**M1** (a) liver

**1**

(b) insulin

*do **not** accept glucagon*

**1**

(c) kidney

**1**

(d) to replace water / ions / salt

**1**

(that is) lost in sweat

**1**

**[5]**

**M2.** (a) (i) (too) big

**1**

cannot fit / pass through filter / through (pores) in membrane / cannot be filtered

*too big to be filtered* = ***2*** *marks*

**1**

(ii) water

**1**

(iii) partially permeable

**1**

(b) any **two** from:

- hazards of operation / named eg
- may be rejected **or** need to use immunosuppressant drugs / long term drug use **or** transplant may need to be replaced
- susceptible to other infections
- shortage of donors
- high <u>initial</u> cost

**2**

**[6]**

**M3.** (a) (i) kidney

**1**

(ii) bladder

**1**

(iii) liver

**1**

(iv) lung(s)

**1**

(v) skin

**1**

(b) (i) 3000

*allow 2970 to 3030*

*correct answer gains **2** marks with or without working*

*if answer incorrect allow **1** mark for evidence of 1550 + 450 + 1000 (allow tolerance of + or – ½ square on each)*

**2**

(ii) 1600

*allow 1570 to 1630*

**1**

(iii) 1400

*allow (b)(i) – (b)(ii)*

**1**

(iv) correct plot from (b)(iii)

*tolerance ½ square ignore width*

**1**

(v) cells swell / overhydrated / damaged

*accept poisoned (by urea)*

**1**

**[11]**

**M4.** (a) pancreas

*allow phonetic spelling*

**1**

(b) (i) A

**1**

shortest / quicker time (to work)

**1**

(ii) D

**1**

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]**

**M5.** (a) (i) water

**1**

(ii) small

**1**

(iii) 3.15

**1**

(b) (i) 21 000

**1**

(ii) 2 years

**1**

(iii) prevent rejection

**1**

**[6]**

**M6.**(a) a higher concentration would be difficult to stir

**1**

(b) (i) methane

**1**

(ii) 60

*100 - (5 + 35) but incorrect answer allow 1 mark*

**2**

(c) (i) aerobic respiration

**1**

(ii) oxygen

**1**

**[6]**

**M7.** (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]**

**M8.** (a) brain

*in correct order only*

**1**

blood

**1**

sweat

**1**

(b) (i) A

**1**

(ii) to replace ions lost (in sweat)

*accept salts*

*allow named examples, eg. prevent cramps*

**1**

(iii) any **one** from:

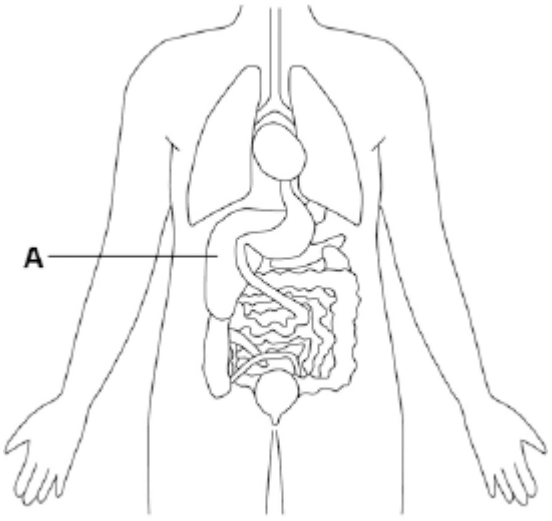
- there is too much glucose / sugar in the sports drink
- they shouldn't have too much glucose / blood sugar
- it would cause their blood glucose / sugar to rise (too high)

**1**

**[6]**

**Q1.** Humans control their internal environment in many ways.

Look at the diagram below.




(a) Name organ **A**.

.....

**(1)**

(b) Organ **A** stores glucose.

People with Type 1 diabetes cannot effectively control the levels of glucose in their blood.

Name the **hormone** people with **Type 1 diabetes** have to inject to decrease their blood glucose level.

.....

**(1)**

(c) Which organ produces urine?

Tick **one** box.

Brain ☐

Lungs ☐

Kidney ☐

Thyroid ☐

**(1)**

(d) Marathon runners often drink sports drinks during a race.

Explain why.

.....

.....

.....

.....

**(2)**

**(Total 5 marks)**

**Q2.** Doctors use dialysis to treat patients with kidney failure.

The table shows the sizes of molecules of some of the substances found in blood plasma.

| Substance | Size of molecule in arbitrary units |
|---|---|
| Water | 18 |
| Sodium ion | 23 |
| Urea | 60 |
| Glucose | 180 |
| Albumin (a blood protein) | 68 000 |

(a) Use information from the table to answer the questions.

(i) Albumin is a blood protein. Albumin is **not** removed from the blood during dialysis.

Explain why.

.....

.....

.....

.....

**(2)**

(ii) During a dialysis session, one patient's body mass decreased by 2 kilograms.

This decrease was mainly due to removal from the blood of one of the substances in the table.

Which substance was this? .....

**(1)**

(iii) The substance you named in part (a)(ii) was able to pass through the dialysis membrane.

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

The substance passed through because the

membrane was

| |
|---|
| mpermeable. |
| partially permeable. |
| surrounded by capillaries. |

**(1)**

(b) For most patients, a kidney transplant is better than continued treatment using dialysis.

Kidney transplants have some disadvantages.

Give **two** disadvantages of kidney transplants.

1 .....

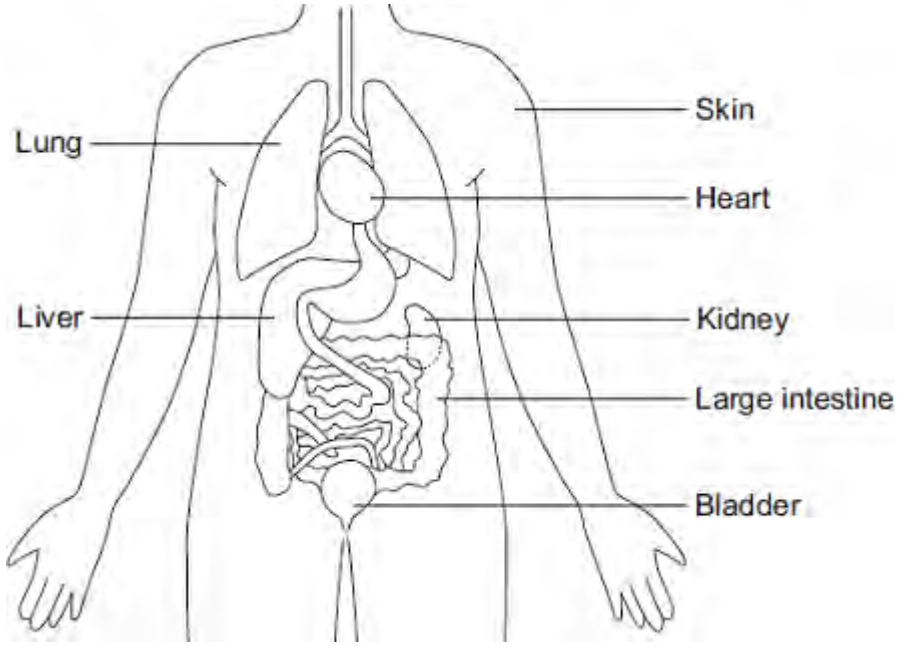
.....

2 .....

.....

**(2)**
**(Total 6 marks)**

**Q3.**The diagram shows some of the organs of the human body.




(a) Which organ labelled on the diagram:

(i) produces urine .....
**(1)**

(ii) stores urine .....
**(1)**

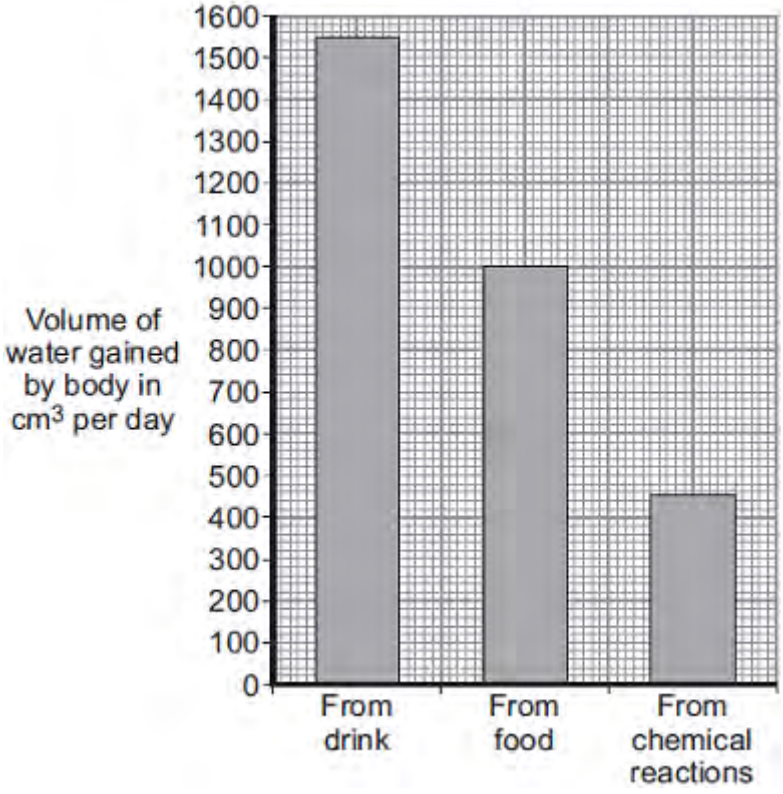
(iii) produces urea .....
**(1)**

(iv) gets rid of carbon dioxide .....
**(1)**

(v) helps to control body temperature? .....
**(1)**

(b) **Bar chart 1** shows the volume of water the human body gains each day.

**Bar chart 1**




Source of water gained by body

(i) Calculate the total volume of water the body gains each day.

.....

.....

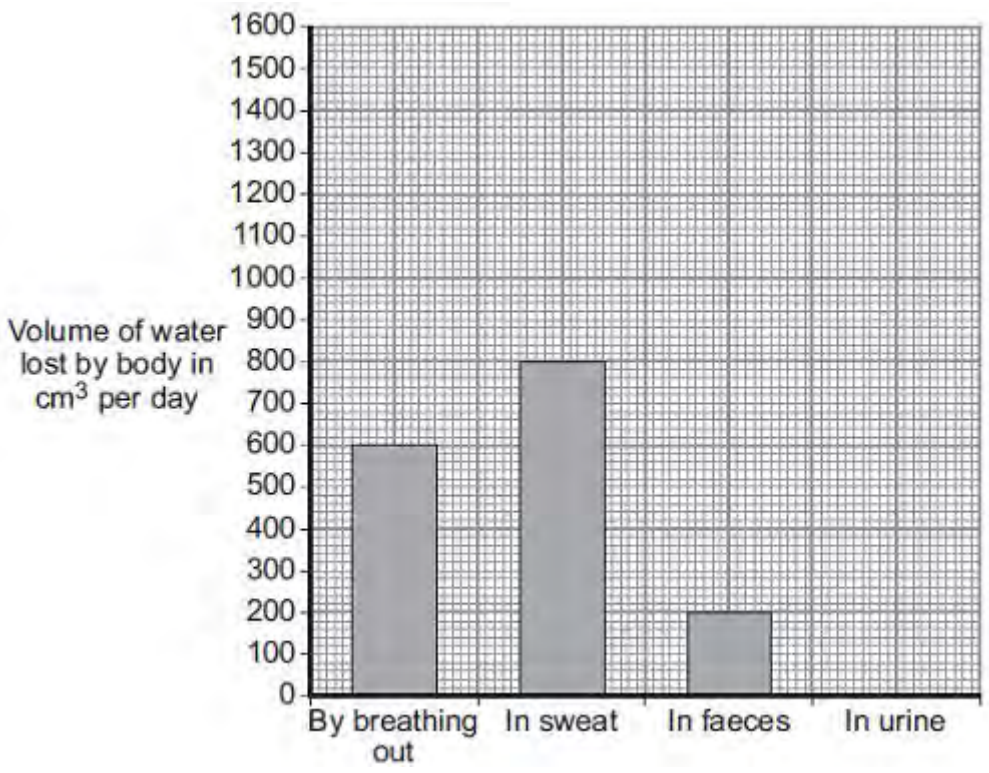
.....

Total volume of water gained = ..... $cm^3$

**(2)**

**Bar chart 2** shows the volume of water lost each day by breathing out, in sweat and in faeces.

**Bar chart 2**




Water lost by body

(ii) Calculate the total volume of water lost each day by breathing out, in sweat and in faeces.

.....

.....

Volume = ..... $cm^3$

**(1)**

(iii) The volume of water the body loses must balance the volume of water he body gains.

Use your answers to part (b)(i) and part (b)(ii) to calculate the volume of water lost in urine.

.....

.....

Volume of water lost in urine = ..... $cm_3$

**(1)**

(iv) Plot your answer to part (b)(iii) on **Bar chart 2**.

**(1)**

(v) After taking some types of recreational drugs, the kidneys produce very little urine.

What happens to the body cells if the kidneys produce very little urine?

.....

.....

**(1)**

**(Total 11 marks)**

**Q4.** 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 injec ing insulin, give **one** other way in which Type 1 diabetes can be controlled.

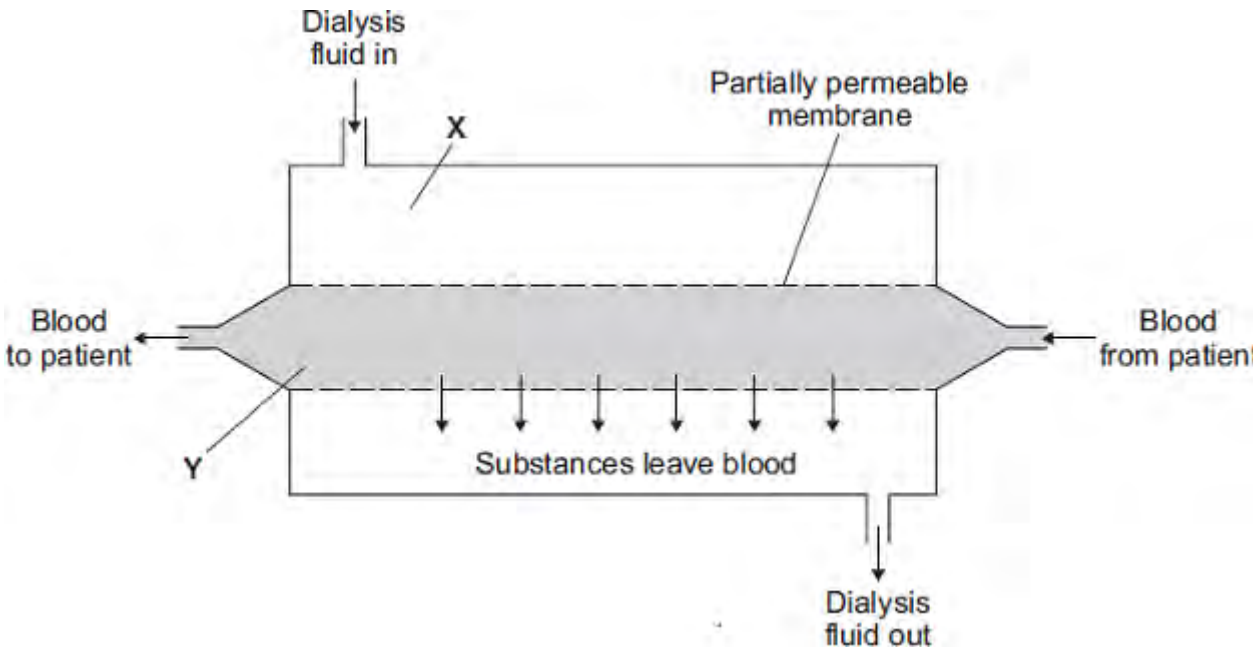
.....

