4.5 Homeostasis and Response Foundation

Name: _____

Class: _____

Date: _____

Time: **234 minutes**

Marks: **232 marks**

Comments:

Q1.

The nervous system allows humans to react to their surroundings.

(a)   Sense organs have receptors. Receptors detect *changes in the environment.*

Which word describes *a change in the environment?*

Draw a ring around **one** answer.

an effector   **a neurone**   **a stimulus**

(1)

(b)   The photograph shows a baby.
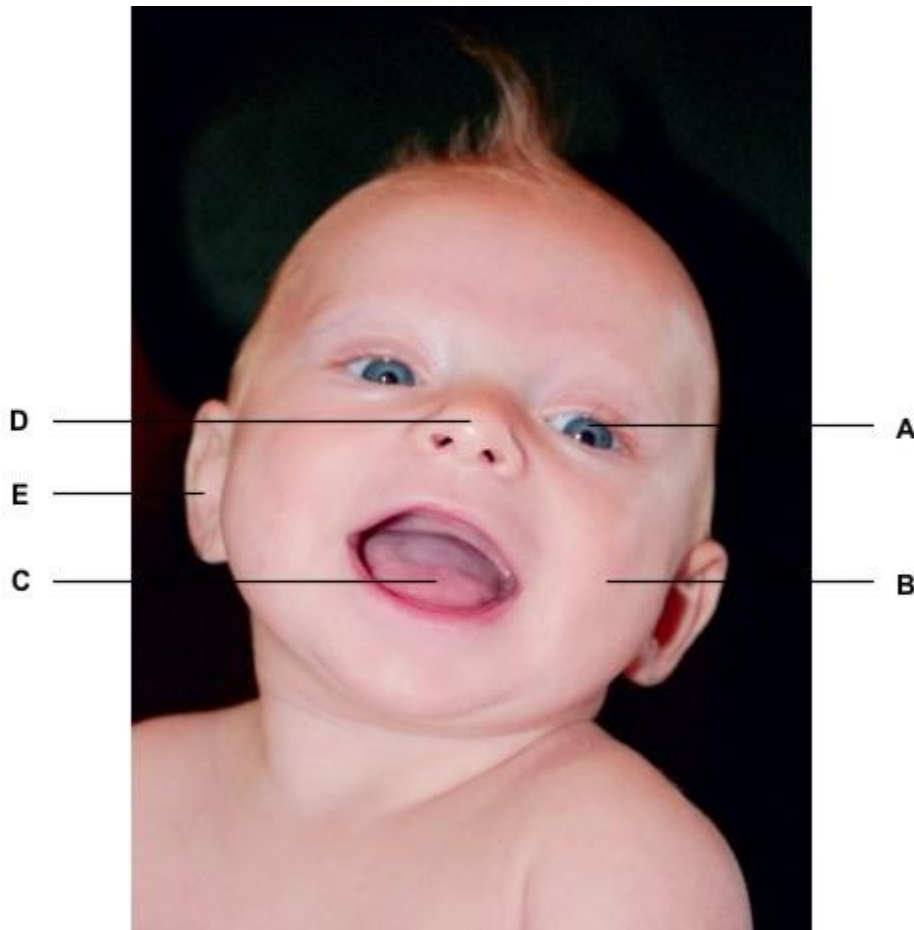Labels **A**, **B**, **C**, **D** and **E** show some of the baby's sense organs.

Answer each question by writing **one** letter, **A**, **B**, **C**, **D** or **E**, in each box.

(i)   Which sense organ has receptors sensitive to light?

(1)

(ii)   Which **two** sense organs have receptors sensitive to chemicals?

and

(iii)   Which sense organ has receptors sensitive to changes in the baby's position?

(1)

(c)   Information from sense organ **A** is passed along nerve cells.
The information is coordinated to produce a response.

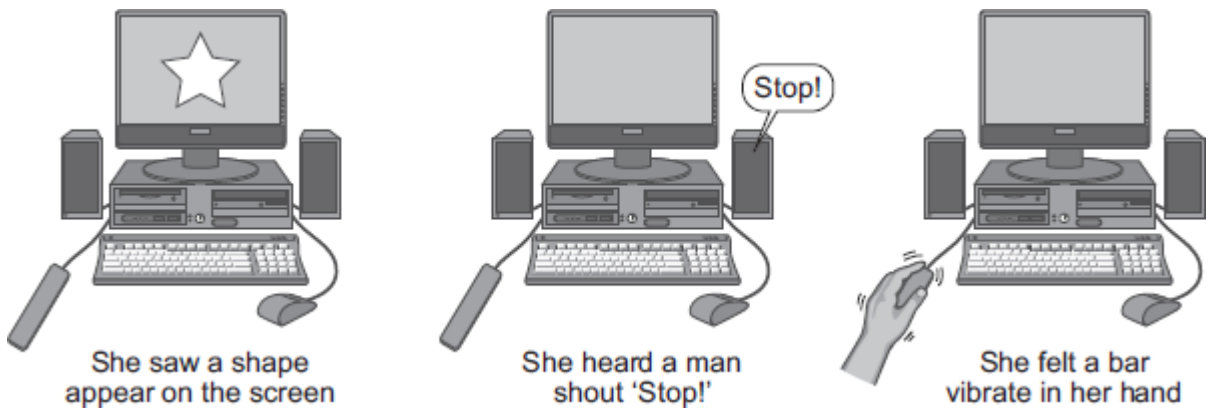Which organ in the body coordinates the information?

_____

(1)
(Total 6 marks)

Q2.

A student investigated her reaction time.

A computer measured how quickly she clicked the mouse when she detected each of three different stimuli as shown in the diagrams.

| She saw a shape appear on the screen | She heard a man shout 'Stop!' | She felt a bar vibrate in her hand |

(a)   Give the stimulus each sense organ detected in this investigation.

Complete each sentence using the correct word from the box.

| chemicals | light | sound | touch |

Receptors in her eyes detected _____ .

Receptors in her ears detected _____ .

Receptors in her skin detected _____ .

(3)

(b)   Each sense organ was tested 4 times and the mean reaction times were calculated.

The table shows the results.

Reaction time for each sense organ in seconds		
Eyes	**Ears**	**Skin**

Test 1	0.23	0.17	0.18
Test 2	0.27	0.14	0.16
Test 3	0.24	0.15	0.35
Test 4	0.26	0.14	0.17
Mean reaction time		0.15	0.17

(i) There is one anomalous result in the table.

Draw a ring around the anomalous result.

(1)

(ii) Calculate the mean reaction time for the eyes.

_____

_____
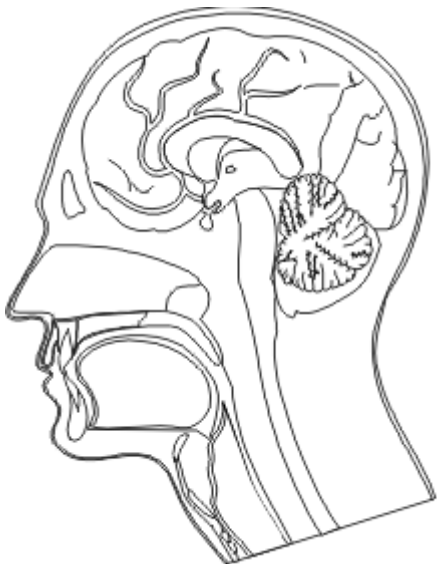
Mean reaction time for the eyes = _____ seconds

(2)

(iii) Give **one** conclusion you can make from these results.

_____

_____

(1)
(Total 7 marks)

Q3.

(a) **On the diagram**, use guidelines to label:

1 the brain;

2 the spinal cord.

(2)

(b)   Some students are investigating the behaviour of a mouse. They use a large empty box. The box has squares marked on the floor, as shown in the diagram.

(C = corner square, S = side square, I = inside square)

C_1	S_1	S_2	S_3	C_2
S_{10}	I_1	I_2	I_3	S_4
S_9	I_6	I_5	I_4	S_5
C_4	S_8	S_7	S_6	C_3

They put a mouse in the empty box. They record which square the mouse is in every minute for 15 minutes. They get these results.

Time (minutes)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Position of mouse	C_1	C_1	S_2	C_3	C_3	S_9	I_3	C_1	C_1	C_1	S_8	C_4	C_4	C_1	S_2

(i)   Fill in the table below to show how much time the mouse spends in the corner squares (C), the side squares (S) and the inside squares (I).

POSITION	TIME (minutes)
Corner (C)	
Side (S)	
Inside (I)	

(3)

(ii)   What pattern is shown by the results?

_____

_____

(1)

(iii)   Suggest how the behaviour of the mouse might help its survival.

_____

_____

_____

_____

(2)

(Total 8 marks)

Q4.

Hormones can be used to control fertility in women.

List A gives the names of three hormones.
List B gives some information about the hormones.

Draw **one** line from each hormone in **List A** to the correct information about the hormone in **List B**.

| List A Hormone	List B Information
	Used in some contraceptive pills
FSH	
	Causes the womb lining to break down
LH	
	Stimulates the release of an egg from the ovary
Progesterone	
	Stimulates eggs to mature in the ovaries

(Total 3 marks)

Q5.

A student accidentally touches a sharp object.

Her hand is immediately pulled away from the object.

The diagram shows the structures involved in this response.
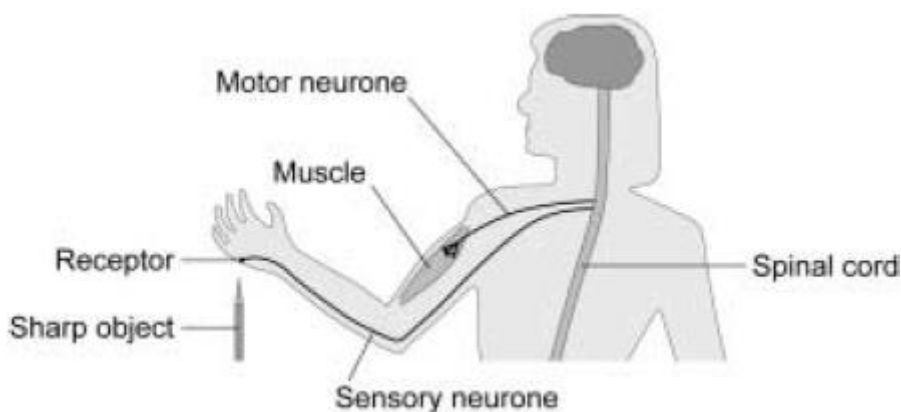
Describe how the structures labelled on the diagram are involved in this reflex action.

_____

_____

_____

_____

_____

_____

_____

_____

(Total 4 marks)

Q6.

Internal conditions in the body are controlled.

Use words from the box to complete each of the following sentences.

blood	**FSH**	**glands**
hormones	**LH**	**white blood cells**

Many processes in the body are controlled by chemical substances called

_____ .

The chemicals are secreted by _____ .

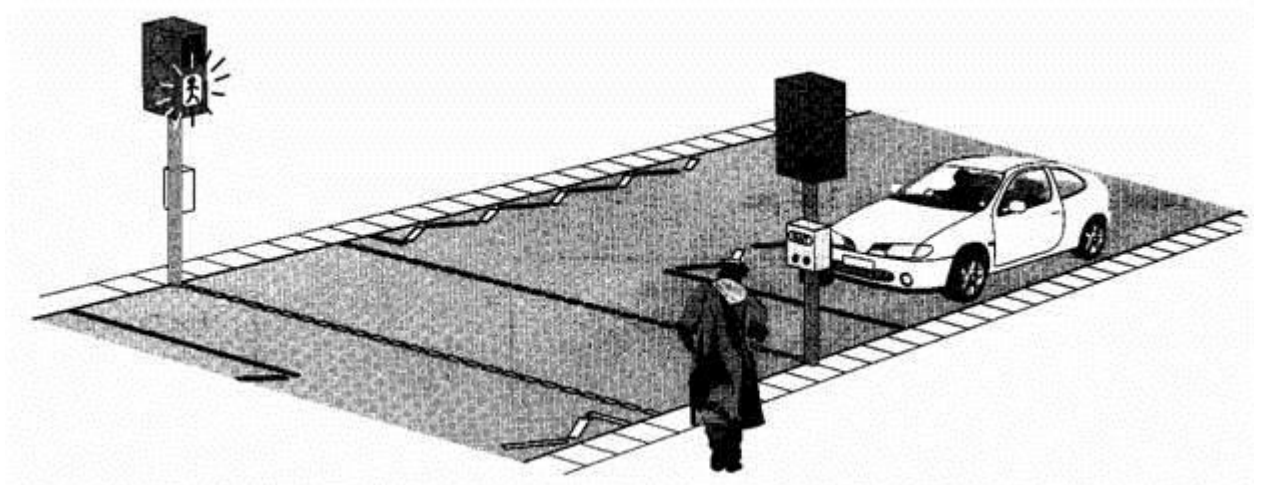They are transported to their target organs in _____ .

One of these chemical substances stimulates the release of an egg from a woman's ovary.

This chemical substance is called _____ .

(Total 4 marks)

Q7.

A man is walking along a street. He plans to cross the road at the pelican crossing.
Pelican crossings show a flashing green person and bleep when it is safe to cross.

(a) State **two** different ways the man uses:

(i) his eyes, to help him cross the road safely;

1. _____

2. _____

(2)

(ii) his ears, to help him cross the road safely.

