

Homeostasis 7

Name: _____

Class: _____

Date: _____

Time: **146 minutes**

Marks: **146 marks**

Comments:

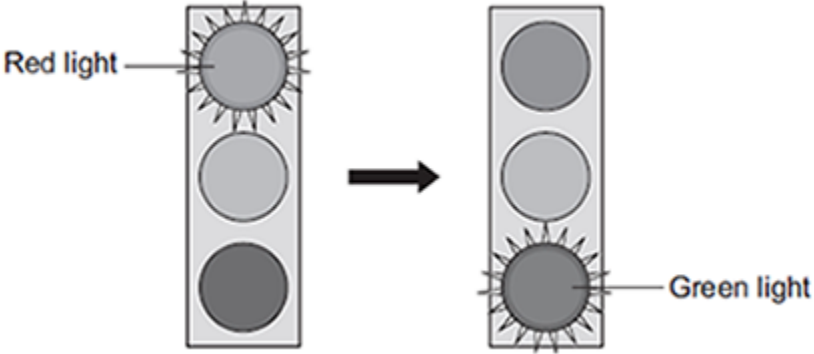
1.

Car drivers need quick reactions to avoid accidents.

A student uses a computer program to measure reaction time.

The computer screen shows a traffic light on red. The traffic light then changes to green.

The diagram below shows the change the person sees on the computer screen.



When the traffic light changes to green the person has to click the computer mouse as quickly as possible.

The computer program works out the time taken to react to the light changing colour.

(a) Special cells detect the change in colour.

(i) What word is used to describe special cells that detect a change in the environment?

Draw a ring around the correct answer.

receptor cells
reflex cells
stimulus cells

(1)

(ii) Where in the body are the special cells that detect the change in colour of the traffic lights?

(1)

(b) The student used the computer program on one computer to measure the reaction times of people of different ages.

(i) Give **one** variable the student should control so that a fair comparison can be made between the people of different ages.

(1)

- (ii) The student did each measurement three times to calculate a mean value.

The table shows the results.

Age in years	Mean reaction time in milliseconds
15	242
30	
45	221
60	258
75	364
90	526

The reaction times for the 30-year-old person were **192**, **174** and **180** milliseconds.

Calculate the mean reaction time of the 30-year-old person.

Mean reaction time = _____ milliseconds

(1)

- (iii) Which **one** of the following is an advantage of repeating each test three times and **not** doing the test just once?

Tick (✓) **one** box.

Any anomalies can be identified.

The results will be more precise.

There will be no errors.

(1)

(iv) Some people think that old people should **not** be allowed to drive a car.

Why is it more dangerous for old people to drive cars?

Use information from the table above to support your answer.

(2)

(Total 7 marks)

2.

Hormones are involved in controlling the menstrual cycle and fertility.

(a) (i) Use the correct answer from the box to complete the sentence.

auxin	follicle stimulating hormone (FSH)	thalidomide
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A hormone produced by the pituitary gland is _____

(1)

(ii) Use the correct answer from the box to complete the sentence.

luteinising hormone (LH)	oestrogen	statin
---------------------------------	------------------	---------------

A hormone produced by the ovaries is _____

(1)

(b) (i) Why are fertility drugs given to some women?

(1)

(ii) A doctor injects fertility drugs into a woman. After the injection, the hormones travel to the woman's ovaries.

How do the hormones travel to the ovaries?

Draw a ring around the correct answer.

through the bloodstream **through the neurones** **through the skin**

(1)

(c) Which **two** hormones are used in contraceptive pills?

Tick (✓) **two** boxes.

FSH	<input type="checkbox"/>	oestrogen	<input type="checkbox"/>
LH	<input type="checkbox"/>	progesterone	<input type="checkbox"/>

(2)
(Total 6 marks)

3.

This question is about the nervous system.

(a) Describe the difference between the function of a receptor and the function of an effector.

In your answer you should give **one** example of a receptor and **one** example of an effector.

(4)

(b) Synapses are important in the nervous system.

(i) What is a synapse?

(2)

(ii) Describe how information passes across a synapse.

(2)

(c) Reflexes may be co-ordinated by the brain or by the spinal cord.

(i) The reflexes from sense organs in the head are co-ordinated by the brain.

Name a sense organ involved in a reflex co-ordinated by the spinal cord.

(1)

(ii) The table shows information about reflexes co-ordinated by the brain and reflexes co-ordinated by the spinal cord.

Organ co-ordinating the reflex	Mean length of neurones involved in cm	Mean time taken for reflex in milliseconds	Mean speed of impulse in cm per millisecond
Brain	12	4	3
Spinal cord	80	50	

Calculate the mean speed of the impulse for the reflex co-ordinated by the spinal cord.

Mean speed = _____ cm per millisecond

(1)

(iii) In reflexes co-ordinated by the brain there are **no** relay neurones.

Suggest why there is a difference in the mean speed of the impulse for the two reflexes.

(2)

(Total 12 marks)

4.

(a) Which organ of the human body produces egg cells?

Draw a ring around the correct answer.

liver

ovary

testis

(1)

(b) An egg joins with a sperm and develops into an embryo.

How many chromosomes are there in each cell of a human embryo?

Draw a ring around the correct answer.

23

46

48

(1)

- (c) Some women find it difficult to have a baby. A doctor may suggest that these women should use In Vitro Fertilisation (IVF) to help them have a baby.

Table 1 shows how successful IVF was for women of different ages at one clinic.

Table 1

Age of women in years	Percentage of women who had a baby
<35	35
35–37	31
38–39	25
40–42	32
43–44	7
>44	0

- (i) A student thought that the result for women aged 40–42 was anomalous.

Suggest why the student thought this result was anomalous.

(1)

- (ii) Describe the general trend in the results in **Table 1**.

You should ignore the anomalous result.

(1)

- (d) Some babies are born with a faulty chromosome.

Scientists investigated whether the chance of having a baby with a faulty chromosome is also related to the age of the woman.

Table 2 shows the scientists' results.

Table 2

Age of women in years	Number of women per 1000 who had a baby with a faulty chromosome
25	2.0
30	2.6
35	6.1
40	19.6
45	66.0

- (i) A 45-year-old woman is more likely than a 25-year-old woman to have a baby with a faulty chromosome.

How many times more likely?

Answer = _____ times

(2)

- (ii) Suggest **two** reasons why many fertility clinics will **not** accept women over 40 years of age for IVF treatment.

Use information from **Table 1** and **Table 2** in your answer.

1. _____

2. _____

(2)

(Total 8 marks)

5.

The heart is part of the circulatory system.

