Homeostasis and Response part 1 AQA Triple Biology

Name: _____

Class: _____

Date: _____

Time: **80 minutes**

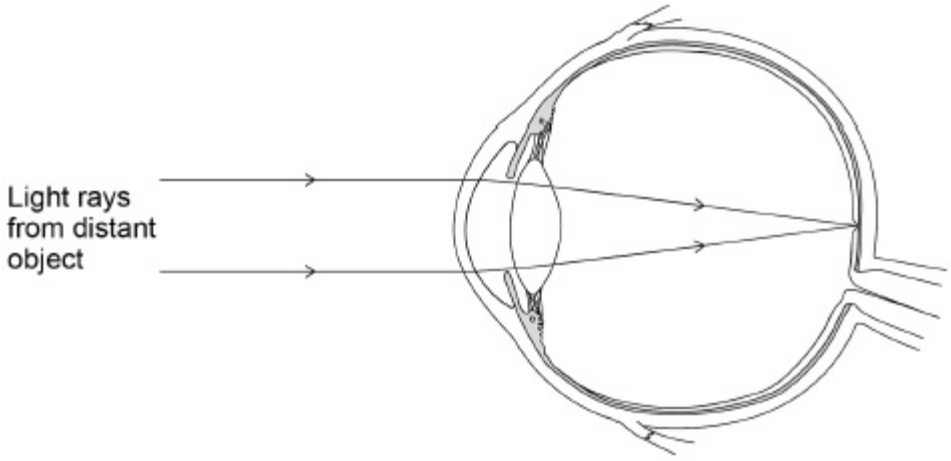
Marks: **76 marks**

Comments:

1. The human eye can focus on objects at different distances.

Figure 1 shows how a clear image of a **distant** object is formed in a person's eye.

Figure 1



(a) Explain how the person's eye could adjust to form a clear image of a **nearer** object.

(6)

(b) Explain why a long-sighted person has difficulty seeing near objects clearly.

(2)

(c) Long-sightedness can be corrected by wearing spectacles.

Describe how spectacle lenses can correct long-sightedness.

(3)

(Total 11 marks)

2. Water conservation is important to the human body.

(a) Which gland releases the hormone that controls water loss from the body?

Tick (✓) **one** box.

- Adrenal ☐
- Pancreas ☐
- Pituitary ☐
- Thyroid ☐

(1)

(b) Which hormone helps the kidneys to control water loss from the body?

Tick (✓) **one** box.

- ADH ☐
- Adrenaline ☐
- LH ☐
- Thyroxine ☐

(1)

(c) A man is walking across a desert.

The man has used up his supply of drinking water.

Explain how the gland you named in part **(a)** and the kidneys reduce water loss.

(3)

(d) Some people have kidney failure.

Doctors may treat patients with kidney failure by either:

- dialysis
- a kidney transplant.

Explain **two** biological reasons why most doctors think that a kidney transplant is a better method of treatment than dialysis.

Do **not** refer to cost or convenience.

Reason 1

Reason 2

(4)

(Total 9 marks)

3. It is important to keep the blood glucose concentration within narrow limits.

(a) A person eats a meal containing a lot of carbohydrate. This causes an increase in the person's blood glucose concentration.

Explain how the hormones insulin **and** glucagon control the person's blood glucose concentration after the meal.

(5)

(b) The body cells of a person with Type 2 diabetes do **not** respond to **insulin**.

A person with Type 2 diabetes often has a higher blood **insulin** concentration than a non-diabetic person.

Explain why.

(3)

Metformin is a drug used for treating people who have Type 2 diabetes.

Scientists investigated the effects of metformin and two other drugs, **A** and **B**.

The scientists wanted to see how the drugs affected the blood glucose concentrations of 220 people with Type 2 diabetes.

This is the method used.

1. Put the 220 people into five groups.

2. Treat each group with a different drug or combination of drugs for several weeks.

3. Give each person a meal high in carbohydrate.

4. Measure the blood glucose concentration of each person 30 minutes after the meal and again 3 hours after the meal.

(c) Suggest **three** variables that the scientists should have controlled in the investigation.

1 _____

_____

2 _____

_____

3 _____

_____

(3)

The scientists recorded their results as a mean value for each group.

The scientists calculated the 'standard deviation' for each group's result.

Standard deviation is a measure of the spread of the individual results above or below (±) the mean value.

The scientists gave each group's result as:

mean ± standard deviation

The larger the standard deviation, the greater is the spread of results around the mean.

(d) Which of the results is the most precise?

Tick (✓) **one** box.

