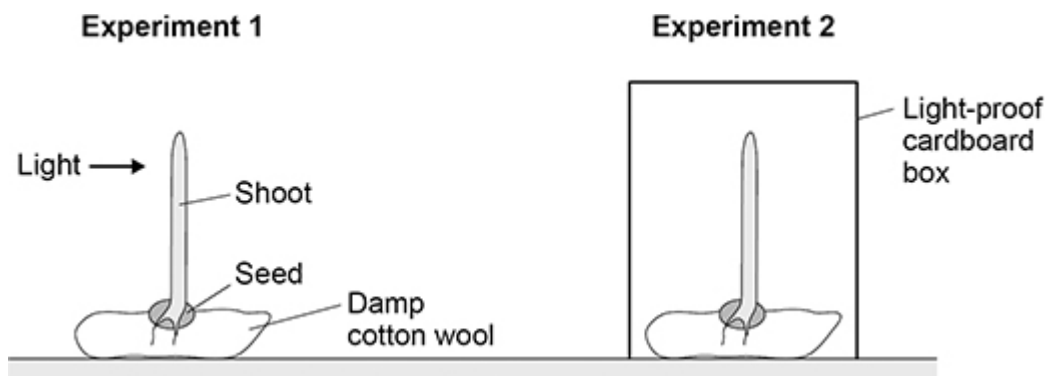
Tick (✓) **one** box.

|             |                          |
|-------------|--------------------------|
| Adaptation  | <input type="checkbox"/> |
| Homeostasis | <input type="checkbox"/> |
| Tropism     | <input type="checkbox"/> |

(1)

A student investigated the effect of one-sided light on the growth of plant seedlings.

The figure below shows how the student set up the investigation.

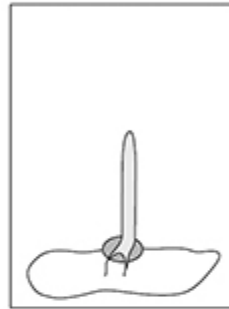
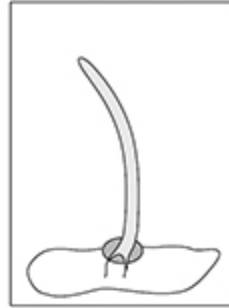


(b) Draw **one** line from each experiment to what the seedling would look like after 12 hours.

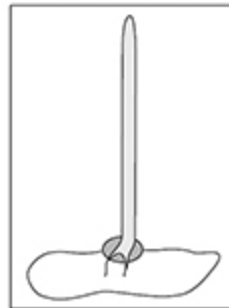
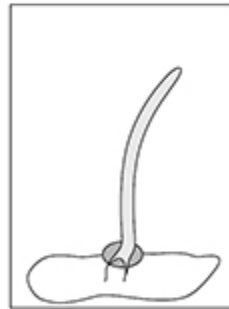
**Experiment**

**What the seedling would look like**

1



2



(2)

(c) Why did the student set up experiment 2 in this investigation?

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(1)

(d) The student wanted to make the investigation of the effect of one-sided light more valid.

The student decided to set up a third experiment.

How should the student set up the third experiment?

Tick (✓) **one** box.

Give no water to the third seedling.

Shine light from all sides on the third seedling.

Turn the third seedling so it is upside-down.

(1)

(e) What is a suitable control variable for the investigation?

Tick (✓) **one** box.

Keep each seedling at the same temperature.

Keep each seedling the same height above the floor.

Use the same size cardboard box for each seedling.

(1)

(f) Give **one** stimulus a plant **root** responds to.

Do **not** refer to light in your answer.

---

(1)

(g) Scientists often repeat investigations several times.

Give **two** reasons why.

1 \_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

\_\_\_\_\_

**(2)**  
**(Total 9 marks)**

## Mark schemes

1.