1. _____

2. _____

(2)

(b) (i) Eyes, ears and skin contain sense receptors.

State the names of **two** other parts of the body which contain sense receptors.

_____ and _____

(2)

(ii) What type of sense receptor is in the skin of his feet?

_____

(1)
(Total 7 marks)

Q8.

In Vitro Fertilisation (IVF) treatment helps infertile women to become pregnant.

(a) Use words from the box to complete each sentence.

ovary	pituitary gland	sperm	uterus

The eggs are collected from the mother's _____

Each egg is fertilised by a _____ .

Each fertilised egg develops into a ball of cells called an embryo.

One or two of these embryos are inserted into the mother's _____ .

(3)

(b) The table shows the effectiveness of IVF treatment in one clinic in 2010.

Age of women in years	Under 35	35 – 37	38 – 40	Over 40
Number of IVF treatments	130.0	100.0	29.0	20.0
Average number of embryos transferred	2.6	2.8	3.3	3.6
Percentage of successful pregnancies	43.0	30.0	21.0	13.0

(i) How does the age of the women affect the average number of embryos transferred?

_____

_____

(1)

(ii)　Look again at the information in the table.

Suggest **one** ethical reason why many people are against IVF treatment.
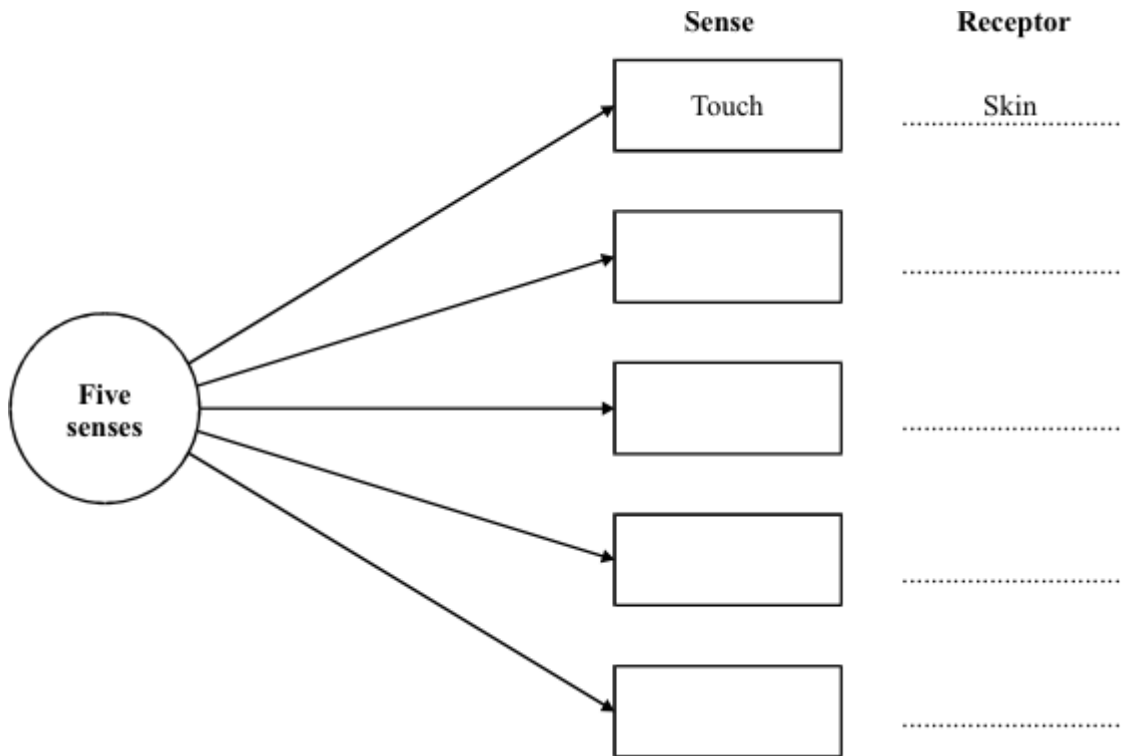
_____

_____

(1)

(Total 5 marks)

Q9.

(a)　Humans have a number of senses, for example touch. Senses are detected by receptors, for example skin detects touch.

In the boxes write the names of **four** other senses. By each box write the name of the receptor.

(8)

(b)　When your hand is touched, the information is passed to your brain. Describe how the information gets from your skin to your brain.
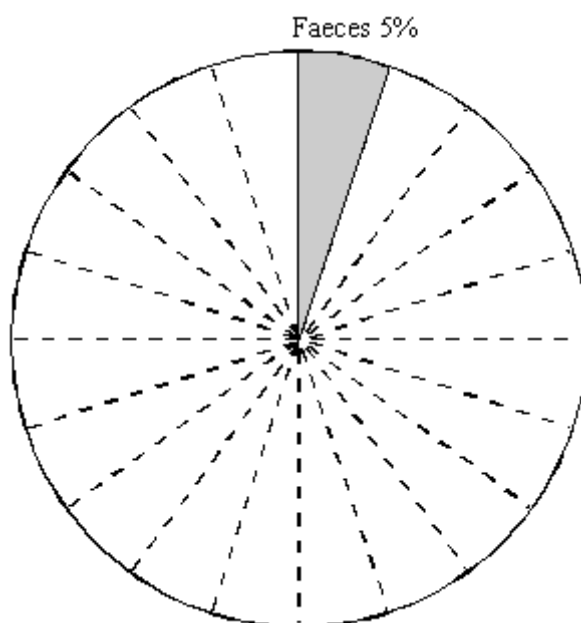
_____

_____

_____

_____

(2)

Q10.

The table below shows how the body loses water.

HOW WATER IS LOST	% (PERCENTAGE)
Breathing	10
Faeces	5
Sweat	45
Urine	40

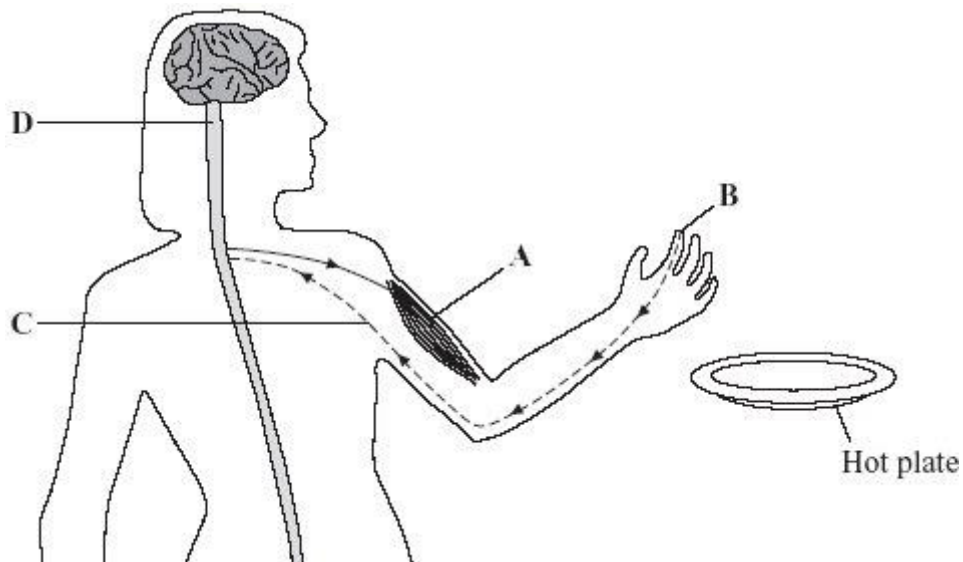Complete the diagram by showing the water loss for breathing, sweat and urine.

Faeces 5%

Q11.

A girl picks up a hot plate. A reflex action causes her to drop it.

The diagram shows some of the structures involved in this reflex action.

Use words from the box to name the structures labelled **A**, **B**, **C** and **D**.

brain	gland	muscle	neurone	receptor	spinal cord

A _____

B _____

C _____

D _____

(Total 4 marks)

Q12.

Two common medicines are paracetamol and ibuprofen. These medicines help to reduce high body temperature.

(a)   Children who were ill with high body temperatures were identified at doctors' surgeries.

These children were put into two groups.
The children in each group were matched for age, gender and body mass.

Group 1:   50 children were given paracetamol.

Group 2:   50 children were given ibuprofen.

(i)   Give **one** control variable in this investigation.

_____

_____

(1)

(ii)   In some investigations when medicines are tested, a placebo is given to one group.

What is a placebo?

_____

_____

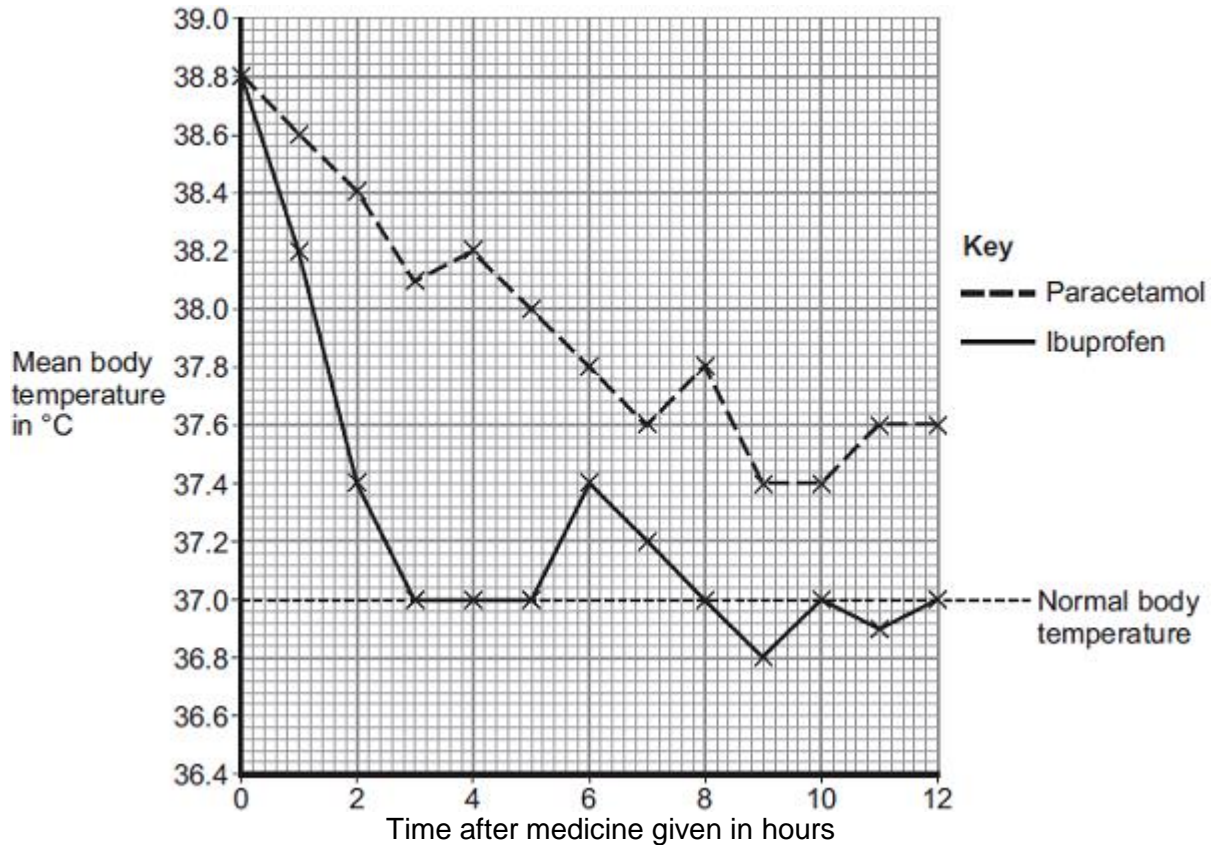**(1)**

(b)   The children's body temperatures were measured before any medicine was given
and every hour after treatment started.

Paracetamol was given every 4 hours. Ibuprofen was given every 6 hours.

The results for the two groups are shown in the figure below.

(i)   What was the mean body temperature 4 hours after paracetamol was given?

_____ °C

(1)

(ii)   Suggest which medicine a parent should give to their child to reduce a high
body temperature to normal.

Use information from the graph.

Medicine: _____

Give **two** reasons for your answer.

_____

_____

_____

_____

(2)

Q13.

(a)   List **A** gives the names of four stimuli. List **B** gives four parts of the human body.

Draw a straight line from each stimulus in List **A** to the part of the body in List **B** which has receptors for that stimulus.
(One has been done for you.)