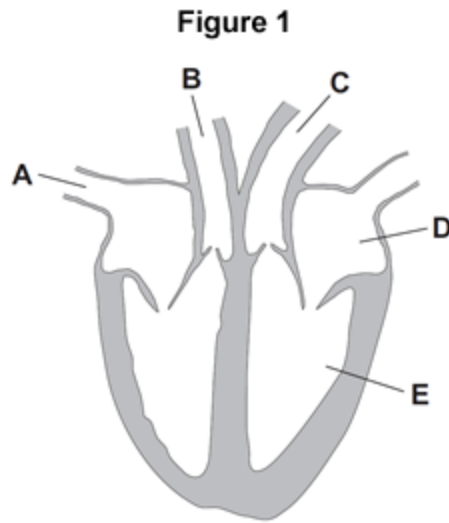
- (a) (i) Name **one** substance transported by the blood in the circulatory system.

(1)

- (ii) What is the main type of tissue in the heart wall?

(1)

- (b) **Figure 1** shows the human heart.



- (i) Which blood vessel, **A**, **B** or **C**, takes blood to the lungs?

(1)

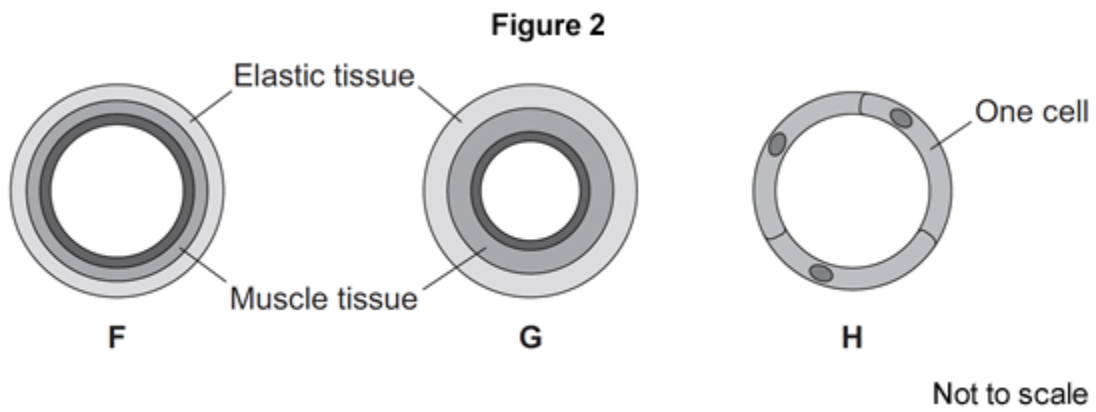
- (ii) Name parts **D** and **E** shown in **Figure 1**.

D _____

E _____

(2)

(c) **Figure 2** shows three types of blood vessel, **F**, **G** and **H**.



(i) What type of blood vessel is **F**?

Tick (✓) **one** box.

an artery

a capillary

a vein

(1)

(ii) A man needs to have a stent fitted to prevent a heart attack.

In which type of blood vessel would the stent be placed?

Tick (✓) **one** box.

an artery

a capillary

a vein

(1)

(iii) Explain how a stent helps to prevent a heart attack.

(2)

(Total 9 marks)

6.

Some people with diabetes do not produce enough insulin to keep their blood glucose at the correct levels.

(a) (i) Which organ monitors blood glucose levels?

Tick (✓) **one** box.

liver

pancreas

skin

(1)

(ii) What effect does insulin have on glucose in the blood?

Tick (✓) **one** box.

Insulin causes glucose to move into the cells.

Insulin increases the amount of glucose in the blood.

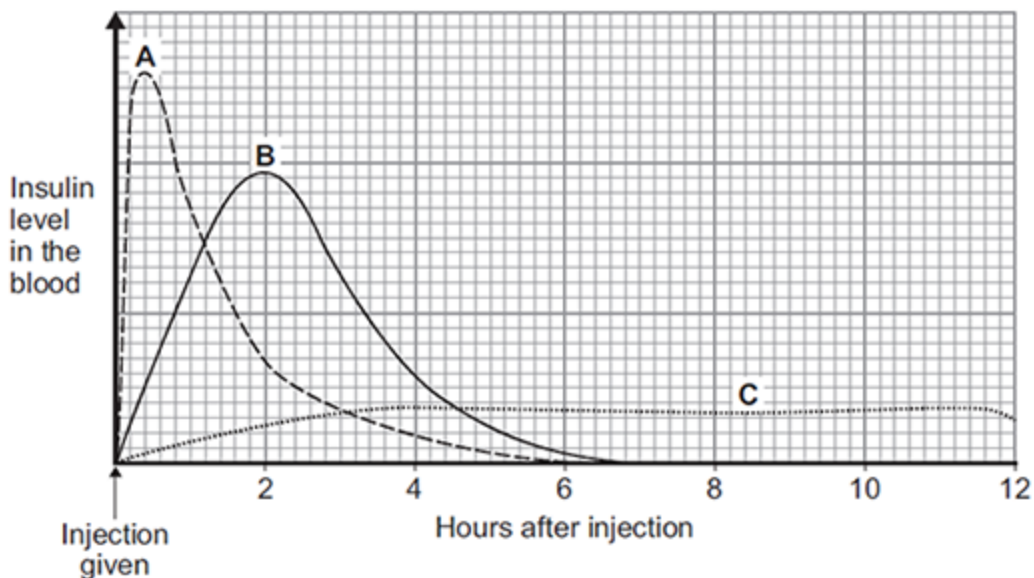
Insulin converts glucose to starch.

(1)

- (b) Some people with diabetes inject insulin several times a day.

There are different types of insulin.

The graph shows some information about three different types of insulin, **A**, **B** and **C**.



- (i) Which type of insulin, **A**, **B** or **C**, should a person with diabetes inject just before eating a meal high in carbohydrates?

Give a reason for your answer.

(2)

- (ii) A woman with diabetes has a blood glucose level of 12 mmol per dm³ of blood.

The woman's normal blood glucose level is 6 mmol per dm³.

The woman will need to inject insulin to lower her blood glucose level.

For each unit of insulin injected the blood glucose level will fall by 3 mmol per dm³.

How many units of insulin does the woman need to inject to bring her blood glucose level down to the normal level?

Number of units = _____

(1)

(c) Some people have pancreas transplants to treat diabetes.

Give **one** possible disadvantage of a pancreas transplant.

Tick (✓) **one** box.

The pancreas could be rejected.

The patient will need to inject insulin every day.

The patient's blood glucose levels may rise and fall too much.

(1)
(Total 6 marks)

7.

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

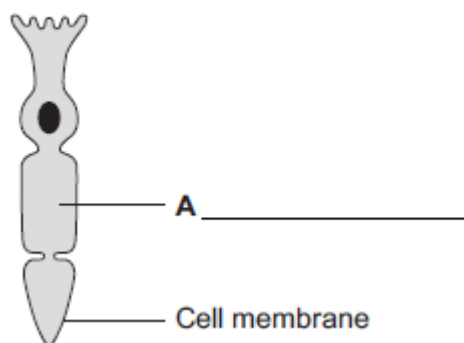
reflex

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
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(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)

8.