**(1)**

**(Total 6 marks)**

**Q5.**People with kidney disease may be treated by dialysis.

The diagram shows a dialysis machine.




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

A person loses mass during dialysis. One patient lost 2.2 kilograms during a dialysis session.

(i) This person lost mass mainly because

| |
|---|
| salt |
| urea |
| water |

was removed from the blood.

**(1)**

(ii) This substance was able to pass through the partially permeable membranes

because its molecules are

| |
|---|
| large. |
| round. |
| small. |

**(1)**

(iii) The concentration of sodium ions at **X** is 3.15 grams per $dm_3$.

At the end of a dialysis session, the most likely concentration of sodium ions

at **Y** would be

| |
|---|
| 0.00 |
| 3.15 |
| 6.30 |

grams per $dm_3$.

**(1)**

(b) The table shows the cost, in the UK, of treating one patient who has kidney disease.

| **Treatment** | **Cost per year in pounds** |
|---|---|
| Dialysis | 30 000 |
| Kidney transplant: | |
| operation + first year's medical care | 51 000 |
| medical care in each further year | 5 000 |

(i) During the first year, dialysis treatment is cheaper than a kidney transplant.

How much cheaper is the dialysis treatment? ..... pounds

**(1)**

(ii) After some time, the cost of treating a patient by a transplant operation would be cheaper than continual treatment by dialysis.

How many years would it take?

Draw a ring around **one** answer.

**2 years** **3 years** **4 years**

**(1)**

(iii) A transplant pa ient needs to take drugs for the rest of his life to suppress the immune system.

Why is it necessary to suppress the immune system ?

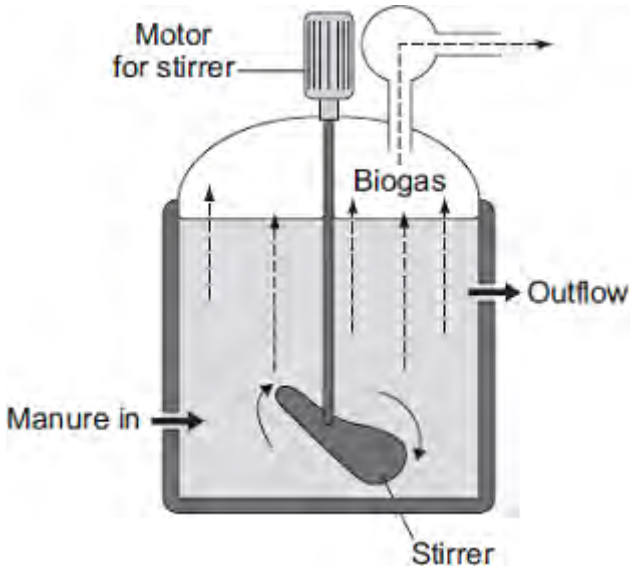
.....

.....

**(1)**

**(Total 6 marks)**

**Q6.** The diagram shows one type of biogas generator.




(a) With his type of biogas generator, the concentration of solids that are fed into the reactor must be kept very low.

Suggest **one** reason for this.

Tick (✓) **one** box.

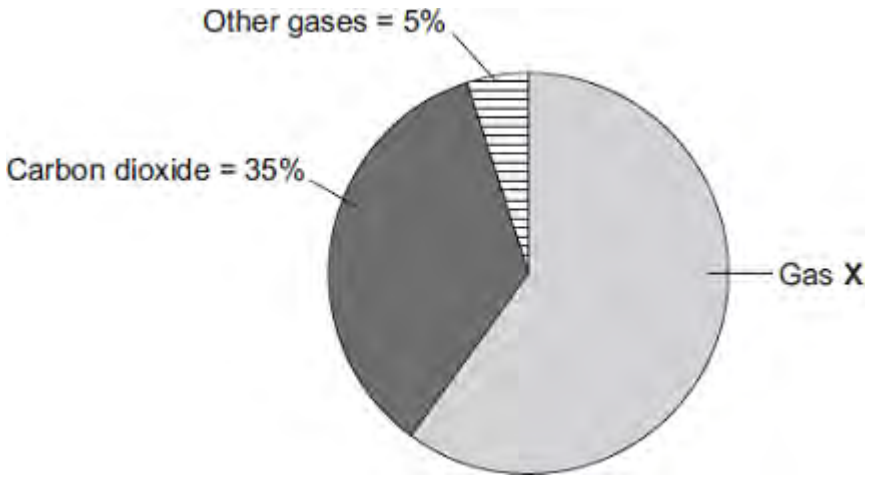
A higher concentration contains too little oxygen. ☐

A higher concentration would be difficult to stir. ☐

A higher concentration contains too much carbon dioxide. ☐

**(1)**

(b) The pie chart shows the percentages of the different gases found in the biogas.




Gas **X** is the main fuel gas found in the biogas.

(i) What is he name of gas **X**?

Draw a ring around **one** answer.

**methane** **nitrogen** **oxygen**

**(1)**

(ii) What is the percentage of gas **X** in the biogas?

Show clearly how you work out your answer.

.....

.....

Percentage of gas **X** = .....

**(2)**

(c) If the biogas generator is not airtight, the biogas contains a much higher percentage of carbon dioxide.

Draw a ring around **one** answer in each part of this question.

(i) The air that leaks in will increase the rate of

aerobic respiration.

anaerobic respiration.

fermentation.

**(1)**

(ii) The process in part (c)(i) occurs because the air contains

ammonia.

nitrogen.

oxygen.

**(1)**

**(Total 6 marks)**

**Q7.** 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**

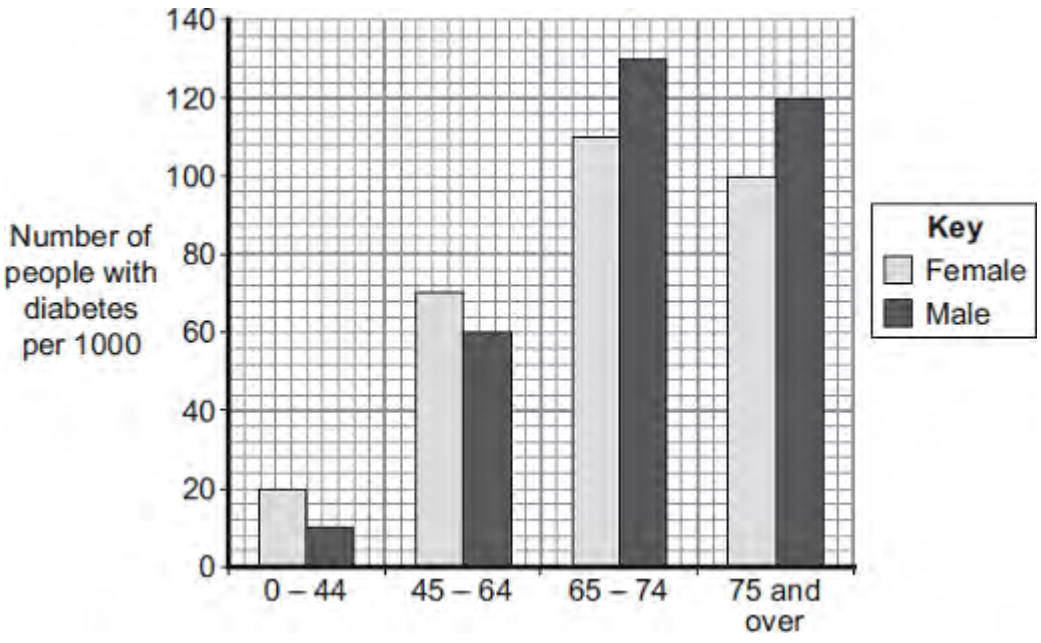
**(1)**

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

.....

**(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 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.

.....

.....

.....

**(2)**

**(Total 8 marks)**

**Q8.**Human body temperature must be kept within narrow limits.

The image shows a cyclist in a race.

© Ljupco/iStock/Thinkstock

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

| | | | | |
|---|---|---|---|---|
| **blood** | **brain** | **kidney** | **sweat** | **urine** |

The cyclist's body temperature is monitored by a centre in the ..... .

This centre is sensitive to the temperature of the cyclist's ..... .

If the cyclist's body temperature increases, his body increases

the production of ..... .

**(3)**

(b) (i) Cyclists drink sports drinks after a race.

The table below shows the ratio of glucose to ions in three sports drinks, **A**, **B** and **C**.

| | **Sports drink** | | |
|---|---|---|---|
| | **A** | **B** | **C** |
| **Ratio of glucose (g per dm3) to ions (mg per $dm_3$)** | 15:14 | 12:1 | 2:7 |

The closer this ra io of glucose to ions is to 1:1 in a sports drink, the faster the body replaces water.

Which sports drink, **A**, **B** or **C**, would replace water fastest in an athlete? ☐

**(1)**

(ii) Why should sports drinks contain ions?

.....

.....

**(1)**

(iii) Why should a person with diabetes **not** drink too much sports drink?

.....

.....

**(1)**

**(Total 6 marks)**

**M1.**(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]**

**M2.** (a) Y - spinal cord / central nervous system / CNS

*do **not** accept spine*

*ignore nerve / nervous system / coordinator*

*ignore grey / white matter*

**1**

W - receptor / nerve ending

*ignore sensory / neurone / stimulus*

**1**

X - effector / muscle

*allow gland*

**1**

(b) any **two** from: eg

*accept reverse argument for each marking point*

- reflex action quicker
- effect of reflex action over shorter period
- hormone involves blood system and reflex involves neurones / nerve cells

  *ignore nervous system / nerves*
- reflex involves impulses and hormone involves chemicals
- reflex action affects only one part of the body

  *ignore involves brain*

  *ignore outside / inside stimuli*

**2**

**[5]**

**M3.** (a) B

**1**

less / no insulin (produced) **or** insulin produced in pancreas

*allow pancreas can't monitor (blood) sugar (level)*

*ignore pancreas can't control (blood) sugar (level)*

*allow increased glucagon production*

*allow A as liver stores less glucose / sugar for **2** marks only*

**1**

(b) (i) (it / protein / insulin) digested / broken down

*if ref to specific enzyme must be correct (protease / pepsin)*

*ignore denatured*

*do **not** accept digested in mouth / other incorrect organs*

**1**

(ii) any **two** from:

*ignore injections*

- (attention to) diet

  *accept examples, eg eat less sugar(y food) **or** eat small regular meals*

  *allow eat less carbohydrate / control diet*

  *ignore cholesterol or balanced / healthy diet*

- exercise

  *ignore keep fit / healthy*

- (pancreas) transplant / stem cells / genetic engineering

**2**

**[5]**

**M4.** (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 actionapply list principleignore 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]**

**M5.** (a) (i) the lower the temperature the shorter the time

*a trend is required*

*accept reverse*

**or**

the lower the temperature the more chance of frostbite

*accept the lower the temperature the faster you get frostbite*

*accept positive correlation but **not** directly proportional*

*ignore wind speed*

**1**

(ii) any value from 5 to below 10

*do **not** accept 10*

*allow less than 10 **or** < 10*

**1**

(b) Muscles 'shiver'

*if more than two boxes ticked deduct **1** mark for each additional tick*

**1**

Blood vessels supplying the skin capillaries constrict

**1**

**[4]**

**M6.** (a) (i) **A** – pituitary

*allow hypothalamus*

**1**

**B** – ovary / ovaries

**1**

(ii) in blood (stream)

*accept in plasma*

*ignore dissolved*

**1**

(b) (i) FSH and Luteinising Hormone (LH)

**1**

(ii) fertilised
OR
reference to sperm

**1**

form embryos / ball of cells or cell division

**1**

(embryo) inserted into mother's womb / uterus

*allow (fertilised egg) is inserted into mother's womb / uterus*

**1**

(iii) any **one** from:

- multiple births lead to low birth weight
- multiple births cause possible harm to mother / fetus / embryo / baby / miscarriages

*allow premature*

*ignore reference to cost / ethics / population*

**1**

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

- almost identical
  *allow S (slightly) more successful*
- both approximately 20%

**1**

(ii) larger numbers (in clinic R) (in 2007)
*allow only 98 (in S) (compared to 1004 (in R))*

**1**

results likely to be more repeatable (in 2008)
*allow more reliable*
*do **not** accept more reproducible / accurate / precise*

**1**

**[11]**

**M7.** (a) (i) without <u>oxygen</u>

*ignore reference to 'air'*

**1**

(ii) otherwise difficult to stir / to pump / to transfer

*allow prevent 'clogging' owtte*

**1**

(iii) need to stir / pump / heat

**1**

(b) (i) rises then falls

**1**

then levels / slight rise

**1**

quantitative descriptor
- e.g. to 80% / max. on day 4 / min. on day 16

*accept other valid quantitative descriptor*

*allow accuracy ± ½ small square*

**1**

(ii) 16 (15.5 to 16.4)

**1**

(c) any **two** from:

- oxygen present
- ($CO_2$ produced) by <u>aerobic</u> respiration

  **or** not much anaerobic respiration
- **not** much methane / $CH_4$ produced

2

**[9]**

**M8.**(a) microorganisms

*allow microbes / bacteria / fungi / decomposers*

1

(microorganisms) respire

*do **not** allow dead plants respire*

1

(respiration / decay / microorganisms) releases (thermal) energy / 'heat'

*ignore produce 'heat'*

*do **not** allow produce energy*

*do **not** allow dead plants release 'heat'*

1

(b) (i) any **three** from:

- (opening) allows oxygen in
- microorganisms / eggs need oxygen

  *allow air for oxygen*
- oxygen needed for respiration
- (opening) allows release of carbon dioxide (from microorganisms / respiration / eggs)

  *allow gaseous exchange (1 mark) of / for microorganisms / eggs (1 mark) if none of first four points given*
- (opening) allows energy / 'heat' to escape
- (closing) retains energy / 'heat' if too cool / at night

  *if no mark awarded for either of these points allow 1 mark for vents open in the day to prevent overheating **and** close at night to prevent it getting too cold*
- (closing) retains moisture

  *allow (opening) releases moisture*

3

(ii) any **one** from:

- maintains sex balance

  *e.g. equal / best / correct numbers of male and female*
- (survival of species depends on there being) males and females in population

*allow so the offspring are not all the same sex*

1

**[7]**

**M9.** 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 apply a 'best-fit' approach to the marking.

**0 marks**
No relevant content.

**Level 1 (1 – 2 marks)**
There is a description of thermoregulation **or** at least one correct mechanism (skin, sweat glands or muscles) but roles may be confused.

**Level 2 (3 – 4 marks)**
There is a description of thermoregulation **or** some correct mechanisms (sweating, shivering, blood flow in the skin).

**Level 3 (5 – 6 marks)**
There is a clear description of thermoregulation by TC or skin **and** some correct control mechanisms.

**examples of biology points made in the response:**

*full marks may be awarded for detailed description of what happens if the core temperature is <u>either</u> too high <u>or</u> too low*

- temperature receptors in TC
- the TC detects (core) body / blood temperature
- temperature receptors in the skin send impulses to the TC, giving information about skin temperature
- if the core body temperature is too high: blood vessels / arterioles supplying the skin capillaries dilate / vasodilation

  ***do not** accept refs to veins instead of arterioles or answers that imply blood vessels have moved up / down through the skin.*

- so that more blood flows (through the skin) and more heat is lost
- sweat glands release more sweat to cool the body
- by evaporation
- if the core body temperature is too low: blood vessels supplying the skin capillaries constrict
- to reduce the flow of blood (through the skin) and less heat is lost

  *allow idea of blood diverted to vital organs in extreme cold*
- muscles may shiver to release (heat) energy

- from respiration, some of which is lost as heat

**[6]**

**Q1.** 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 ..... | ..... <br> ..... |
| 2 ..... | ..... <br> ..... |

**(4)**

(ii) Some effectors help to control body temperature.

