

1 People with type 1 diabetes inject insulin to control their blood glucose level.

A pancreas transplant is another treatment for type 1 diabetes.

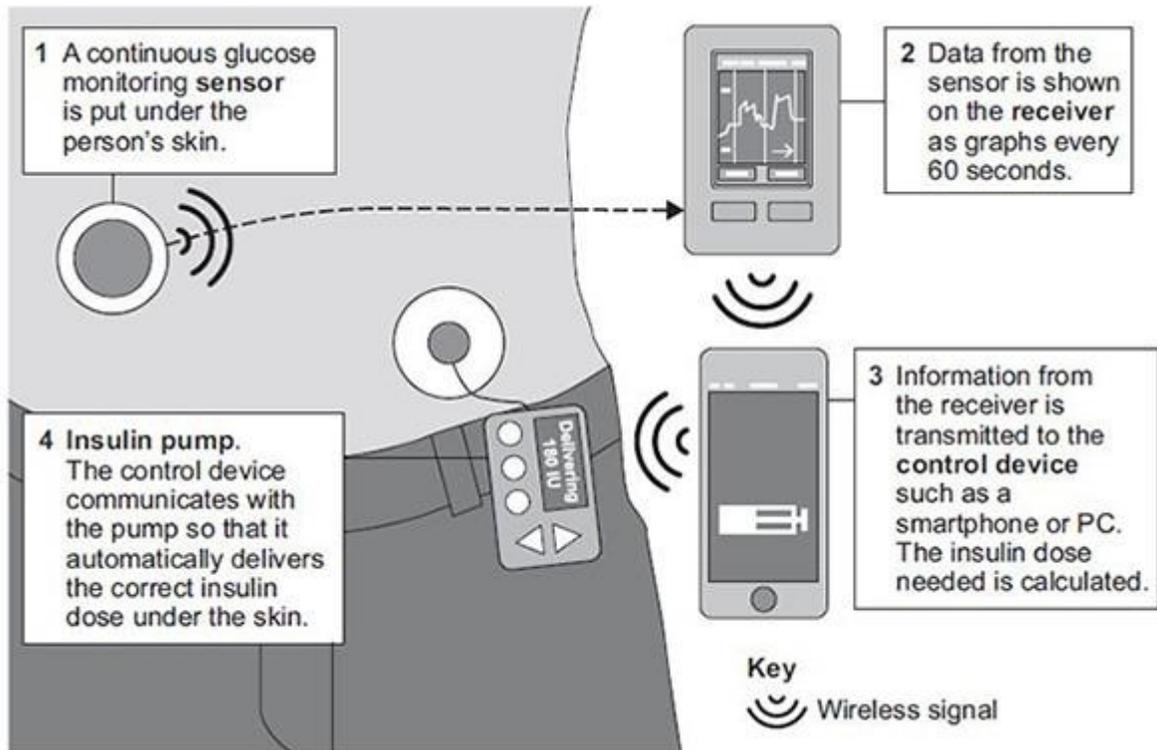
One risk of a pancreas transplant is organ rejection.

(a) Explain why a transplanted organ may be rejected.

(3)

(b) Scientists have developed an artificial pancreas to treat type 1 diabetes.

The diagram below shows how an artificial pancreas works.



- (i) A woman with type 1 diabetes has an artificial pancreas. The woman eats a meal high in sugar. The meal causes her blood glucose level to rise.

Use information from the diagram above to describe what happens to bring the blood glucose level of the woman back to normal.

(4)

- (ii) The traditional way of monitoring and treating type 1 diabetes is to take a small sample of blood and put it on a test strip to find out how much insulin to inject.

Suggest **one** possible advantage, other than not having to do blood tests, of the method used in the diagram above.

(1)

(Total 8 marks)

