4-5 Homeostasis and response – Biology

1.0 Diabetes is a disease in which blood glucose (sugar) concentration may rise more than normal.

1.1 Which organ in the body monitors this rise in blood sugar?

[1 mark]

Tick **one** box.

Adrenal ☐

Pancreas ☐

Pituitary ☐

Thyroid ☐

1.2 One way of treating diabetes is by careful attention to diet.

Figure 1 shows the recommended diet for a person with diabetes.

Figure 2 shows a diet for a person without diabetes.

Figure 1

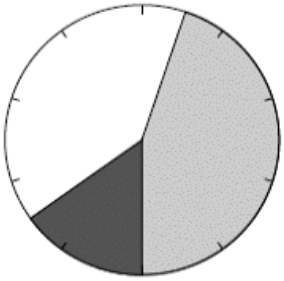
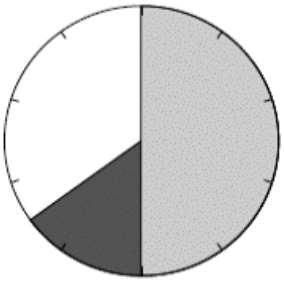
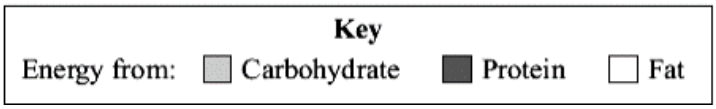


Figure 2





Give **two** ways in which the recommended diet of a person with diabetes is different from the diet of a person without diabetes.

[2 marks]

Recommendation 1: _____

_____

Recommendation 2: _____

_____

1.3 Other than diet, give **one** way in which diabetes may be treated.

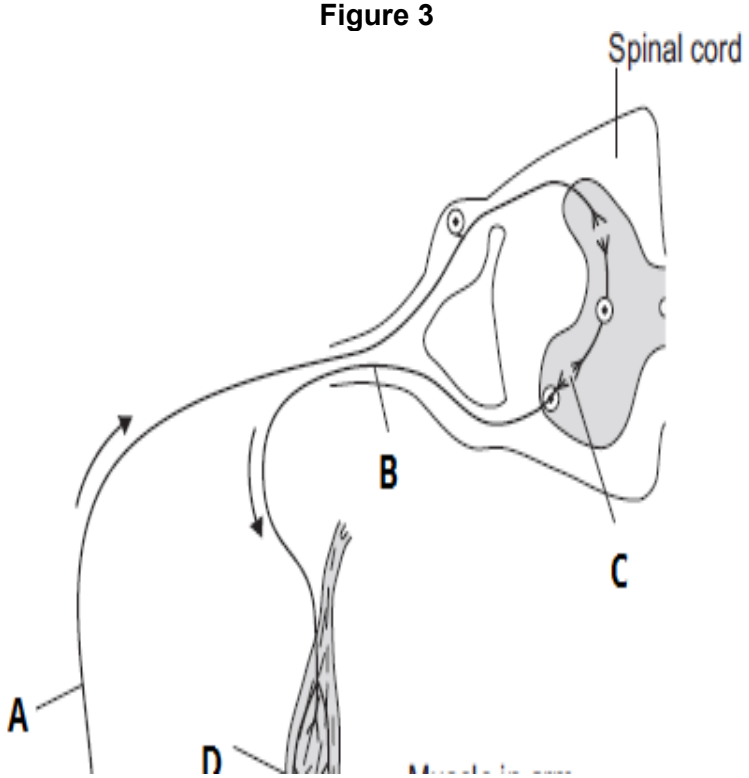
[1 mark]

_____

_____

2.0 **Figure 3** shows the neurones and parts of the body involved in a response to touching a hot object.

Figure 3



A neurone is a nerve cell. Neurones carry impulses around the body.

2.1 What is **B**?

[1 mark]

Tick **one** box.

Effector ☐

Motor neurone ☐

Relay neurone ☐

Sensory neurone ☐

2.2 Synapses are one of the structures in a reflex arc.

Which part, **A**, **B**, **C** or **D** is a synapse?

[1 mark]

Tick **one** box.

A ☐

B ☐

C ☐

D ☐

2.3 The hand touches a hot object.

An impulse travels through the nervous system to the muscle (point **D**). The muscle moves the hand away from the hot object.

What does the muscle do to move the hand away from the hot object?

[1 mark]

_____

2.4 The action described in **2.3** is a reflex action.

How can you tell that this action is **not** a conscious action?

[1 mark]

Use information from the diagram.