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

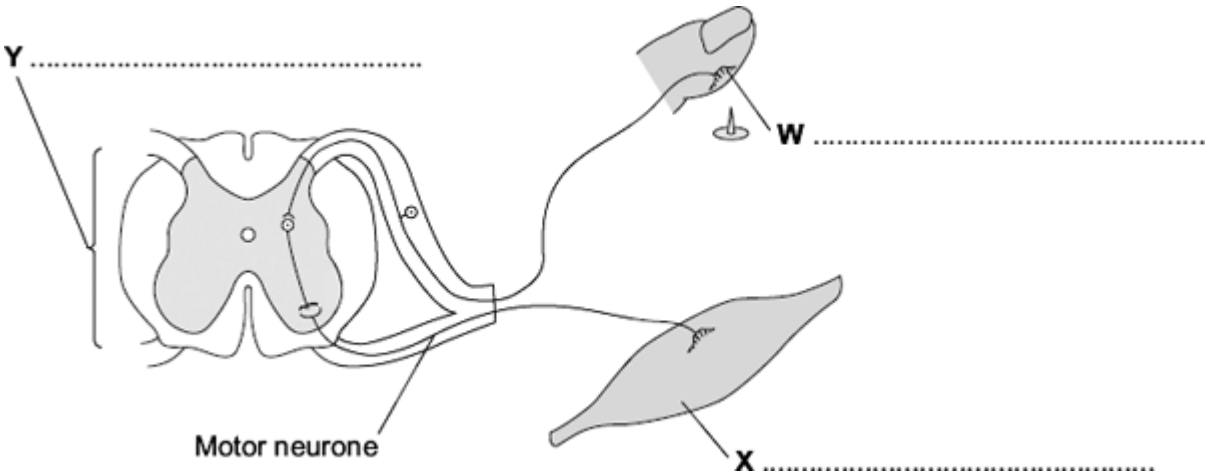
.....

.....

**(1)**

**(Total 7 marks)**

**Q2.** The diagram shows the structures involved in a reflex action.




(a) On the diagram, name the structures labelled **W**, **X** and **Y**.

**(3)**

(b) The control of blood sugar level is an example of an action controlled by hormones.

Give **two** ways in which a reflex action is different from an action controlled by hormones.

1 .....

.....

.....

2 .....

.....

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**(2)**
**(Total 5 marks)**

**Q3.** Diabetes is a disease in which a person's blood glucose concentration may rise.

Doctors give people drugs to treat diabetes.

The table shows some of the side effects on the body of four drugs, **A, B, C** and **insulin,** used to treat diabetes.

| Drug | Side effects on the body |
|---|---|
| **A** | Weight loss<br>Liver, kidney and heart damage<br>Feeling of sickness |
| **B** | Weight gain<br>Damage to some cells in pancreas |
| **C** | More water is kept in the body<br>Weight gain<br>ncreased chance of bone breakage in women |
| **Insulin** | A little more water is kept in the body<br>Weight gain<br>ncreased risk of lung damage |

(a) Which drug, **A, B, C** or **insulin,** is most likely to result in an increase in blood sugar concentration in some people?

Explain your answer.

Drug .....

Explanation

.....

.....

**(2)**

(b) (i) Drugs **A, B and C** can be taken as tablets.

The chemicals in the tablets are absorbed into the blood from the digestive system.

Insulin is a protein.

Insulin **cannot** be taken as a tablet.

Why?

.....

**(1)**

(ii) Other than using drugs, give **two** methods of treating diabetes.

1 .....

2 .....

**(2)**

**(Total 5 marks)**

**Q4.** 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.

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**(3)**

**(Total 6 marks)**

**Q5.** A group of students is going on an outdoor expedition.
The students need to keep warm in windy conditions.

The table shows the effect of wind speed on how quickly someone gets frostbite at different air temperatures.

| Wind speed in metres per second | Air temperature in °C | | | | |
|---|---|---|---|---|---|
| | **10** | **0** | **–10** | **–20** | **–30** |
| **0** | | | | | |
| **5** | | | | | |
| **10** | | | | | |
| **15** | | | | | |
| **20** | | | | | |

**Key**

Time taken to get frostbite:

- No frostbite
- 30 minutes
- 10 minutes
- 5 minutes

(a) (i) Describe the effect of changing air temperature on the time taken to get frostbite.

.....

.....

**(1)**

(ii) What is the longest time it is safe to stay outside when the air temperature is –20 °C and the wind speed is 10 metres per second?

..... minutes

**(1)**

(b) When core body temperature begins to fall, changes may happen in the body.

Which **two** changes will happen when core body temperature begins to fall?

Tick (✓) **two** boxes.

More blood flows through skin capillaries ☐

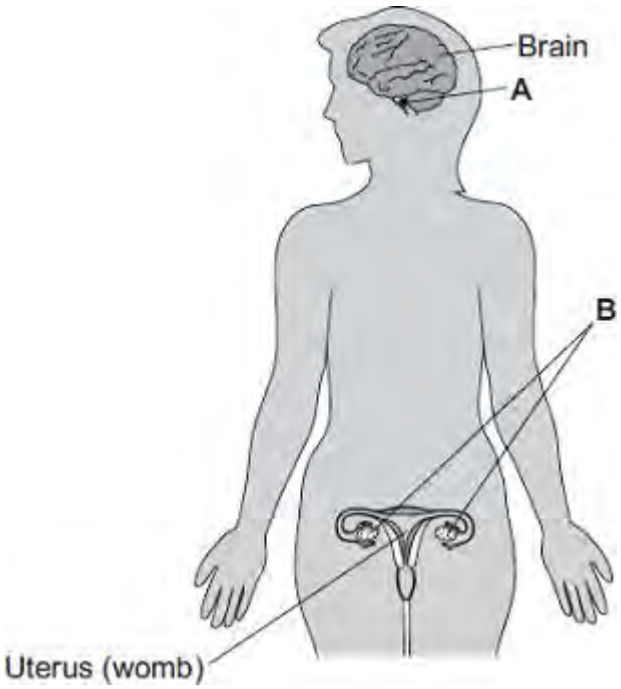
Muscles 'shiver' ☐

Blood vessels supplying the skin capillaries constrict ☐

Sweat glands release more sweat ☐

**(2)**
**(Total 4 marks)**

**Q6.** The diagram shows the position of two glands, **A** and **B**, in a woman.




(a) (i) Name glands **A** and **B**.

**A** .....

**B** .....

**(2)**

(ii) Gland **A** produces the hormone Follicle Stimulating Hormone (FSH).

FSH controls changes in gland **B**.

How does FSH move from gland **A** to gland **B**?

.....

**(1)**

(b) (i) A woman is not able to become pregnant. The woman does not produce mature eggs. The woman decides to have In Vitro Fertilisation (IVF) treatment.

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

Tick (✓) **one** box.

FSH and Luteinising Hormone (LH) ☐

FSH and oestrogen ☐

Luteinising Hormone (LH) and oestrogen ☐

**(1)**

(ii) Giving these hormones to the woman helps her to produce several mature eggs.
Doctors collect the mature eggs from the woman in an operation.

Describe how the mature eggs are used in IVF treatment so that the woman may become pregnant.

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**(3)**

(iii) IVF clinics have been set a target to reduce multiple births.

| |
|---|
| At least 76% of IVF treatments should result in single babies and a maximum of 24% of treatments should result in multiple births. |

Suggest **one** reason why the clinics have been set this target to reduce multiple births.

.....

.....

**(1)**

(c) Two clinics, **R** and **S**, used IVF treatment on women in 2007. Doctors at each clinic used the results of the treatments to predict the success rate of treatments in 2008.

The table shows the information.

| | **Total number of IVF treatments in 2007** | **Number of IVF treatments resulting in pregnancy in 2007** | **Predicted percentage success rate in 2008** |
|---|---|---|---|
| Clinic **R** | 1004 | 200 | 18–23 |
| Clinic **S** | 98 | 20 | 3–56 |

(i) Compare the success rates of the two clinics in 2007.

.....

.....

**(1)**

(ii) The range of the predicted success rate in 2008 for clinic **R** is much smaller than the range of the predicted success rate for clinic **S**.

Suggest why.

.....

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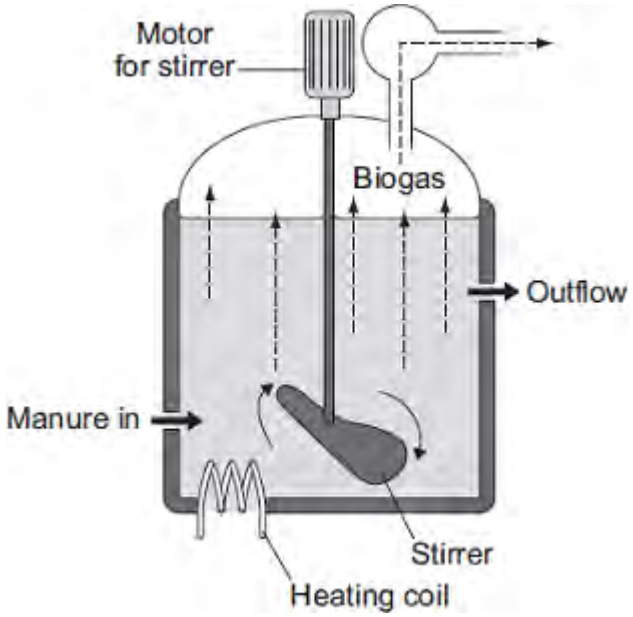
**(2)**

**(Total 11 marks)**

**Q7.** The diagram shows one type of *anaerobic* digester. The digester is used to produce biogas.




(a) (i) What does *anaerobic* mean?

.....

.....

**(1)**

(ii) The concentration of solids that are fed into this digester must be kept very low.

Suggest **one** reason why.

.....

.....

**(1)**

(iii) This digester is more expensive to run than some other simpler designs of biogas generator.

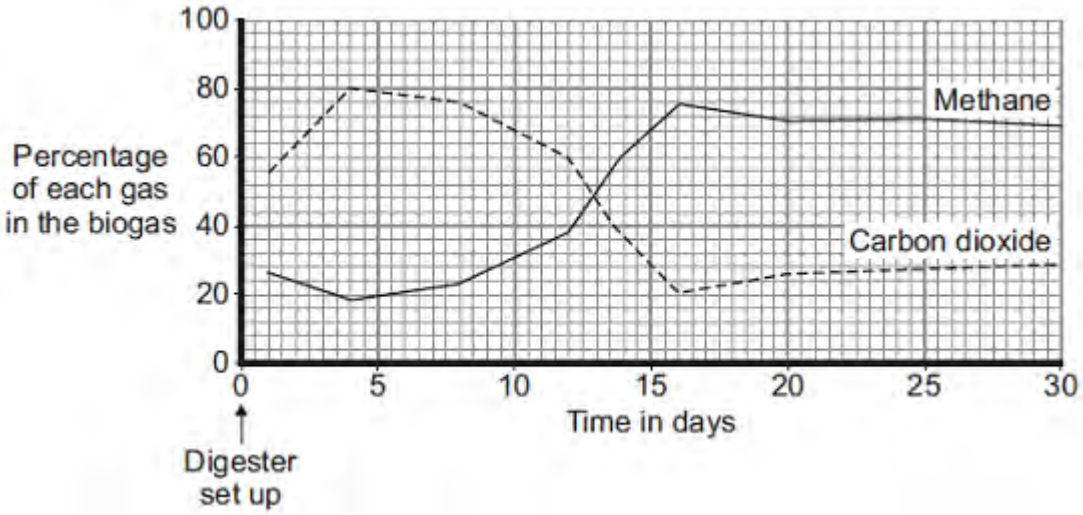
Suggest **one** reason why.

.....

.....

**(1)**

(b) The graph shows how the composition of the biogas produced by the digester changed over the first 30 days after the digester was set up.




Use information from the graph to answer the following questions.

(i) Describe how the percentage of carbon dioxide changed over the 30 days.

.....

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**(3)**

(ii) On which day was the best quality biogas produced? .....

**(1)**

(c) Four days after the digester was first set up, the biogas contained a high percentage of carbon dioxide.

Suggest an explanation for this.

.....

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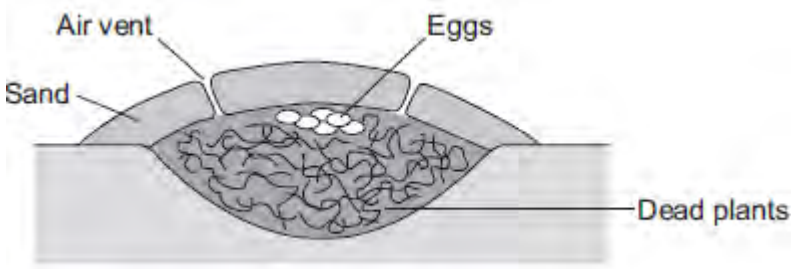
**(2)**
**(Total 9 marks)**

**Q8.** Most birds sit on their eggs to keep them warm until they hatch.

Megapode birds:

- dig a large hole in sand
- fill the hole with dead plants
- lay their eggs on top of the dead plants
- cover the surface with a thick layer of sand.

The image below shows a megapode bird's nest.




(a) The dead plants in the nest decay. The decaying process helps to keep the eggs warm for many weeks.

Suggest how.

.....

.....

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.....

.....

**(3)**

(b) (i) Megapode birds open and close the air vents of the nest at different times of

the day.

Suggest reasons why it is necessary to open and close the air vents.

.....

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.....

.....

**(3)**

(ii) The sex of a megapode bird that hatches from an egg depends on the temperature at which the egg was kept.

Use this information to suggest why it is important for megapode birds to control the temperature of their nests.

.....

.....

**(1)**
**(Total 7 marks)**

**Q9.In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

The human body is kept at a constant internal temperature of about 37 °C.

Body temperature is monitored and controlled by the thermoregulatory centre in the brain.

Describe what happens in the body to keep the body temperature constant.

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Extra space .....