2 *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

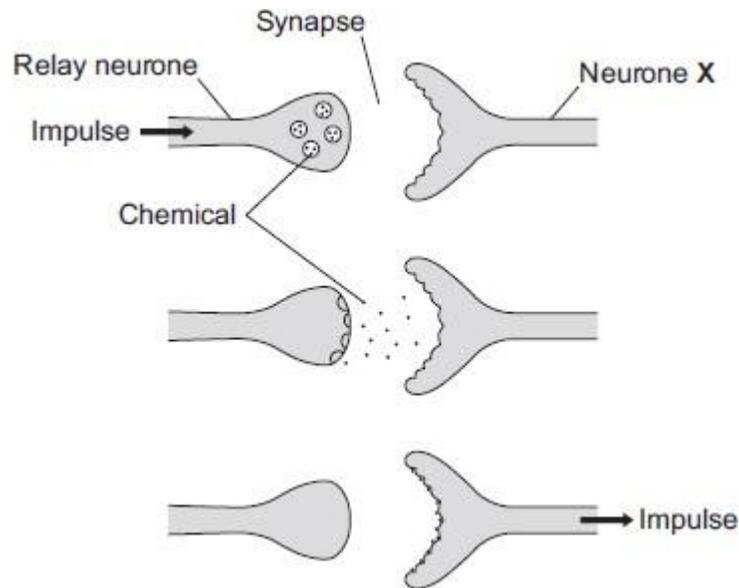
Homeostasis keeps conditions in the body relatively constant.

The amount of water in the body is controlled by homeostasis.

Kidney function is controlled by a gland in the brain.

3

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)

4 A student measured the effect of concentration of glucose on the absorption of light using a colorimeter.

A colorimeter measures how much light is absorbed as it passes through a solution.

The student used reagent **A**. When reagent **A** is added to glucose solution a blue compound is formed.

This is the method used.

1. Put 10 cm³ of 0.03 g/cm³ into a test tube.
2. Add 5cm³ of reagent **A**.
3. Place the test tube into the colorimeter.
4. Record the light absorbed.
5. Repeat steps 1–4 with different concentrations of glucose solution.

Table 1 shows the student's results.

Table 1

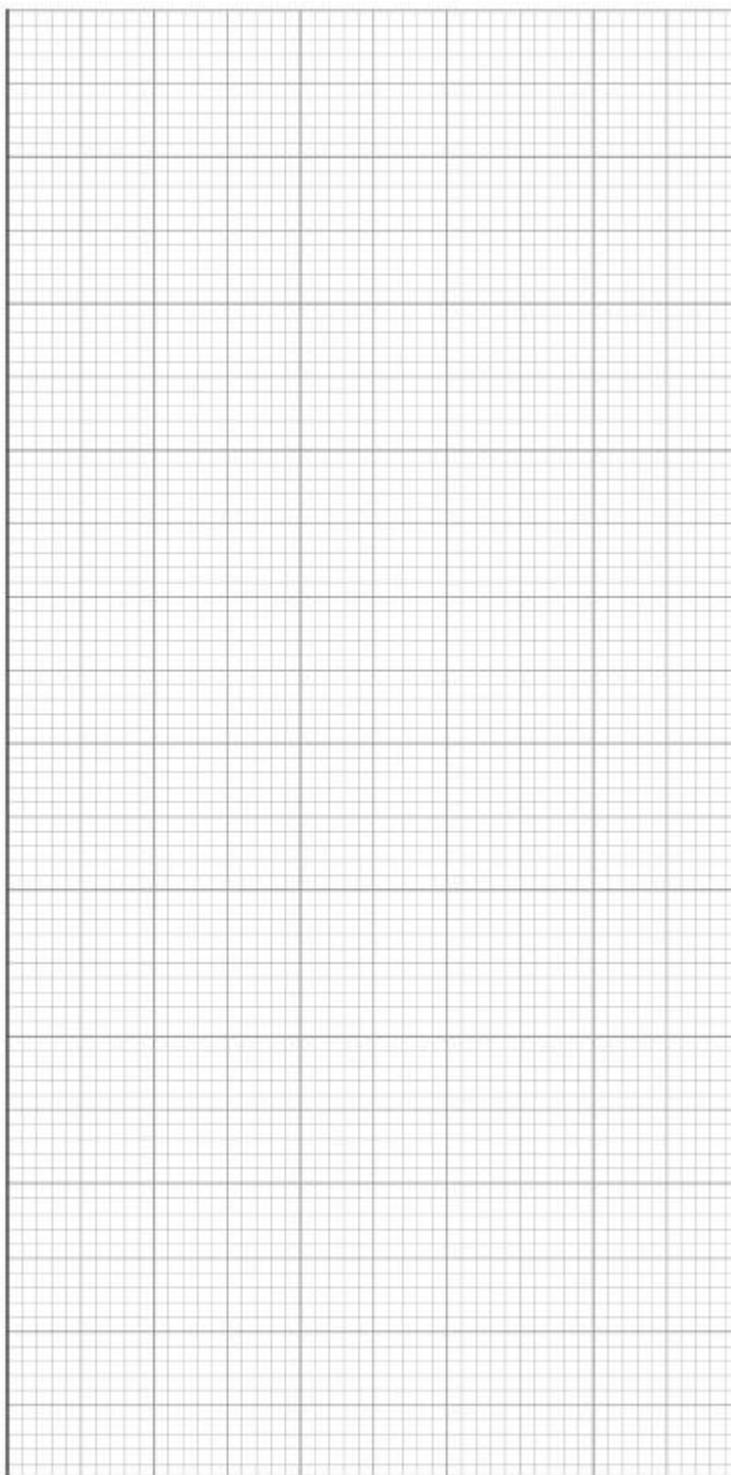
Concentration of glucose solution in g/cm ³	Light absorbed in arbitrary units
0.03	0.07
0.05	0.13
0.09	0.20
0.12	0.27
0.15	0.33