List A Stimulus	List B Parts of the body
Touch	Skin
Light	Tongue
Chemicals	Eye
Sound	Ear
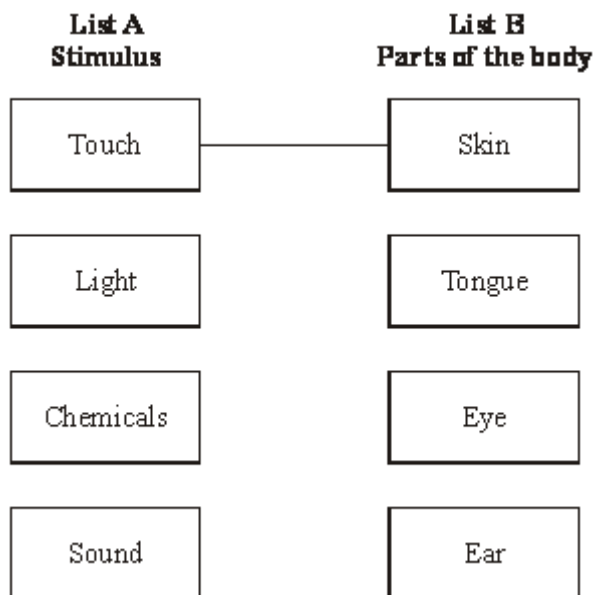
(3)

(b)   Complete the following sentence by choosing the correct words from the box.

brain   glands   motor   sensory

To make us aware of a stimulus, impulses are sent along a _____ neurone
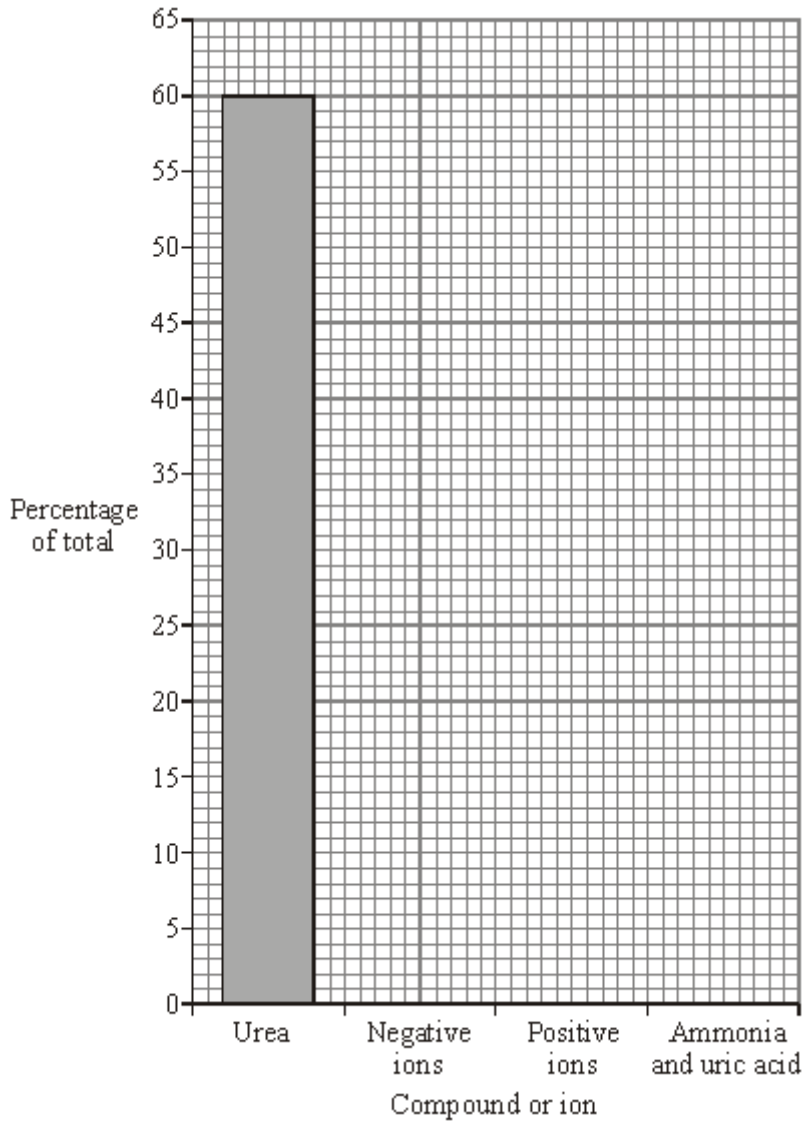
to the _____

(2)
(Total 5 marks)

Q14.

(a)   The table shows the compounds and ions dissolved in a student's urine.

Compound or ion	Percentage of total
urea	60
negative ions	25
positive ions	10
ammonia and uric acid	5

(i)   Complete the bar chart. One bar has been drawn for you.

(2)

(ii)   There is a total of 10 g of compounds and ions dissolved in a sample of this student's urine. Calculate the mass of urea in the sample. Show clearly how you work out your answer.

_____

_____

_____

Mass of urea _____ g

(2)

(b)   Use words from the box to complete the sentences.

| anus   bladder   kidneys   liver   lungs |

Plasma transports carbon dioxide from the body to the _____ .

Plasma transports urea from the _____ to the _____ .

(3)

(Total 7 marks)

Q15.

The drawing below shows a light-sensitive (receptor) cell from the eye. The structures labelled A, B and C, can be found in most animal cells.
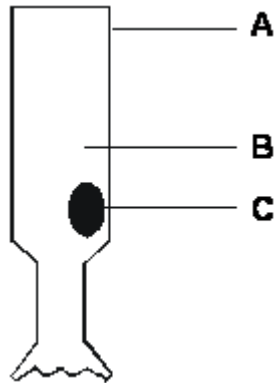
(a)   Name the structures labelled A, B and C.

A   _____

B   _____

C   _____

(3)

(b)   Describe, as fully as you can, what happens in the nervous system when this receptor cell is stimulated by light.

_____

_____

_____

_____

(3)
(Total 6 marks)

Q16.

Humans use receptors to help them to respond to stimuli in the environment. Match up each receptor with the correct sense. One has been done for you.

Receptor	Sense
ear	hearing
skin	taste
tongue	balance
skin	touch
eye	smell
ear	sight
nose	temperature

(The ear is linked to hearing)
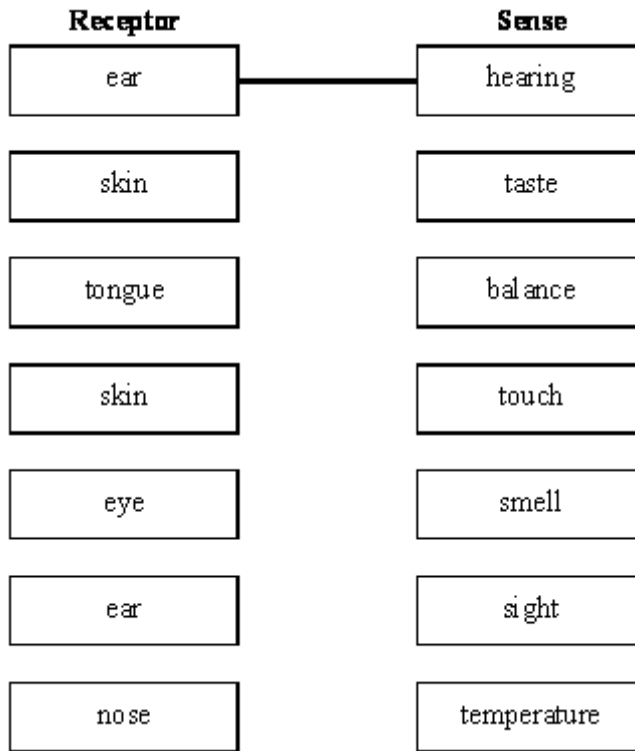
(Total 5 marks)

Q17.

(a)   **List A** gives the names of three hormones.

List B gives information about the three hormones.

Draw a line from each substance in **List A** to the correct information in **List B**.

List A Hormone   **List B Information**

Used in some contraceptive pills to stop eggs maturing

FSH

Used as a fertility drug to make eggs mature

LH

Causes the lining of the womb to break down

Oestrogen

Stimulates the release of eggs in IVF

(3)

(b)   The table gives information about three methods of giving hormones to stop a woman becoming pregnant.

	The 'pill'	The 'patch'	The 'implant'
How the hormone is given	Swallowed each day for 21 days out of every 28 days.	Stuck onto the skin. Each patch lasts three weeks. There is a one week gap between each patch.	Needs an operation to put it under the skin. Lasts for up to 5 years.

Use the information in the table to answer these questions.

(i)   Which of the three methods is likely to be the most reliable?

_____

(1)

(ii)   Explain why you chose this method.

_____

_____

(1)

(iii)   Give **one** disadvantage of the method you have chosen.

_____

(1)
(Total 6 marks)

Q18.

The diagram shows the structures involved in the knee-jerk reflex. When the tendon is struck with the hammer, the receptor is stimulated and the lower leg moves forward.
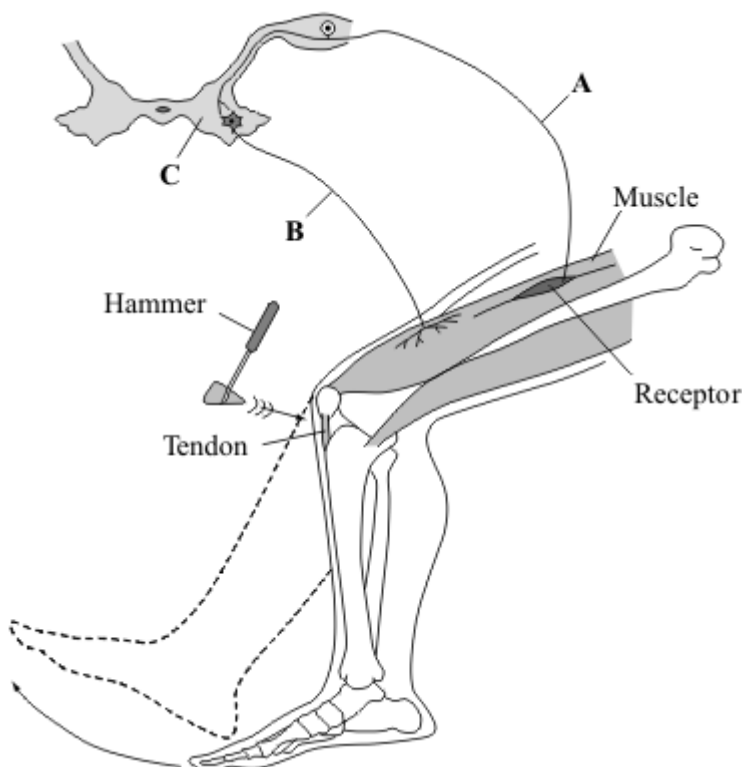
(a)   Name the structures labelled **A**, **B** and **C**.

A _____

B _____

C _____

(3)

(b)   How is information passed from structure **A** to structure **B**?

_____

_____

(1)

(c)   What is the effector in this response?

_____

(1)

(Total 5 marks)

Q19.

The bar chart shows different ways in which water is lost from and gained by the body on one day.

The volumes of water lost in the sweat and in the breath are labelled on the bars.

(a)   How much water was lost in the urine and faeces? _____ cm³

(1)

(b)   Water is lost from the body in urine, faeces, sweat and breath.

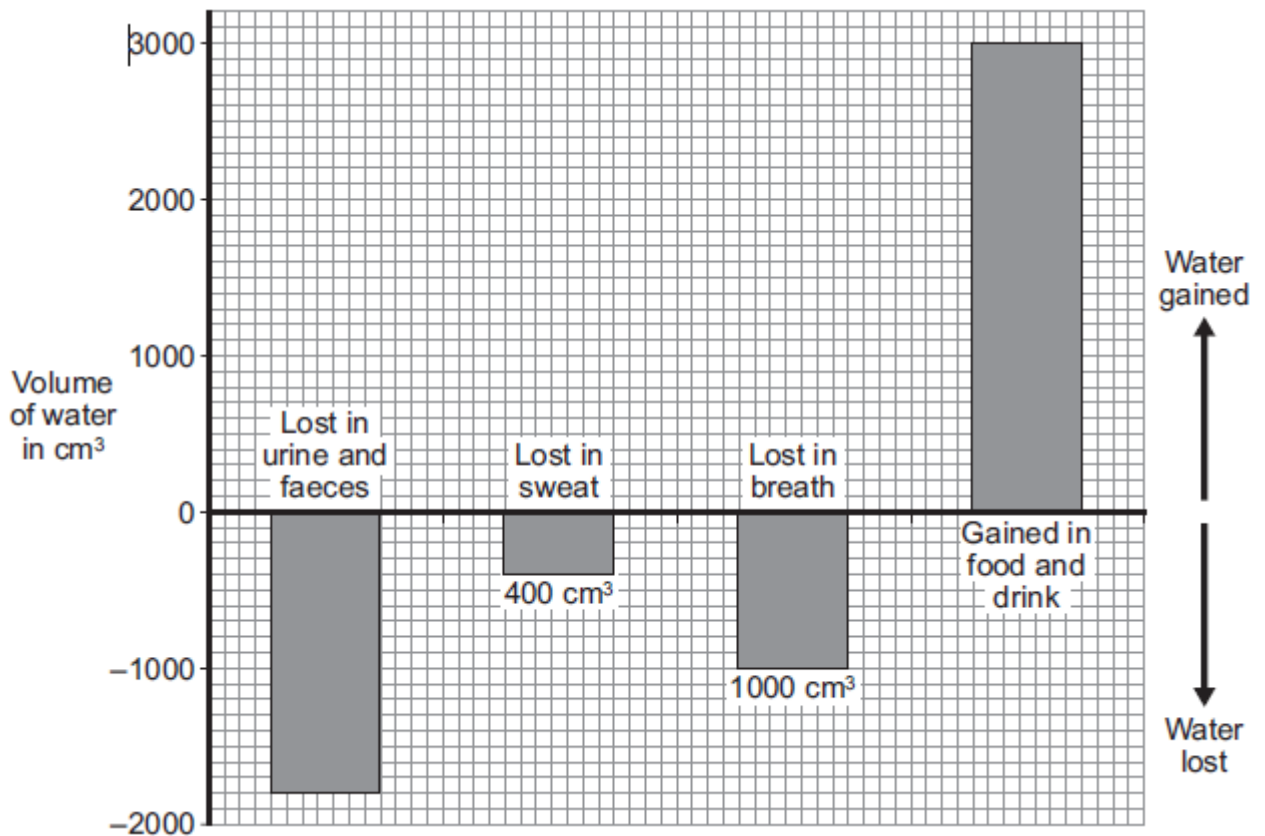What was the total volume of water lost from the body on this day?