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**(Total 6 marks)**

**M1.** (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 <u>absorbed</u> 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 <u>made</u> / <u>produced</u> 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]**

**M2.** (a) in rainforest:

*accept converse*

(water from) sweat does not evaporate (as much)

*max **1** if not clear whether desert or rainforest*

**1**

any **one** from:

- (due to) less wind / higher moisture / humidity
- less cooling effect

*ignore references to temperature*

**1**

(b) blood vessels supplying capillaries dilate / widen **or** vasodilation

*do **not** award mark if candidate refers only to blood vessels dilating **or** to capillaries dilating.*

*accept 'arteries' or 'arterioles' for 'blood vessels supplying, capillaries' but do **not** accept 'veins'.*

*ignore expand / get bigger / relax / open*

*do **not** accept idea of blood vessels moving*

**1**

more blood (through skin / surface capillaries) leads to greater <u>heat loss</u>

**1**

**[4]**

**M3.** (a) proteins are not filtered

**1**

glucose is filtered and (re)absorbed

*allow glucose (completely) <u>re</u>absorbed*

**1**

ions are filtered and some (re)absorbed

*allow some ions are <u>re</u>absorbed*

**1**

urea is filtered [and some / none (re)absorbed]

*allow some / no urea is <u>re</u>absorbed*

**1**

(b) <u>more / a lot of</u> sweating occurred

*accept converse arguments for cold day*

**1**

<u>more / a lot of</u> water loss (by sweating)

**1**

<u>more / a lot of</u> water reabsorption / <u>more</u> water absorption by the kidney

**1**

lower volume of urine

*allow less urine / less water in urine*

**1**

**[8]**

**M4.** (a) 0.18

*award both marks for correct answer irrespective of working*
*if no answer or incorrect answer*
*allow **1** mark for 45 × 100 / 25000*

**2**

(b) heat / thermal

*allow heat <u>from</u> respiration*

**1**

(c) energy / mass / biomass lost / not passed on **or** energy / mass / biomass is used **or** not enough energy / mass / biomass left

*ignore reference to losses via eg respiration / excretion / movement / heat*

**1**

a sensible / appropriate use of figures including heron

*eg <u>only</u> **2** from frog / to heron*
*ignore units*

**1**

(d) any **three** from:

*accept marking points if candidate uses other terms for microorganisms*

- (microorganisms) decay / decompose / digest / breakdown / rot
  *ignore eat*
- (breakdown) releases minerals / nutrients / ions / salts / named
  *ignore food*
- (microorganisms) respiration
  *ignore other organisms respiring*
- (microorganisms / respiration) release of carbon dioxide

**3**

**[8]**

**M5.** (a) (i) 1 hour 15 mins / 1.25 hours / 75 mins

*allow 1:15*

*ignore 1.15 hours*

**1**

(ii) increase in (core / body) temperature

*ignore numbers*

**1**

(due to an) increase in <u>respiration</u> **or** more <u>muscle</u> contraction

**1**

releasing energy (as a waste product)

*allow produces 'heat'*

*do **not** allow making energy*

**1**

skin temperature decreases

**1**

(because there is) sweating

**1**

(which) evaporates and cools the skin

*ignore references to vasodilation or vasoconstriction*

**1**

(iii) (there is) dilation of vessels (supplying skin capillaries)

*allow vasodilation*

*allow blood vessels widen*

*ignore expand*

*do **not** accept dilating capillaries or moving vessels*

**1**

(so) more blood flows (near skin) (surface) **or** blood is closer (to the skin)

*ignore ref to heat*

**1**

(c) pancreas detects (low) blood glucose

**1**

produces glucagon

*do **not** allow glucagon made in the liver*

**1**

(so) glycogen is converted to glucose

*allow adrenaline released which increases conversion of glycogen to glucose*

***or***

*reduced insulin production so less glucose into cells / less glucose converted to glycogen*

*for 1 mark*

**1**

**[12]**

**M6.**(a) if body temperature too high blood vessels supplying skin (capillaries) dilate / widen

*do **not** accept capillaries / veins dilate/constrict*

**1**

if body temperature is too low blood vessels supplying skin (capillaries) constrict / narrow

*do **not** accept idea of blood vessels moving (through skin)*

**1**

*ignore expand*

*accept arteries / arterioles for 'blood vessels'*

*if no reference to skin allow blood vessels dilate and blood vessels constrict for one mark*

so more / less blood flows through skin (capillaries) or near<u>er</u> the surface of the skin

*must correctly relate to dilation or constriction*

**1**

so more / less heat is lost (from the skin by radiation)

*must correctly relate to dilation or constriction*

**1**

(b) sweat <u>released</u>

**1**

cannot evaporate because of high humidity / all the water vapour in the air

**1**

so less heat lost / less cooling

**or**

it is evaporation of sweat that cools the body

**1**

**[7]**

**M7.**(a) Pancreas

*allow phonetic spelling*

**1**

(b) any **three** from:

***max 2*** *if any one process goes on in wrong organ*

- (amino acids) broken down
- (amino acids) form urea
- (amino acids broken down / converted **or** urea formed) in liver
- (urea / broken down amino acids) removed / filtered by kidney
  *do **not** allow amino acids filtered / removed by kidney*
- (urine / urea / broken down amino acids) stored / held in bladder
  *do **not** allow amino acids stored / held in bladder*

**3**

**[4]**

**M8.** (a) (i) **A**

**1**

(ii) (protein) molecule is large
*ignore letters*

**1**

cannot pass through filter
*(protein is) too big to get through the filter = 2 marks*

**1**

(b) **B** is taken back into the blood **or**
**B** is reabsorbed

**1**

reabsorbed completely

**or** reabsorbed after filtration

**1**

(c) RBC is too big to pass through filter

**1**

Haemoglobin is inside red blood cells
**or** haemoglobin released when RBC bursts

**1**

Haemoglobin is small enough to pass through filter

**or** haemoglobin diameter

**1**

**[8]**

**Q1.** The pancreas and the liver are both involved in the control of the concentration of glucose in the blood.

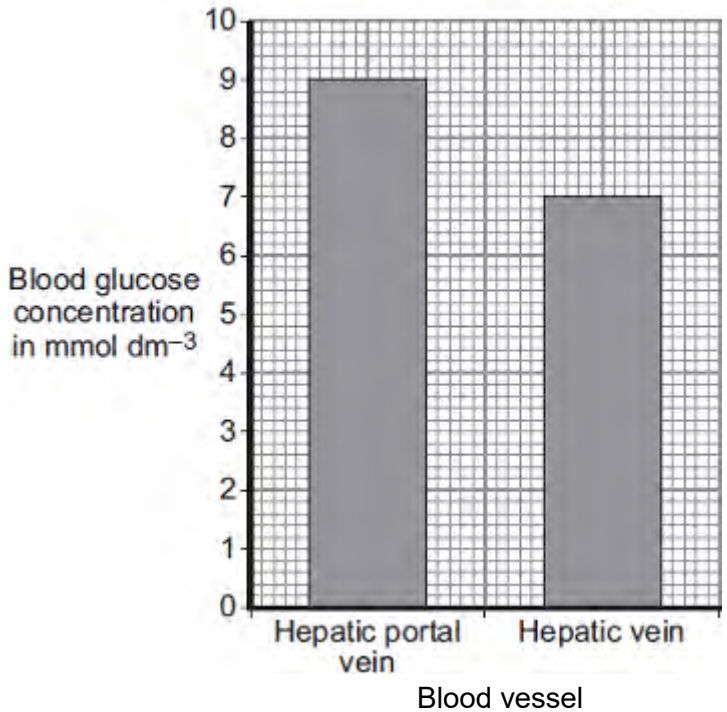
The liver has two veins:

- 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.

**Graph 1**




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

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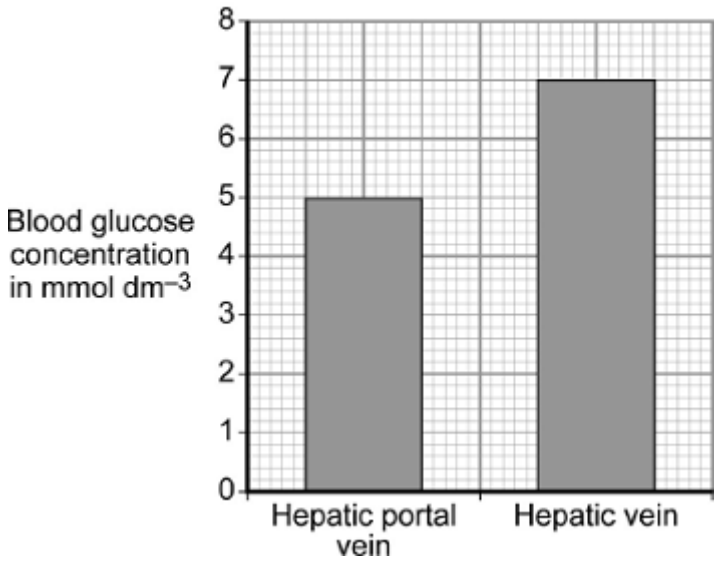
.....

.....

**(3)**

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

**Graph 2**




(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.

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**(3)**
**(Total 7 marks)**

**Q2.** One group of scientists is working in a hot desert and another group is working in a tropical rainforest.

The table shows information about the scientists and the conditions in the desert and the rainforest.

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

(a) Both groups of scientists are doing similar jobs. The jobs cause the scientists to sweat a lot.

Use information from the table to explain the difference in the mean core body temperature of the two groups of scientists.

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.....

.....

**(2)**

(b) Changes to blood vessels in the skin help to decrease body temperature.

Explain how.

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**(2)**
**(Total 4 marks)**

**Q3.** Use your knowledge of how the kidney works to answer the following questions.

(a) Blood plasma contains mineral ions, glucose, urea and proteins.

Explain why urine contains mineral ions and urea, but **no** glucose or protein.

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.....

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.....

.....

**(4)**

(b) A man ate and drank the same amounts of the same substances and he did the same amount of exercise on two different days. On one of the two days the weather was hot and on the other day the weather was cold.

The man's urine contained a higher concentration of mineral ions and urea on the hot day than on the cold day.

Explain why.

.....

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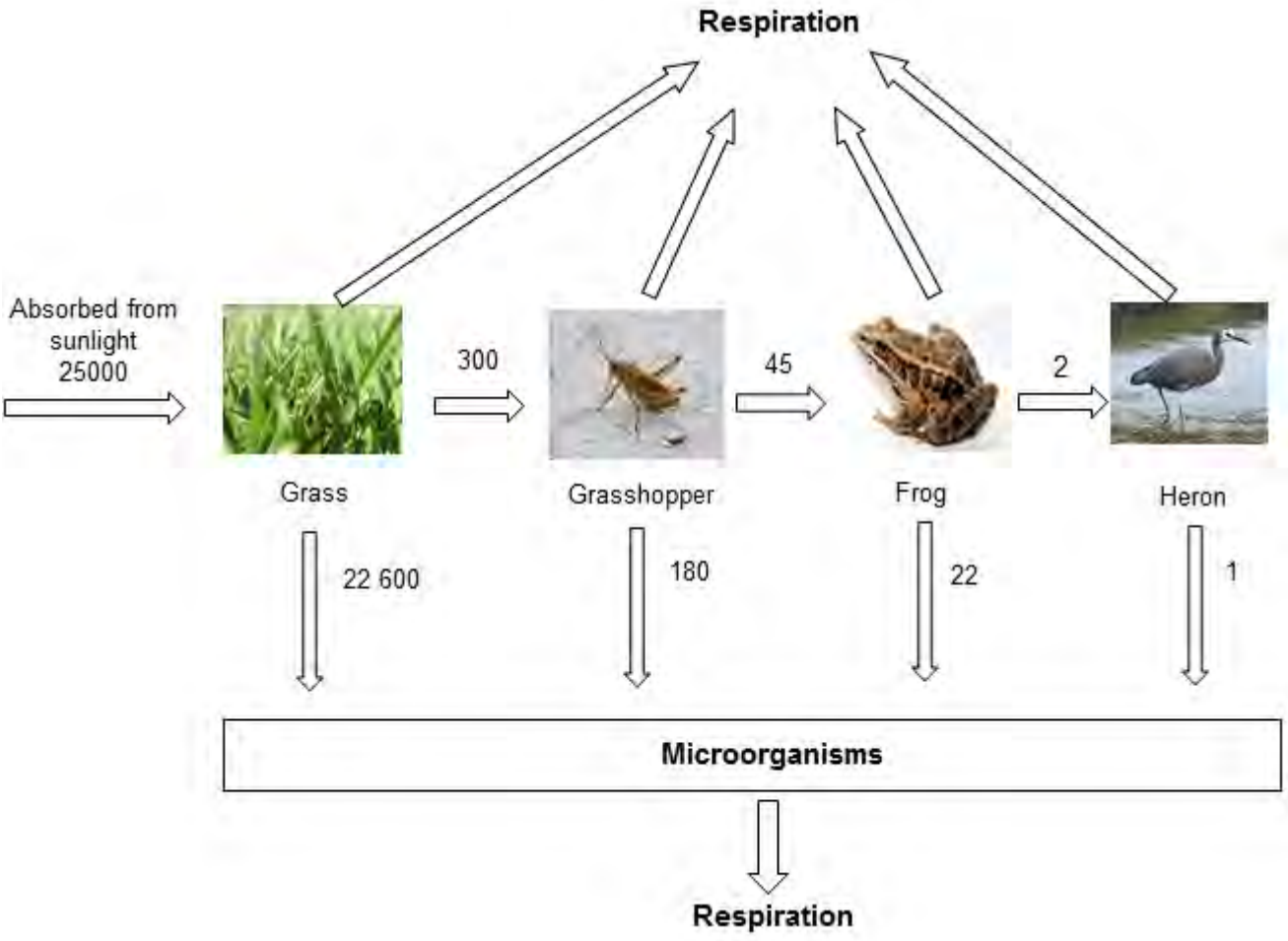
**(4)**

**(Total 8 marks**

**Q4.** The diagram shows the annual energy flow through 1 $m^2$ of a habitat.

The unit, in each case, is kJ per $m^2$ per year.




(a) Calculate the percentage of the energy absorbed by the grass from sunlight that is transferred to the frog.

Show clearly how you work out your answer.

.....

.....

Answer ..... %

**(2)**

(b) All of the energy the grass absorbs from the sun is eventually lost to the surroundings.

In what form is this energy lost?

.....

**(1)**

(c) Food chains are usually **not** more than five organisms long.

Explain why.

To gain full marks you must use data from the diagram.

.....

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.....

.....

**(2)**

(d) In this habitat microorganisms help to recycle materials.

Explain how.

.....

.....

.....

.....

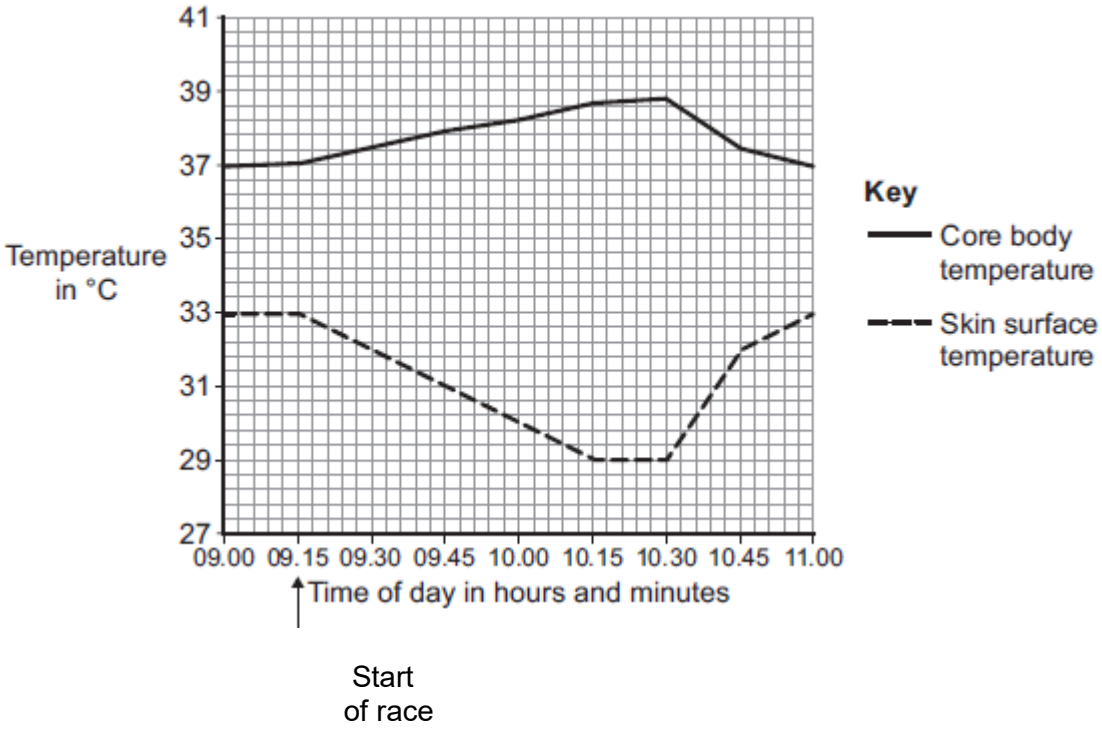
.....

.....

**(3)**
**(Total 8 marks)**

Grass by By Catarina Carvalho from Lisboa, Portugal (Flickr) [CC-BY-2.0], via Wikimedia Commons. Grasshopper by I, Daniel Schwen [GFDL, CC-BY-SA-3.0], via Wikimedia Commons. Frog by Brian Gratwicke (Pickerel Frog) [CC-BY-2.0], via Wikimedia Commons. Heron by Glen Fergus (Own work, Otago Peninsula, New Zealand) [CC-BY-SA-2.5], via W kimedia Commons.