(a) Plot the data from **Table 1** on the grid.

You should:

- add suitable scales
- draw a line of best fit.

Light
absorbance



Concentration of glucose solution in g/cm³

(4)

(b) Explain why more light is absorbed when the concentration of glucose is higher.

(2)

The students repeated the method using two drinks instead of the glucose solutions.

Table 2 shows their results.

Table 2

Drink	Light absorbed in arbitrary units
X	0.25
Y	0.40

(c) Determine the concentration of glucose in drink X.

Use **Table 2** and your graph.

Concentration of glucose in drink X = _____ g/cm³

(1)

(d) After a person consumes drink Y there is a change in blood glucose concentration.

Describe how the person's body will detect and respond to the change in blood glucose concentration.

(4)

(e) Recent research into diabetes suggests that blocking glucagon secretion can prevent high blood glucose levels.

Explain how blocking glucagon secretion could keep blood glucose levels in the normal range.

(2)

A new treatment for people with Type 1 diabetes could be available in the future.

The new treatment involves using stem cells from an adult donor.

The stem cells are stimulated to become insulin secreting cells.

(f) Where in the donor's body could stem cells come from?

(1)

(g) Suggest **three** possible advantages of using stem cells to treat diabetes compared with the use of insulin injections.

1. _____

2. _____

3. _____

(3)

(h) Some people are worried about the use of stem cells to treat diabetes.

Suggest **two** possible disadvantages of using stem cells to treat diabetes compared with the use of insulin injections.

1. _____

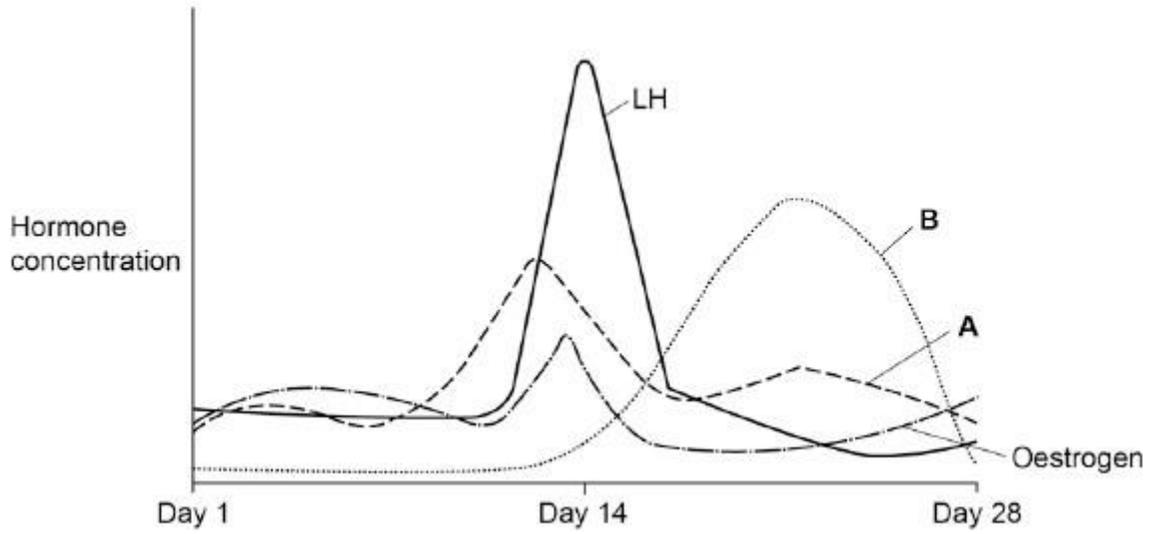
2. _____

(2)

(Total 19 marks)

5

The figure below shows how the concentrations of the reproductive hormones in the blood of a woman change over 28 days.



