Homeostasis 3

Name: _____

Class: _____

Date: _____

Time: **74 minutes**

Marks: **68 marks**

Comments:

1. This question is about reproduction.

(a) Which **two** statements are true for sexual reproduction in humans?

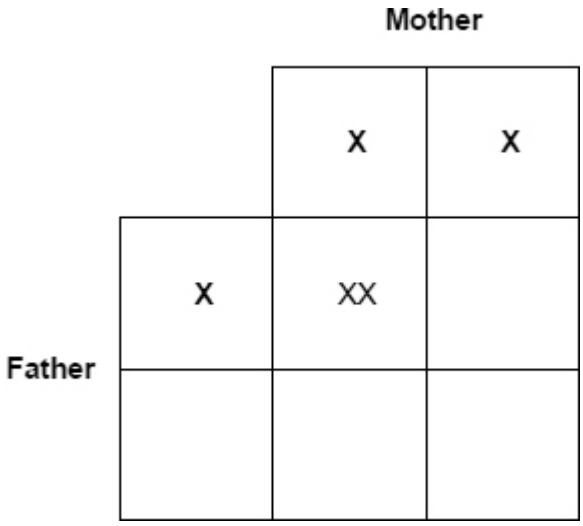
Tick (✓) **two** boxes.

Gametes are formed.	☐
Offspring are clones.	☐
Offspring are genetically identical to parents.	☐
Only one parent is involved.	☐
Sperm and egg fuse.	☐

(2)

(b) Humans reproduce by sexual reproduction.

Complete the diagram below to show the inheritance of sex.



(3)

(c) Draw a ring around the genotype of all male children in the diagram above.

(1)

(d) When children reach puberty, reproductive hormones cause changes in their bodies.

Draw **one** line from each hormone to the change the hormone causes at puberty.

Hormone	**Change the hormone causes at puberty**
Oestrogen	Breasts develop
	Skin turns lighter
Testosterone	Voice becomes deeper
	Wisdom teeth appear

(2)

A woman does **not** want to become pregnant.

She considers two methods of contraception.

(e) Draw **one** line from each method of contraception to how the method prevents pregnancy.

Method of contraception	How the method prevents pregnancy
Condom	Embryos do not implant in the uterus
Oral contraceptive (the pill)	Hormones stop eggs maturing
	Sperm are killed
	Sperm do not reach the egg

(2)

(f) Give **one** advantage and **one** disadvantage of taking oral contraceptives to prevent pregnancy.

Advantage _____

_____

Disadvantage _____

_____

(2)

(Total 12 marks)

2. Homeostasis regulates the internal conditions of the human body.

(a) Which **two** processes are regulated by homeostasis?

Tick (✓) **two** boxes.

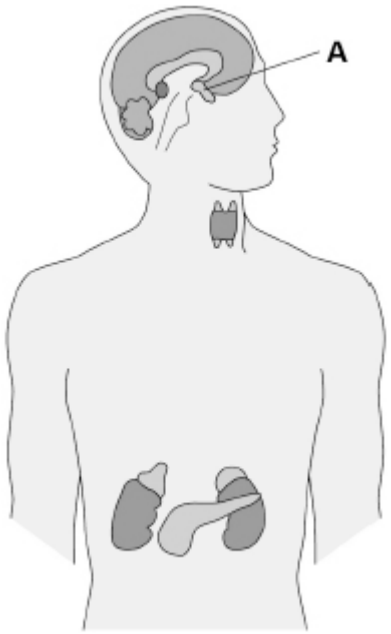
Controlling water output in urine	☐
Defending the body against pathogens	☐
How quickly you walk	☐
Keeping cool on a hot day	☐
Waking up in the morning	☐

(2)

Hormones are produced by glands in the endocrine system.

Each hormone has an effect on a target organ.

The diagram below shows glands of the endocrine system.



(b) What is the name of gland **A**?

Tick (✓) **one** box.

Pancreas ☐

Pituitary ☐

Thyroid ☐

(1)

Before eating a sugar-coated cereal a person had a blood glucose concentration of 5.2 mmol/dm^3

Soon after eating the cereal the person had a blood glucose concentration of 8.4 mmol/dm^3

(c) Calculate the increase in the blood glucose concentration.