**Q5.** The graph shows the core body temperature and the skin surface temperature of a cyclist before, during and after a race.




(a) (i) When the cyclist finished the race, his core body temperature started to decrease.

How long did the race last?

.....

**(1)**

(ii) Describe and explain the different patterns shown in the core body temperature and skin surface temperature between 09.15 and 10.15.

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**(6)**

(iii) After 10.30, the core body temperature decreased.

Explain how changes in the blood vessels supplying the skin caused the skin surface temperature to increase.

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**(2)**

(b) During the race, the cyclist's blood glucose concentration began to decrease.

Describe how the body responds when the blood glucose concentration begins to decrease.

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**(3)**
**(Total 12 marks)**

**Q6.**Humans maintain an almost constant body temperature.

(a) Describe the role of blood vessels in the control of body temperature.

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**(4)**

(b) An athlete can run a marathon in 2 hours 15 minutes on a dry day in outside temperatures up to 35 °C.

If the air is dry, his body will **not** overheat.

In humid conditions the same athlete can run the marathon in the same time. However, in humid conditions, if the outside temperature goes over 18 °C then his body **will** overheat.

Suggest an explanation for the athlete overheating in humid conditions.

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**(3)**
**(Total 7 marks)**

**Q7.**(a) Which organ in the body monitors the concentration of glucose (sugar) in the blood?

.....

**(1)**

(b) In a healthy person, insulin prevents high levels of glucose in the blood.
To make insulin, cells in the pancreas need amino acids.

Amino acids cannot be stored in the body.

Describe, as fully as you can, what happens to amino acids that cannot be stored in the body.

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**(3)**
**(Total 4 marks)**

**Q8.** Urine consists of water, ions and other substances such as urea.
Urine is formed in the kidney by filtering the blood.
The diameter of the pores in the filter is about 6 nanometres.

The table shows the diameters of the molecules of some of the substances in the blood.

| Substance | Diameter of molecule in nanometres |
|---|---|
| **A** | 10 to 20 |
| **B** | 1 |
| **C** | 0.6 |
| **D** | 0.5 |
| **E** | 0.2 |

Use information from the table and your own knowledge to answer the questions.

(a) (i) Which substance, **A**, **B**, **C**, **D** or **E**, is protein? ☐

**(1)**

(ii) Protein is **not** found in the urine of a healthy person.

Explain why.

.....

.....

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.....

**(2)**

(b) Substance **B** is **not** found in the urine of a healthy person.
Suggest an explanation for this.

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**(2)**

(c) Haemolytic anaemia is a disease in which some of the red blood cells burst open.

Small amounts of haemoglobin may be found in the urine of a person suffering from haemolytic anaemia.
The diameter of a haemoglobin molecule is 5.5 nanometres.

Haemoglobin is **not** found in the urine of a healthy person, but haemoglobin can be found in the urine of a person with haemolytic anaemia.

Explain why.

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.....

.....

.....

.....

.....

**(3)**
**(Total 8 marks)**

**M1.** (a) liver

**1**

(b) insulin

*do **not** accept glucagon*

**1**

(c) kidney

**1**

(d) to replace water / ions / salt

**1**

(that is) lost in sweat

**1**

**[5]**

**M2.** (a) (i) kidney

**1**

(ii) bladder

**1**

(iii) liver

**1**

(iv) lung(s)

**1**

(v) skin

**1**

(b) (i) 3000

*allow 2970 to 3030*

*correct answer gains **2** marks with or without working*

*if answer incorrect allow **1** mark for evidence of 1550 + 450 + 1000 (allow tolerance of + or – ½ square on each)*

**2**

(ii) 1600

*allow 1570 to 1630*

**1**

(iii) 1400

*allow (b)(i) – (b)(ii)*

**1**

(iv) correct plot from (b)(iii)

*tolerance ½ square ignore width*

**1**

(v) cells swell / overhydrated / damaged

*accept poisoned (by urea)*

1

**[11]**

**M3.** (a) (i) water

**1**

(ii) small

**1**

(iii) 3.15

**1**

(b) (i) 21 000

**1**

(ii) 2 years

**1**

(iii) prevent rejection

**1**

**[6]**

**M4.** (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]**

**M5.** (a) (i) skin

**1**

(ii) kidneys

*accept kidney*

**1**

(iii) lungs

*accept lung*

**1**

(b) (i) multiply temperature by number of students at that temperature and add them up

*allow (36.8 5) + (36.9 3) + (37.0 6) + (37.1 7) + (37.2 3)*

*allow 888*

**1**

divide by number of students

*allow divide by 24*

**1**

(ii) 10 / ten

**1**

(iii) so <u>enzymes</u> work (well)

*ignore death / overheating / hypothermia*

*allow body <u>reactions</u> work (well)*

**1**

**[7]**

**M6.**(a) brain

*in correct order only*

**1**

blood

**1**

sweat

**1**

(b) (i) A

**1**

(ii) to replace ions lost (in sweat)

*accept salts*

*allow named examples, eg. prevent cramps*

**1**

(iii) any **one** from:

- there is too much glucose / sugar in the sports drink
- they shouldn't have too much glucose / blood sugar
- it would cause their blood glucose / sugar to rise (too high)

**1**

**[6]**

**M7.** (a) (i) **B**

**1**

(ii) **D**

**1**

(iii) **C**

**1**

(b) (i) insulin

**1**

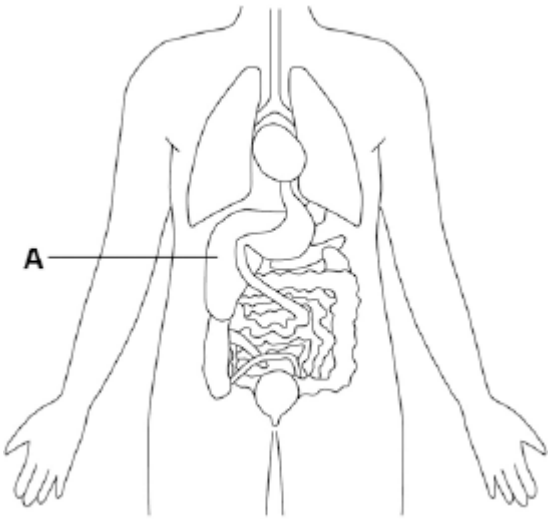
(ii) pancreas

**1**

**[5]**

**Q1.**Humans control their internal environment in many ways.

Look at the diagram below.




(a) Name organ **A**.

.....

**(1)**

(b) Organ **A** stores glucose.

People with Type 1 diabetes cannot effectively control the levels of glucose in their blood.

Name the **hormone** people with **Type 1 diabetes** have to inject to decrease their blood glucose level.

.....

**(1)**

(c) Which organ produces urine?

Tick **one** box.

Brain ☐

Lungs ☐

Kidney ☐

Thyroid ☐

**(1)**

(d) Marathon runners often drink sports drinks during a race.

Explain why.

.....

.....

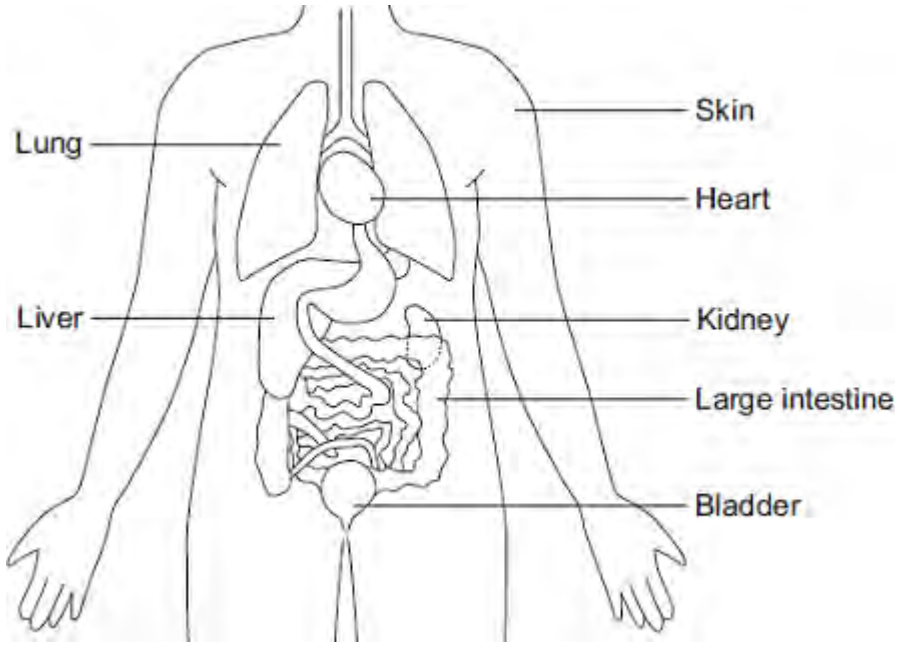
.....

.....

**(2)**

**(Total 5 marks)**

**Q2.**The diagram shows some of the organs of the human body.




(a) Which organ labelled on the diagram:

(i) produces urine .....
**(1)**

(ii) stores urine .....
**(1)**

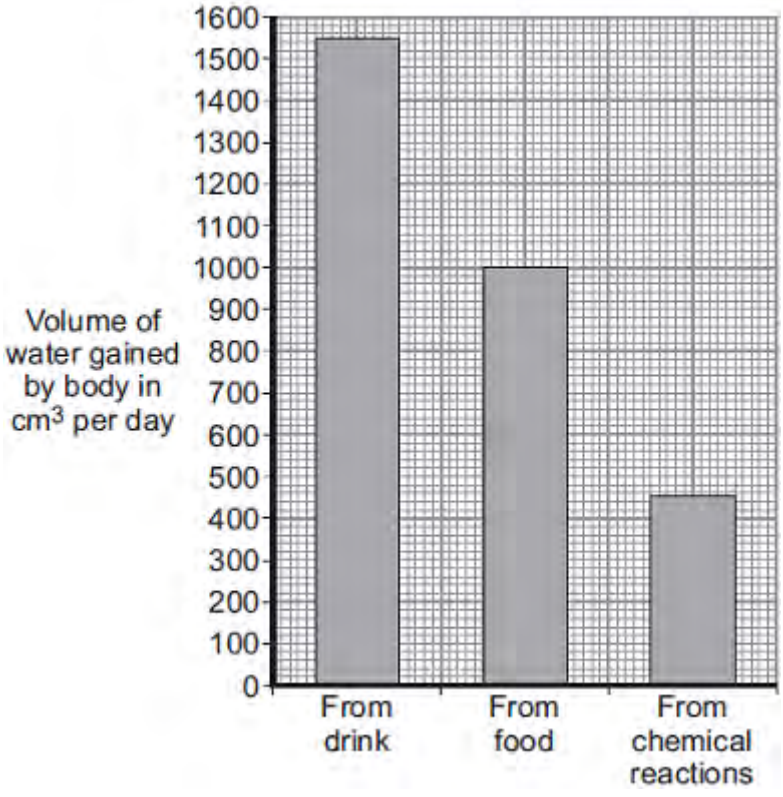
(iii) produces urea .....
**(1)**

(iv) gets rid of carbon dioxide .....
**(1)**

(v) helps to control body temperature? .....
**(1)**

(b) **Bar chart 1** shows the volume of water the human body gains each day.

**Bar chart 1**




Source of water gained by body

(i) Calculate the total volume of water the body gains each day.

.....

.....

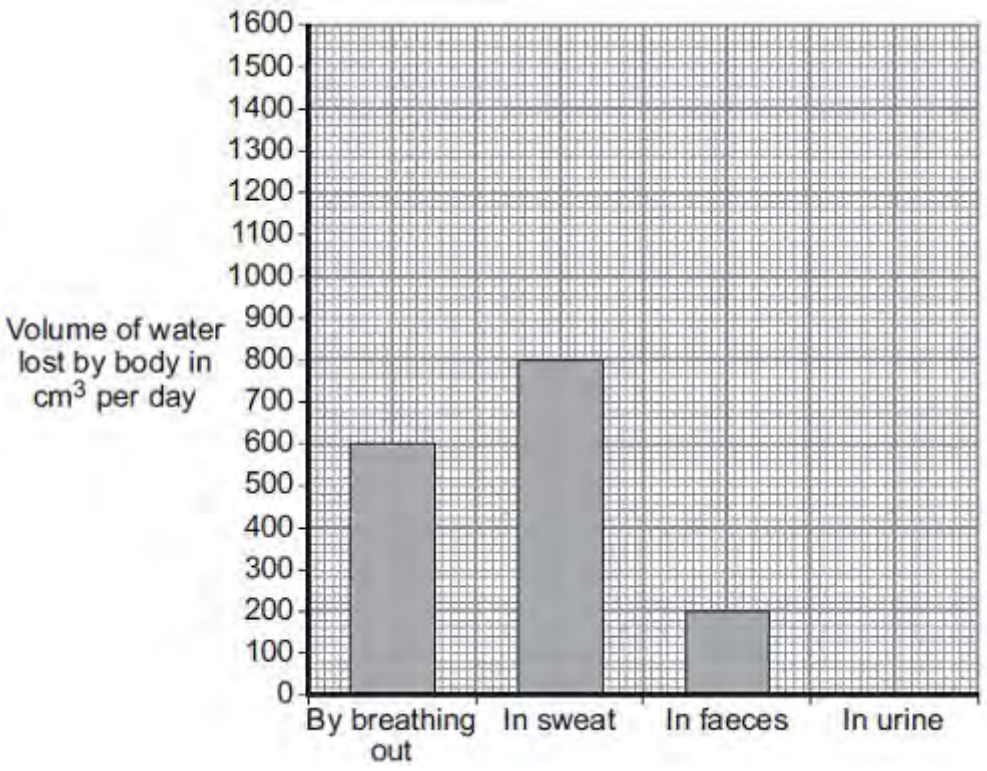
.....

Total volume of water gained = ..... $cm^3$

**(2)**

**Bar chart 2** shows the volume of water lost each day by breathing out, in sweat and in faeces.

**Bar chart 2**




Water lost by body

(ii) Calculate the total volume of water lost each day by breathing out, in sweat and in faeces.

.....

.....

Volume = ..... $cm^3$

**(1)**

(iii) The volume of water the body loses must balance the volume of water the body gains.

Use your answers to part (b)(i) and part (b)(ii) to calculate the volume of water lost in urine.

.....

.....

Volume of water lost in urine = ..... $cm_3$

**(1)**

(iv) Plot your answer to part (b)(iii) on **Bar chart 2**.

**(1)**

(v) After taking some types of recreational drugs, the kidneys produce very little urine.

What happens to the body cells if the kidneys produce very little urine?

.....