_____

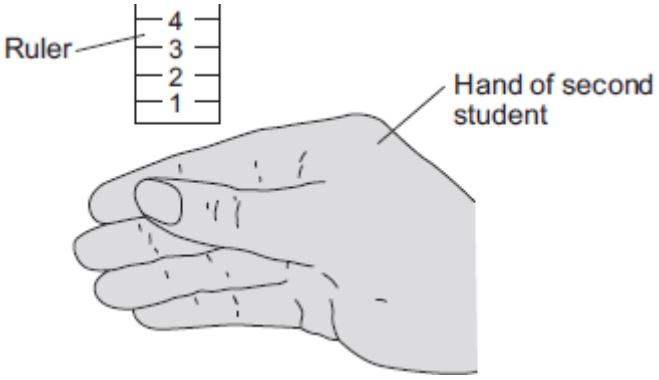
_____

2.5 Some students investigated the effect of caffeine on a person's reaction time.

The students used the following steps.

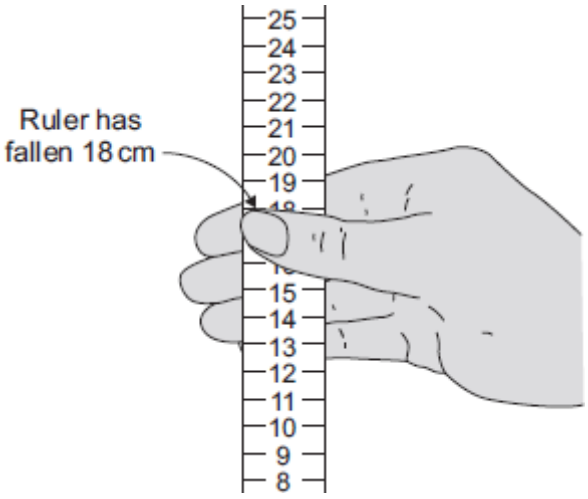
1. One student held a ruler just above a second student's hand, as shown in **Figure 4**.

Figure 4



2. The student let go of the ruler. The second student caught it as soon as possible, as shown in **Figure 5**.

Figure 5



3. The students repeated this experiment seven more times.
4. The student catching the ruler then drank a cup of strong coffee.

   Coffee contains caffeine.
5. Fifteen minutes after drinking the coffee the students repeated steps 1 to 3.

Table 1 and **Table 2** show the students' results.

Table 1

Distance ruler fell before it was caught in cm
Before drinking coffee
17
21
24
16
20
16
13
21
Mean = 18.5

Table 2

Distance ruler fell before it was caught in cm
After drinking coffee
8
13
11
16
9
14
13
13
Mean = 12.2

What is the mode for the results after drinking coffee?

[1 mark]

_____

2.6 The students used the reading on the ruler as a measure of the reaction time.

What can you conclude about the effect of caffeine on reaction time?

[1 mark]

_____

_____

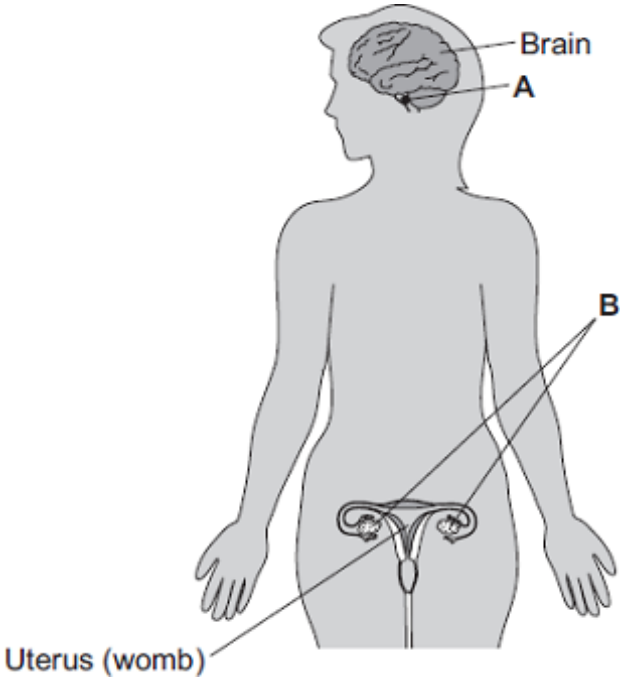
2.7 Which of the statements below show that the experiment was repeatable, and which show that it was reproducible?

[2 marks]

	Repeatable	**Reproducible**
The same student repeated the experiment		
The same student got similar results each time		
A different student repeated the experiment		
A different student got similar results each time		

3.0 **Figure 6** shows the position of two glands, **A** and **B**, in a woman.

Figure 6



3.1 Name glands **A** and **B**.

[2 marks]

A _____

B _____

3.2 Gland **A** produces the hormone Follicle Stimulating Hormone (FSH).
FSH controls changes in gland **B**.
Describe how FSH moves from gland **A** to gland **B**.

[1 mark]

_____

3.3 Oestrogen is a reproductive hormone.
Which gland secretes oestrogen?

[1 mark]

_____

3.4 A woman is not able to become pregnant.

The woman does not produce mature eggs. The doctor treats the woman by giving her injections of hormones.