(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**.

9. This question is about the nervous system.

(a) Describe the function of receptors in the skin.

(2)

(b) A response is caused when information in the nervous system reaches an effector.

(i) There are two different types of effector.

Complete the table to show:

- the two different types of effector
- the response each type of effector makes.

Type of effector	Response the effector makes
1 _____	_____ _____
2 _____	_____ _____

(4)

(ii) Some effectors help to control body temperature.

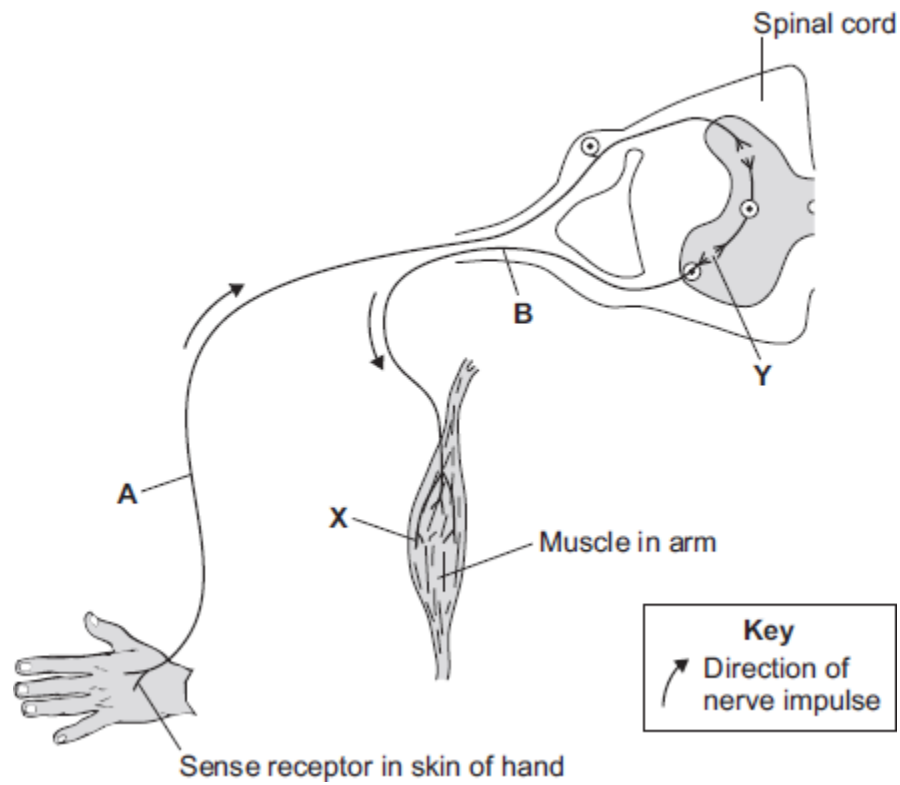
Give **one** reason why it is important to control body temperature.

(1)

(Total 7 marks)

10. (a) **Diagram 1** shows the neurones and parts of the body involved in a response to touching a hot object.

Diagram 1



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

(i) Draw a ring around the correct answer to complete each sentence.

Neurone **A** is a

- motor neurone.
- relay neurone.
- sensory neurone.

At point **Y** there is a tiny gap between two neurones called

- an effector.
- a receptor.
- a synapse.

(2)

- (ii) The hand touches a hot object. An impulse travels through the nervous system to the muscle (point **X**). The muscle moves the hand away from the hot object.

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

Tick (✓) **one** box.

contract

relax

stretch

(1)

- (iii) The action described in part (a) (ii) is a reflex action.

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

Use information from the diagram.

(1)

- (iv) Reflex actions like this are useful.

Explain why.

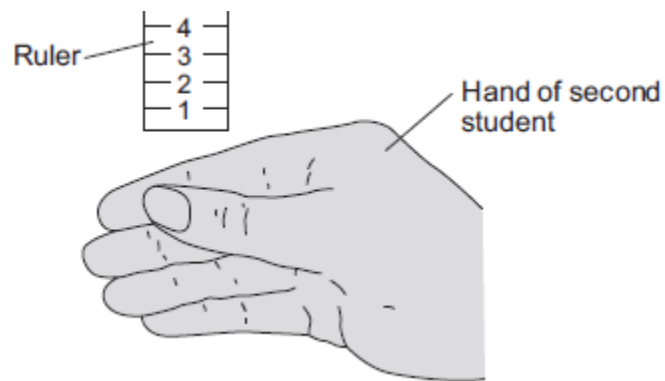
(2)

- (b) Some students investigated the effect of caffeine on a person's reaction time.

The students used the following steps.

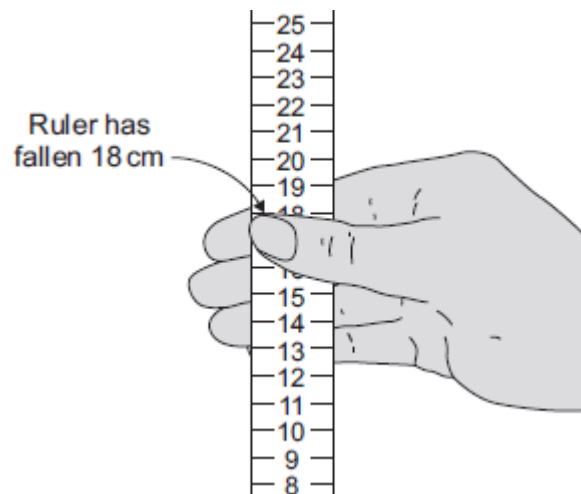
1. One student held a ruler just above a second student's hand, as shown in **Diagram 2**.

Diagram 2



2. The student let go of the ruler. The second student caught it as soon as possible, as shown in **Diagram 3**.

Diagram 3



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
18
21
25
15
19
16
12
21
Mean = 18.4

Table 2

Distance ruler fell before it was caught in cm
After drinking coffee
8
13
11
17
10
14
13
13
Mean = 12.4

- (i) The students used the reading on the ruler as a measure of the reaction time. What do the results show about the effect of caffeine on reaction time?

(1)

- (ii) Look carefully at **all** the data in **Table 1** and **Table 2**.

Using the data in **Table 1** and **Table 2**, give **one** reason why a scientist may **not** accept your conclusion in part (b) (i).

(1)

(iii) How could the students improve their investigation?

Suggest **two** ways.