Mean = 171.6 ± 16.3 ☐

Mean = 177.2 ± 15.4 ☐

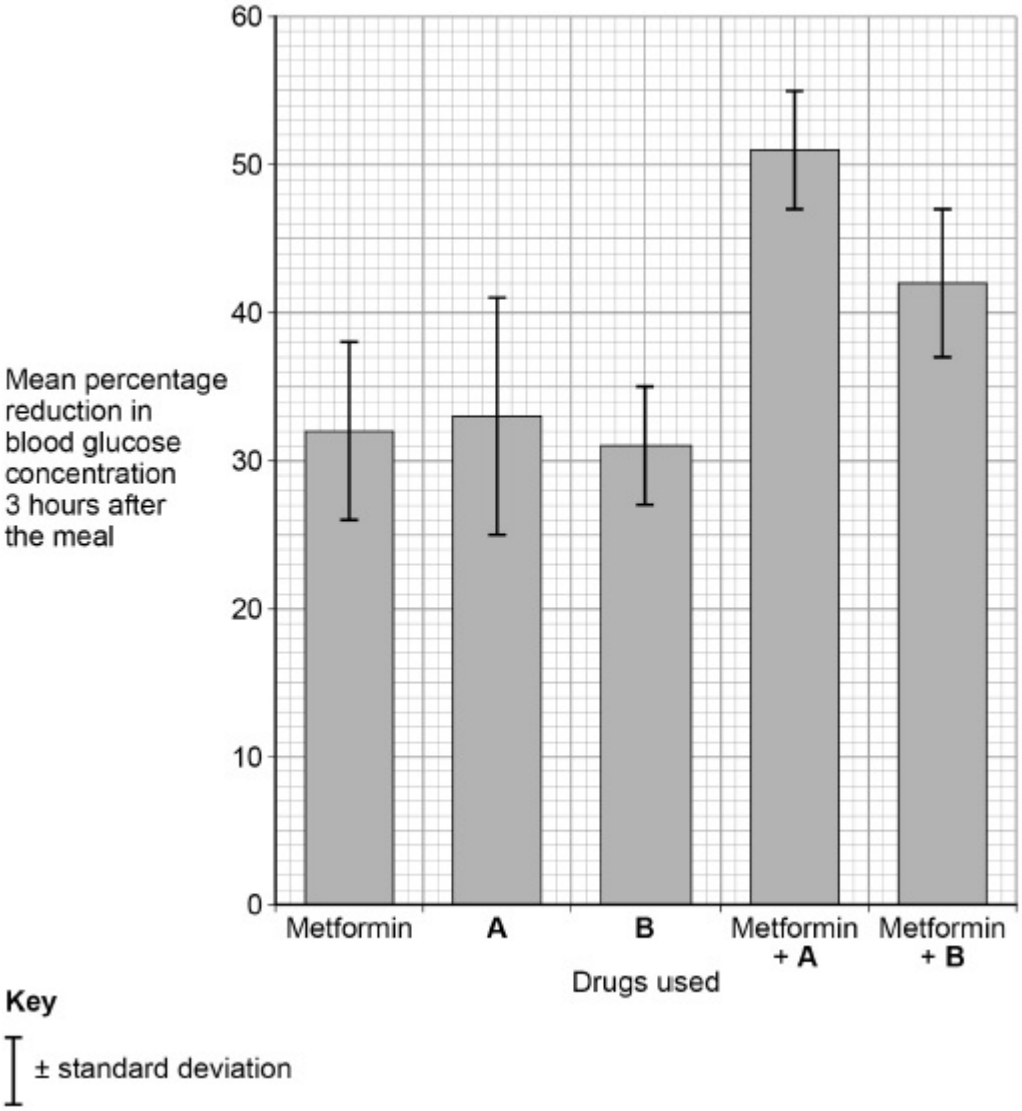
Mean = 182.5 ± 18.2 ☐

Mean = 205.2 ± 19.4 ☐

(1)

The following table and the figure show the scientists' results.

Drugs used	Metformin	A	B	Metformin + A	Metformin + B
Number of people	60	40	25	65	30
Mean blood glucose concentration 30 minutes after the meal in mg/100 cm^3 ± standard deviation	177.2 ± 15.4	182.5 ± 18.2	171.6 ± 16.3	205.2 ± 19.4	206.5 ± 19.6



In the table and the figure some standard deviations of results overlap.

- An overlap of standard deviations shows the difference between the means is **not** significant.
- **No** overlap of standard deviations shows a significant difference between the means.

(e) A student looked at the scientists' method and the results in the table and figure above.