_____

Increase = _____ mmol/dm^3

(1)

(d) The person needed medication to decrease their blood glucose concentration.

Suggest what disorder the person has.

_____

(1)

(e) There is a problem with the hormone control of the person.

What is the problem?

Tick (✓) **one** box.

The blood is not taking hormones to target organs. ☐

The pancreas is not releasing insulin. ☐

The pituitary gland is not being stimulated. ☐

(1)

(f) The person:

- works in an office
- drives to work
- is overweight
- watches the television and reads every night
- drinks a hot chocolate every night.

Suggest **two** lifestyle changes the person could make to help treat their disorder.

1. _____

_____

2. _____

_____

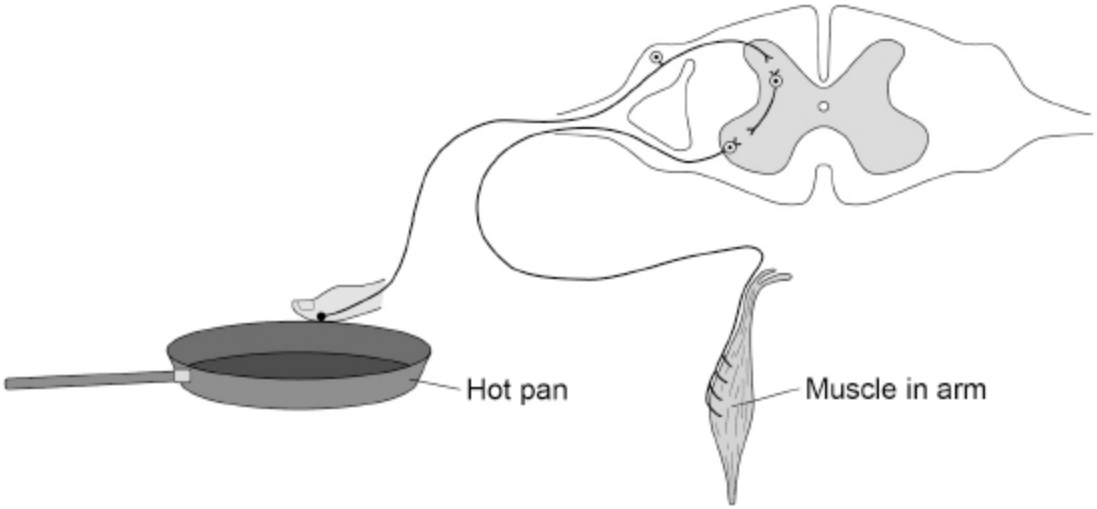
(2)

(Total 8 marks)

3. Human reactions are a response to an external change.

(a) Reflex actions help to protect the body against damage.

The diagram below shows the nervous pathway for a reflex action.



A stimulus from the hot pan will cause the muscle in the arm to contract and move the finger away.

Describe how the stimulus from the hot pan reaches the muscle in the arm.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(b) A student investigated whether using the right hand or the left hand had an effect on reaction time.

The student only tested right-handed people.

Describe a method for the student's investigation.

Include details of the test you would use for reaction time**.**

(4)

A different student carried out an investigation to see if playing tennis improved reaction time.

The student used two groups of six people.

The table below shows the results.

Person	Reaction time in seconds	
	People who play tennis	People who do not play tennis
1	0.2	0.3
2	0.4	0.4
3	0.3	0.6
4	0.4	0.5
5	0.2	0.3
6	0.3	0.2
Mean	**X**	0.4

(c) Calculate mean value **X** in the table above.

_____

_____

_____

X = _____ seconds

(2)

(d) What is the dependent variable in the student's investigation?

_____

(1)

The student concluded:

'Playing tennis improves reaction time.'

(e) Give **one** piece of evidence which supports the conclusion.

_____

_____

(1)

(f) Give **one** piece of evidence which does **not** support the conclusion.