1. _____

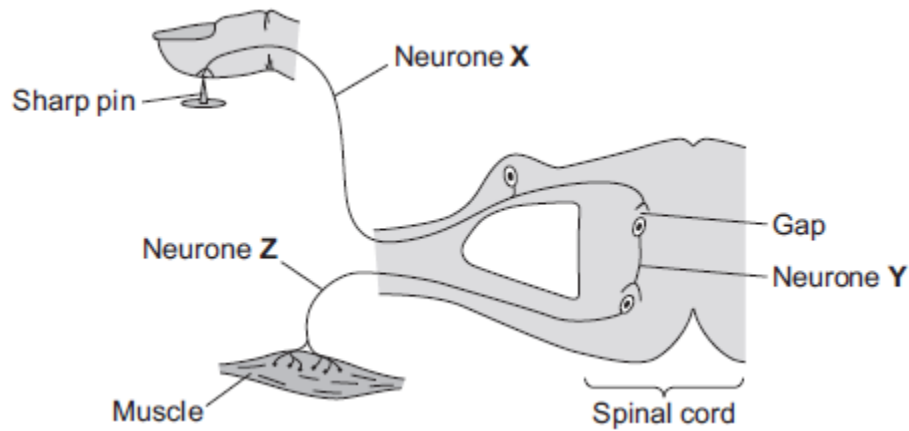
2. _____

(2)

(Total 10 marks)

11.

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



(a) What type of neurone is neurone **X**?

Draw a ring around the correct answer.

motor neurone

relay neurone

sensory neurone

(1)

(b) There is a gap between neurone **X** and neurone **Y**.

(i) What word is used to describe a gap between two neurones?

Draw a ring around the correct answer.

effector

receptor

synapse

(1)

(ii) Draw a ring around the correct answer to complete the sentence.

Information passes across the gap as

a chemical.

an electrical impulse.

pressure.

(1)

- (c) Describe what happens to the muscle when it receives an impulse from neurone **Z**. How does this reflex action help the body?

What happens to the muscle _____

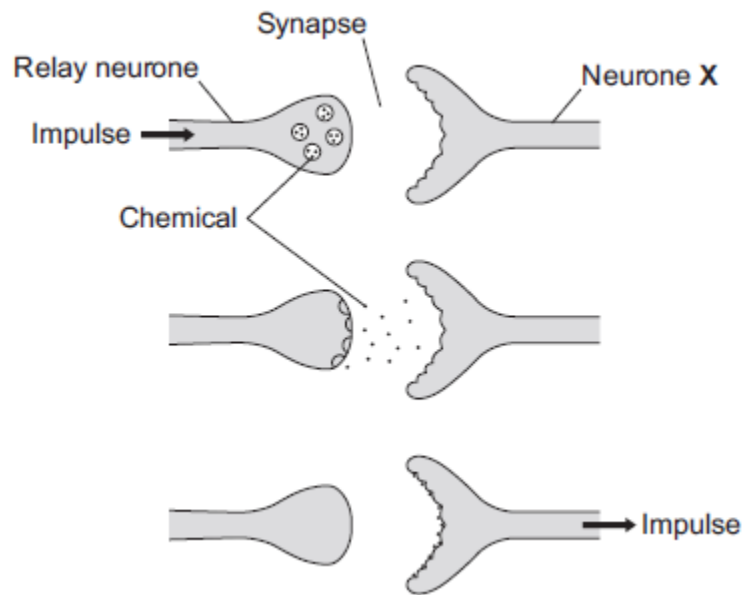
How this helps the body _____

(2)

(Total 5 marks)

12.

The diagram below shows how a nerve impulse passing along a relay neurone causes an impulse to be sent along another type of neurone, neurone **X**.



- (a) What type of neurone is neurone **X**?

(1)

- (b) Describe how information passes from the relay neurone to neurone **X**. Use the diagram to help you.

(3)

- (c) Scientists investigated the effect of two toxins on the way in which information passes across synapses. The table below shows the results.

Toxin	Effect at the synapse
Curare	Decreases the effect of the chemical on neurone X
Strychnine	Increases the amount of the chemical made in the relay neurone

Describe the effect of each of the toxins on the response by muscles.

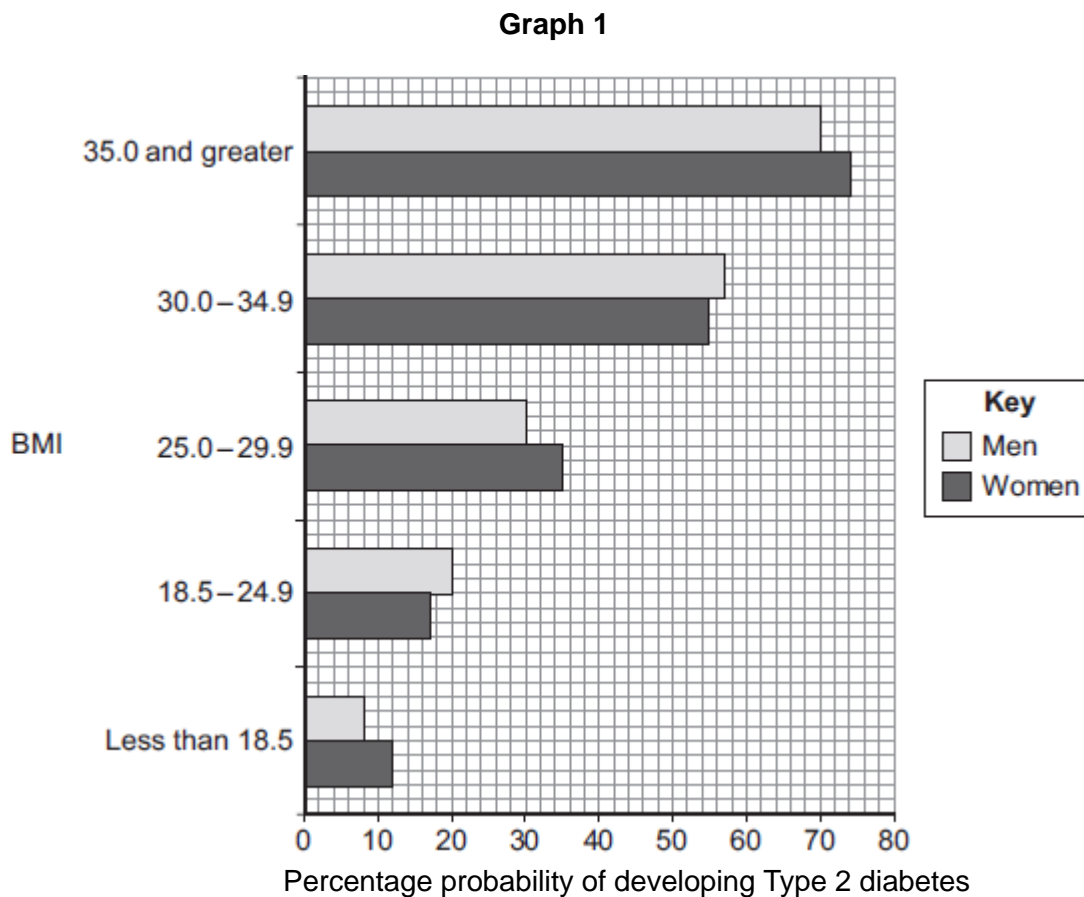
Curare _____

Strychnine _____

(2)
(Total 6 marks)

(c) Body mass index (BMI) is a person's body weight divided by the square of his or her height.