Show clearly how you work out your answer.

_____

_____

Answer = _____ cm³

(2)

(c)   The volume of water lost should balance the volume of water gained.

What should the person do to balance the water gained with the water lost?

_____

_____

_____

_____

(2)
(Total 5 marks)

Q20.

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

(a)   Which organ in the body monitors this rise in blood sugar?

Draw a ring around your answer.

liver   pancreas   stomach

(1)

(b)   One way of treating diabetes is by careful attention to diet.

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

Chart 2 shows a diet for a person without diabetes.

Chart 1 Person with diabetes   **Chart 2 Person without diabetes**
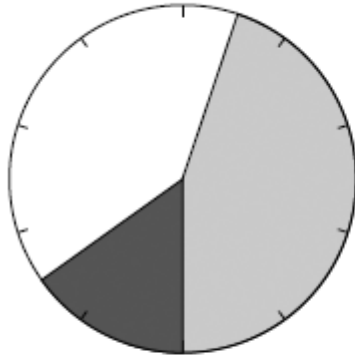
Key

Energy from: ☐ Carbohydrate   ■ Protein   ☐ Fat
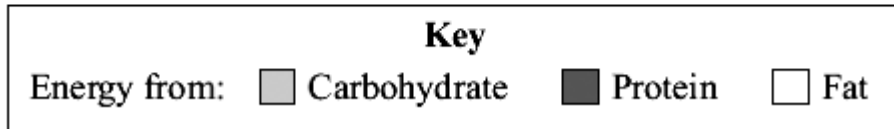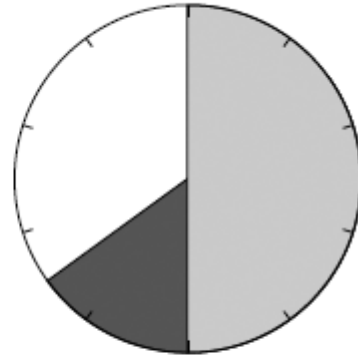
How is the recommended diet of a person with diabetes different from the diet of a person without diabetes?

Use information from the charts.

Tick (✔) **two** box.

The diabetic should get more energy from fat.   ☐

The diabetic should get more energy from protein.   ☐

The diabetic should get less energy from carbohydrate.   ☐

The diabetic should get less energy from protein.   ☐

(2)

(c)   Other than diet, give **one** way in which diabetes may be treated.

_____

_____

(1)
(Total 4 marks)

Q21.

Diabetes is caused when the body does not produce enough insulin.

(a)   The bar graph shows the number of people with diabetes per 1000 of population.
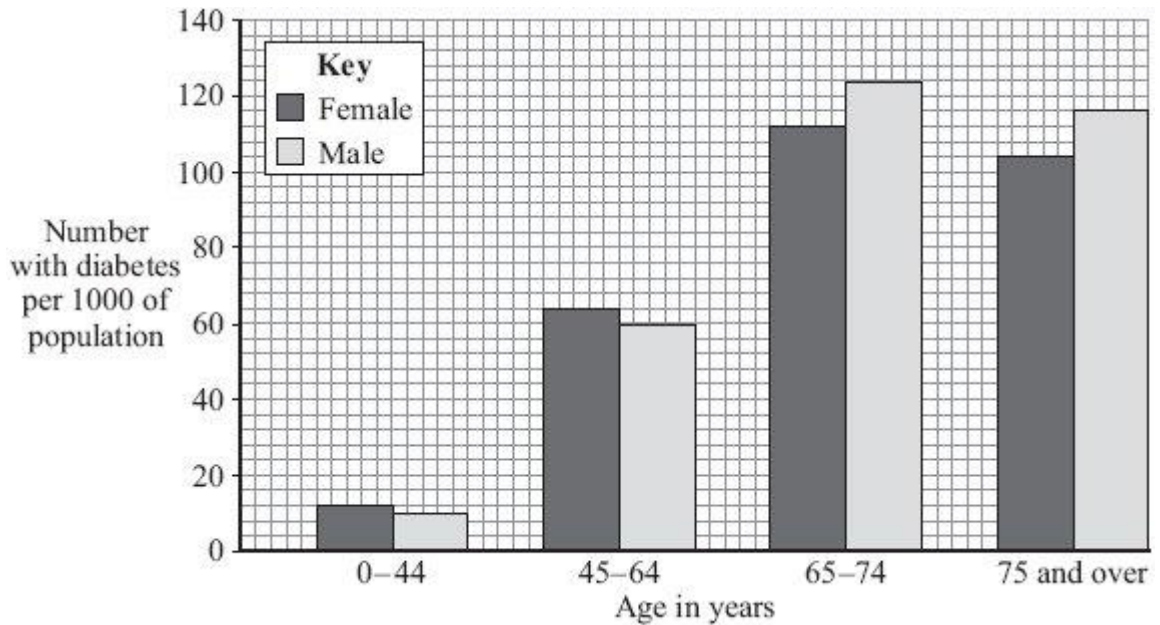
(i) How many more males aged between 45 and 64 years of age have diabetes than males under 45 years of age?

Show clearly how you work out your answer.

_____

_____

Answer _____ per 1000 of population

(2)

(ii) Describe the way in which the number of females with diabetes changes with age.

_____

_____

_____

_____

_____

(2)

(b) One way of treating diabetes is by injecting insulin.

Insulin is a protein.

(i) If insulin is taken by mouth, it is broken down in the digestive system.

Where in the digestive system would insulin be broken down?

Draw a ring around your answer.

liver **mouth** **stomach**

(1)

(ii) Give **one** way of treating diabetes instead of using insulin.

_____

_____

(1)

(Total 6 marks)

Q22.

A student accidentally touches a sharp object.
Her hand is immediately pulled away from the object.
The diagram shows the structures involved in this response.
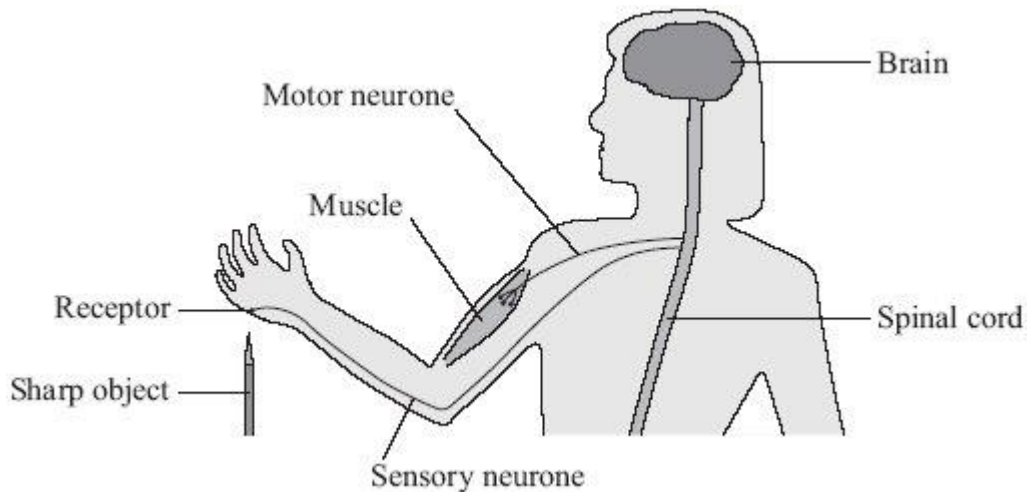
(a)   Use the correct word or phrase **from the diagram** to complete each sentence.

(i)   The stimulus is detected by the _____

(1)

(ii)   Impulses travel to the central nervous system along a

cell called a _____

(1)

(iii)   Impulses travel from the central nervous system to the effector

along a cell called a _____

(1)

(iv)   The hand is pulled away from the sharp object by the

_____

(1)

(b)   Where in the body are there cells sensitive to:

(i)   light _____

(1)

(ii)   sound _____

(1)

(iii)   changes in position? _____

(1)

(Total 7 marks)

Q23.

Diabetes is a disease in which the concentration of glucose in a person's blood may rise to fatally high levels. Insulin controls the concentration of glucose in the blood.

(a)   Where is insulin produced?

Draw a ring around **one** answer.

gall bladder   **liver**   **pancreas**

(1)

(b)   Diabetics may control their blood glucose by injecting insulin.

Apart from using insulin, give **one** other way diabetics may reduce their blood glucose.

_____

(1)

(c)   The bar chart shows the number of people with diabetes in different age groups in the UK.
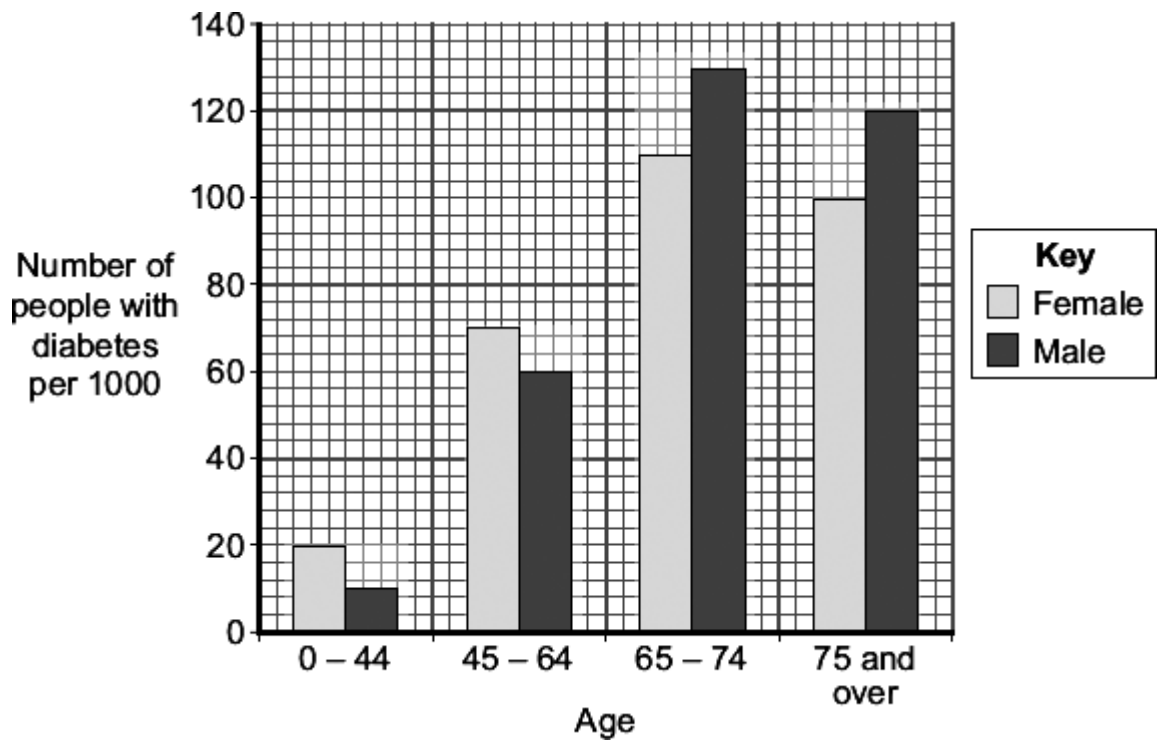
(i)   Describe how the number of males with diabetes changes between the ages of 0 - 44 and 75 and over.

_____

_____

_____

_____

_____

_____

(3)

(ii)   Compare the number of males and females with diabetes:

between the ages of 0 and 64 years

_____

_____

over the age of 65.

_____

_____

(2)
(Total 7 marks)

Q24.

The photograph shows a girl waiting to cross a road.

© Lionel Lassman

(a)   Name **two** different sense organs she would use to detect when it is safe to cross the road.

1. _____

2. _____

(2)

(b)   Which sense organ contains receptors that help the girl to keep her balance?

_____

(1)

(c)   (i)   Complete the sentence.

A car driver automatically brakes if a child dashes out into the road.

This is called a _____ action.

(1)

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

In the nervous system, information passes along cells called

| effectors |
| neurones |
| synapses |

.

(1)
(Total 5 marks)

Q25.

Our bodies control the concentration of glucose in the blood.

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

(a)   The concentration of glucose in the blood is controlled by a

hormone called

| carbohydrase. |
| insulin. |
| protease. |

(1)

(b)   This hormone is produced by the

| intestine. |
| stomach. |
| pancreas. |

(1)

(c)   If the body does not produce enough of this hormone,

the person develops

| diabetes. |
| cystic fibrosis. |
| Huntington's disease. |

(1)
(Total 3 marks)

Q26.