The student stated:

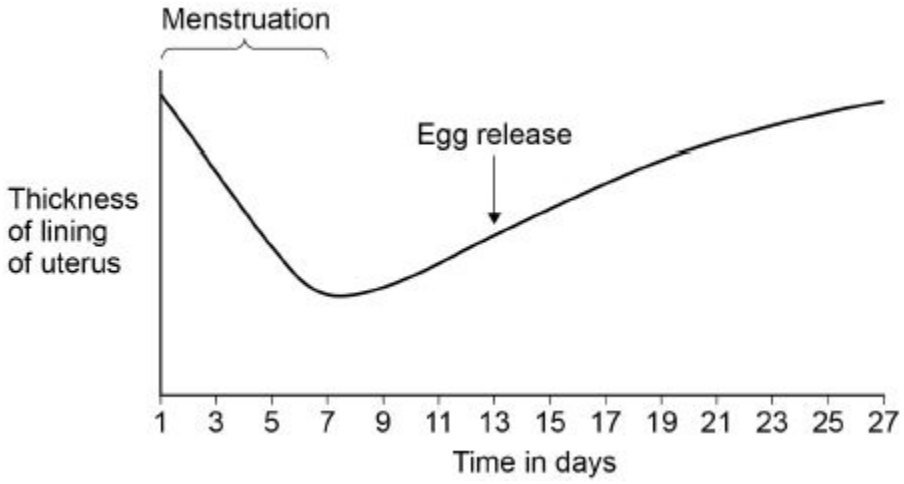
'Metformin works better when used with other drugs.'

Evaluate the student's statement.

(6)

(Total 18 marks)

4. The graph below shows some changes that occur during the menstrual cycle.



(a) The graph above shows that the lining of the uterus thickens between days 7 and 27.

What is the purpose of thickening the lining of the uterus?

Tick **one** box.

To allow implantation of the embryo ☐

To break down waste ☐

To prevent sperm reaching the egg ☐

(1)

(b) Which hormone causes thickening of the lining of the uterus?

Tick **one** box.

Auxin ☐

Oestrogen ☐

Testosterone ☐

(1)

(c) On which day is fertilisation most likely to occur?

Use information from the graph above.

_____

(1)

Contraception can be used to lower the chance of pregnancy.

(d) Draw **one** line from each method of contraception to how the method works.

Method of contraception	**How the method works**
Contraceptive pill	Barrier to prevent sperm reaching the egg
Diaphragm	Contains hormones to stop eggs maturing
Spermicidal cream	Kills sperm
	Slows down sperm production

(3)

(e) The table below gives information about some different methods of contraception.

Method	**Number of pregnancies per 100 women in one year**	**Possible Side effects**
Diaphragm and spermicidal cream	8	Usually none, but can cause bladder infection in some women
Condom	2	None
Contraceptive pill	1	Mood swings, headaches, high blood pressure, blood clots, breast cancer

A man and a woman decide to use the condom as their method of contraception.

Suggest **three** reasons for this decision.

Use information from the table above and your own knowledge.

1. _____

_____

2. _____

_____

3. _____

_____

(3)

(Total 9 marks)

5. A person with Type 1 diabetes cannot make enough insulin.

(a) Which organ makes insulin?

Tick **one** box.

Adrenal gland	☐
Pancreas	☐
Pituitary gland	☐
Thyroid	☐

(1)

(b) A person with Type 1 diabetes can control the concentration of glucose in the blood by injecting insulin.

Complete the sentences.

Choose answers from the box.

DNA	**glycogen**	**kidney**
liver	**protein**	**skin**

Insulin acts on an organ called the _____ .

This organ then takes in excess glucose from the blood and changes

the glucose into _____ .

(2)

(c) Insulin cannot be taken as a tablet. This is because insulin is a type of protein.

What would happen to the insulin in the tablet if it reached the stomach?

_____

_____

(1)