(i) **Graph 1** shows the relationship between BMI and the percentage probability of developing Type 2 diabetes.

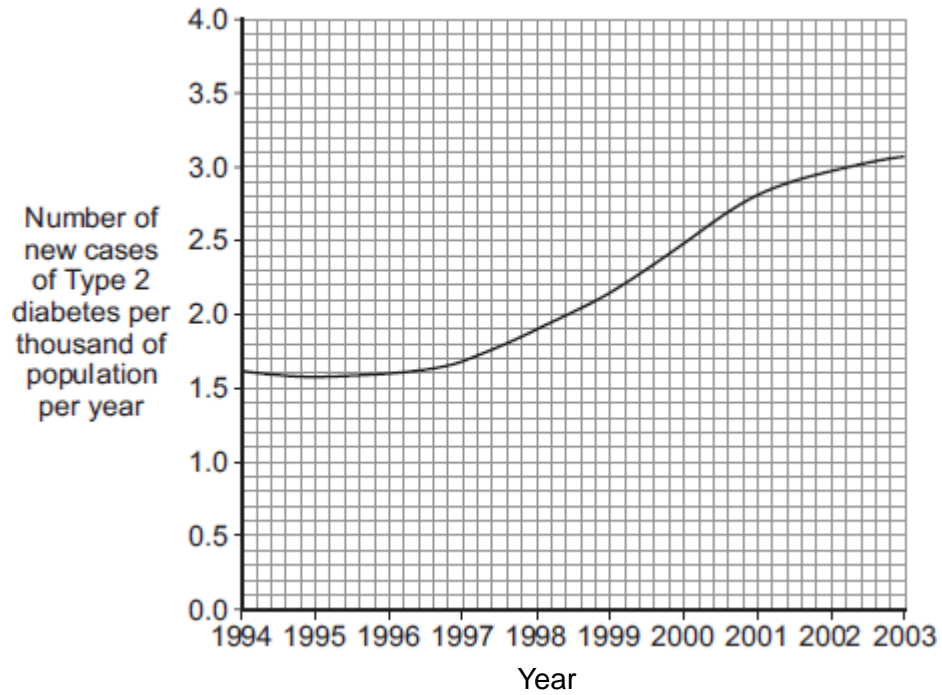


Suggest an explanation for the relationship between BMI and the risk of developing Type 2 diabetes.

(2)

- (ii) **Graph 2** shows changes in the number of new cases of Type 2 diabetes in the UK.

Graph 2



Suggest explanations for the trend shown by the data in **Graph 2**.

(3)

(Total 12 marks)

14.

One factor that may affect body mass is *metabolic rate*.

- (a) (i) What is meant by *metabolic rate* ?

(1)

(ii) Metabolic rate is affected by the amount of activity a person does.

Give **two** other factors that may affect a person's metabolic rate.

1. _____

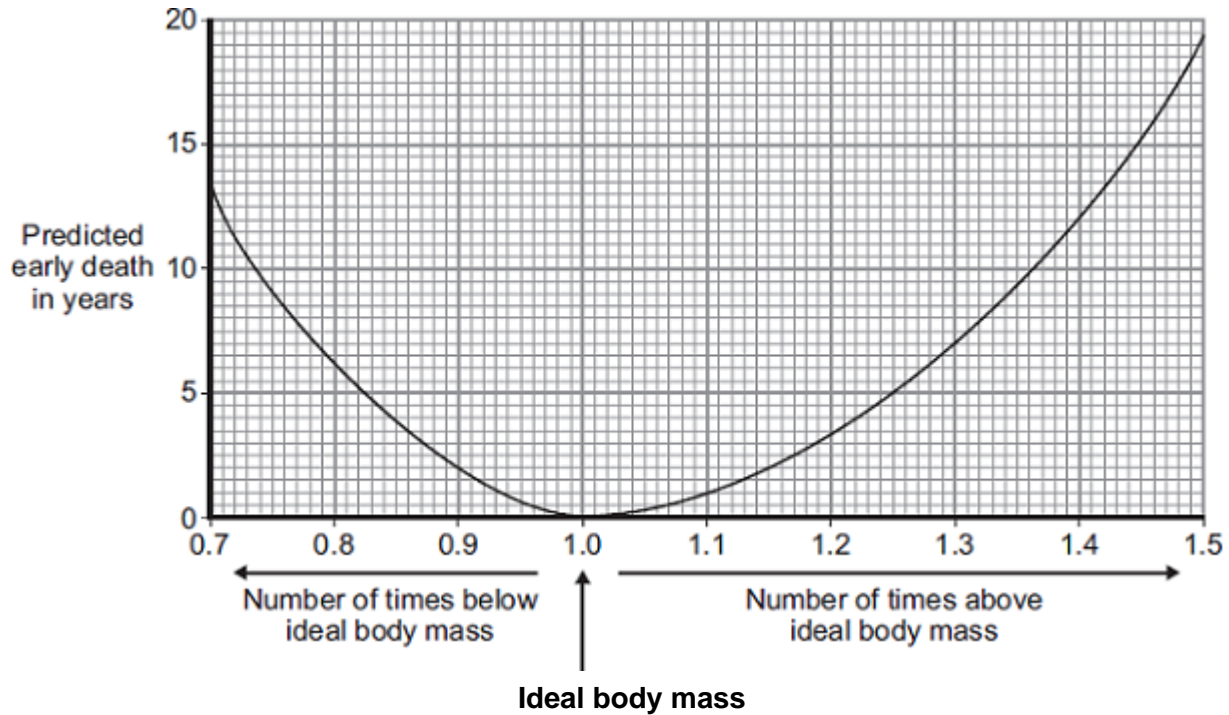
2. _____

(2)

- (b) Predicted early death is the number of years that a person will die before the mean age of death for the whole population. The predicted early death of a person is affected by their body mass.

Scientists have calculated the effect of body mass on predicted early death.

The graph shows the results of the scientists' calculations.



The number of times above or below ideal body mass is given by the equation:

$$\frac{\text{Actual body mass}}{\text{Ideal body mass}}$$

In the UK the mean age of death for women is 82.

A woman has a body mass of 70 kg. The woman's ideal body mass is 56 kg.

- (i) Use the information from the graph to predict the age of this woman when she dies.

Age at death = _____ years

(2)

(ii) The woman could live longer by changing her lifestyle.

Give **two** changes she should make.