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
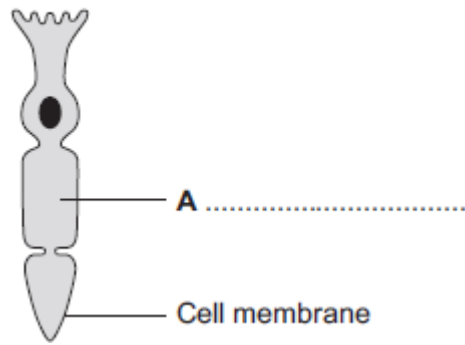
Use the correct answer from the box to label part **A** on **Figure 1**.

chloroplast	cytoplasm	vacuole

(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	

(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)

Q27.

The photograph shows a new-born baby.

By SCA Svenska Cellulosa Aktiebolaget [CC-BY-2.0], via Wikimedia Commons

(a) New-born babies have reflex actions. The reflex actions help new-born babies to survive.

Draw a line from each reflex action to the way in which it helps the baby to survive.

Reflex action	How the reflex action helps the baby
	Helps the baby to hold on to the mother
If milk goes down the baby's windpipe the baby coughs	
	Prevents the baby from choking
If the mother touches the palm of the baby's hand, the baby clenches	

its fist.	
	Helps to protect some of the baby's receptors
If the mother strokes the baby's mouth, the baby begins to suck.	
	Helps the baby to crawl
If a bright light shines on the baby, the baby's eyes shut.	
	Helps the baby to feed

(4)

(b)　Which **two** of the following may be effectors in reflex actions?

Tick (✓) **two** boxes.

Brain ☐

Glands ☐

Motor neurones ☐

Muscles ☐

Sensory neurones ☐

(2)
(Total 6 marks)

Q28.

Hormones control the menstrual cycle.

(a)　Name **two** of the hormones involved in the menstrual cycle.

1. _____

2. _____

(2)

(b)   Hormones are used in some types of contraception.

Complete the sentence.

When used as contraceptives, hormones stop _____ becoming mature.

(1)

(c)   There are several ways of using hormones as contraceptives.

These include:

•   taking a contraceptive pill each day for 21 days of the menstrual cycle

•   using a contraceptive implant.

The contraceptive implant is put under the skin of a woman's arm.

The implant releases contraceptive hormones for three years before the implant needs to be replaced.

(i)   Suggest **one** advantage of using this implant rather than taking contraceptive pills.

_____

_____

(1)

(ii)   Suggest **one** disadvantage of using this implant rather than taking contraceptive pills.

_____

_____

(1)
(Total 5 marks)

Q29.

The diagram shows some of the stages in IVF (in vitro fertilisation).
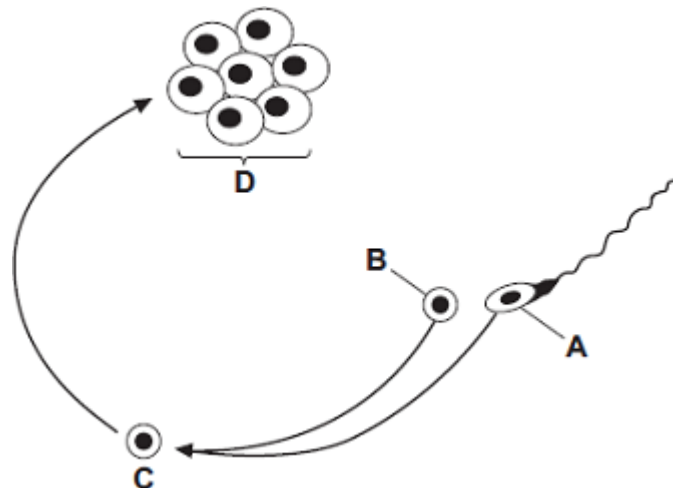
(a)   Use words from the box to name structures **A**, **B**, **C** and **D**.

egg	embryo	fertilised egg	ovary	sperm

Structure **A** _____

Structure **B** _____

Structure **C** _____

Structure **D** _____

(4)

(b)   What do doctors do next with structure **D**?

_____

_____

_____

_____

(2)

(c)   The table gives statistics for an IVF clinic.

	Age of women treated			
	Below 35 years	35 – 37 years	38 – 39 years	40 – 42 years
Number of women treated	414	207	106	53
Number of women who produced one baby	90	43	17	1
Number of women who produced twins	24	8	4	1
Number of women who produced triplets	1	0	0	0

(i)   About what proportion of the treated women aged 35 – 37 years produced one or more babies?

Draw a ring around your answer.

one quarter   **one third**   **half**

(1)

(ii)   This clinic does **not** give IVF treatment to women over 42 years of age.

Use data from the table to explain why.

_____

_____

_____

_____

(2)

(iii)   The committee which regulates IVF treatment now advises that only one
embryo is used in each treatment.

Suggest **one** reason for this.

_____

_____

(1)

(Total 10 marks)

Q30.

Our nervous system controls our reactions.

Figure 1 shows the part of the nervous system involved in the rapid response to a
stimulus.
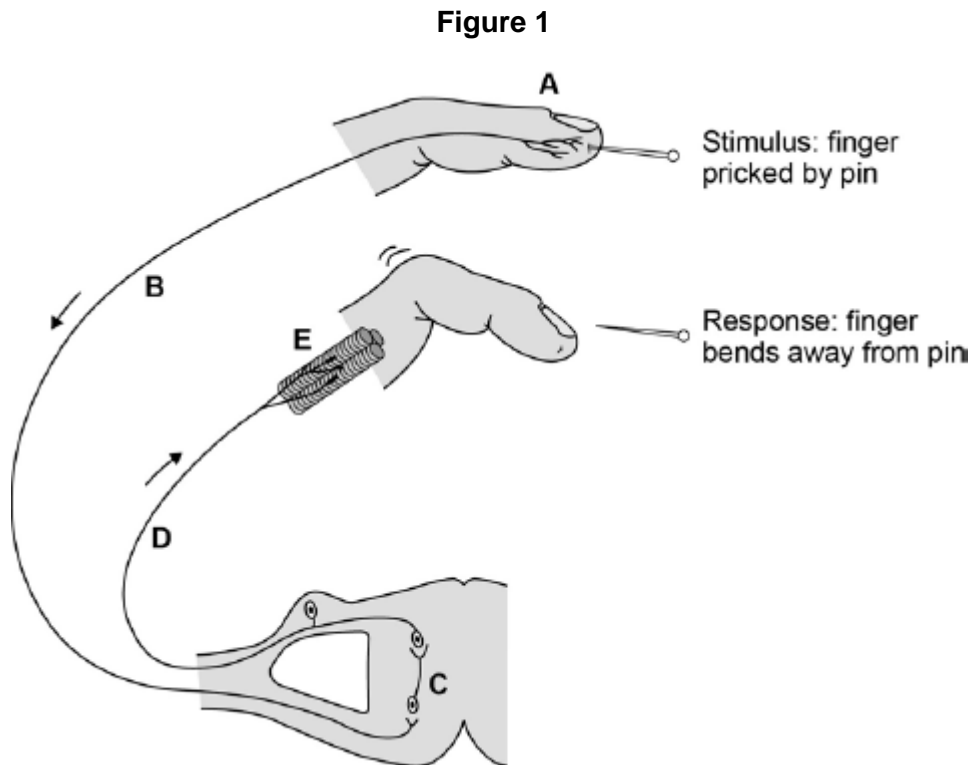
Figure 1

(a)   What is this type of rapid response called?

Tick **one** box.

Circular action	☐
Fast action	☐
Forced action	☐
Reflex action	☐

(1)

(b)   Features of the nervous system are labelled **A**, **B**, **C**, **D** and **E** on **Figure 1**.

Draw **one** line from each feature to the correct label from **Figure 1**.

Feature	**Label**
	A
Effector	B
Relay neurone	C
Sensory neurone	D
	E

(3)

(c)   Two students compare their reactions using a ruler.

This is the method used.

1.   Student **A** sits with his elbow on a table top.

2.   Student **B** holds the ruler so the bottom of the ruler is level with the top of student **A**'s thumb.

3.   Student **B** drops the ruler.

4.   Student **A** catches the ruler.

5.   Record the drop distance.

6.   Repeat steps 1 to 5 four more times.

7.   Repeat the whole experiment with student **A** dropping the ruler and student **B** catching it.
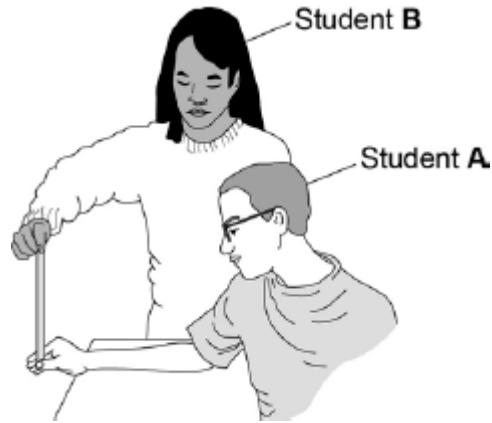
Both students are right-handed.

The students are testing the hypothesis:

the drop distance of the ruler is smaller when a right-handed person uses their right hand to catch the ruler.

Student **A** uses his right hand to catch the ruler.

Student **B** uses her left hand to catch the ruler.

Complete the sentence.

Use an answer from the box.

control	dependent	independent

The drop distance was the _____ variable.

(1)

(d)   The table below shows the students' results.

Student	Drop distance in cm				
	Test 1	Test 2	Test 3	Test 4	Test 5
Student **A**	17.5	15.5	15.0	23.5	17.0
Student **B**	20.5		19.5	21.0	19.0

Figure 2 shows student **B**'s Test 2 result.

Figure 2
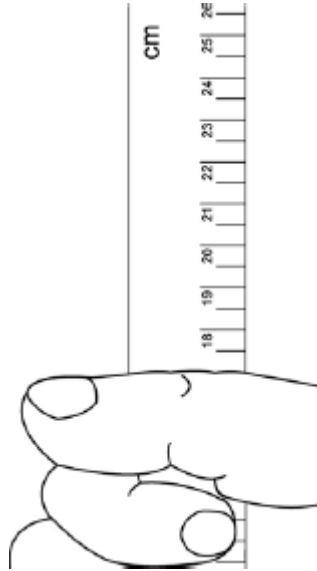
Use **Figure 2** to complete the missing result for Test 2.

Write the answer in the table above.

(1)

(e)   What was the resolution of the ruler the students used?

Tick **one** box.

0.1 cm   ☐

0.5 cm   ☐

1 cm   ☐

10 cm   ☐

(1)

(f)   One of the results in the table above is anomalous.

Identify the anomalous result.

Give the reason why you chose your answer.

_____

_____

_____

(2)

(g)   The students are testing the hypothesis:

the drop distance of the ruler is smaller when a right-handed person uses their right hand to catch the ruler.

The results in the table above are not a good test of the hypothesis.

What is one reason why?

Tick **one** box.

The drop distances are very variable ☐

The drop distance for Student **A** is sometimes bigger than the drop distance for Student **B** ☐

The results are for the left and right hands of different people ☐

The drop distances are not measured accurately enough ☐

(1)
(Total 10 marks)

Q31.

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)

Q32.

Diabetes is a disease in which the concentration of glucose in a person's blood may rise to fatally high levels.
Insulin controls the concentration of glucose in the blood.

(a) Where is insulin produced?

Draw a ring around **one** answer.

gall bladder   **liver**   **pancreas**

(1)

(b) People with diabetes may control their blood glucose by injecting insulin.

(i) If insulin is taken by mouth, it is digested in the stomach.

What type of substance is insulin?

Draw a ring around **one** answer.

carbohydrate   **fat**   **protein**

(1)

(ii) Apart from using insulin, give **one** other way people with diabetes may reduce their blood glucose.

_____

(c)   The bar chart shows the number of people with diabetes in different age groups in the UK.
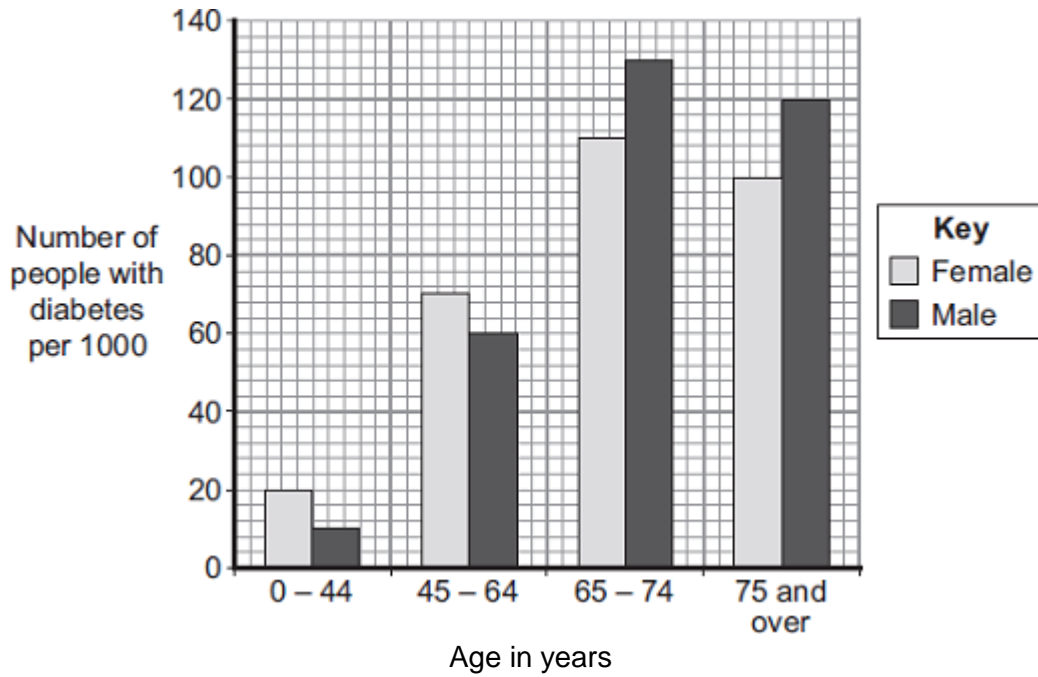
(i)   Describe how the number of males with diabetes changes between the ages of 0 – 44 years and 75 years and over.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(ii)   Compare the number of males and females with diabetes:

between the ages of 0 and 64 years

_____

_____

_____

over the age of 65 years.