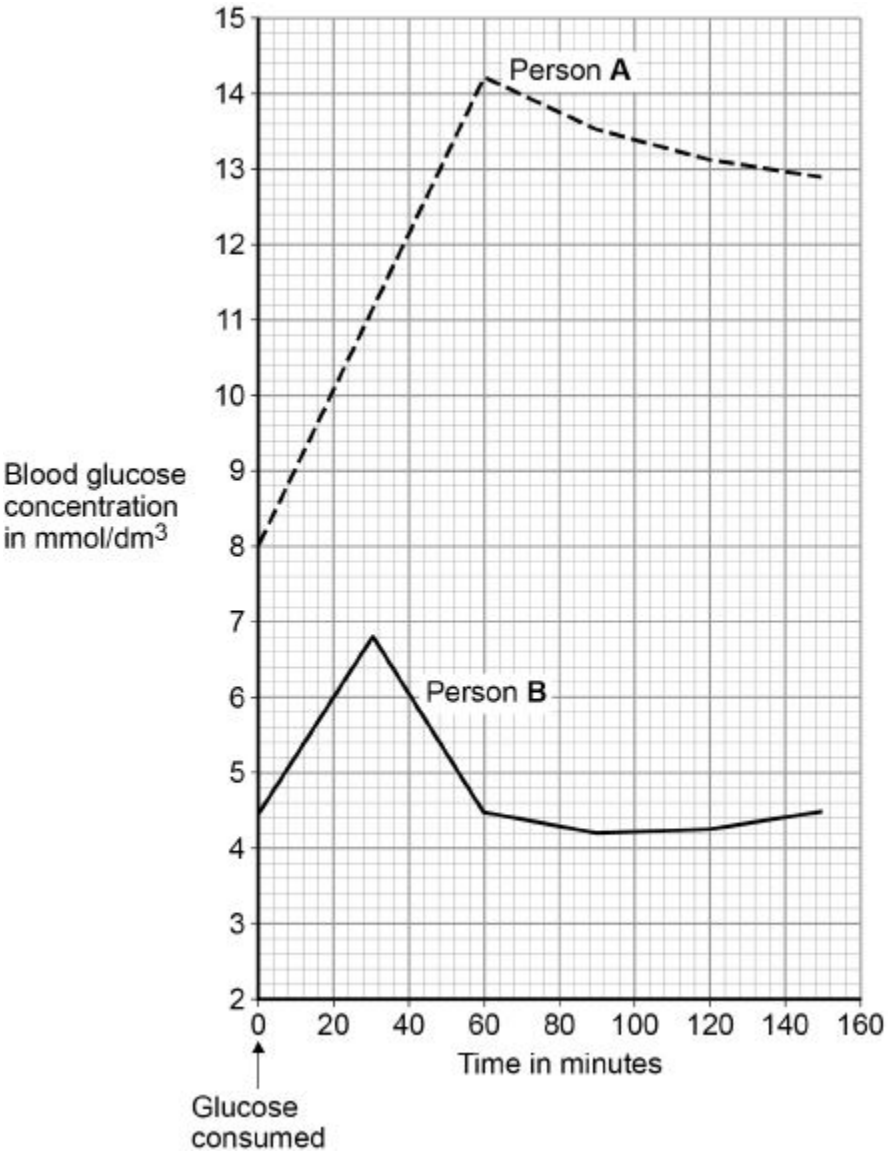
Two people each drank the same volume of a glucose drink.

Person **A** has Type 1 diabetes.

Person **B** does **not** have diabetes.

Figure 1 shows how the concentration of glucose in their blood changed.

Figure 1



(d) How much higher was the **highest** concentration of glucose in the blood of person **A** than the **highest** concentration in person **B**?

Use information from **Figure 1**.

_____

_____

_____

_____

Answer = _____ mmol/dm^3

(2)

(e) Describe **one** other way that the results for person **A** were different from the results for person **B**.

Use information from **Figure 1**.

_____

_____

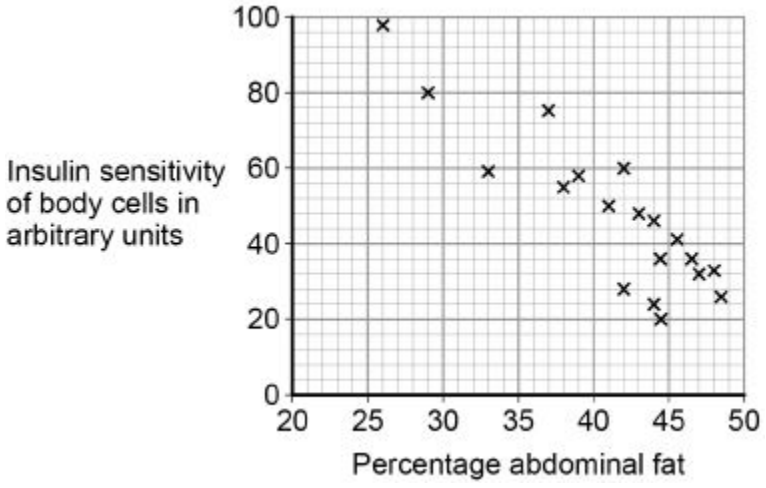
(1)

Type 2 diabetes is another form of diabetes. Type 2 diabetes is common in obese people.

People with Type 2 diabetes make enough insulin, but still cannot control their blood glucose concentration. This is because the body cells are not sensitive to the insulin.

Figure 2 shows information about abdominal fat and insulin sensitivity in body cells.

Figure 2



(f) What type of relationship is shown in **Figure 2**?

Tick **one** box.

A negative correlation ☐

No correlation ☐

A positive correlation ☐

(1)

(g) A person is at risk of developing Type 2 diabetes.

Suggest **two** ways the person could lower the chance of developing Type 2 diabetes.

1. _____

_____

2. _____

_____

(2)

(Total 10 marks)

6. Many human actions are reflexes.

(a) Which **two** of the following are examples of reflex actions?

Tick **two** boxes.