_____

_____

(1)

(Total 13 marks)

4. (a) In sexual reproduction, cells divide by meiosis to form gametes.

Which **two** statements are true for cell division by meiosis?

Tick (✓) **two** boxes.

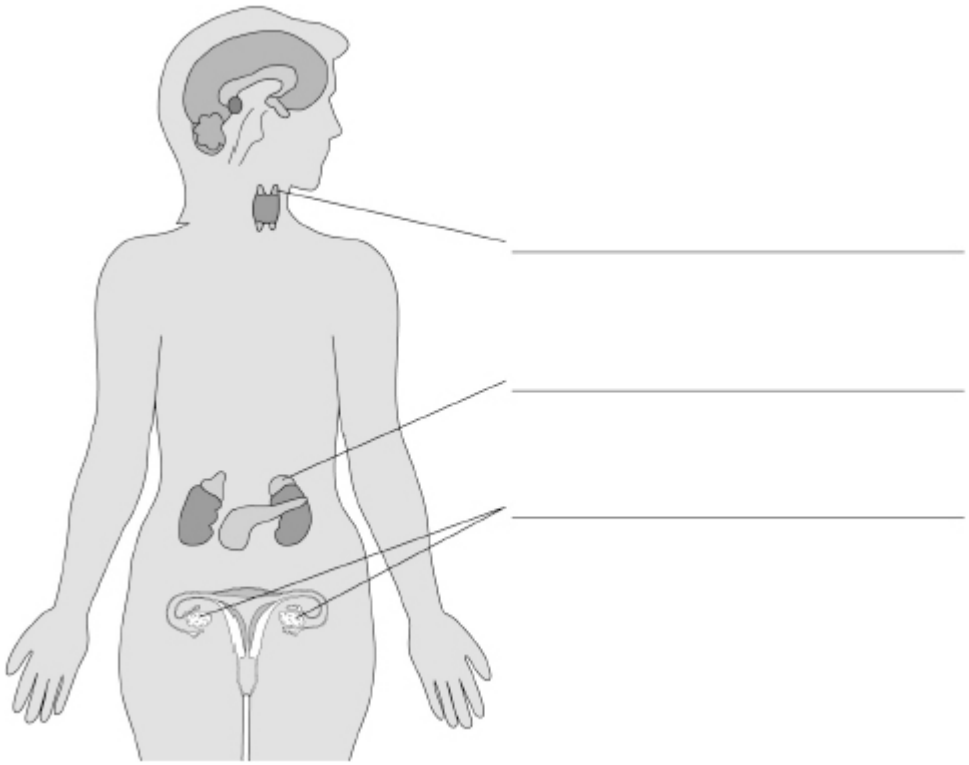
Daughter cells have two sets of chromosomes.	☐
Four daughter cells are formed.	☐
The daughter cells are genetically identical.	☐
The DNA replicates twice.	☐
The parent cell divides twice.	☐

(2)

Hormones are released from endocrine glands.

Each hormone travels in the bloodstream to a target organ.

The diagram below shows the position of endocrine glands in a female.



(b) Label the endocrine glands on the diagram above.

(3)

(c) Complete the table below.

Hormone	**Name of gland which releases hormone**	**Target organ of hormone**
Luteinising hormone (LH)	Pituitary gland	
	Adrenal gland	
Glucagon		

(3)

Millions of geranium plants are sold each year in garden centres.

Geraniums can be reproduced asexually or sexually.

The image below shows a potted geranium plant.

Garden centres usually grow new geranium plants by asexual reproduction.

(d) Suggest **two** advantages for garden centres of growing geraniums by asexual reproduction compared with sexual reproduction.

1. _____

_____

2. _____

_____

(2)

(e) Suggest **two** disadvantages for garden centres of growing geraniums by asexual reproduction compared with sexual reproduction.

1. _____

_____

2. _____

_____

(2)

(Total 12 marks)

5. Conditions inside the human body are controlled.

(a) What is the control of conditions inside the body called?

Tick (✓) **one** box.

Excretion	☐
Fertilisation	☐
Homeostasis	☐
Osmosis	☐

(1)

(b) What are the **two** ways information is sent to control body conditions?