1. _____

2. _____

(2)

(Total 7 marks)

15.

Type 1 diabetes develops when the body does not produce enough insulin.

(a) Which organ produces insulin?

(1)

(b) One treatment for diabetes is to inject insulin.

The table gives the properties of four different types of insulin, **A**, **B**, **C** and **D**.

Type of insulin	Time taken for the insulin to begin to work in minutes	Time taken for insulin to reach maximum concentration in the blood in minutes	Time when insulin is no longer effective in hours
A	15-20	30-90	3-4
B	30-60	80-120	4-6
C	120-240	360-600	14-16
D	240-360	600-960	18-20

(i) Some people with diabetes need to inject insulin just before a meal to stop a big increase in blood sugar concentration.

Which type of insulin, **A**, **B**, **C** or **D**, should these people with diabetes inject just before a meal?

Give the reason for your answer.

(2)

- (ii) A person with diabetes is told to inject type **B** insulin immediately after breakfast at 09.00.
The person with diabetes is told to then inject a second type of insulin at lunchtime at 12.00.
The second type of insulin should keep the blood sugar level under control for the rest of the 24 hours.

Which type of insulin, **A**, **C** or **D**, should this person with diabetes inject at lunchtime?

Give the reason for your answer.

(2)

- (iii) Apart from injecting insulin, give **one** other way in which Type 1 diabetes can be controlled.

(1)

(Total 6 marks)

16.

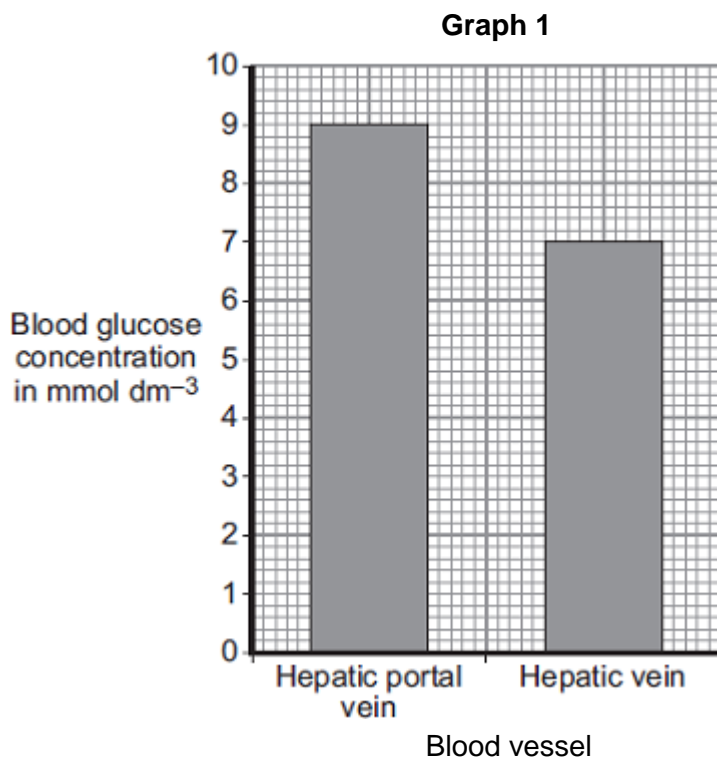
The pancreas and the liver are both involved in the control of the concentration of glucose in the blood.

The liver has two veins:

- the hepatic portal vein taking blood from the small intestine to the liver
- the hepatic vein taking blood from the liver back towards the heart.

Scientists measured the concentration of glucose in samples of blood taken from the hepatic portal vein and the hepatic vein. The samples were taken 1 hour and 6 hours after a meal.

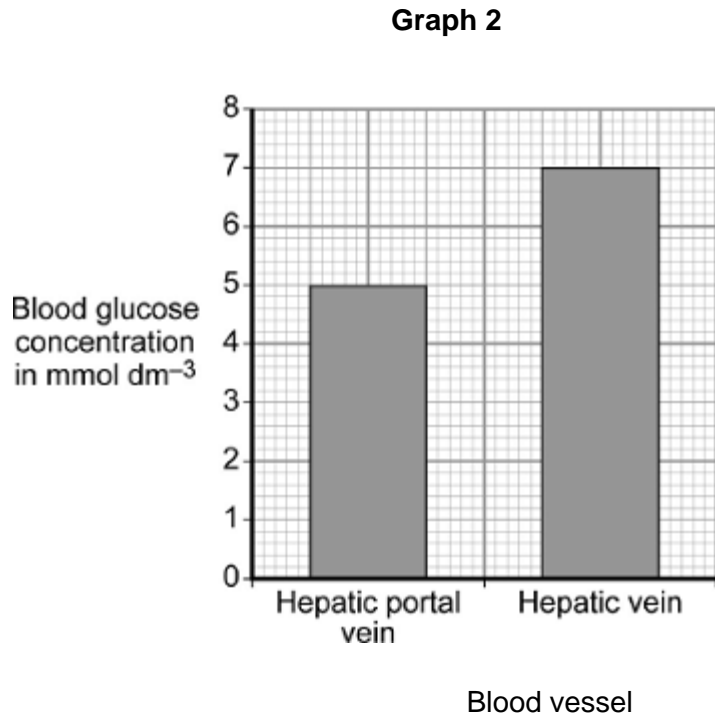
Graph 1 shows the concentration of glucose in the two blood vessels 1 hour after the meal.



- (a) The concentration of glucose in the blood of the two vessels is different. Explain why.

(3)

- (b) **Graph 2** shows the concentration of glucose in the two blood vessels 6 hours after the meal.



- (i) The concentration of glucose in the blood in the hepatic portal vein 1 hour after the meal is different from the concentration after 6 hours.

Why?

(1)

- (ii) The person does **not** eat any more food during the next 6 hours after the meal.

However, 6 hours after the meal, the concentration of glucose in the blood in the hepatic vein is higher than the concentration of glucose in the blood in the hepatic portal vein.

Explain why.

(3)

(Total 7 marks)

17.

The human body produces many hormones.

- (a) (i) What is a *hormone*?

(1)

- (ii) Name an organ that produces a hormone.

(1)

- (iii) How are hormones transported to their target organs?