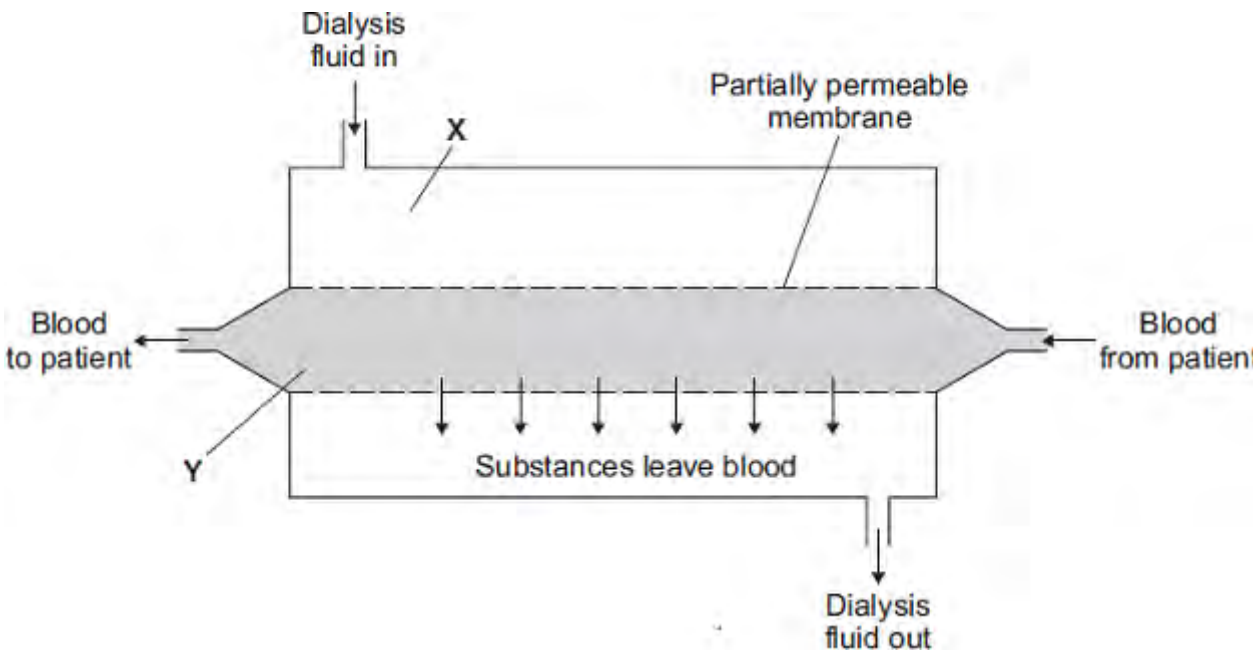
.....

**(1)**

**(Total 11 marks)**

**Q3.**People with kidney disease may be treated by dialysis.

The diagram shows a dialysis machine.




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

A person loses mass during dialysis. One patient lost 2.2 kilograms during a dialysis session.

(i) This person lost mass mainly because

| |
|---|
| salt |
| urea |
| water |

was removed from the blood.

**(1)**

(ii) This substance was able to pass through the partially permeable membranes

because its molecules are

| |
|---|
| large. |
| round. |
| small. |

**(1)**

(iii) The concentration of sodium ions at **X** is 3.15 grams per $dm_3$.

At the end of a dialysis session, the most likely concentration of sodium ions

at **Y** would be

| |
|---|
| 0.00 |
| 3.15 |
| 6.30 |

grams per $dm_3$.

**(1)**

(b) The table shows the cost, in the UK, of treating one patient who has kidney disease.

| **Treatment** | | **Cost per year in pounds** |
|---|---|---|
| Dialysis | | 30 000 |
| Kidney transplant: | | |
| | operation + first year's medical care medical care in | 51 000 |
| | each further year | 5 000 |

(i) During the first year, dialysis treatment is cheaper than a kidney transplant.

How much cheaper is the dialysis treatment? ..... pounds

**(1)**

(ii) After some time, the cost of treating a patient by a transplant operation would be cheaper than continual treatment by dialysis.

How many years would it take?

Draw a ring around **one** answer.

**2 years** **3 years** **4 years**

**(1)**

(iii) A transplant pa ient needs to take drugs for the rest of his life to suppress the immune system.

Why is it necessary to suppress the immune system ?

.....

.....

**(1)**

**(Total 6 marks)**

**Q4.** 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**

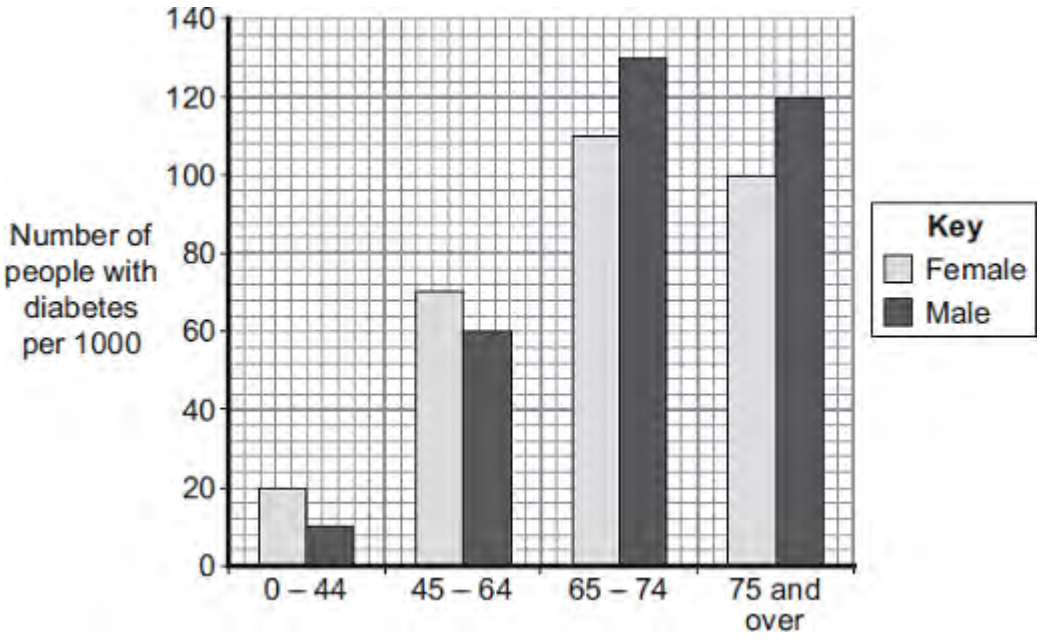
**(1)**

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

.....

**(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 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.

.....

.....

.....

**(2)**

**(Total 8 marks)**

**Q5.** The body controls internal conditions.

(a) Use words from the box to complete he sentences about water loss from the body.

| | | | |
|---|---|---|---|
| **kidneys** | **liver** | **lungs** | **skin** |

(i) Water is lost in sweat via the .....

**(1)**

(ii) Water is lost in urine via the .....

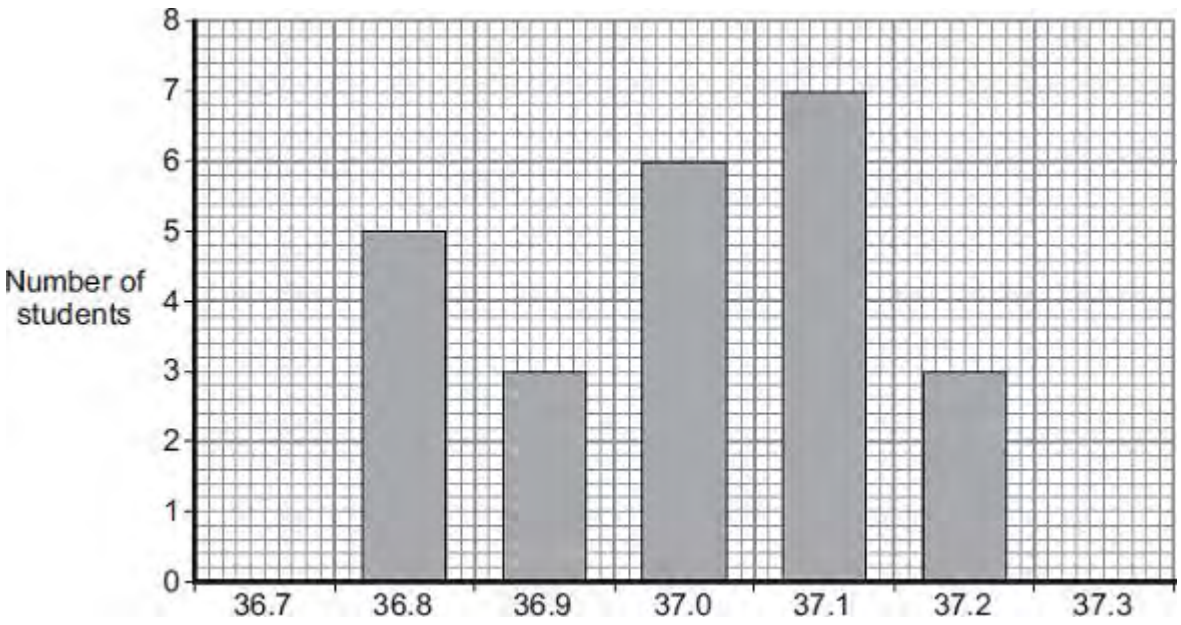
**(1)**

(iii) Water is lost in the breath via the .....

**(1)**

(b) Students investigated body temperature in the class.

The bar chart shows the results.




(i) One student used the bar chart to calculate the mean body temperature of the class.

The student calculated the mean body temperature as 37.0 °C.

How did the student use the bar chart to calculate the mean?

.....

.....

.....

.....

**(2)**

(ii) How many students had a body temperature higher than the mean of 37.0 °C

.....

**(1)**

(iii) Body temperature must be kept within a narrow range.

Why?

.....

.....

**(1)**

**(Total 7 marks)**

**Q6.** Human body temperature must be kept within narrow limits.

The image shows a cyclist in a race.

© Ljupco/iStock/Thinkstock

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

| | | | | |
|---|---|---|---|---|
| **blood** | **brain** | **kidney** | **sweat** | **urine** |

The cyclist's body temperature is monitored by a centre in the ..... .

This centre is sensitive to the temperature of the cyclist's ..... .

If the cyclist's body temperature increases, his body increases

the production of ..... .

**(3)**

(b) (i) Cyclists drink sports drinks after a race.

The table below shows the ratio of glucose to ions in three sports drinks, **A**, **B** and **C**.

| | **Sports drink** | | |
|---|---|---|---|
| | **A** | **B** | **C** |
| **Ratio of glucose (g per dm3) to ions (mg per $dm_3$)** | 15:14 | 12:1 | 2:7 |

The closer this ra io of glucose to ions is to 1:1 in a sports drink, the faster the body replaces water.

Which sports drink, **A**, **B** or **C**, would replace water fastest in an athlete? ☐

**(1)**

(ii) Why should sports drinks contain ions?

.....

.....

**(1)**

(iii) Why should a person with diabetes **not** drink too much sports drink?

.....

.....

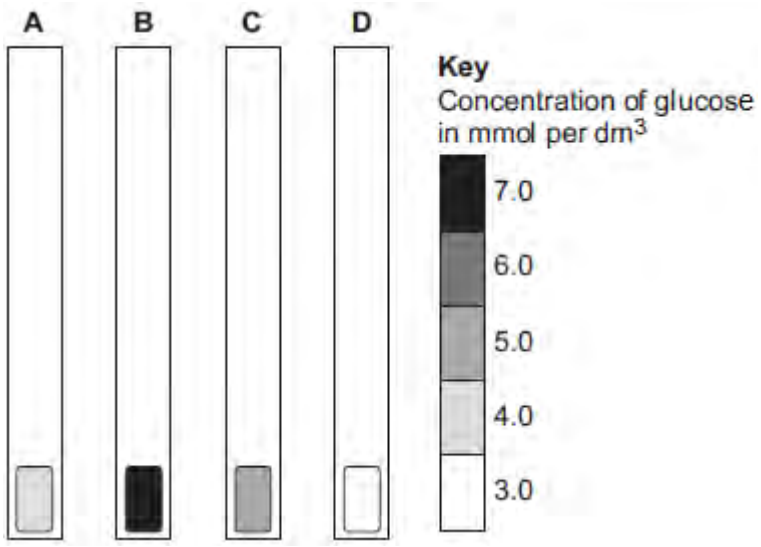
**(1)**

**(Total 6 marks)**

**Q7.**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 concentra ion 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)**

**M1.** (a) B

**1**

less / no insulin (produced) **or** insulin produced in pancreas

*allow pancreas can't monitor (blood) sugar (level)*

*ignore pancreas can't control (blood) sugar (level)*

*allow <u>increased</u> glucagon production*

*allow A as liver stores less glucose / sugar for **2** marks only*

**1**

(b) (i) (it / protein / insulin) digested / broken down

*if ref to specific enzyme must be correct (protease / pepsin)*

*ignore denatured*

*do **not** accept digested in mouth / other incorrect organs*

**1**

(ii) any **two** from:

*ignore injections*

- (attention to) diet

  *accept examples, eg eat less sugar(y food) **or** eat small regular meals*

  *allow eat less carbohydrate / control diet*

  *ignore cholesterol or balanced / healthy diet*

- exercise

  *ignore keep fit / healthy*

- (pancreas) transplant / stem cells / genetic engineering

**2**

**[5]**

**M2.** (a) person with muscle disease:

*allow reverse argument for healthy person*

any **three** from:

*NB all points are comparative except peak (point 3)*
*allow use of **two** approximate figures as a comparison*

- higher resting rate **or** higher at start
- when exercise starts / then increases more / more rapidly
  *accept description eg rise …. fall*
- peaks (then falls)
- levels off later than healthy person
- higher rate during exercise
  *if no other marks awarded allow **1** mark for 'it's higher'*
- greater range

**3**

(b) (i) oxygen

*accept adrenaline*
*accept $O_2$*
*do **not** accept O, O2 or $O^2$*

**1**

(ii) cannot release sugar / glucose (from glycogen)

**or**

cannot store glucose / sugar (as glycogen)

**1**

need to receive glucose / sugar (from elsewhere)

*ignore oxygen*

**1**

for energy / respiration / cannot store energy

*ignore aerobic / anaerobic*

1

**[7]**

**M3.** (a) (i) chemical

**1**

(ii) pituitary gland

**1**

(b) 8

*allow 9 or 10*

**1**

(c) (i) any **four** from:

- progesterone starts being produced at 4 weeks / no progesterone before 4 weeks
- and then / from 4 weeks increases
- oestrogen at constant / low level (from 0) to 20 weeks
- and then / from 20 weeks increases
- from 20 − 36 weeks level of O rises more steeply than that of P

**or**

- P is always higher than 0 from 6 to 36 weeks

*if no other marks awarded, allow progesterone and oestrogen both increase / rise for **1** mark.*

**4**

(ii) oxytocin

**1**

level of oxytocin increases just before birth

**1**

**[9]**

**M4.** (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]**

**M5.** (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 actionapply list principleignore 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]**

**M6.** (a) (i) **A** – pituitary
*allow hypothalamus*
**1**

**B** – ovary / ovaries
**1**

(ii) in blood (stream)
*accept in plasma*
*ignore dissolved*
**1**

(b) (i) FSH and Luteinising Hormone (LH)
**1**

(ii) fertilised
OR
reference to sperm
**1**

form embryos / ball of cells or cell division
**1**

(embryo) inserted into mother's womb / uterus
*allow (fertilised egg) is inserted into mother's womb / uterus*
**1**

(iii) any **one** from:

- multiple births lead to low birth weight
- multiple births cause possible harm to mother / fetus / embryo /

baby / miscarriages
*allow premature*
*ignore reference to cost / ethics / population*

**1**

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

- almost identical
  *allow S (slightly) more successful*
- both approximately 20%

**1**

(ii) larger numbers (in clinic R) (in 2007)
*allow <u>only</u> 98 (in S) (compared to 1004 (in R))*

**1**

results likely to be more repeatable (in 2008)
*allow more reliable*
*do **not** accept more reproducible / accurate / precise*

**1**

**[11]**

**M7.** (a) (i) 3.0
*accept 3*

**1**

(ii) any **two** from:

- take in water
- take in ions / minerals / nutrients
  *accept salts / named ions*
  *ignore food*
- anchorage / support

**2**

(iii) asexual reproduction

**1**

(b) (i) a tropism

**1**

(ii) if tip exposed / **A** – grows / bends towards light
*allow <u>tip</u> of **A** moves towards light*
*ignore **A** responds to light*
*allow remained 'straight'*

**1**

if tip covered / **B** – did not grow towards light / remained vertical
*ignore **B** does not respond to light*
*ignore phototropism*
*<u>only</u> **A** grows towards the light = 2 marks*

**1**

(c) (i) auxin

**1**

(ii) hormone comes from the tip

**1**

more on shady side / moves away from light

*allow reference to right-hand side*

**1**

stimulates growth

**1**

more growth on shady side (than on light side)

*answer must be comparative*

*ignore phototropism*

*ignore cell division*

**1**

**[12]**

**Q1.** Diabetes is a disease in which a person's blood glucose concentration may rise.

Doctors give people drugs to treat diabetes.