Tick (✓) **two** boxes.

By antigens ☐

By hormones ☐

By muscles ☐

By nerve impulses ☐

By red blood cells ☐

(2)

(c) One condition in the body that needs to be controlled is the level of water.

Give **one** other condition in the human body that needs to be controlled.

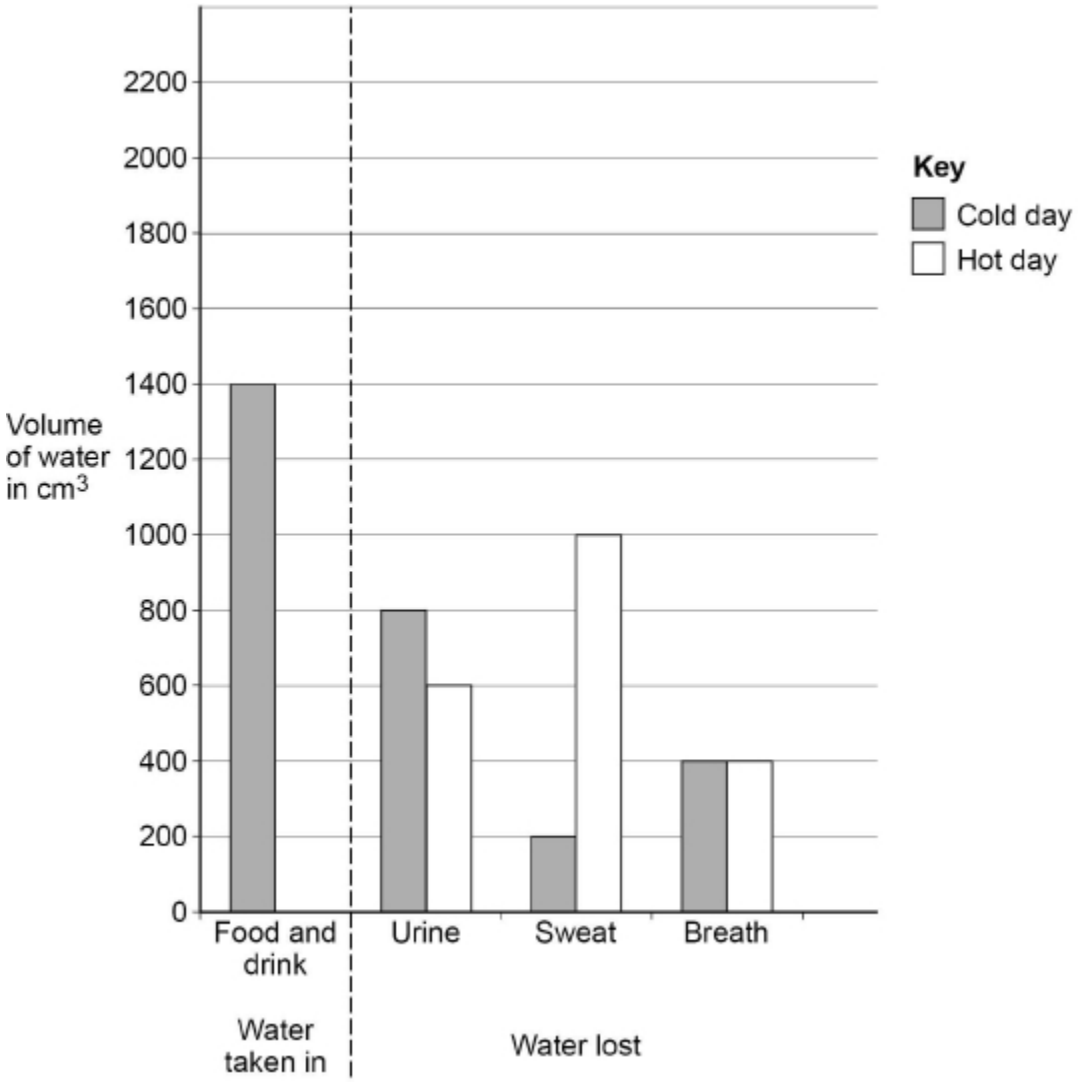
_____

_____

(1)

The graph shows the volumes of water taken in and lost by one person.