Jumping in the air to catch a ball ☐

Raising a hand to protect the eyes in bright light ☐

Releasing saliva when food enters the mouth ☐

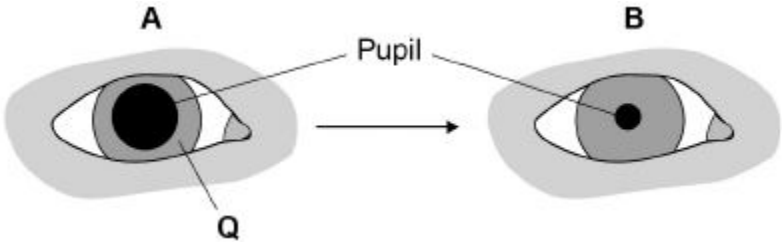
Running away from danger ☐

Withdrawing the hand from a sharp object ☐

(2)

Figure 1 shows how the size of the pupil of the human eye can change by reflex action.

Figure 1



(b) Name **one** stimulus that would cause the pupil to change in size from **A** to **B**, as shown in **Figure 1**.

_____

(1)

(c) Structure **Q** causes the change in size of the pupil.

Name structure **Q**.

_____

(1)

(d) Describe how structure **Q** causes the change in the size of the pupil from **A** to **B**.

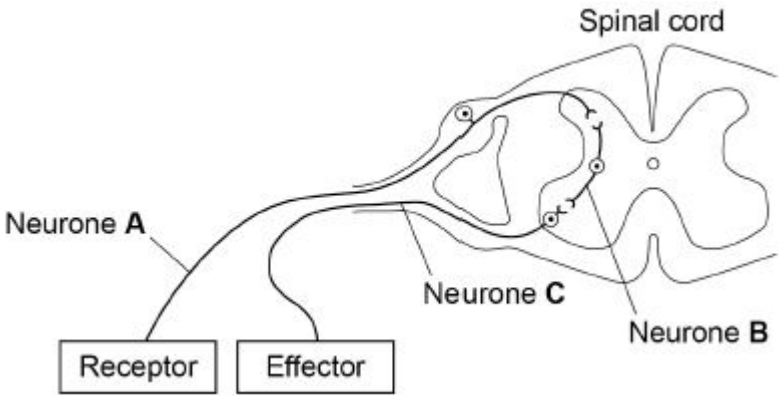
_____

_____

(1)

(e) **Figure 2** shows some structures involved in the coordination of a reflex action.

Figure 2



Describe how the structures shown in **Figure 2** help to coordinate a reflex action.

(6)

(Total 11 marks)

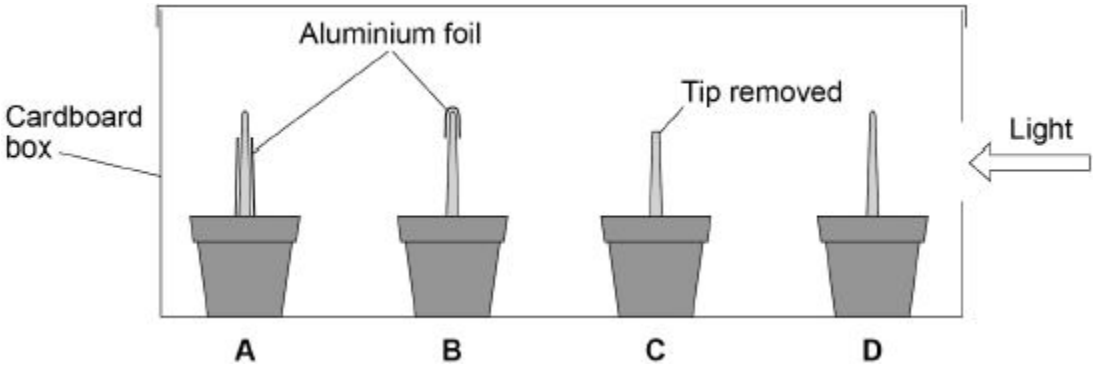
7. Some students investigated phototropism in plant seedlings.

This is the method used.

1. Measure the lengths of the shoots of 20 seedlings.
2. Set up four groups of seedlings as follows:
   - **A** − bottom of shoot covered in aluminium foil
   - **B** − tip covered in aluminium foil
   - **C** − tip removed
   - **D** − no changes.
3. Put the seedlings in a cardboard box.
4. Use a lamp to shine a light into the box through a hole in one side.
5. After one day, re-measure the lengths of the shoots.
6. Make a drawing of the appearance of one seedling from each group.

Figure 1 shows the appearance of one seedling in each group at the start of the investigation.

Figure 1



(a) Which **two** conditions should the students have kept constant for each group of seedlings?

Tick **two** boxes.

- The length of the roots ☐
- The number of seedlings in each group ☐
- The temperature ☐
- The thickness of the aluminium foil ☐
- The volume of water added to the soil ☐

(2)

(b) What is the purpose of the aluminium foil?

Tick **one** box.