Which **two** hormones will help the woman produce and release mature eggs?

[2 marks]

Tick **two** boxes.

Follicle Stimulating Hormone (FSH)	☐
Luteinising Hormone (LH)	☐
Oestrogen	☐
Progesterone	☐
Testosterone	☐

3.5 Hormones control some actions in the body. The nervous system controls some actions as well. Reflex actions are part of the nervous system.

Give **two** ways in which a hormone controlled action is different from a reflex action.

[2 marks]

1 _____

_____

2 _____

_____

3.6 There are different types of contraception that are used to prevent pregnancy.

Explain how hormonal and non-hormonal methods of contraception prevent pregnancy occurring.

[2 marks]

Hormonal methods_____

_____

Non-hormonal methods_____

_____

3.7 A new fertility treatment that could allow women to have IVF in their lunch hour has been developed.

Figure 7 shows the *Invocell* device.

Figure 7

Invocell is a sealed capsule that allows fertilisation to take place inside the woman's body, in the vagina.

- Eggs are removed from the ovaries while the woman is under sedation.
- The eggs and sperm are put into the *Invocell* capsule.
- The capsule is placed inside her vagina.
- After three days the capsule is removed and the best embryo is transferred to the woman's womb.

This IVF treatment can be performed in a doctor's surgery because at no time are eggs, sperm or embryo stored outside the body. No costs are involved for laboratory incubation.

Evaluate the use of the *Invocell* technique compared with standard IVF treatment.

[4 marks]

4.0 Blood glucose concentration is monitored and controlled by the pancreas.

Explain what would happen to maintain blood glucose concentration if somebody ate some glucose tablets.

[4 marks]

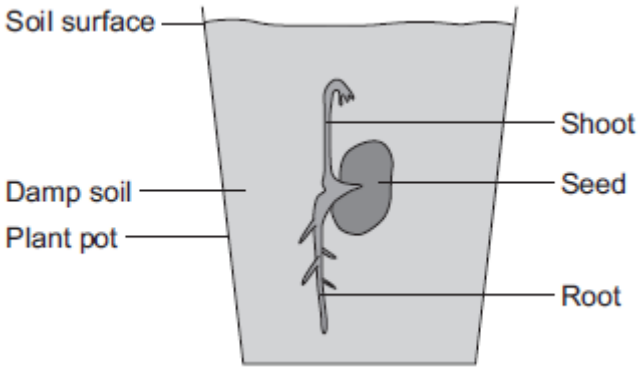
5.0 A student investigated growth in plants.

The student:

- planted a seed in damp soil in a plant pot
- put the plant pot in a dark cupboard.

Figure 8 shows the result after five days.

Figure 8



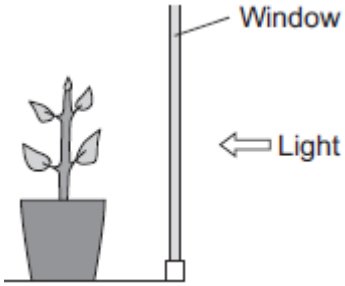
5.1 Compare the growth of the root and shoot after five days.

[2 marks]

In another investigation a student put the plant pot by a window with lots of light.

Figure 9 shows the plant.

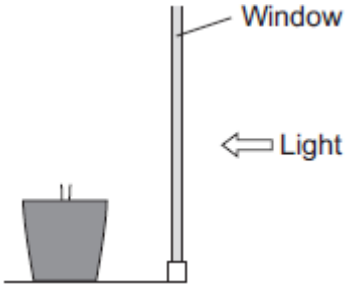
Figure 9



5.2 Complete **Figure 10** to show the appearance of the student's plant after 20 days by the window.

[1 mark]

Figure 10



5.3 Name the plant hormone that causes the plant to grow in the way you have shown in **5.3**

[1 mark]

6.0 The kidneys remove waste materials from the liquid part of the blood.

Table 3 shows the concentration of certain substances

- in the liquid part of the blood
- in the liquid that has just been filtered from the blood in the kidneys
- in the solution in the bladder.

Table 3

Substance	Concentration (%)		
	In liquid part of blood	**In liquid that has been filtered in the kidneys**	**In liquid in the bladder**
Protein	7.0	0	0
Salt	0.35	0.35	0.5
Glucose		0.1	0
Urea	0.03	0.03	

6.1 Suggest the concentration of glucose in the blood.

[1 mark]

_____

6.2 What would the concentration (%) of urea in the bladder be?

Tick **one** box.

0 ☐

0.3 ☐

0.03 ☐

0.01 ☐

[1 mark]

6.3 What happens to the glucose in the liquid that is filtered in the kidneys?

[1 mark]

_____

6.4 Explain why the concentration of salt in the liquid in the bladder is greater than the concentration of salt in the liquid that is filtered in the kidneys.