The volume for water taken in on a hot day has **not** been plotted on the bar graph.



(d) The person lost 1400 cm^3 of water on the cold day.

How much extra water did they lose on the hot day?

_____

_____

_____

_____

Extra volume of water lost = _____ cm^3

(2)

(e) Explain why the volume of water lost on a hot day is higher than on a cold day.

_____

_____

_____

_____

(2)

(f) A boy drank 750 cm^3 of water.

His total intake of water for that day was 3000 cm^3

Calculate the percentage of the boy's total intake that the 750 cm^3 represents.

_____

_____

_____

_____

Percentage = _____ %

(2)

(Total 10 marks)

6. Some students investigated the effect of drinking caffeine on reaction time.

They used a drink containing 32.25 mg of caffeine per 100 cm^3

This is the method used.

1. Divide the students into four groups, **A**, **B**, **C** and **D**.

2. Measure and record the reaction time of each student using the ruler-drop test.

3. Students in:
   - group **A** drink 200 cm^3 of water
   - group **B** drink 200 cm^3 of the caffeine drink
   - group **C** drink 400 cm^3 of the caffeine drink
   - group **D** drink 600 cm^3 of the caffeine drink.

4. Repeat step 2 after 15 minutes.

(a) Describe how to do the ruler-drop test.

_____

_____

_____

_____

_____

_____

_____

(3)

(b) **Table 1** shows the mass of caffeine taken in by each student.

Table 1

Group	Mass of caffeine in mg
A	0
B	64.5
C	129.0
D	**X**

Calculate value **X**.

_____

_____

X = _____ mg

(1)

(c) Why did group **A** drink water instead of the caffeine drink?

_____

_____

(1)

Table 2 was used to convert the results of the ruler-drop test into reaction times.

Table 2

Distance in cm	Reaction time in s	Distance in cm	Reaction time in s
2	0.064	28	0.239
4	0.090	30	0.247
6	0.111	32	0.256
8	0.128	34	0.263
10	0.143	36	0.271
12	0.156	38	0.278
14	0.169	40	0.286
16	0.181	42	0.293
18	0.192	44	0.300
20	0.202	46	0.306
22	0.212	48	0.313
24	0.221	50	0.319
26	0.230	52	0.326