_____

_____

Q33.

Blood glucose concentration in humans must be kept between 4.4 and 6.1 mmol per dm^3.

Four students, **A**, **B**, **C** and **D**, tested their blood glucose concentration with glucose testing strips.

The diagram shows the results of their tests and the key from the test strip bottle.
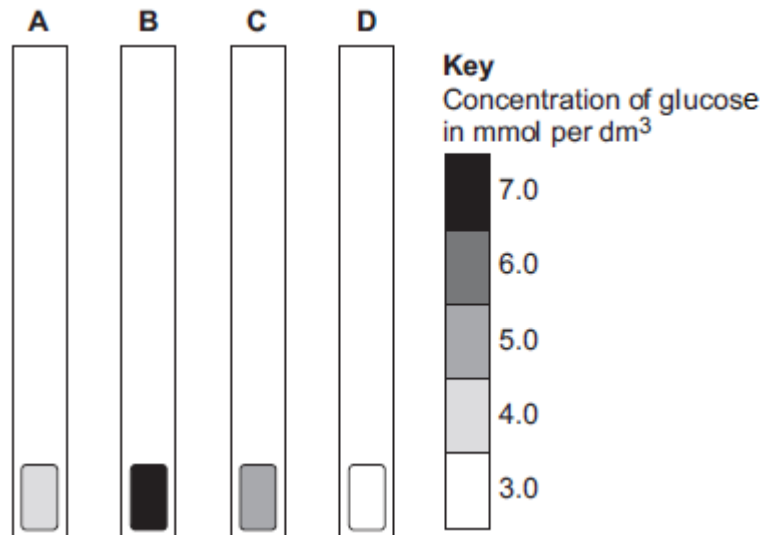
(a)   (i)   Which student, **A**, **B**, **C** or **D**, has diabetes and has eaten a large piece of cake?

(1)

(ii)   Which student, **A**, **B**, **C** or **D**, is in most need of eating carbohydrates?

(1)

(iii)   Which student, **A**, **B**, **C** or **D**, has a healthy blood glucose concentration?

(1)

(b)   (i)   Name the hormone that people with diabetes inject to prevent their blood glucose concentration from becoming too high.

(1)

(ii)   Blood glucose concentration is monitored in the body.

Which organ monitors blood glucose concentration?

Draw a ring around the correct answer.

brain   **liver**   **pancreas**

(1)
(Total 5 marks)

Q34.

Blood sugar levels in the body are controlled by insulin.

(a)   How does insulin travel around the body?

_____

_____

(1)

(b)   The table below shows the blood sugar levels for two people after eating a meal.

Time after eating in hours	Blood sugar levels in mg per 100 cm^3 of blood	
	Person A	Person B
0	70	130
1	150	230
2	90	185
3	80	165
4	75	140

Use data from the table above to complete the graph in the figure below.

Plot the points for person **A**.

The first two points have been plotted for you.

Draw a line through all the points.
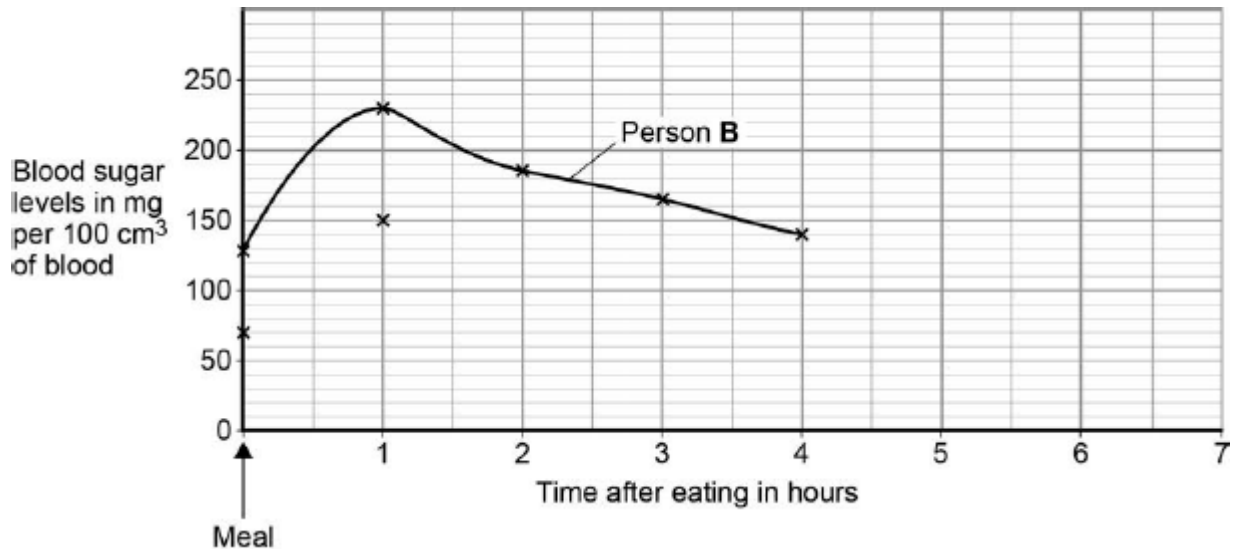
(3)

(c) How long after the meal is person **B**'s insulin production at its peak?

_____

_____

(1)

(d) What is the greatest **decrease** in the blood sugar level of person **B** in an hour?

_____

_____

_____

Decrease = _____ mg per 100 cm^3

(2)

(e) Estimate how long after eating the meal it will take for person **B**'s blood sugar level to return to the level before the meal.

Show your working on the figure above.

_____

_____

(2)
(Total 9 marks)

Q35.
(a) **Diagram 1** shows the neurones and parts of the body involved in a response to touching a hot object.

Diagram 1

Spinal cord

B

Y

A

X

Muscle in arm

Key
Direction of
nerve impulse

Sense receptor in skin of hand
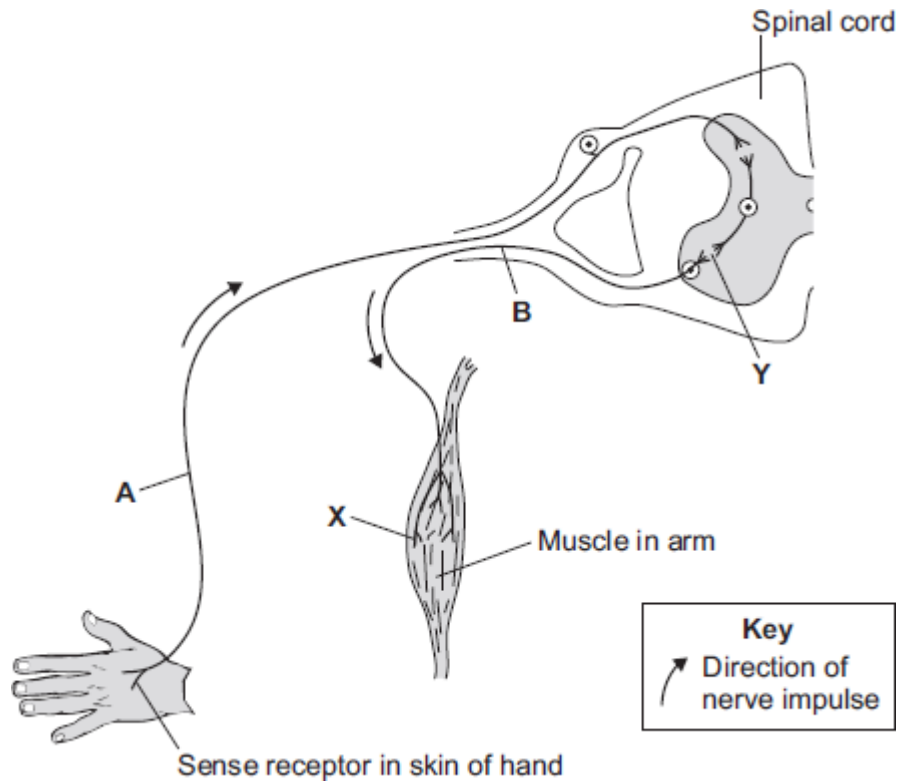
A neurone is a nerve cell. Neurones carry impulses around the body.

(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   ☐

(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.

_____

_____

(iv) Reflex actions like this are useful.

Explain why.

_____

_____

_____

_____

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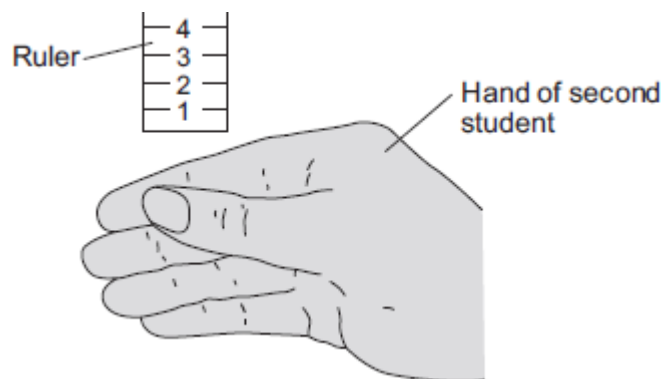
2. The student let go of the ruler. The second student caught it as soon as possible, as shown in **Diagram 3**.

Diagram 3

Ruler has fallen 18 cm
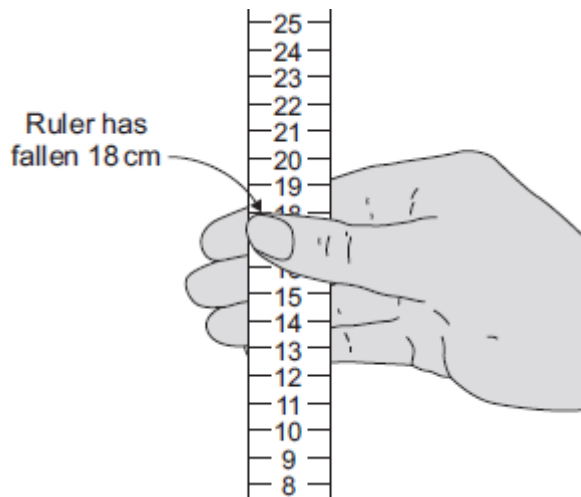
3. The students repeated this experiment seven more times.

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	Table 2
Distance ruler fell before it was caught in cm	**Distance ruler fell before it was caught in cm**
Before drinking coffee	**After drinking coffee**
18	8
21	13
25	11
15	17
19	10
16	14
12	13
21	13
Mean = 18.4	**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?

       _____

       _____

(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)

Q36.

The diagram below shows the pathway for a simple reflex action.
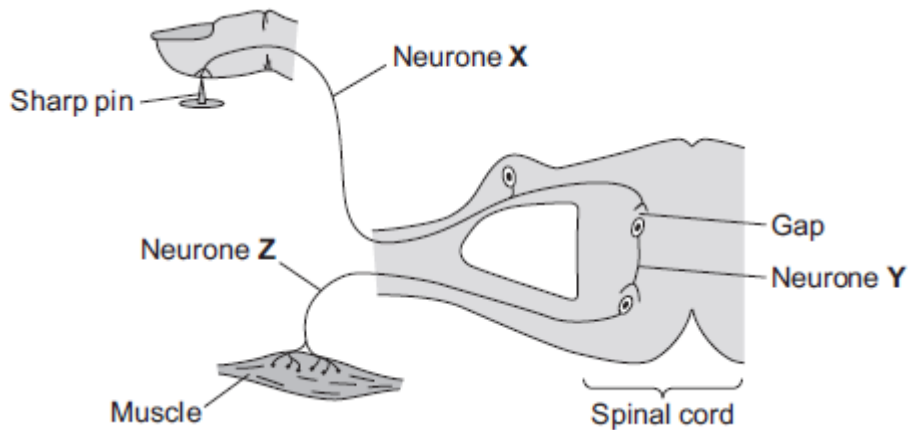
(a)   What type of neurone is neurone **X**?

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)

Q37.

A person with Type 1 diabetes does **not** produce enough of the hormone insulin.

(a)   Where is the hormone insulin produced?

Tick **one** box.

Brain ☐

Pancreas ☐

Pituitary ☐

Thyroid ☐

(1)

(b)   How does insulin travel around the body?

_____

_____

(1)

(c)   The same concentration and volume of glucose solution was given to two people.

•   Person with Type 1 diabetes.

•   Person without Type 1 diabetes.