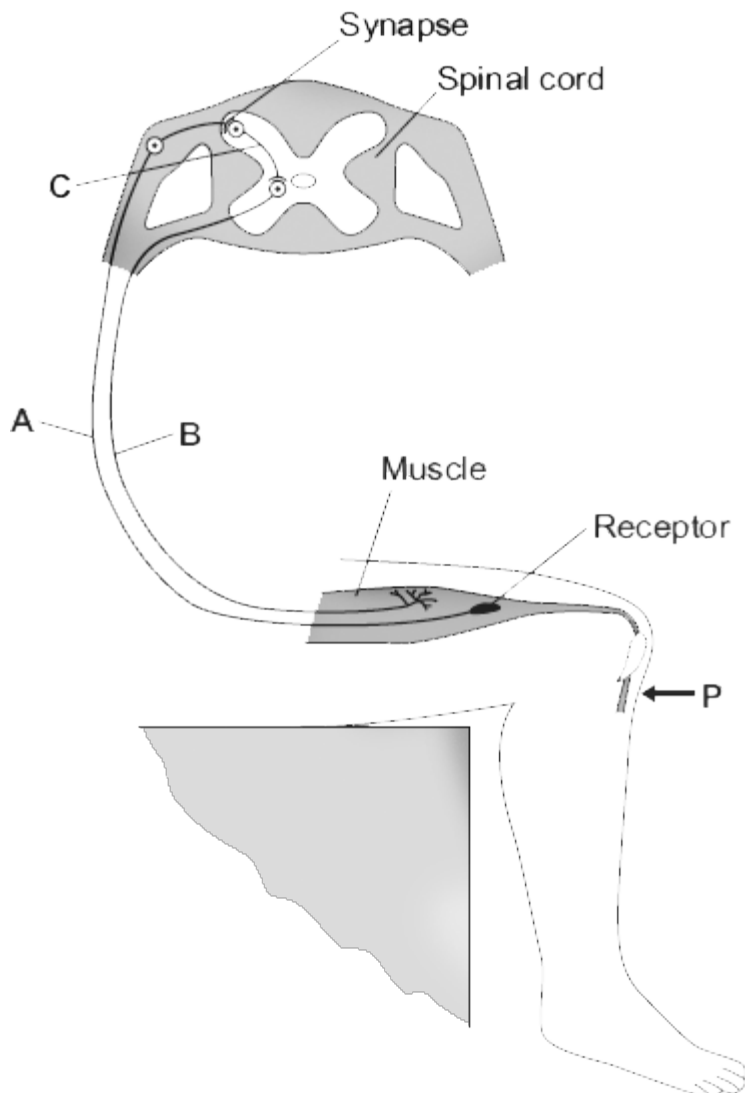
(1)

(b) Describe how the hormones FSH, oestrogen and LH are involved in the control of the menstrual cycle.

(3)
(Total 6 marks)

18.

The diagram shows the nervous pathway used to coordinate the knee-jerk reflex. When the person is hit at point **P**, the lower leg is suddenly raised.



(a) Name neurones **A**, **B** and **C**.

A _____

B _____

C _____

(3)

(b) The receptor in the muscle in the leg is sensitive to a stimulus.

Suggest the stimulus.

(1)

(c) Describe what happens at the synapse during this reflex.

(3)

(Total 7 marks)

Mark schemes

- 1.** (a) (i) receptor cells 1
- (ii) eye(s)
accept retina 1
- (b) (i) any **one** from:
• gender / sex
• quality of eyesight
eg wearing glasses
• eg of factor that might affect reaction times
eg alcohol consumption / distractions / tiredness / health / time of day / amount of practice (at this test)
do not allow time / age 1
- (ii) 182
allow 182.0 1
- (iii) Any anomalies can be identified. 1
- (iv) reaction time (too) long **or** reactions (too) slow 1
allow reaction time (too) slow
allow examples of data quoted or derived from the table, eg (mean) reaction time for 90 year olds is 162 ms longer than for 75 year olds
- (so) more likely to have / cause an accident 1
- [7]**
- 2.** (a) (i) follicle stimulating hormone / FSH 1
- (ii) oestrogen 1
- (b) (i) any **one** from:
• to help them have a baby / get pregnant
ignore to make them fertile
• to stimulate egg production / release / maturation
• own levels of FSH / LH / hormone (too) low
allow to increase hormone / FSH / LH levels
do not allow to increase oestrogen levels 1
- (ii) through the bloodstream 1

(c) oestrogen

1

progesterone

1

[6]

3.

(a) receptors detect / sense stimuli / change in surroundings **or** convert stimulus into an impulse

ignore send impulses to brain / spinal cord

1

example of a receptor

allow any appropriate organ or part of an organ, eg eye / retina or named type of receptor eg light receptor

1

effectors allow / make response **or** convert an impulse to an action

ignore receive impulses from brain / spinal cord

1

(effector) muscle / gland

allow an example

ignore eg arm / leg

1

(b) (i) junction

allow idea of a (small) gap / space

*do **not** allow if implication is that the neurones move*

1

between neuron(e)s

allow named types of neurones

1

(ii) chemical

allow answers in terms of specific types of neurone

allow neurotransmitter / named neurotransmitter released

1

any **one** from:

- (chemical released) from one neurone
ignore produced
- (chemical) passes (across synapse) to next neurone to stimulate / cause (electrical) impulse
allow diffuses for passes (across)

1

(c) (i) skin

ignore hand / leg

1

(ii) 1.6 (cm per millisecond)
allow 2 if evidence of rounding up of 1.6 1

(iii) any **two** from:
ignore length of neurones
• synapses slow down transmission / impulse
allow idea of movement of chemical being slower than electrical impulse
• fewer synapses (via brain)
allow one synapse compared to two or only one synapse
• (therefore) fewer delays
allow impulse travels more slowly in relay neurones 2

[12]

4. (a) ovary 1

(b) 46 1

(c) (i) does not fit the pattern
or
it is higher than the 3rd value / it should be lower than the 3rd value / it should be between the 3rd and 5th values
do not allow use of incorrect figures 1

(ii) As age increases % of women (having a baby) decreases 1

(d) (i) 33
allow 1 mark for $\frac{66}{2}$
if no answer / wrong answer 2

(ii) low success rate 1

more likely to have a baby with health problems / abnormalities / a faulty chromosome 1

[8]

5.	(a) (i)	any one from:		
		<ul style="list-style-type: none"> • glucose • oxygen • carbon dioxide • urea • water 		
			<i>allow hormones</i>	
			<i>allow named example of a product of digestion</i>	1
		(ii)	(cardiac) muscle	
			<i>allow muscular</i>	1
		(b) (i)	B	1
		(ii)	D atrium / atria	
			<i>ignore references to left or right</i>	1
			E ventricle(s)	
		<i>ignore references to left or right</i>	1	
	(c) (i)	a vein	1	
	(ii)	an artery	1	
	(iii)	keeps artery open / wider		
		<i>allow ecf from part cii</i>	1	
		(so) blood / oxygen can pass through (to the heart muscle)	1	
			[9]	
6.	(a) (i)	pancreas	1	
		Insulin causes glucose to move into cells.	1	
	(b) (i)	A	1	
		rapid rise or fastest	1	
	(ii)	2	1	

(c) The pancreas could be rejected.

1

[6]

7.

(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]

8.

(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]

9.