(a) Name hormones **A** and **B**.

A _____

B _____

(2)

(b) Use information from the figure above to explain what happens on Day 14.

(2)

(c) In Vitro Fertilisation (IVF) treatment can be used to help women become pregnant.

IVF uses some of the hormones shown in the figure above.

Explain why IVF increases the chance of some women becoming pregnant.

(6)

(Total 10 marks)

6

Hormones are released from glands.

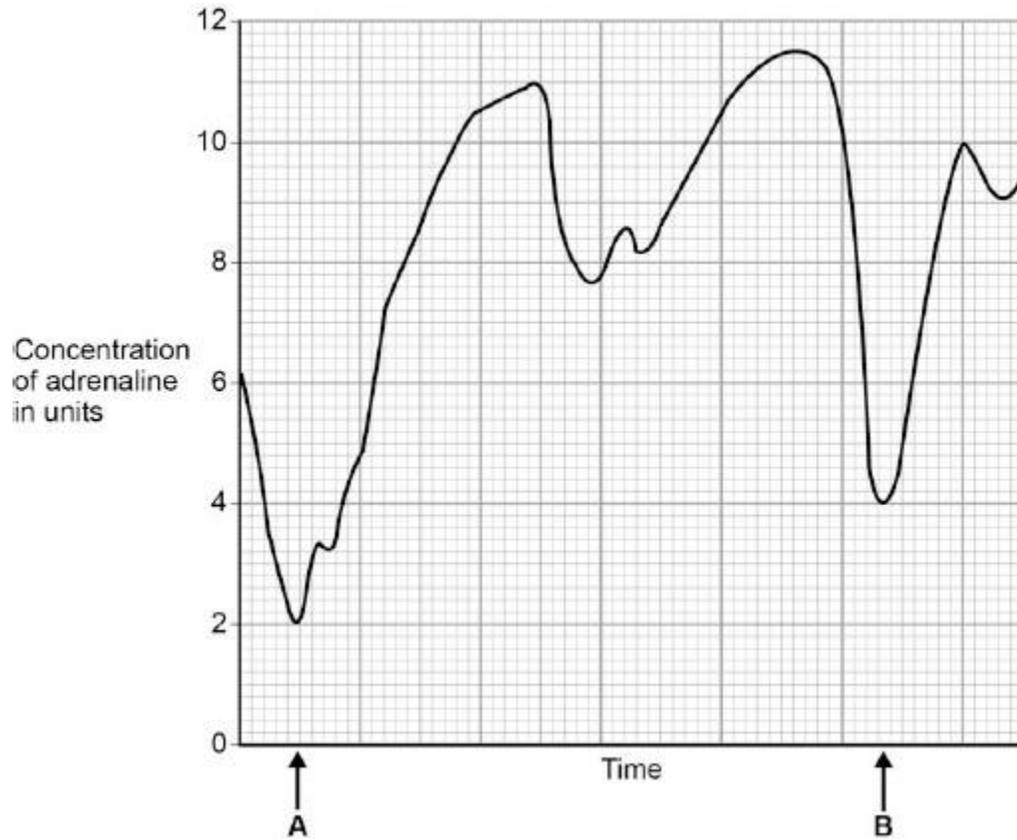
(a) Which gland produces hormones to control other glands in the endocrine system?

Tick **one** box.

- Adrenal
- Ovary
- Pituitary
- Thyroid

(1)

- (b) The figure below shows the level of adrenaline in a man's bloodstream while he was watching a 12-minute film.



Calculate the percentage increase in adrenaline after point **B**.

Percentage increase in adrenaline = _____

(2)

- (c) Suggest why the percentage increase in adrenaline after point **B** is different from the percentage increase after point **A**.

(2)

(d) Adrenaline causes changes in the body to prepare for a 'fight or flight' response.

What changes in the man's body are caused by adrenaline?