(d) Estimate the reaction time for a student who recorded a distance of 23 cm

_____

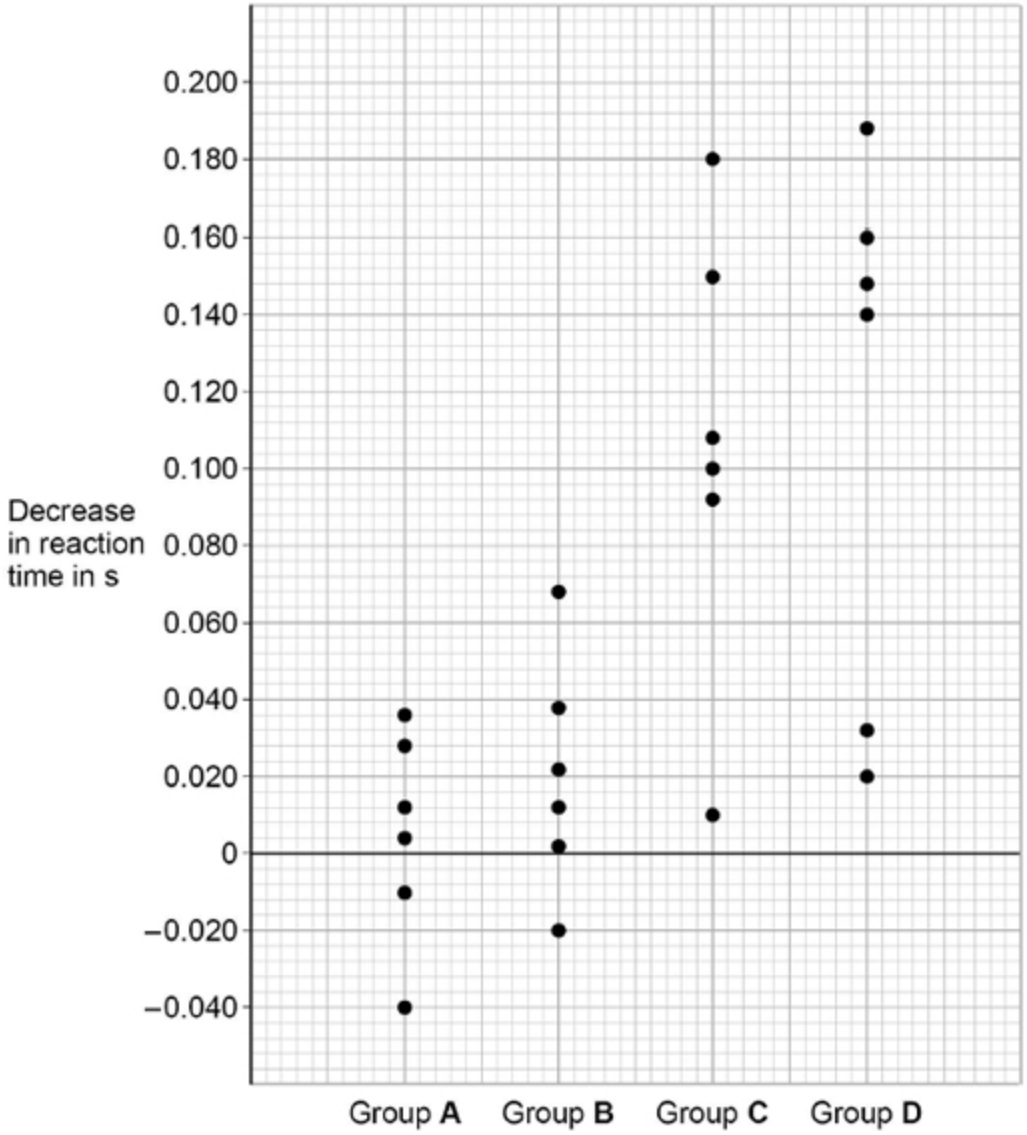
_____

Reaction time = _____ s

(1)

Students calculated the decrease in their reaction time after the drink compared with before the drink.

The graph shows the results for each student.



(e) Describe the effect of the mass of caffeine taken in on the decrease in reaction time.

_____

_____

_____

(1)

(f) For three students the decrease in reaction time was negative.

Give the reason why the value was negative.

_____

_____

(1)

(g) What is the range of results for group **C**?

_____

(1)

(h) Suggest **two** variables that should have been controlled in this investigation.

1 _____

_____

2 _____

_____

(2)

(i) Explain why the ruler-drop test does **not** involve a reflex action.

_____

_____

_____

_____

(2)

(Total 13 marks)

1. (a) gametes are formed

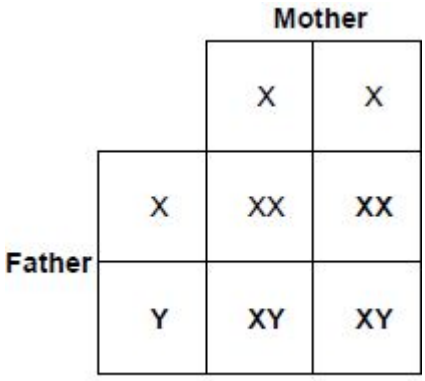
1

sperm and egg fuse

1

(b) Y gamete for father

1



all derivations correct = 2 marks 1 or 2 correct = 1 mark
allow correct derivations from incorrect gamete