The figure below shows how the blood glucose concentration of these two people

changed after they each drank a glucose solution.
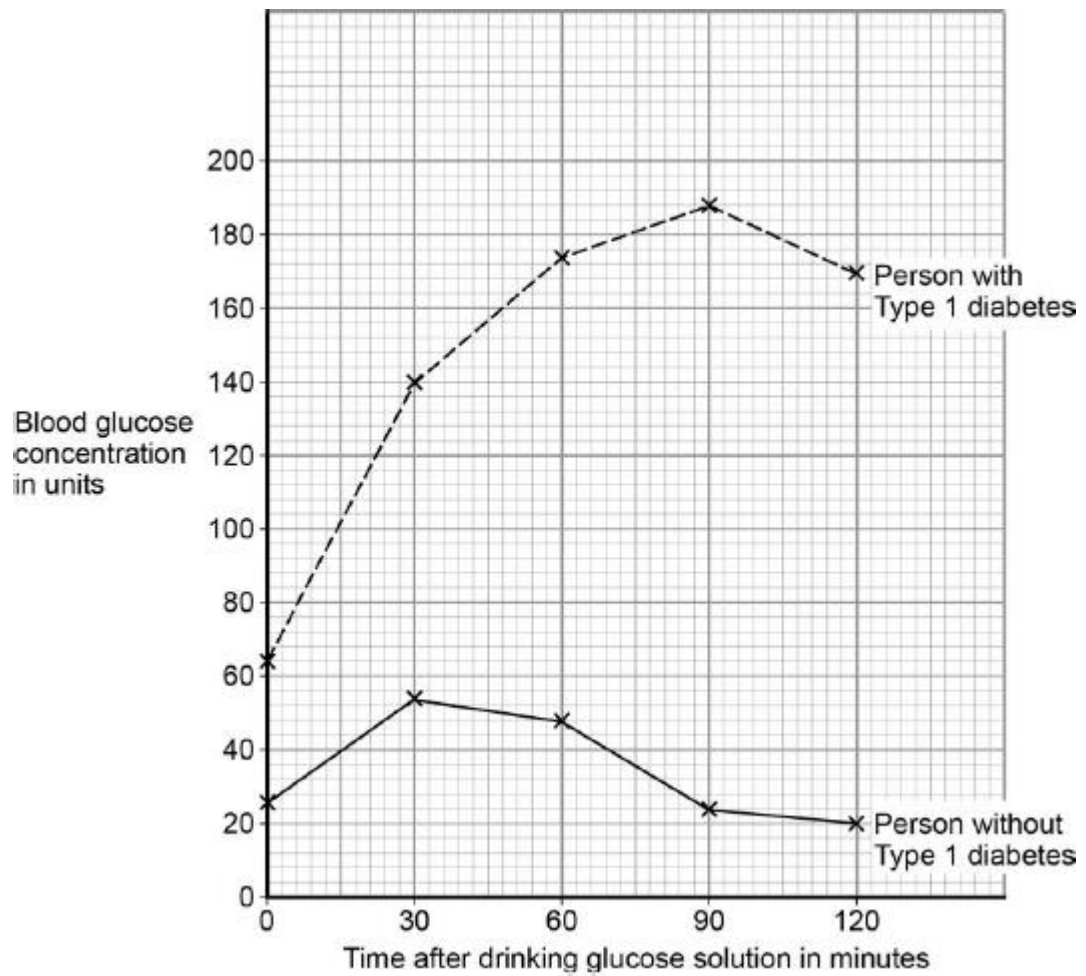
Look at the figure above.

Compare the blood glucose concentrations of the two people.

Include similarities and differences in your answer.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(d)   People with diabetes may be asked to control their diet.

Explain how this can help to reduce the risk of developing health problems.

_____

_____

_____

_____

_____

_____

(3)

(Total 9 marks)

Q38.

The table shows four ways in which water leaves the body, and the amounts lost on a cool day.

	WATER LOSS (cm³)	
	COLD DAY	HOT DAY
Breath	400	the same
Skin	500	
Urine	1500	
Faeces	150	

(a) (i)   Fill in the table to show whether on a hot day the amount of water lost would be

less   more   the same

The first answer has been done for you.

(3)

(ii)   Name the process by which we lose water from the skin.

_____

(1)

(b)   On a cool day the body gained 2550 cm³ of water.
1500 cm³ came directly from drinking.
Give **two** other ways in which the body may gain water.

1. _____

2. _____

(2)

(Total 6 marks)

Mark schemes

Q1.

(a) a stimulus

1

(b) (i) **A**

1

(ii) **C**

either order

1

D

1

(iii) **E**

1

(c) brain

allow spinal cord / CNS / <u>central</u> nervous system
*do **not** allow spine*

1

[6]

Q2.

(a) light

must be in correct order
allow light waves

1

sound

allow sound waves

1

touch

1

(b) (i) 0.35 in skin column circled

only look at figures in table more than one figure circled
negates mark
ignore values written in table for mean reaction time for eyes

1

(ii) 0.25 (seconds)

allow 1 mark for $\dfrac{0.23 + 0.27 + 0.24 + 0.26}{4}$

or 1 / 4

2

(iii) any **one** from:

ignore figures / references to sensitivity

• the ears / sound had the shortest reaction time
allow fastest

- the eyes / light had the longest reaction time
  allow slowest

- ears and skin had similar reaction times
  ignore references to anomalies or repeat values

1

[7]

Q3.

(a)   brain correctly labelled spine correctly labelled
for 1 mark each

2

(b)   (i)   10
          4
          1
          for 1 mark each

3

mouse spends most time in corners
for 1 mark

1

(ii)   2 of:
idea that it is trying to make itself less conspicuous to predators
idea of looking for food
any 2 for 1 mark each

2

[8]

Q4.
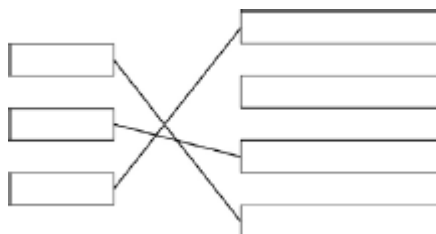
extra lines negate mark(s)

[3]

Q5.

receptor detects stimulus / sharp object

1

impulse / information / message passes along sensory neurone to
spinal cord

1

from spinal cord along motor neurone to muscle

1

muscle contracts

1

[4]

Q6.

hormones

words must be in correct order

1

glands

1

blood

1

LH

1

[4]

Q7.

(a) (i) any **two** from

see the (green) light **or** sign **or** man
for seeing where to go to avoid
objects
see cars (that are stopped)

answer must show that the person sees something

2

(ii) any **two** from

hear the bleeps **or** noise
to listen for traffic or danger
for balance

answer must show that the person hears something

2

(b) (i) nose

credit smell

1

tongue

credit taste but not mouth
credit temperature sensor

1

(ii) any **one** from

*do not accept sensory receptors **or** neurone*

touch
pain

credit nerves

pressure
temperature

credit heat
do not accept cold

1

[7]

Q8.

(a) ovary

1

sperm

1

uterus

1

must be in correct order
accept phonetic spelling – see marking guidance 3.6

(b) (i) more embryos transferred in older women / average increases with age
ignore chance of pregnancy / number of treatments

1

(ii) *answer must relate to data in table*

(many) embryos die / destroyed / do not survive
allow low success rate / often does not work
allow could lead to multiple births
ignore less successful in older women
ignore older women should not have babies
ignore not natural / finance
ignore religion / 'against God's will'

1

[5]

Q9.

(a)

the senses may be in any box.
do not credit list of receptors
the appropriate organ must be adjacent

2

Mark first	Look for suitable
Sense	**Receptor**
taste	tongue **or** taste buds

do not credit mouth

2

smell	nose
hearing	ear cochlea

2

vision **or** sight **or** seeing	eye **or** retina

do not credit light but eye correct as receptor
do not credit looking

heat **or** temperature   skin
          movement   ear **or** semi-circular
                                            canals
                    do not credit feel or alternatives to touch or pressure

          balance   eye **or** ear
                                            or both **or**
                                            semi-circular
                                            canals

                                                                                    2

     (b)   any **two** from three

           a sensor **or** receptor **or** detector feels
          the touch **or** starts the process
                    accept nerve endings in skin

           a signal **or** impulse is sent
          along a nerve **or** neurone **or** spinal
          cord **or** (central) nervous system
                    do not credit message
                    do not credit spine
                    beware of repeat of stem

                                                                                    2
                                                                                        [10]

Q10.

     1 sector correct
                    gains 1 mark

     but all sectors correct   B = 2   S = 9   U = 8
                    gains 2 marks

     all sections labelled correctly (w.r.t. sector size)
                    for 1 mark

                                                                                        [3]

Q11.

     A   –   muscle
                                                                                    1

     B   –   receptor
                                                                                    1

     C   –   neurone
                                                                                    1

     D   –   spinal cord
                                                                                    1
                                                                                        [4]

Q12.

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

                    •   age

- gender
- body mass
- number in group / 50
  allow number of children
- high body temperature
  allow starting temperature
  allow dose / amount of drug given

1

    (ii)   any **one** from:

- tablet that does not contain a drug / anything
  allow sugar pill
  *do **not** allow a different drug*
- fake drug

1

(b)   (i)   38.2 (°C)

1

    (ii)   ibuprofen
        no mark for drug
        no marks if wrong drug selected

any **two** from:

- reduced body temperature fast(er)
  allow acts fast(er)
- maintained temperature in normal range / around 37 °C (longer / for several hours)
- paracetamol did not reduce temperature to normal / 37 °C
  accept ibuprofen did reduce temperature to normal / 37 °C
- ibuprofen given less frequently
  allow less drug needed
  ignore cheaper unless qualified

2

[5]

Q13.

(a)   **Stimulus**   **Part of the body**
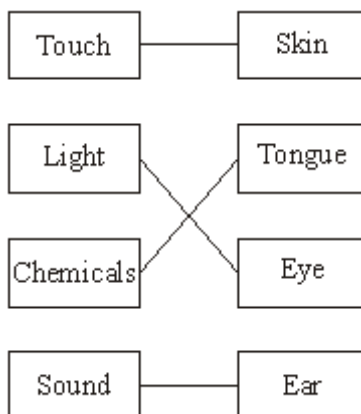
1 mark for each correct line

*if **2** lines to **one** box, CANCEL mark*

max 3

(b) <u>in correct sequence</u>:

sensory

1

brain

1

[5]

Q14.

(a) (i)   all plots correct

Tolerance ± $\frac{1}{2}$ square
allow 1 mark for 2 correct plots

2

(ii)   6

correct answer with no working = 2
allow 1 mark for (60 ÷ 100) × 10
N.B. correct answer from incorrectly
recalled relationship / substitution = 0

2

(b) lungs

1

liver

1

kidneys

1

[7]

Q15.

(a)   A – cell membrane
B – cytoplasm
C – nucleus
each for 1 mark

3

(b)   (nerve) impulse sent along nerve fibre to brain
each for 1 mark

3

[6]

Q16.
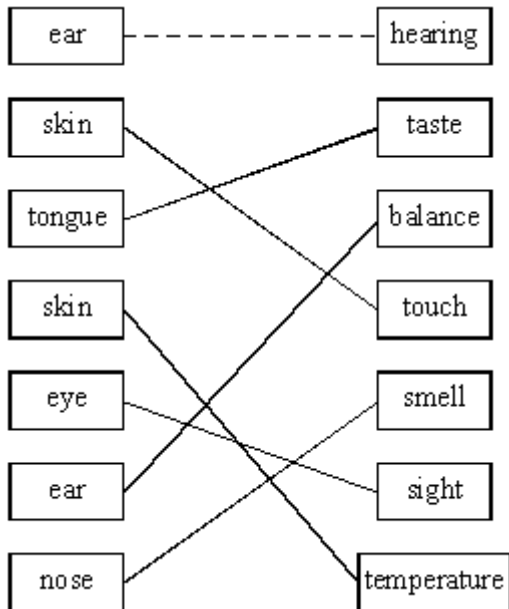
*one correct **1** mark*
*two correct **2** marks*
*three correct **3** marks*
*four correct **4** marks*
*five or six correct **5** marks*
(•   for 6ᵗʰ correct mark)

both skin boxes can be connected to either touch or temperature

*do **not** credit where more than one link goes to or from any box (except for skin, touch and temperature)*

[5]

Q17.

(a)
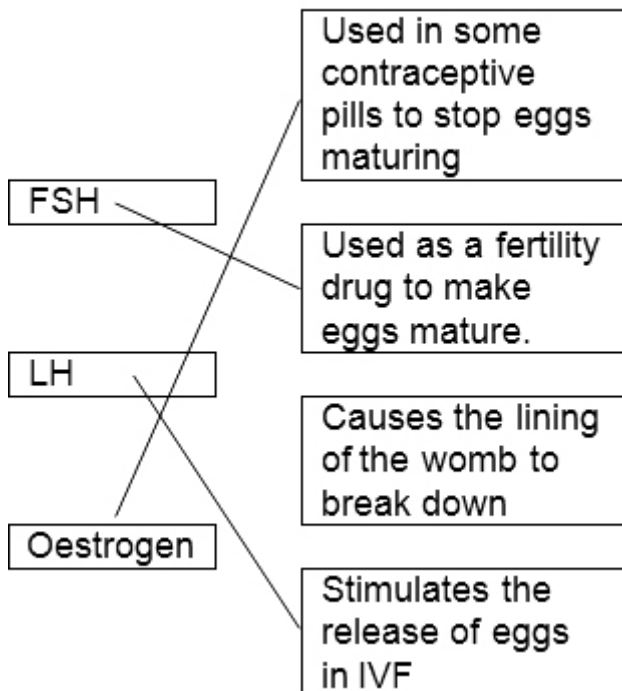
mark each line from left hand box
two lines from left hand box cancels mark for that box

3

(b) (i) implant

1

(ii) any **one** from:

allow explanation for their method in (b)(i)

- lasts for 5 years / long(est)

- cannot forget to take / replace it / lose it

- (hormone) there all the time
  ignore expense
  ignore STDs
  ignore side effects

1

(iii) any **one** from:

accept correct disadvantage for wrong method in (b)(i)

- needs surgery / operation
  allow it could go wrong

- painful

- infection

- have to wait five years for a child or more difficult to have a change of mind
  ignore expense
  ignore STDs
  ignore side effects

1

[6]

Q18.