(2)

(Total 7 marks)

Mark schemes

- 1** (a) immune system
allow white blood cells / lymphocytes
ignore phagocytes 1
- produces antibodies 1
- (which) attack the antigens on the transplanted organ / pancreas
*allow transplanted organs have foreign antigens at start of explanation **and** linked to attacking the organ* 1
- (b) (i) change / rise detected by the sensor 1
- information used to calculate how much insulin she is going to need (bring her blood glucose back to normal) 1
- (pump delivers) insulin into the blood 1
- (causing) glucose to move into cells
allow (liver) converts glucose to glycogen 1
max 2 if no ref. to artificial pancreas
- (ii) any **one** from:
• it is more accurate **or** less chance of human error
• (glucose) level will remain more stable **or** no big rises and falls in blood sugar levels
• you don't forget to test and / or inject insulin
• if ill or in coma insulin is still injected
ignore continuous and automatic unqualified 1

[8]

2 Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.

0 marks

No relevant content.

Level 1 (1 – 2 marks)

There is a brief description of kidney function including a mention of pituitary gland **or** hormones but roles may be confused.

Level 2 (3 – 4 marks)

There is a clear description of kidney function in relation to fluctuations in blood water levels and the roles of the pituitary gland **or** hormone is mentioned with correct role.

Level 3 (5 – 6 marks)

There is a clear and detailed scientific description of kidney function in relation to fluctuations in blood water levels and of the roles of the pituitary gland and ADH.

examples of biology points made in the response:

- if water content too low, ADH released
- from pituitary gland
- into the blood
- (causing) kidney reabsorbs more water
- more concentrated / small volume urine produced
- if water content too high, ADH lowered / not produced
- less water reabsorbed by kidney
- more dilute / larger volume urine produced

full marks may be awarded for detailed description of either water loss or gain

[6]

3 (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]

- 4** (a) scales drawn
should use more than 50% of the graph paper 1
- all five points plotted
allow ± 0.5 small square tolerance
allow 1 mark for 3 or 4 points plotted accurately 2
- line of best fit drawn 1
- (b) the higher the concentration of glucose the darker the blue compound that is formed 1
- the blue compound absorbs the light 1
- (c) 0.13
allow 0.12
allow ecf from graph drawn in part (a) 1
- (d) increase in blood glucose detected by the pancreas 1
- insulin is released from the pancreas 1
- glucose would move into cells 1
- glucose converted to glycogen (for storage) in the liver 1
- (e) glycogen isn't converted to glucose 1
- therefore more glucose isn't released into the bloodstream 1

- (f) pancreas
or
bone marrow

*do **not** accept embryo
allow other correct sources of stem cells*

1

- (g) any **three** from:

- would not need to inject insulin
- continuous control
- would not need to test blood glucose levels (via blood tests)
- won't need to monitor carbohydrate intake
- no risk of forgetting to inject insulin

3

- (h) any **two** from:

- fear that the cells could become cancerous
- possible transmission of other disease
- may form other types of cell

2

[19]

5

- (a) **A** FSH

allow follicle stimulating hormone

1

B Progesterone

1

- (b) LH peaks

allow luteinising hormone

1

which causes an egg to be released.

1

(c) Level 3 (5–6 marks):

A detailed and coherent explanation is given, which logically links the role of different hormones to their use in IVF and a clear explanation of how IVF increases the chance of a successful pregnancy.

Level 2 (3–4 marks):

An attempt is made to link the role of hormones to their use in IVF. The logic used in explaining how IVF increases the chance of a successful pregnancy may not be clear or linked to the hormones.

Level 1 (1–2 marks):

Discrete relevant points made. The logic may be unclear and links may not be made.

0 marks:

No relevant content

Indicative content

Identification of hormones used in IVF:

- FSH
- LH.

Role of hormones in IVF:

- FSH causes eggs to mature
- LH causes the eggs to be released.

Effect on chance of successful pregnancy:

- high levels of hormones cause many eggs to be matured and released
- sperm and eggs are collected and eggs are fertilised (so increased probability of fertilisation)
- fertilised eggs are given time to develop into a small ball of cells
- some are transferred into the mother (uterus), to increase the probability of one successfully implanting.

6

[10]

6

(a) Pituitary

1

(b) $\frac{10-4}{4}$ or $\frac{6}{4}$

1

= 150 (%)

1

(c) the level in the blood is already higher than it was before point **A**

1

levels hadn't returned to normal yet (before the next scare)

allow he had already been scared so he was expecting the second scare

1

(d) increased oxygen to brain / muscles

1

increased glucose to brain / muscles

1

[7]