The table shows some of the side effects on the body of four drugs, **A, B, C** and **insulin,** used to treat diabetes.

| Drug | Side effects on the body |
|---|---|
| **A** | Weight loss<br>Liver, kidney and heart damage<br>Feeling of sickness |
| **B** | Weight gain<br>Damage to some cells in pancreas |
| **C** | More water is kept in the body<br>Weight gain<br>ncreased chance of bone breakage in women |
| **Insulin** | A little more water is kept in the body<br>Weight gain<br>ncreased risk of lung damage |

(a) Which drug, **A, B, C** or **insulin,** is most likely to result in an increase in blood sugar concentration in some people?

Explain your answer.

Drug .....

Explanation

.....

.....

**(2)**

(b) (i) Drugs **A, B and C** can be taken as tablets.

The chemicals in the tablets are absorbed into the blood from the digestive system.

Insulin is a protein.

Insulin **cannot** be taken as a tablet.

Why?

.....

**(1)**

(ii) Other than using drugs, give **two** methods of treating diabetes.

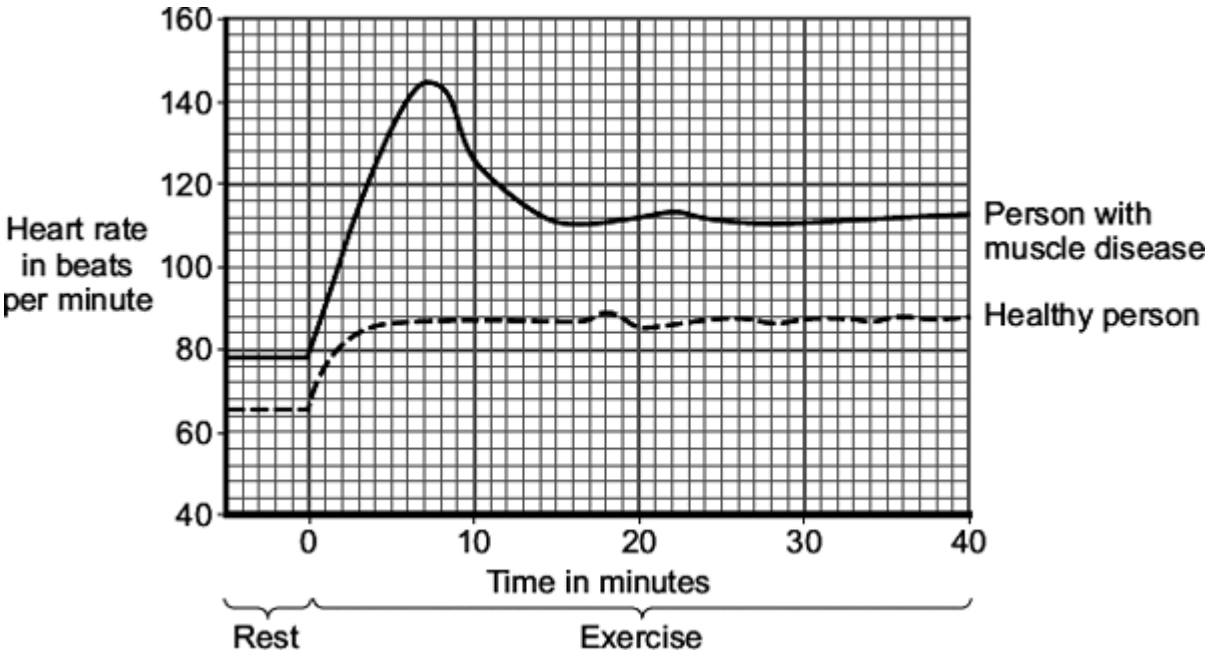
1 .....

2 .....

**(2)**
**(Total 5 marks)**

**Q2.** Two people did the same amount of gentle exercise on an exercise cycle. One person had a muscle disease and the other had healthy muscles.

The graph shows the effect of the exercise on the heart rates of these two people.




(a) Describe **three** ways in which the results for the person with the muscle disease are different from the results for the healthy person.

To gain full marks in this question you need to include data from the graph in your answer.

1 .....

.....

2 .....

.....

3 .....

.....

**(3)**

(b) The blood transports glucose to the muscles at a faster rate during exercise than when a person is at rest.

(i) Name **one** other substance that the blood transports to the muscles at a faster rate during exercise.

.....

**(1)**

(ii) People with the muscle disease are not able to store glycogen in their muscles.

The results shown in the graph for the person with the muscle disease are different from the results for the healthy person.

Suggest an explanation for the difference in the results.

.....

.....

.....

.....

.....

.....

.....

.....

.....

**(3)**
**(Total 7 marks)**

**Q3.** This question is about hormones.

(a) (i) Hormones carry messages.

What type of messenger is a hormone?

Draw a ring around the correct answer.

**chemical** **electrical** **environmental**

**(1)**

(ii) Which part of the brain secretes hormones?

Draw a ring around the correct answer.

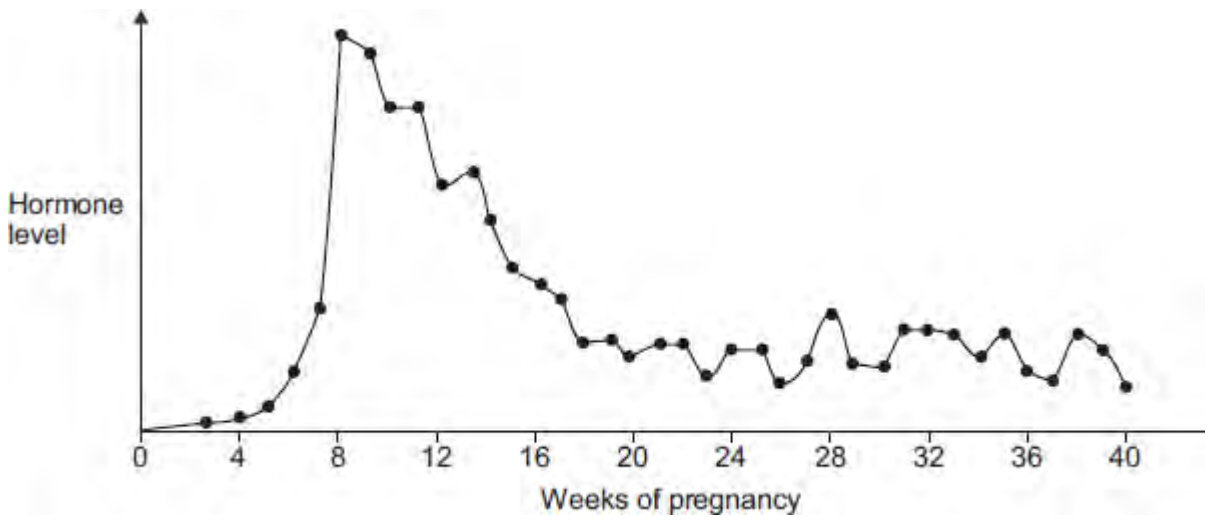
**cerebellum** **medulla** **pituitary gland**

**(1)**

(b) **Figure 1** shows the level of a pregnancy hormone over a 40-week pregnancy.

This hormone can be detected in a pregnancy test.

**Figure 1**




A woman takes a pregnancy test.

In which week of pregnancy is the test most likely to give a positive result?

Use information from **Figure 1**.

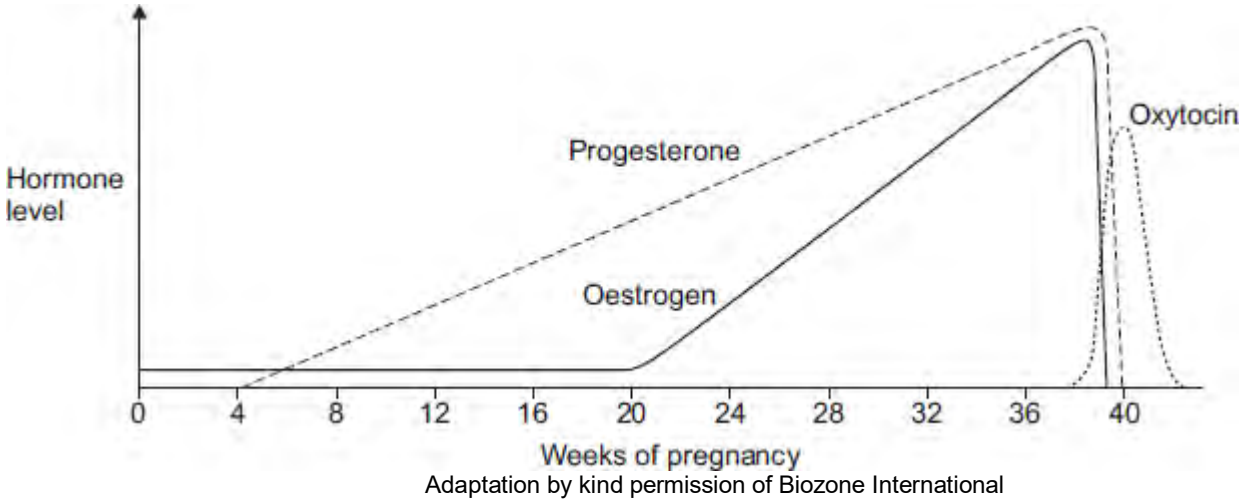
Write the correct answer in the box.

**(1)**

(c) **Figure 2** shows the levels of three other hormones during pregnancy.

The baby is usually born at about 40 weeks.

**Figure 2**




Adaptation by kind permission of Biozone International

(i) Describe the patterns in the levels of oestrogen and progesterone from 0 to 36 weeks.

.....

.....

.....

.....

.....

.....

.....

.....

**(4)**

(ii) Which hormone is likely to stimulate contractions of the uterus (womb)

when the baby is born?

Use information from **Figure 2** to give a reason for your answer.

.....

.....

.....

.....

**(2)**
**(Total 9 marks)**

**Q4.**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.....

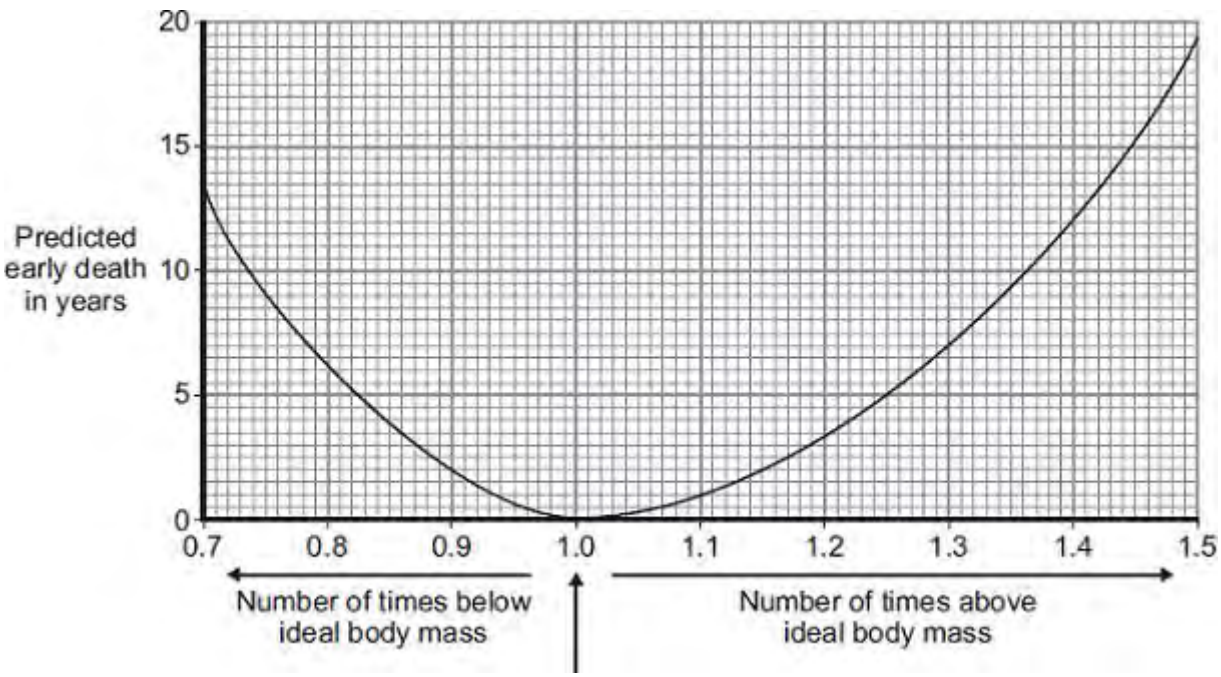
.....

**(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.



**Ideal body mass**

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)**

**Q5.** 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.

.....

.....

.....

.....

.....

.....

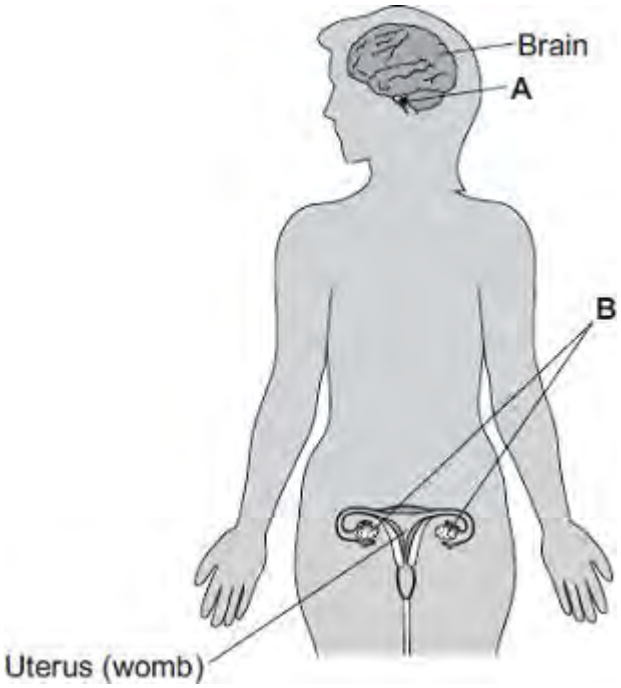
.....

.....

**(3)**

**(Total 6 marks)**

**Q6.** The diagram shows the position of two glands, **A** and **B**, in a woman.




(a) (i) Name glands **A** and **B**.

**A** .....

**B** .....

**(2)**

(ii) Gland **A** produces the hormone Follicle Stimulating Hormone (FSH).

FSH controls changes in gland **B**.

How does FSH move from gland **A** to gland **B**?

.....

**(1)**

(b) (i) A woman is not able to become pregnant. The woman does not produce mature eggs. The woman decides to have In Vitro Fertilisation (IVF) treatment.

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

Tick (✓) **one** box.

FSH and Luteinising Hormone (LH) ☐

FSH and oestrogen ☐

Luteinising Hormone (LH) and oestrogen ☐

**(1)**

(ii) Giving these hormones to the woman helps her to produce several mature eggs.
Doctors collect the mature eggs from the woman in an operation.

Describe how the mature eggs are used in IVF treatment so that the woman may become pregnant.

.....

.....

.....

.....

.....

.....

**(3)**

(iii) IVF clinics have been set a target to reduce multiple births.

| |
|---|
| At least 76% of IVF treatments should result in single babies and a maximum of 24% of treatments should result in multiple births. |

Suggest **one** reason why the clinics have been set this target to reduce multiple births.

.....

.....

**(1)**

(c) Two clinics, **R** and **S**, used IVF treatment on women in 2007. Doctors at each clinic used the results of the treatments to predict the success rate of treatments in 2008.