(a) detect changes in surroundings **or** detect stimuli

allow any named stimulus for skin

1

convert information to impulse

allow send impulse to sensory neurones / brain

1

(b) (i)

muscle	contract(ion)
gland	release / secrete / produce chemical / hormone / enzyme

1 mark for each effector

1 mark for each response

response must match type of effector (if given)

ignore examples

ignore relax(ation) / movement for contraction

*do **not** allow expansion for muscles*

4

(ii) any **one** from:

- (maintain temperature at which) enzymes work best
- so chemical reactions are fast(est)
- prevent damage to cells / enzymes
allow prevent enzymes being denatured (by temperature being too high)

1

[7]

10.

- (a) (i) sensory neurone 1
a synapse 1
- (ii) contract 1
- (iii) not connected to brain / coordinated only by spinal cord 1
- (iv) automatic / rapid (response) 1
allow no thinking / faster / less time
- protects body from danger / from damage / from burning 1
- (b) (i) caffeine decreases reaction time 1
accept caffeine speeds up / quicker reactions
- (ii) the two sets of results overlap (considerably) 1
allow use of appropriate numbers – eg 5 of the ‘after’ results overlap with the ‘before’ results
allow ‘wide spread of results’
allow ‘it was just one person’ or ‘it was a small sample’
accept use of one pair of results only – if meaning is clear
accept use of one pair of overlapping results
- (iii) any **two** sensible suggestions: eg 2
- more repetitions
 - perform investigation on several other people
 - use other (measured) amounts of coffee
 - use different / more time intervals
 - other suggested measure of reaction time – eg computer-generated light flash + time measurement
 - use pure caffeine or caffeine tablets

[10]

11.

- (a) sensory neurone 1
- (b) (i) synapse 1
- (ii) a chemical 1

(c) (What happens to the muscle)
mark both parts of the question together

any **one** from:

- contraction / contracts
ignore relaxation / relaxes / tenses
- gets shorter

1

(How this helps the body)

idea of protection for body (from damage / pain)

eg moves finger / arm away (from pin / stimulus / source of pain)

1

[5]

12.

(a) motor

allow efferent / postsynaptic
*allow **another** relay (neurone)*

1

(b) release of chemical (from relay neurone)

allow ecf for 'motor' neurone from (a)
allow release of neurotransmitter / named example

1

chemical crosses gap / junction / synapse

allow diffuses across
allow chemical moves to X

1

chemical attaches to X / motor / next neurone (causing impulse)

1

(c) (curare) decrease / no contraction

accept (muscle) relaxes

1

(strychnine) increase / more contraction

*if no other mark awarded allow 1 mark for (curare) decrease / no response **and** (strychnine) increase / more response*

1

[6]

13.

(a) any **six** from:

- hormone(s) / named produced by pancreas
- if blood glucose levels are too high, insulin is produced / released
- allowing glucose to move from the blood into the cells / named eg liver
- glucose is converted to glycogen
- if blood glucose levels fall, glucagon is produced / released
- glycogen is converted to glucose
- causing glucose to be released into the blood

6

(b) diabetes that occurs when the body (cells) do not respond / are less responsive to insulin

1

(c) (i) higher BMIs due to increase in mass / weight (relative to height) / obesity

1

obesity / being overweight / being fat is a (significant) risk factor for Type 2 diabetes

allow causes Type 2 diabetes

1

(ii) any **three** from:

- related to described change in diet eg fast foods
- and less exercise
- which increases the chance of obesity / increases BMI
- increased awareness has helped to slow the increase

3

[12]

14.

(a) (i) rate of chemical reactions (in the body)

1

(ii) any **two** from:

- heredity / inheritance / genetics
- proportion of muscle to fat **or** (body) mass
allow (body) weight / BMI
- age / growth rate
- gender
*accept hormone balance or environmental temperature
ignore exercise / activity*

2

(b) (i) 77

correct answer with or without working gains 2 marks

*allow 1 mark for 70 / 56 **or** 1.25 **or** 5*

2

- (ii) increase exercise
accept a way of increasing exercise 1
- reduce food intake
accept examples such as eat less fat / sugar
*allow go on a diet **or** take in fewer calories*
ignore lose weight
ignore medical treatments such as gastric band / liposuction 1

[7]

15.

- (a) pancreas
allow phonetic spelling 1
- (b) (i) A

shortest / quicker time (to work) 1
- (ii) D

acts for longest time
mark dependent on D
allow D will last until 09.00 / breakfast / 24 hours 1
- (iii) diet / exercise
if 'diet' is qualified, then will need correct qualification, e.g. 'less carbohydrate / sugar'
accept pancreas transplant / stem cell treatment 1

[6]

16.

- (a) (concentration high) in the hepatic portal vein is blood with glucose absorbed from the intestine 1
- concentration is lower in the hepatic vein because insulin 1
- (has caused) glucose to be converted into glycogen 1
- or**
- allows glucose into liver cells
- (b) (i) (after 6 hours) most of the glucose has been absorbed from the intestine **or** from food into the blood 1

- (ii) because glucagon (made in the pancreas) causes
if biological terms incorrectly spelt they must be phonetically accurate
do **not** accept glucagon made / produced by the liver

1

glycogen to be converted into glucose

1

glucose released into blood

allow the liver maintains the correct / constant level of glucose in the blood

1

[7]

17.

- (a) (i) any **one** from:

- chemical messenger / message
allow substance / material which is a messenger
- chemical / substance produced by a gland
allow material produced by a gland
- chemical / substance transported to / acting on a target organ
- chemical / substance that controls body functions

1

- (ii) gland / named endocrine gland

brain alone is insufficient
allow phonetic spelling

1

- (iii) in blood / plasma **or** circulatory system **or** bloodstream

accept blood vessels / named
do **not** accept blood cells / named

1

- (b) *each hormone must be linked to correct action*
apply list principle
ignore the gland producing hormone

FSH stimulates oestrogen (production) / egg maturation / egg ripening

ignore production / development of egg

1

oestrogen inhibits FSH

allow oestrogen stimulates LH / build up of uterine lining

1

LH stimulates egg / ovum release / ovulation
accept LH inhibits oestrogen
accept LH controls / stimulates
growth of corpus luteum
ignore production of egg

1

[6]

18.

(a) *ignore nerve / neuron(e) throughout*

A sensory

accept afferent

1

B motor

accept efferent

1

C relay

accept intermediate

1

(b) stretch

allow pressure / pull / tension (in muscle)

*allow a hit at (point) **P***

ignore pain

1

(c) any **three** from:

- chemical (release)

accept neurotransmitter / acetylcholine

- diffuses (across the gap / synapse)

- transmits impulse / information (across synapse)

allow transmits signal / message

- between neurones / nerve cells / named

if named, must be either sensory / A to relay / C or relay / C to motor / B

allow 'to the next neurone'

3

[7]