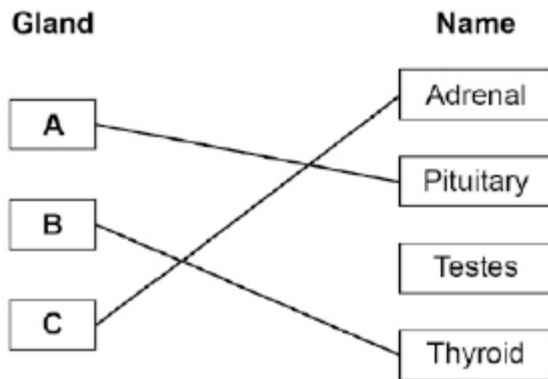
(a) the endocrine system

1

(b) by the blood

1

(c)



do **not** accept more than one line from a box on the left

3

(d) D

1

(e) the liver

1

(f) any **one** from:

*allow sugar for glucose*

- lowers (blood) glucose

*allow controls (blood) glucose*

- (makes) cells / liver / muscles take in glucose
- (changes) glucose to glycogen

*allow makes glycogen*

1

(g) follicle stimulating hormone (FSH)

1

(h) oestrogen

1

progesterone

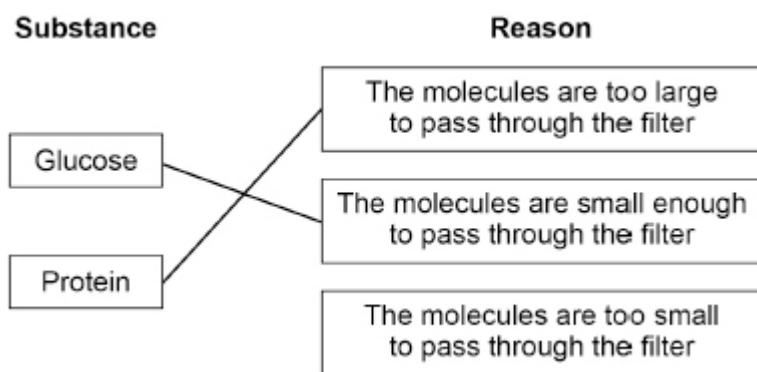
1

- (i) any **two** from:
- oral contraceptive  
*allow the pill*
  - injection
  - implant  
*allow contraceptive rod*
  - (skin) patch
  - (some) IUDs  
*allow IUS*  
*allow named methods*  
*allow coil with hormone*

2

[13]

**2.** (a)



do **not** accept more than one line from a box on the left

2

(b) 158.1 (dm<sup>3</sup>)

1

(c) **Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.

5–6

**Level 2:** Some logically linked reasons are given. There may also be a simple judgement.

3–4

**Level 1:** Relevant points are made. They are not logically linked.

1–2

**No relevant content**

0

## Indicative content

### points for transplant:

- transplant is cheaper
- numerical comparison, eg £18 000 cheaper in first year and £30 000 cheaper in subsequent years
- less / no inconvenience, eg time **or** cost for hospital visits
- less / no restriction on lifestyle
- less / no restriction on diet or fluid intake
- no danger of infection from eg puncturing skin or blood in contact with machine
- less / no possibility of blood clots
- no need to take anti-clotting drugs
- transplanted kidney keeps water / urea / ions in blood at correct level at all times
- feel well all the time

### points against transplant:

- danger of rejection
- need tissue match for transplant
- donors in short supply
- possibility of organ damage due to anaesthetic
- possibility of infection in surgery
- possibility of damage due to surgery
- need to take immunosuppressant drugs
- may suffer other infections due to suppressed immune system
- may need repeat operation (after about 10 years)

For **Level 3** students should refer to both points for and points against.

(d)  $4 \times 5\,000 = 20\,000$

1

$20\,000 + 17\,000$

*allow  $25\,000 + 17\,000$*

1

(£) 37 000

*allow  $(25\,000 + 17\,000) = (£) 42\,000$*

1

[12]

3.