(a) **A** sensory (neurone)
   ignore nerve

1

   B motor (neurone)
   ignore nerve

1

   C spinal cord / central nervous system / grey matter

1

(b) by chemical / substance
   allow transmitter

1

(c) muscle
   allow extensor
   ignore muscle names

1

[5]

Q19.

(a)   1800

> *allow - / minus 1800*

1

(b)   3200

> *award both marks for correct answer irrespective of working*
> *allow - / minus 3200*
> *award **2** marks for 200 or -200 irrespective of working*
> *allow ecf from part (a) for both routes to 2 marks*
> *if no answer **or** incorrect answer then indication of addition of 1800 **or** their (a), 1000 and 400 gains **1** mark*

2

(c)   drink <u>more</u> / take in <u>more</u> from food & drink

> *allow ecf from (b), ie if answer to (b) is less than 3000 then accept drink less*
> *if answer to (b) is exactly 3000 accept do nothing*

1

200 (cm³)

> *accept ecf from (b) answer should be difference between (b) and 3000 if answer to (b) is 3000 accept they are the same*
> ***NB** drink / take in 3200 (cm³) of water = **1** mark*
> *drink / take in 200 (cm³) of water = **2** marks*
> *ignore references to exercise / sweat*

1

[5]

Q20.

(a)   pancreas

1

(b)   the diabetic should get more energy from fat

1

the diabetic should get less energy from carbohydrate

1

(c)   (use) insulin

> *allow pancreas / stem cell transplant*
> *do **not** allow injection / transplant /stem cells / tablets alone*
> *ignore exercise*

1

[4]

Q21.

(a)   (i)   50

> *award **2** marks for correct answer irrespective of working*
> *award **1** mark for selection of 60 **and** 10*

2

(ii)   any **two** from:

- increases

- (then) decreases

- highest at 65 – 74 (years old) **or** maximum 112 (per thousand)
allow peaks at 65 - 74
ignore comparisons with men

2

(b) (i) stomach

1

(ii) any sensible reference to diet **or** carbohydrate intake **or**
pancreas / stem cell transplant
*eg eat less / no sugary food **or** eat more fibre **or** go on a diet*
***or** watch what you eat*
ignore eat more protein
*do **not** accept reduce salt*

1

[6]

Q22.

(a) (i) receptor

1

(ii) sensory neurone

1

(iii) motor neurone

1

(iv) muscle

1

(b) (i) eye(s)
allow retina
ignore sight

1

(ii) ear(s)
ignore hearing
*do **not** allow ear drum*

1

(iii) ear(s)
ignore balance

1

[7]

Q23.

(a) pancreas

1

(b) any **one** from

- (controlling / changing) diet
accept descriptions as to how diet could be changed eg eat

less sugar(y foods) ignore reference to fat / protein

- exercise
  accept example eg go for a run

- pancreas transplant
  accept named drug eg metformin

1

(c) (i) increase
  ignore reference to women

1

then fall

1

relevant data quote (for male)
  max at ages 65 - 74
  eg starts at 10 (per thousand) **or** *max at 130 (per thousand)*
  or *ends at 120 (per thousand)*
  accept a difference between any pairs of numbers in data set
  quoting of scale or per thousand but not 'thousands'
  accuracy ± 2

1

(ii) *ignore numbers*

  (between 0 and 64) more females (than males) / less males
  allow eg females more diabetic than males

1

  (over 65) more males (than females) / less females

1

[7]

Q24.

(a) eye / sight / eyesight
  either order

1

  ear / hearing
  ignore light

1

(b) ear

1

(c) (i) reflex

1

(ii) neurons

1

[5]

Q25.

(a) insulin
  extra ring drawn cancels the mark

1

    (b)   pancreas

                     extra ring drawn cancels the mark

1

    (c)   diabetes

                     extra ring drawn cancels the mark

1

[3]

Q26.

    (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]

Q27.

    (a)

If milk goes down		Helps the baby hold
If the mother touches		Prevents the baby choking
If the mother strokes		Helps to protect some of the baby's
If a bright light is shone		Helps the baby to crawl
		Helps the baby to feed
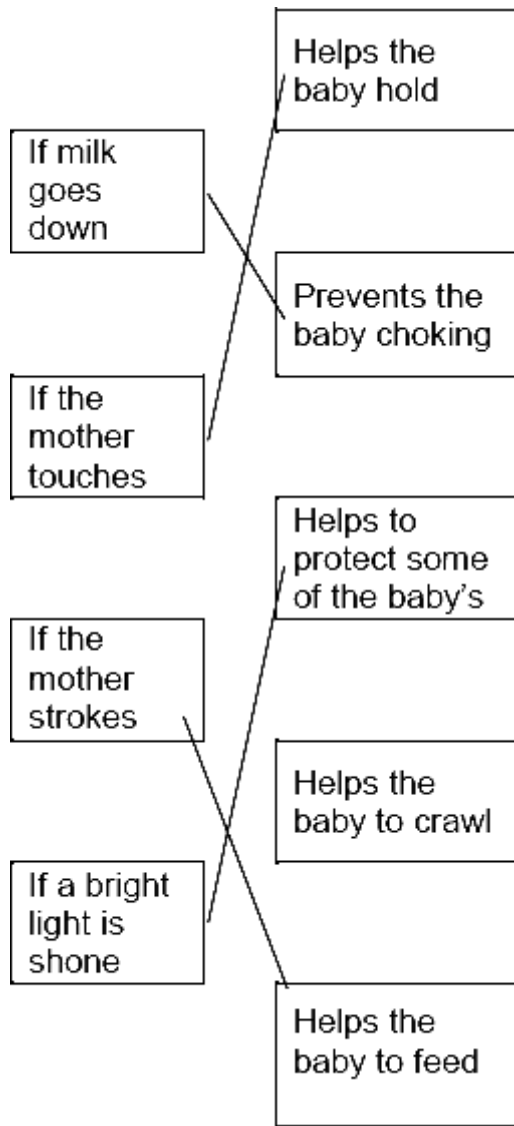
*all four correct = **4** marks*
*three correct = **3** marks*
*two correct = **2** marks*
*one correct = **1** mark*
extra line from a statement cancels the mark

4

(b)   glands

1

muscles

1 mark for each correct tick
each extra box ticked cancels 1 mark

1

[6]

Q28.

(a)   any **two** from:

• FSH

*do **not** accept FHS*

• LH

*do **not** accept LSH*

- oestrogen
  allow progesterone as alternative to any hormone

2

(b) egg(s) / egg cell(s) / ova
  *do **not** accept ovaries*
  *do **not** accept fertilised eggs*

1

(c) (i) any **one** from:
  ignore faster

- don't have to take (pill) every day
  ignore side effects

- can't forget to take
  ignore cost

- more reliable

- lasts 3 years / lasts longer

- hormone level in blood more constant

1

(ii) any **one** from:
  ignore cost

- eg painful (to insert) / uncomfortable / causes rash
  ignore side effects unqualified

- woman can't take it out

- more difficult to stop treatment

- needs to be removed if woman decides to become pregnant
  allow have to wait three years to become pregnant

1

[5]

Q29.

(a) **A** sperm

1

B egg

1

C fertilised egg

1

D embryo

1

(b) insert into mother
  ignore fertilise / check fertilisation / check viability

1

womb / uterus

1

(c) (i)   one quarter

1

(ii) no / little chance of success over 42

1

reference to table of only two women in the age bracket 40-42 years
became pregnant
*the statement 'only 2 out of 53 40-42 year old women
became pregnant / had babies' gains **2** marks*

1

(iii) so fewer twins / multiple births
or
multiple births more dangerous

1

[10]

Q30.

(a) Reflex action

1

(b) **Feature**   **Label**
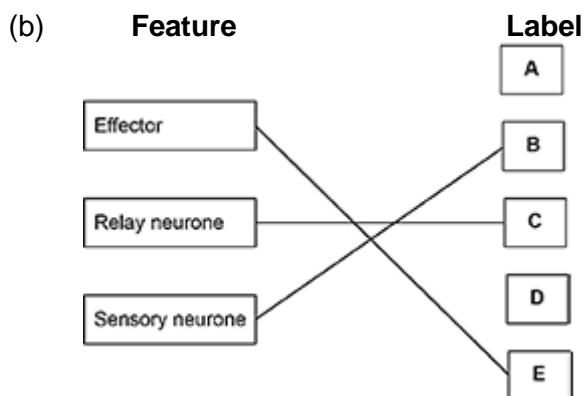

extra lines from the left negate the mark

3

(c) dependent

1

(d) 17.0
allow answers in range 17.0–17.3 cm

1

(e) 0.5 cm

1

(f) 23.5

1

does not fit the pattern **or** at least 5 cm higher than the other values

1

(g) The results are for the left and right hands of different people

1

[10]

Q31.

   (a)   pancreas

             allow phonetic spelling

                                             1

   (b)   (i)   A

                                             1

               short<u>est</u> / quick<u>er</u> time (to work)

                                           1

        (ii)   D

                                           1

             acts for long<u>est</u> 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]

Q32.

   (a)   pancreas

             apply list principle

                                           1

   (b)   (i)   protein

                 apply list principle

                                         1

        (ii)   any **one** from:

             •   (controlling / changing) diet

                  accept sugar(y foods) / named eg

                  ignore references to starch / fat / protein / fibre

             •   exercise

                  accept example, eg go for a run

             •   pancreas transplant

                  accept named drug eg metformin

                                         1

   (c)   (i)   increase

                 ignore reference to women

                                         1

             then fall

                                         1

             relevant data quote (for male)

                 *eg max at ages 65–74 **or** starts at 10 (per thousand) **or** max*

at 130 (per thousand) *or ends at 120 (per thousand)*
accept a difference between any pairs of numbers in data set
accept quotes from scale eg '130' or '130 per thousand' but
not *'130 thousand'; to within accuracy of +/- 2 (per thousand)*

1

    (ii)   (between 0 and 64) more females (than males) **or** less males (than females)
ignore numbers
allow eg females more diabetic than males

1

           (over 65) more males (than females) or less females (than males)
allow eg males more diabetic than females

1

[8]

Q33.

    (a)   (i)   **B**

1

          (ii)   **D**

1

          (iii) **C**

1

    (b)   (i)   insulin

1

          (ii)   pancreas

1

[5]

Q34.

    (a)   in the blood(stream)
allow plasma
ignore dissolved or in solution

1

    (b)   all three plots correct
*accept two correct plots for **1** mark*

2

        suitable line drawn

1

    (c)   1 hour

1

    (d)   230−185
identification of steepest part of graph and correct readings taken

1

        = 45

1

(e)   line on graph showing extrapolation for person **B**

correct value read from graph (at 130 mg per 100 cm^3)

*allow **1** mark for a value of 4.5–5 hours if no extrapolation shown*

2

[9]

Q35.
(a)   (i)   sensory neurone

1

a synapse

1

(ii)   contract

1

(iii)   not connected to brain / coordinated <u>only</u> by spinal cord

1

(iv)   automatic / rapid (response)

allow no thinking / faster / less time

1

protects body from danger / from damage / from burning

1

(b)   (i)   caffeine decreases reaction time

accept caffeine speeds up / quicker reactions

1

(ii)   the two sets of results overlap (considerably)

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

1

(iii)   any **two** sensible suggestions: eg

•   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

2

[10]

Q36.
(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

1

• gets shorter

(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]

Q37.

(a) pancreas

1

(b) (in the) blood(stream)
        allow in the (blood) plasma

1

        *ignore dissolved **or** in solution*

(c) any **two** from:

• concentration rises and falls in both people
• concentration is higher at start / always in person with diabetes
• concentration rises higher in person with diabetes
        allow correct use of figures

2

plus any **two** from:

• concentration rises more rapidly in person with diabetes
• concentration stays high for longer in person with diabetes
• concentration does not return to starting level during test in person with diabetes,
    yet concentration returns to starting concentration by 90 minutes in person without diabetes
• concentration goes below starting concentration only in person without diabetes

2

(d) reduce carbohydrate / glucose / sugar in diet

1

(so) blood glucose concentration does not increase as much

1

(so) there is reduced named effect (of prolonged high blood glucose)

allow reduced short or long term consequences such as tiredness

or

increase urination

or

thirst

or *eye / kidney / nerve / heart disease*

1

[9]

Q38.

(a)　(i)　　more
less
the same
(*accept* appropriate numbers)
　　　for 1 mark each

3

(ii)　sweating / evaporation / perspiration
　　　for 1 mark

1

(b)　in food / named solid food / eating
from respiration
　　　for 1 mark each

2

[6]