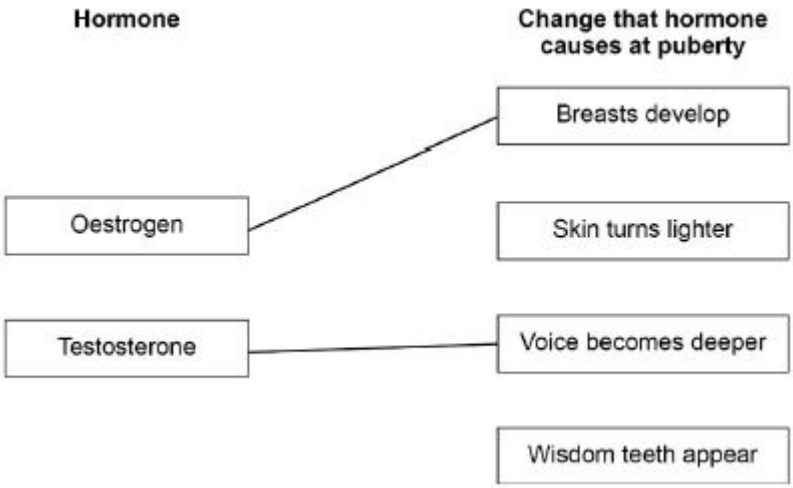
2

(c) rings drawn around all XY

allow one ring drawn around both XY
ignore ring drawn around father's genotype
ecf any letter for Y, except X

1

(d)

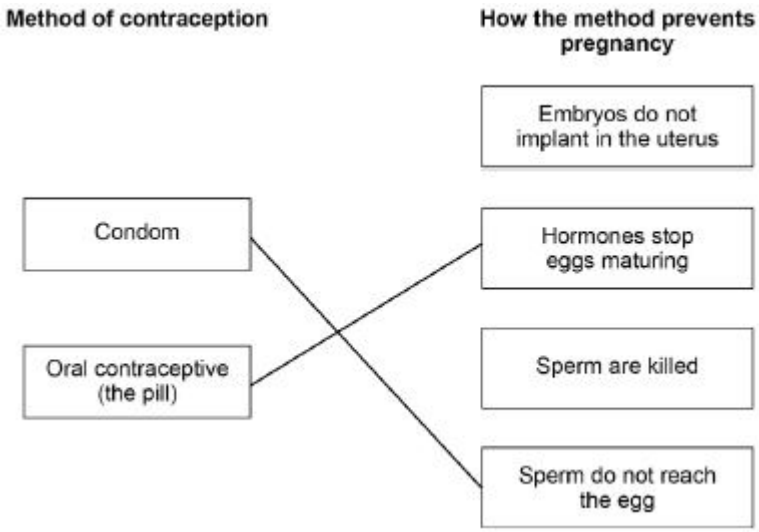


1

If more than one line from a hormone no mark for that hormone

1

(e)



1

If more than one line from a method of contraception no mark for that method

1

(f) advantage –
any **one** from:

- very reliable
- easy to take
- do not have to rely on partner
- helps to treat acne or period pain

ignore you do not get pregnant

1

disadvantage –
any **one** from:

- may cause side effects

allow described eg headaches, nausea, putting on weight

- may affect her fertility later
- have to remember to take it (every day)

allow you have to take it every day

- does not protect against STIs ignore you do not get pregnant

1

[12]

2. (a) controlling water output in urine

1

keeping cool on a hot day

1

(b) pituitary

1

(c) (8.4 – 5.2 =) 3.2 (mmol/dm^3)

1

(d) diabetes

ignore type of diabetes

1

(e) the pancreas is not releasing insulin

1

(f) change diet

allow description of suitable diet change e.g. use sweetener in hot chocolate, eat less sugary / starchy food or stop eating sugar-coated cereal

1

take more exercise

allow description e.g. go to gym instead of reading and TV, walk / cycle to work

allow change to an active job

if no other marks awarded allow 1 mark for lose weight.

1

[8]

3. (a) any **four** from:

- (stimulus is) detected by the receptor
- (initiates) an electrical impulse
- (impulse) travels via the neurones
- sensory, relay and motor

  allow in this order only
- crosses synapses
- (crosses synapses) as a chemical

4

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

3–4

Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.