(a) accommodation

1

(b) B

1

(c) E

1

(d) becomes fatter / thicker / wider

*allow more convex / curved / rounded*

*ignore larger / smaller*

1

(e) any **two** from:

- (muscles in the iris) contract  
*allow (muscles in the iris) shorten*  
*ignore circular / radial muscles*  
*ignore (muscles in the iris) relax*  
*do **not** accept ciliary muscles contract*
- reduce size of pupil  
*allow constrict pupil*  
*allow reduce size of aperture / gap / hole*
- reduces (amount of) light entering  
*allow reduces (amount of) light reaching retina*

2

(f) **Level 2:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.

3–4

**Level 1:** The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.

1–2

**No relevant content**

0

**Indicative content**

- identification of method eg ruler drop
- correct details of method chosen eg hold ruler above thumb
- repetitions – at least two more times
- repeat with (at least 2 more) other students
  
- tested without coffee **and** with coffee **or** with different amounts of coffee
- calculate mean value with coffee and without coffee
- compare results with and without coffee
  
- correct control variables for method chosen, eg:
  - o same age
  - o sex
  - o BMI
  - o amount of sleep
  - o volume / concentration / type of coffee
  - o time interval between drinking and testing
  - o control variable within method described

For **Level 2** reference to collecting results with and without coffee along with how the investigation is designed to create valid results is required

[10]

- 4.** (a) if (concentration of substance) **Q** becomes high (hormone) **A** is released / used 1
- if (concentration of substance) **Q** becomes low (hormone) **B** is released / used 1
- hormone(s) / **A** / **B** brings (concentration of) substance **Q** back to ideal / normal 1
- allow answers in terms of insulin for hormone **A** and / or glucagon for hormone **B***
- allow answers in terms of blood glucose (concentration) for substance **Q***
- (b) (thyroxine) increases (basal) metabolic rate
- allow (thyroxine) increases metabolism*
- allow (thyroxine) increases respiration*
- allow (thyroxine) increases reactions in cells* 1
- respiration releases energy
- allow respiration releases heat do **not** accept energy being produced / made / created*
- allow respiration is exothermic* 1
- (c) (kidney) tubules less permeable to water 1
- (so) less water is reabsorbed
- allow (so) less water taken back into the blood* 1
- (so) more water in urine causing increased rate of production (of urine)
- allow (so) more water in urine causing increased volume (of urine)* 1
- (so) more water in urine causing lower concentration of dissolved substances (in urine)
- (so) more water in urine causing more dilute urine* 1
- [9]**
- 5.** (a) as volume of follicles rises oestrogen concentration (in blood) rises (for 7 / 8 days)
- allow (positive) correlation between oestrogen concentration and volume of follicles (for 7 / 8 days)*
- or** oestrogen concentration is in proportion to follicle volume (for 7 / 8 days)
- do **not** accept an increase of oestrogen concentration causes an increase of follicle volume*
- 1

(b) (volume of one follicle)

$$= \frac{4}{3} \times 3.14 \times 11^3$$

*allow*  $\frac{4}{3} \times \pi \times 11^3$

1

$$= 5572.(4533)$$

*allow* 5575(.279...)

1

(total volume of follicles) = 39 000 (mm<sup>3</sup>)

1

$$\frac{39\ 000}{5572} 6.99\dots$$

*allow use of an incorrect volume (from Figure 12) and / or an incorrectly calculated volume of one follicle*

1

7

*do not accept 7.0*

1

(c) (lack of FSH causes) lack of oestrogen (production)

*allow lack of FSH causes lack of follicle development / growth / maturation*

1

breast development is dependent on oestrogen (from follicles)

*allow (female) secondary sexual characteristics are dependent on oestrogen (from follicles)*

1

(d) gametes correct:

**H + h and H + h**

1

correct derivation of offspring genotypes:

**HH Hh Hh hh**

*allow correct for gametes stated in mp1*

1

correct phenotype for each genotype

*allow correct for genotypes stated in mp2*

*do not accept if no **hh** offspring*

1

(e) mother (has **hh** so) passes on **h**

1

father (has **Hh** so) passes on **H**  
or **h** with equal probability

1

(so) child will be **Hh** / heterozygous with 0.5 probability and produces FSH

1

*allow annotated genetic diagram for all marks*

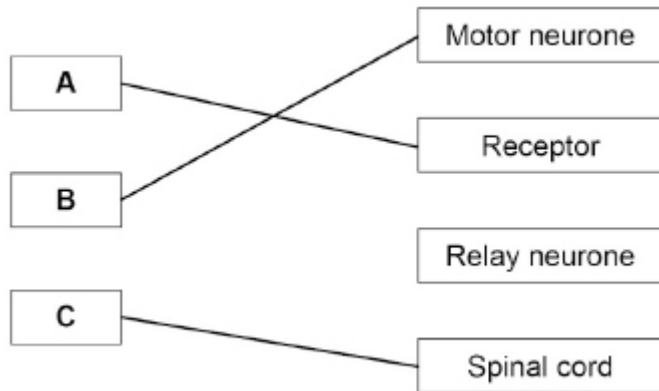
[14]

6.

(a) a reflex action is automatic

1

(b)



*do not accept more than one line from a box on the left*

3

(c) blinking when an insect flies into the eye

1

removing the hand from a hot object

1

(d) *View with the table*  
*Mark with (e)*

$$\frac{(320 + 304 + 315 + 308 + 313)}{5}$$

*allow*  $\frac{1560}{5}$

1

312

*if no other mark awarded allow 1 mark for*  $\frac{315 + 307 + 357}{3} = 326(.3)$

1

- (e) *View with the table*  
*Mark with (d)*

ring drawn around 635 in the table

*allow 635 or test 5 (next to question) if no ring drawn on the table*

1

- (f) any **two** from:

- age
- drugs

*allow a named example of a drug such as alcohol / caffeine*

- tiredness / sleep
- sex

*allow gender*

*allow practice at the test **or** playing computer games*

*allow distractions*

2

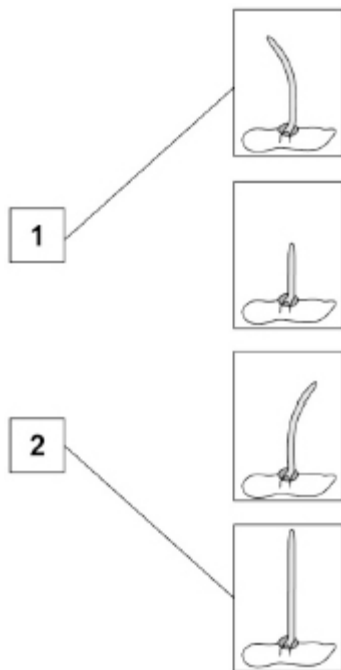
[11]

7.

- (a) tropism

1

- (b)



*do **not** accept more than one line from a box on the left*

2

- (c) to show the response in experiment 1 is caused by (1-sided) light

*allow to compare (with experiment 1)*

*allow to show the difference between (1-sided) light and no light*

**or**

as a control

*do **not** accept control variable*

1

- (d) shine light from all sides on the third seedling 1
- (e) keep each seedling at the same temperature 1
- (f) any **one** from:
- gravity
  - water
    - allow moisture*
  - chemicals / minerals / ions
    - allow a named chemical such as nitrate*
    - ignore nutrients*
    - ignore light*
- 1
- (g) because of variation (in results)  
**or**  
to identify / eliminate anomalies  
*allow example such as some may not grow*
- 1
- to calculate a mean  
*allow to calculate an average*
- or**  
a mean value would be more representative / typical  
*ignore to improve accuracy / precision / validity*
- 1

[9]