[1 mark]

_____

_____

7.0 One group of students are working in a hot desert and another group is working in a tropical rainforest.

Table 1 shows information about the students and the conditions in the desert and the rainforest.

Table 1

Information	Hot desert	Rainforest
Mean core body temperature of students in °C	37.3	38.9
Air temperature in °C	36.0	35.5
Mean percentage concentration of moisture in the air	9.0	92.0
Mean wind speed at ground level in metres per second	12.0	3.0

Both groups of students are doing similar jobs. The jobs cause the students to sweat a lot.

7.1 Use information from **Table 1** to explain the difference in the mean core body temperature of the two groups of scientists.

[2 marks]

7.2 Changes to blood vessels in the skin help to decrease body temperature.

Explain how.

[2 marks]

MARK SCHEME

Qu No.		Extra Information	Marks
1.1	pancreas		1
1.2	(person with diabetes), should get more energy from fats should get less energy from carbohydrates	allow converse if clearly describing person without diabetes allow eat more fats allow eat less carbohydrates	1 1
1.3	any **one** from: • exercise • (injecting) insulin • pancreas transplant • artificial pancreas		1

Qu No.		Extra Information	Marks
2.1	motor neurone		1
2.2	C		1
2.3	contract		1
2.4	not connected to the brain **or** coordinated <u>only</u> by the spinal cord		1
2.5	13		1
2.6	caffeine decreases reaction time	allow caffeine speeds up reactions	1
2.7	<table><tr><th></th><th>Repeatable</th><th>Reproducible</th></tr><tr><td>The same student repeated the experiment</td><td>✓</td><td></td></tr><tr><td>The same student got similar results each time</td><td>✓</td><td></td></tr><tr><td>A different student repeated the experiment</td><td></td><td>✓</td></tr><tr><td>A different student got similar results each time</td><td></td><td>✓</td></tr></table>	one mark per correct column	2

Qu No.		Extra Information	Marks
3.1	(A) pituitary (B) ovary/ovaries		1 1
3.2	in blood (stream) or in (blood) plasma	ignore dissolved	1
3.3	ovary/ovaries		1
3.4	follicle stimulating hormone / FSH luteinising hormone / LH	in either order	1 1
3.5	(hormone controlled action), (is a) slower action lasts longer	allow converse if clearly describing nervous action	1 1
3.6	(hormonal methods) some release hormones/oestrogen/progesterone to stop eggs being matured and/or released (such as the contraceptive pill or implant) (non-hormonal methods) stop sperm reaching the egg (such as condoms, spermicidal cream, abstinence or sterilization) **or** stop the fertilized egg implanting in the womb (such as some IUDs)		1 1
3.7			
Level 2:	A coherent evaluation is provided which considers a range of points both advantages and disadvantages of *Invocell*. If a conclusion is given, it is consistent with the reasoning.		3–4
Level 1:	Discrete relevant point made. The logic may be unclear and the conclusion, if present, may not be consistent with the reasoning.		1–2
	No relevant content.		0
Indicative content			
advantages of *Invocell* • low(er) cost • quick(er) • laboratory/incubator/equipment not needed • more convenient **disadvantages of *Invocell*** • embryo development cannot be monitored • cannot be used where male is infertile • (risk of) infection or pain in vagina • argued conclusion			

Qu No.		Extra Information	Marks
4.0	glucose levels in blood will rise pancreas releases insulin glucose is converted to glycogen (in liver) glucose level falls **or** returns to normal	 do **not** allow liver releasing insulin allow glucose is taken up by cells 	1 1 1 1

Qu No.		Extra Information	Marks
5.1	The root had grown in the direction of the force of gravity The shoot had grown against the force of gravity	do **not** allow references to light, heat or water	1 1
5.2	diagram completed to show stem bending/leaning towards the window	the bend can be at/from any point above pot level ignore any leaves drawn	1
5.3	auxin		1

Qu No.		Extra Information	Marks
6.1	0.1		1
6.2	0.3		1
6.3	it is all reabsorbed		1
6.4	most of the water is reabsorbed, but only some salt		1

Qu No.		Extra Information	Marks
7.1	(in rainforest), (water from) sweat does not evaporate (as much) (due to) less wind **or** higher moisture/humidity	max 1 if unclear whether desert or rainforest	1 1
7.2	blood vessels supplying capillaries dilate/widen **or** vasodilation (therefore) more blood (through skin/surface capillaries) leads to greater heat loss	do **not** award mark if candidate refers only to blood vessels dilating or to capillaries dilating. accept 'arteries' or 'arterioles' for 'blood vessels supplying, capillaries' do **not** accept 'veins' dilating ignore expand/get bigger/relax/open do **not** accept idea of blood vessels moving	1 1