To hold the shoot straight ☐

To keep the shoot warm ☐

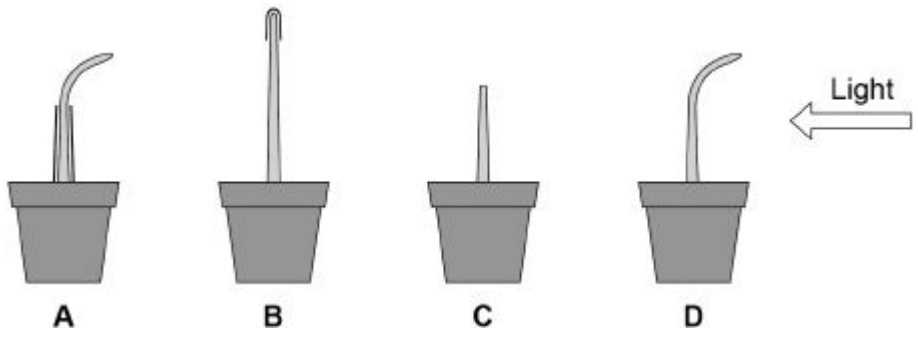
To remove the effect of gravity ☐

To stop light reaching the shoot ☐

(1)

Figure 2 shows the students' results.

Figure 2



	A	B	C	D
Mean length of shoot at start in mm	23	24	21	25
Mean length of shoot after 1 day in mm	28	30	23	30
Mean change in length of shoot in mm	5	6	2	5

(c) Suggest how the students measured the lengths of the curved shoots of seedlings **A** and **D** at the end of the investigation.

_____

_____

_____

_____

(2)

(d) The students concluded that the **tip** of the shoot is needed for the plant to respond to light.

Give evidence for this conclusion from **Figure 2**.

_____

_____

_____

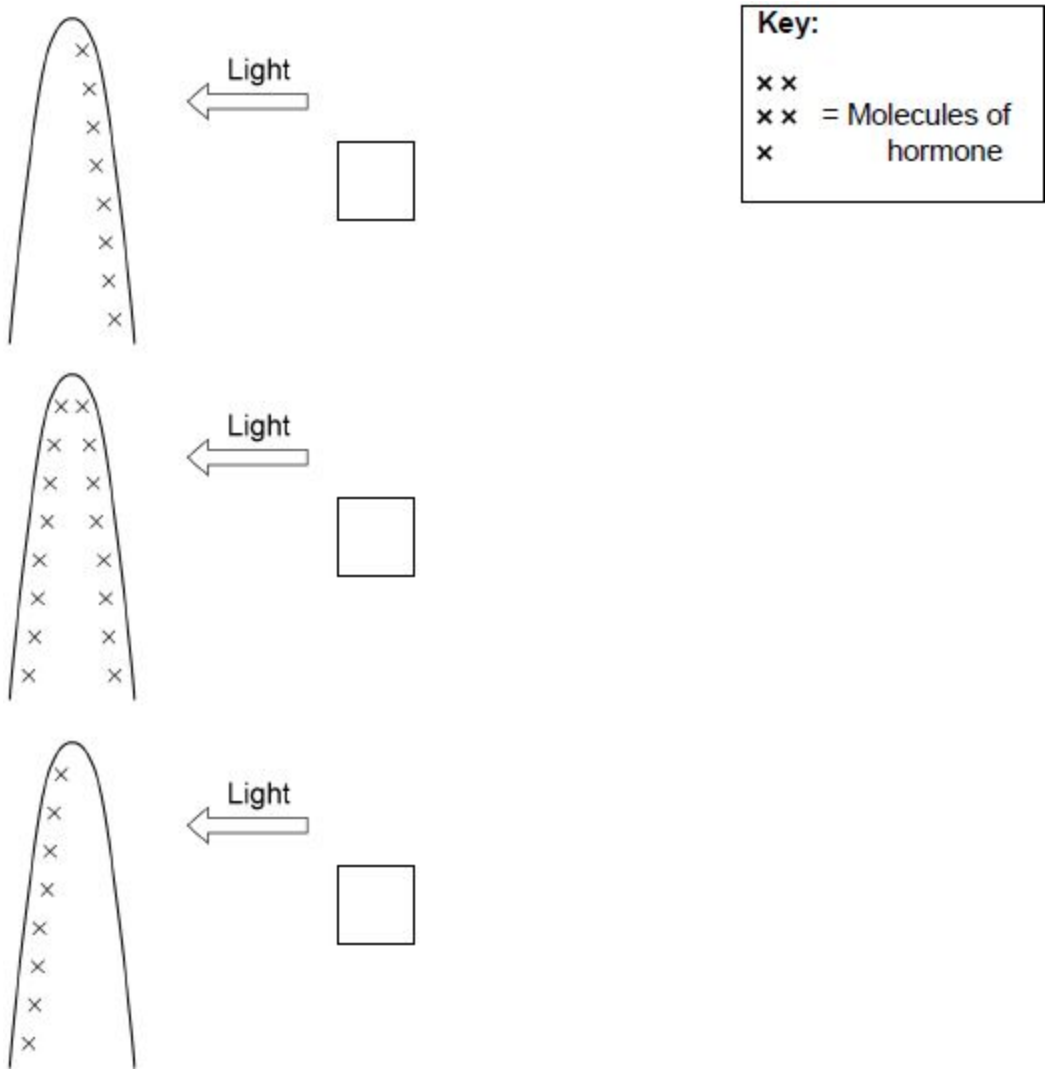
_____

(2)

(e) A hormone stimulates growth in shoots.