1–2

No relevant content

0

Indicative content

- select at least 3 people
- do reaction time test at least 3 times using right hand
- details on how to do test in valid manner
- find a mean
- remove anomalous readings
- repeat for each person for left hand
- select people of same age
- select people of same gender
- same time of day
- other control such as amount of coffee, sleep.

To access level 2 the right hand and left hand of each person must be compared

(c)

$$\frac{(0.2 + 0.4 + 0.3 + 0.4 + 0.2 + 0.3)}{6}$$

or

$$\frac{1.8}{6}$$

1

0.3

1

(d) reaction time

allow time

1

(e) students who play tennis (regularly) had shorter / faster (mean) reaction time(s)

1

(f) any **one** from:

- overlap in times between two groups

  allow correctly described as comparative data

- small difference in (mean) times

- small sample used

  allow students who did not play tennis may have played other (ball) games

1

[13]

4. (a) four daughter cells are formed

1

the parent cell divides twice

1

(b) thyroid (gland)

in this order only

1

adrenal (gland)

1

ovary / ovaries

1

(c)

Hormone	**Name of gland which releases hormone**	**Target organ of hormone**	
Luteinising hormone (LH)	Pituitary gland	**Ovary**	**1**
Adrenaline	Adrenal gland	**Heart / lungs / liver**	**1**
Glucagon	**Pancreas**	**Liver / muscle**	**1**

(d) only need 1 parent plant

1

will produce (many genetically) identical plants

*allow for **1** mark it is a faster process*

*allow for **1** mark will produce a large number of plants at one time*

ignore clones unqualified

1

(e) any **two** from:

- genetically identical so will all be susceptible to same diseases / pathogens
- no genetic variety for new colours / characteristics to offer customers
- no genetic variety leads to weaker / unhealthy plants (due to lack of evolution)

2

[12]

5. (a) homeostasis

1

(b) by hormones

1

by nerve impulses

1

(c) any **one** from:

ignore water

- temperature
- (blood) glucose / sugar (concentration)

allow pH / ions / salts

allow oxygen or carbon dioxide

1

(d)

*an answer of 600 (cm^3) scores **2** marks*

2000 − 1400

allow 800 − 200

1

600 (cm^3)

1

*if no mark awarded allow (600 + 1000 + 400 =) 2000 for **1** mark*

(e) more sweat (on hot day)

1

cools the body

1

(f) $\frac{750}{3000} \times 100$

1

25 (%)

1

*an answer of 25 (%) scores **2** marks*

[10]

6.

(a) hold a ruler (just) above the (open) hand of the other student

ignore near the hand

1

drop the ruler and other student catches it

*do **not** accept give verbal signal*

1

record where the ruler is caught

1

ignore timing

(b) 193.5

1

(c) to compare the effect of no caffeine

allow as a control (group)

allow to show the effect of caffeine

1

*do **not** accept control variable*

(d) 0.217 (s)

allow any value in the range 0.2150 to 0.2180

1

(e) as mass of caffeine increases the decrease / change in reaction time increases

allow converse

ignore caffeine decreases reaction time

*do **not** accept the greater the increase in reaction time the greater the mass of caffeine*

1

(f) their reaction time was greater (after the drink)

allow converse

allow slower / longer for greater

*do **not** accept anomalous result*

1

(g) 0.01(0) to 0.18(0)

or

0.18(0) to 0.01(0)

allow values in range 0.008 to 0.012

and

0.178 to 0.182

or

0.17(0)

allow correct calculation from values in range

if no values are given, allow answers in the range 0.166 to 0.174

allow $0.01 \leq C \leq 0.18$

ignore units

1

(h) any **two** from:

- (same range of) age
- (same) sex / gender
- (same) height / weight / BMI
- all had no caffeine / medication / drugs earlier that day
- equally tired or (same) amount of sleep
- practice of the ruler drop test
- starting point of ruler / hand

  allow height ruler dropped from
- same point to take measurement above / below the thumb / finger
- using the same hand
- (same) number of students in each group

*do **not** accept volume / concentration of caffeine*

2

(i) not automatic

allow it is a voluntary action

1

(because) it involves the (conscious part of the) brain

allow because it involves thinking / decision or conscious action

1

[13]