Which distribution of the hormone would cause the results seen in shoot **D**?

Tick **one** box.



(1)

(Total 8 marks)

1. (a) ciliary muscles contract

1

(so ciliary muscles have a) smaller diameter

1

(so) suspensory ligaments loosen / slacken

*do **not** accept 'relax'*

1

(so) lens thickens **or** lens becomes more curved / rounded

allow lens becomes fatter

ignore lens becomes bigger

1

(thicker) lens is more convergent

*allow light rays bent (inwards) more **or** light refracted more*

1

light rays / image focused on retina

allow light rays meet on retina

1

(b) eye(-ball) is (too) short **or** lens cannot be thickened enough

*allow ciliary muscles (too) weak **or** lens not (sufficiently) elastic*

1

(so) light 'focuses' behind retina

allow (so) image forms behind retina

1

(c) convex / converging lens

allow shape described eg thicker in middle

1

light rays bent / refracted (inwards) more

allow changes direction of light rays further inwards

1

light rays focused on retina

*allow light rays brought to a point on retina **or** light rays converge on retina **or** focused / clear image forms on retina*

1

[11]

2. (a) pituitary

1

(b) ADH

1

(c)

*allow ecf for name of hormone from part **(b)***

ignore name of gland

high(er) concentration of blood **causes** (more) ADH / hormone release

allow low(er) water potential of blood causes (more) ADH / hormone release
*allow alternative descriptions in terms of – eg low(er) water concentration / level **or** high(er) osmotic pressure **or** high(er) solute concentration / level*

1

(and hormone / ADH causes) increased permeability of kidney tubules (to water)

allow increased permeability of collecting duct / distal convoluted tubule

1

(so) increased water reabsorption

allow more water taken back into blood

ignore reference to urine

1

(d)

allow converse if clearly describing dialysis
explanation must match reason

changes in concentrations / levels of substances / urea are minimised

allow no change in concentration / level of substances / urea
allow correctly named substances

1

(so) less / no chance of causing damage to body cells / tissues

*allow eg less / no osmotic stress **or** not poisoned by urea*

1

not repeatedly puncturing skin **or** blood not in contact with machine

allow blood does not leave the body

1

(so) less / no chance of infection **or** less / no chance of blood clots **or** no need to take anti-clotting drugs

allow less / no chance of microorganisms entering body
allow only one operation so less chance of infection for 2 marks
allow dialysis requires anti-clotting drugs and so may lose more blood if cut for 2 marks

1

[9]

3. (a)

ignore incorrect organ secreting insulin / glucagon

(blood glucose increases after meal causing) insulin secretion

allow (blood glucose increases after meal causing) insulin increase

1

insulin causes glucose to enter cells / liver / muscles

1

(insulin causes) glucose conversion to glycogen

1

*allow glucose converted to glycogen in cells / liver / muscles for **2** marks*

(so) blood glucose decreases causing glucagon secretion

allow increase in glucagon when blood glucose is low

1

glucagon causes glycogen to be converted to glucose

1

(b) cells / liver / muscles absorb less glucose

allow cells / liver / muscles convert less glucose to glycogen

*do **not** accept no absorption / conversion of glucose*

1

(so) glucose concentration in blood remains high

allow (so) glucose concentration in blood does not decrease

1

(high blood glucose stimulates / causes) pancreas to release more insulin

allow more insulin is released from pancreas to 'try' to reduce blood glucose

1

(c) any **three** from:

- age
- height **and** mass
  allow BMI
- proportion of males and females **or** group size
  allow sex of the participants
- (same) severity of diabetes
- (same) activity (during investigation)
- (same) type of meal
- dose of drug
- (similar) blood glucose concentrations at start
  allow how much / type of food / drink consumed before
- other health conditions **or** other drugs being taken
  allow may not have followed drug-taking regime beforehand

3

(d) Mean = 177.2 + 15.4

1

(e) **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

Pro:

- Met + A gives larger (%) reduction (in blood glucose) than Met alone
- so statement is supported

- Met + B gives larger (%) reduction (in blood glucose) than Met alone
- so statement is supported

- Met + A SD does not overlap with Met SD
- so difference is significant

Con:

- Met + B SD overlaps with Met SD
- so difference is not significant
- difference in results could be due to chance

- number of people used is not very large
- number of people in each group is different
- so may not be representative **or** may not be repeatable / reproducible
- so anomalies will have a bigger impact on smaller groups

- 30 minute / starting levels of blood glucose are different
- all 30 minute / starting levels are higher in the 2-drug trial
- so may cause different % reductions

- no information about control variables **or** named e.g.
- concentration of drugs not given / may differ
- so results may not be valid

for level 3 an inclusion of a discussion of significance is required

[18]

4. (a) to allow implantation of the embryo

1

(b) oestrogen

1

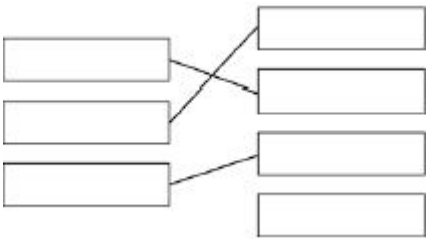
(c) 13 / 14 / 15 / 16

allow any number in range 13 to 16

allow any range within these values e.g. 14−16

1

(d)



extra line from a method cancels the mark

1
1
1

(e) more reliable than diaphragm / spermicidal cream

allow fewer pregnancies than diaphragm / spermicidal cream

1

low chance of pregnancy

allow only 1 more pregnancy than the pill (per 100 women per year)

allow almost as good as the pill

allow reference to one named example

1

no side effects

allow easy to get / buy

allow easy to use

allow prevent / reduce spread of STDs / gonorrhoea / HIV

ignore cost

1

[9]

5. (a) pancreas

1

(b) liver

1

glycogen

1

in this order

(c) would be digested / broken down (by enzymes / protease / pepsin / acid or to amino acids)

allow denatured (by acid)

1

(d) use of 14.2 **and** 6.8

1

7.4

*allow an answer of 7.2 or 7.3 (using 14.1 and / or 6.9) for **1** mark*

1

*an answer of 7.4 scores **2** marks*

(e) any **one** from:

- (person A's) results are higher

  ignore A peaks at a higher level than B

- (A) increases for a longer time **or** peaks later

- (A) takes longer to decrease **or** takes longer to return to normal

  allow other correct comparisons

  allow a description using pairs of figures from graph at a given time

1

allow converse comparisons with person B as the subject

(f) a negative correlation

1

(g) less carbohydrate / sugar / fat in diet

allow go on a diet
allow eat less
allow balanced / healthy diet

or

lose weight **or** maintain a healthy weight

ignore diet unqualified

1

(more) exercise

allow examples of exercise

1

[10]

6. (a) releasing saliva when food enters the mouth

1

withdrawing the hand from a sharp object

1

(b) bright light

allow described method of increasing light

ignore light unqualified

allow correctly named drug e.g. morphine / heroin

1

(c) iris

1

(d) muscle contraction

allow muscles shorten

ignore radial / circular

ignore muscles relax / constrict

*do **not** accept muscles expand*

*do **not** accept ciliary muscle contracts*

1

(e) **Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.

4–6

Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.

1–3

No relevant content

0

Indicative content

- receptor detects stimulus
- e.g. receptor detects pressure
- receptor generates impulses / electrical signals

- neurones conduct impulses / electrical signals
- neurone A conducts impulses to spinal cord
- neurone A = sensory neurone
- synapse between neurones
- chemical (/ neurotransmitter) crosses synapse
- chemical stimulates impulse(s) in neurone B
- neurone B = relay neurone
- neurone C = motor neurone

- effector carries out response
- e.g. muscles of the arm / leg contract
- muscles contract **or** gland secretes chemicals

to access **level 2**, candidates need to consider, in terms of the indicative content, the receptor, the neurones and the effector in the correct sequence

[11]

7. (a) the temperature

1

the volume of water added to the soil

1

(b) to stop light reaching the shoot

1

(c) piece of thread (along shoot and mark length)

allow straighten the shoot

1

transfer to ruler / mm-scale

*allow use of (flexible) tape measure for **2** marks*

1

(d) tip covered / B / removed / C grows straight up **or** does not bend (towards light)

allow tip covered / B / removed / C does not respond (to light)

1

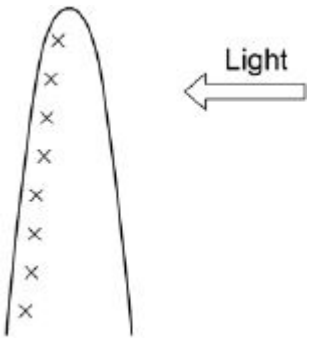
tip exposed / A / not covered / D bends (towards light)

tip exposed / A / not covered / D does respond (to light)

*allow only the ones with exposed tips or only A **and** D bend towards the light for **2** marks*

1

(e)



1

[8]