The table shows the information.

| | Total number of IVF treatments in 2007 | Number of IVF treatments resulting in pregnancy in 2007 | Predicted percentage success rate in 2008 |
|---|---|---|---|
| Clinic **R** | 1004 | 200 | 18–23 |
| Clinic **S** | 98 | 20 | 3–56 |

(i) Compare the success rates of the two clinics in 2007.

.....

.....

**(1)**

(ii) The range of the predicted success rate in 2008 for clinic **R** is much smaller than the range of the predicted success rate for clinic **S**.

Suggest why.

.....

.....

.....

.....

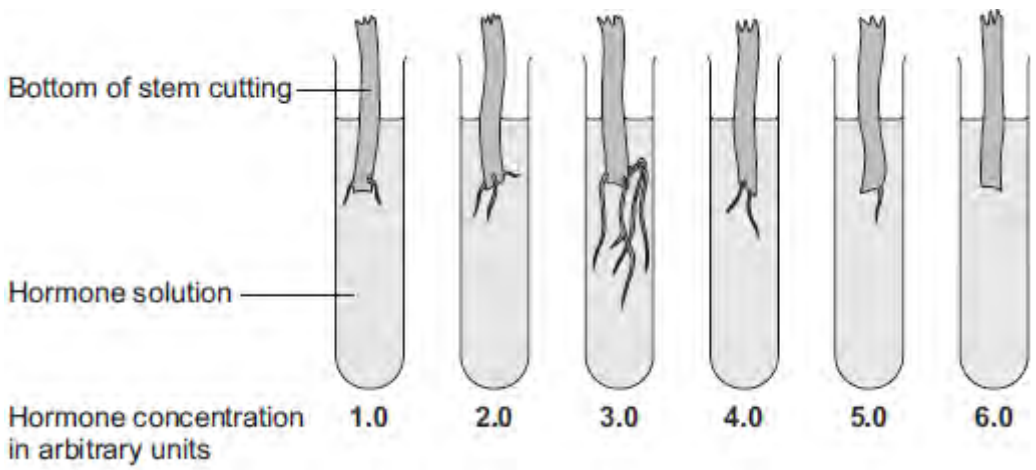
**(2)**

**(Total 11 marks)**

**Q7.**(a) A student investigated the effect of a plant hormone on the growth of roots by plant cuttings.

The student took six stem cuttings from the same plant. He put the cuttings in test tubes containing hormone solutions of different concentrations.

The image below shows the six cuttings after 2 weeks.




(i) What is the best concentration of hormone for encouraging root growth?

..... arbitrary units

**(1)**

(ii) Give **two** functions of plant roots.

1 .....

.....

2 .....

.....

**(2)**

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

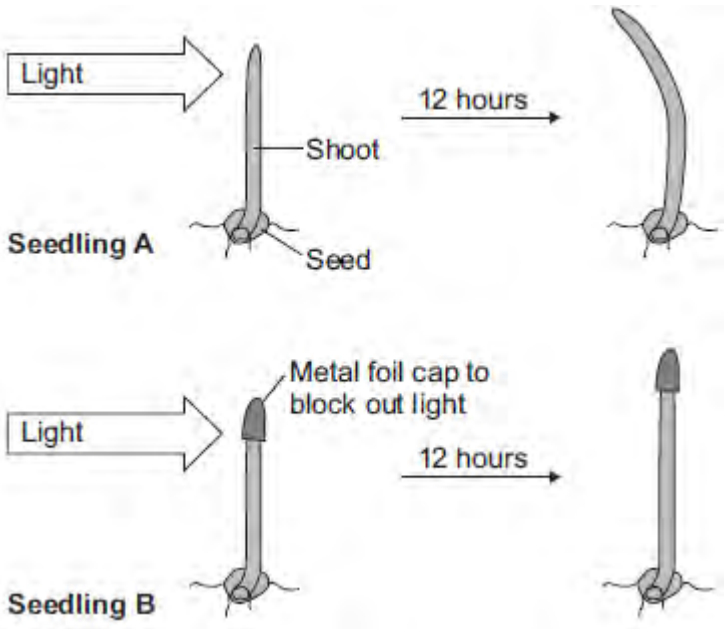
Taking cuttings to produce new plants is an example of

| |
|---|
| asexual reproduction. |
| genetic engineering. |
| sexual reproduction. |

**(1)**

(b) Another student investigated the effect of light, shining from one side, on the growth of plant shoots.

The diagram below shows how the student treated the shoots and the results she obtained after 12 hours.




(i) What is the response to light shown by **Seedling A** called?

Tick (✓) **one** box.

cloning ☐

a reflex ☐

a tropism ☐

**(1)**

(ii) The student concluded that the shoot **tip** is sensitive to light.

What evidence is there in the diagram above for this conclusion?

.....

.....

.....

.....

**(2)**

(c) The seedling produces a hormone which helps to control its response to light.

(i) What is the name of the hormone?

Tick (✓) **one** box.

auxin ☐

glucagon ☐

glycerol ☐

**(1)**

(ii) How does the hormone control the response of **Seedling A** to light shining from one side?

.....

.....

.....

.....

.....

.....

.....

.....

**(4)**
**(Total 12 marks)**

**M1.** (a) if too high <u>insulin</u> released from pancreas

**1**

so glucose is moved into cells

*allow glucose is stored*

**1**

if too low, <u>glucagon</u> is released (from pancreas)

**1**

causes glycogen to be converted to glucose <u>and</u> released into the blood

**1**

(b) type 1 not enough / no insulin produced

**1**

whereas type 2 cells do not respond to insulin

**1**

type 1 is treated with injections of insulin

**1**

whereas type 2 is treated with diet and exercise
**or**
loss of weight
**or**
drugs

**1**

(c) $(3.45 \times 10^6) + (5.49 \times 10^5) = 3.999 \times 10^6$
**or**
3 450 000 + 549 000 = 3 999 000

*allow 3.999 × $10^6$* ***or*** *3 999 000 with no working shown for* ***1*** *mark*

**1**

$\frac{3.999 \times 10^6}{6.5 \times 10^7} \times 100$

**or**

$\frac{3\,999\,000}{65\,000\,000} \times 100$

= 6.15

*allow 6.15 with no working shown for **2** marks*
*allow for **1** mark for a calculation using either:*

$\frac{3.45 \times 10^6}{6.5 \times 10^7}$

***or***

$\frac{3\,450\,000}{65\,000\,000}$

***or***

$\frac{5.49 \times 10^6}{6.5 \times 10^7}$

***or***

$\frac{549\,000}{65\,000\,000}$

**1**

6.2

*allow 6.2 with no working shown for **3** marks*

**1**

*allow ecf from second step correctly rounded for **1** mark*

(d) could be other reasons for glucose in urine
**or**
blood test gives current / immediate result, urine levels might be several hours old
**or**
not always glucose in urine

**1**

(e) results not affected by glucose from food
**or**
8 hours is sufficient time for insulin to have acted on any glucose from food eaten

**or**
so that there is a low starting point to show the effect

**1**

(f) (patient **A**)

*no mark for identifying **A***

glucose level much higher (than **B**)

**1**

and remains high / does not fall

**1**

**[15]**

**M2.** (a) Pancreas

*allow phonetic spelling*

**1**

(b) any **three** from:

***max 2** if any one process goes on in wrong organ*

- (amino acids) broken down
- (amino acids) form urea
- (amino acids broken down / converted **or** urea formed) in liver
- (urea / broken down amino acids) removed / filtered by kidney

  *do **not** allow amino acids filtered / removed by kidney*
- (urine / urea / broken down amino acids) stored / held in bladder

  *do **not** allow amino acids stored / held in bladder*

**3**

**[4]**

**M3.** (a) (i) 1 hour 15 mins / 1.25 hours / 75 mins

*allow 1:15*

*ignore 1.15 hours*

**1**

(ii) increase in (core / body) temperature

*ignore numbers*

**1**

(due to an) increase in <u>respiration</u> **or** more <u>muscle</u> contraction

**1**

releasing energy (as a waste product)

*allow produces 'heat'*

*do **not** allow making energy*

**1**

skin temperature decreases

**1**

(because there is) sweating

**1**

(which) evaporates and cools the skin

*ignore references to vasodilation or vasoconstriction*

**1**

(iii) (there is) dilation of vessels (supplying skin capillaries)

*allow vasodilation*

*allow blood vessels widen*

*ignore expand*

*do **not** accept dilating capillaries or moving vessels*

**1**

(so) more blood flows (near skin) (surface) **or** blood is closer (to the skin)

*ignore ref to heat*

**1**

(c) pancreas detects (low) blood glucose

**1**

produces glucagon

*do **not** allow glucagon made in the liver*

**1**

(so) glycogen is converted to glucose

*allow adrenaline released which increases conversion of glycogen to glucose*

***or***

*reduced insulin production so less glucose into cells / less glucose converted to glycogen*

*for 1 mark*

1

**[12]**

**M4.** 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 <u>either</u> water loss or gain*

**[6]**

**M5.** (a) (the kidney) filters the blood

*ignore refs to hormones and drugs*

**1**

(and then) reabsorbs <u>all</u> of the glucose

**1**

reabsorbs some of the ions

*allow salts*

*ignore minerals*

**1**

reabsorbs some of the water

**1**

releases urea (in urine)

**1**

(b) (i) should fall from 28 (to the end of dialysis)

*ignore any line drawn after end of dialysis*

*allow + / - 0.5 square*

*graph line must fall to / below*

*below 15*

**1**

(ii) should stay level at about 6 throughout

*ignore slight variations*

*allow + / - 1 square*

*ignore any line drawn after end of dialysis*

**1**

(c) (i) immune system

*allow white blood cells / lymphocytes*

**1**

(produces) antibodies

**1**

(which) attack the antigens (on the transplanted kidney)

*non-matching antigens insufficient*

**1**

(ii) any **one** from:

- tissue typing (to find match)
- treating with drugs that suppress the immune system

*accept treat with immunosuppressants.*

**1**

**[11]**

**M6.** (a) Too much thyroxine is released into the blood

**1**

which raises BMR

**1**

causing increase in formation of glycogen / lipids / proteins
**or**
increase in rate of respiration
**or**
increase in breakdown of excess proteins

**1**

(b) FSH causes eggs to mature and stimulate ovaries to produce oestrogen

**1**

LH stimulates the egg to be released

**1**

(c) (missing a dose causes a) dip / drop in progesterone levels

**1**

(therefore) FSH is not inhibited anymore

**1**

(therefore) LH is not inhibited anymore

**1**

(and consequently) an egg is matured and released
*allow (and consequently) an egg is available to be fertilised*

**1**

**[9]**

**Q1.**Homeostasis controls the internal conditions of the body.

(a) Explain how blood glucose levels are controlled in the body of someone who does **not** have diabetes.

.....

.....

.....

.....

.....

.....

.....

.....

**(4)**

(b) Compare how each type of diabetes is caused.

Suggest how each type of diabetes can be treated.

.....

.....

.....

.....

.....

.....

.....

.....

**(4)**

(c) Look at the table below.

| | |
|---|---|
| **Population of UK in 2015** | $6.5 \times 10^7$ |
| **Number of people diagnosed with diabetes** | $3.45 \times 10^6$ |

| | |
|---|---|
| **Estimated number of people with undiagnosed diabetes** | $5.49 \times 10^5$ |

Calculate the percentage (%) of the UK population estimated to have diabetes.

You should include both diagnosed and undiagnosed people in your calculation.

Give your answer to 2 significant figures.

.....

.....

.....

.....

.....

Estimated percentage of population with diabetes = ..... %

**(3)**

(d) A urine test can be used to check for the presence of glucose in the urine.

Diabetes can also be diagnosed with a blood test to measure the concentration of blood glucose.

Suggest why a blood test is more reliable than a urine test.

.....

.....

**(1)**

(e) A blood test called the glucose tolerance test checks how well the body processes glucose.

Concentrations of glucose in the blood are measured before and after drinking a glucose drink.

Patients are not allowed to eat food for 8 hours before the glucose tolerance test.

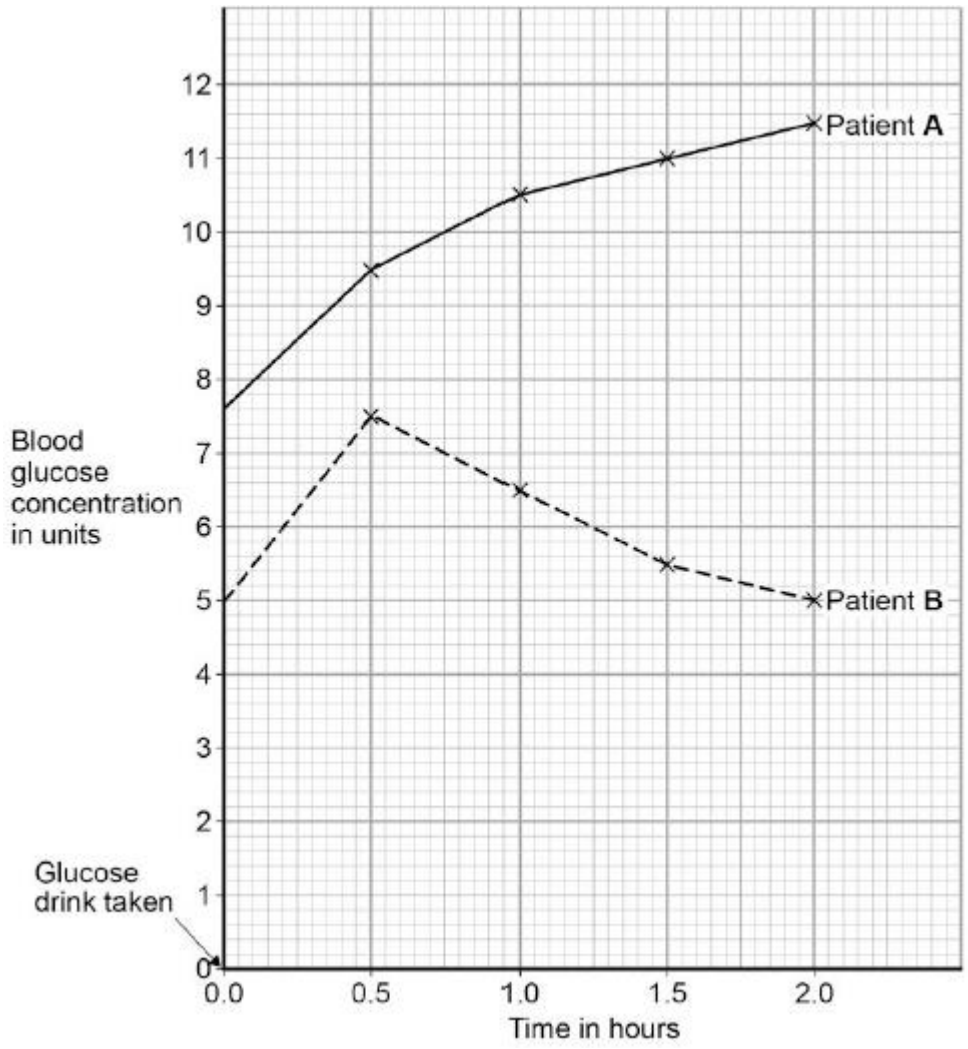
Suggest why patients are **not** allowed to eat for 8 hours before the test.

.....

.....

**(1)**

(f) The diagram below shows the results of a glucose tolerance test for two patients, **A** and **B**.




Which patient has diabetes?

Justify your answer.

Patient .....

Justification .....

.....

.....

.....

**(2)**

**(Total 15 marks)**

**Q2.**(a) Which organ in the body monitors the concentration of glucose (sugar) in the blood?

.....

**(1)**

(b) In a healthy person, insulin prevents high levels of glucose in the blood.
To make insulin, cells in the pancreas need amino acids.

Amino acids cannot be stored in the body.

Describe, as fully as you can, what happens to amino acids that cannot be stored in the body.

.....

.....

.....

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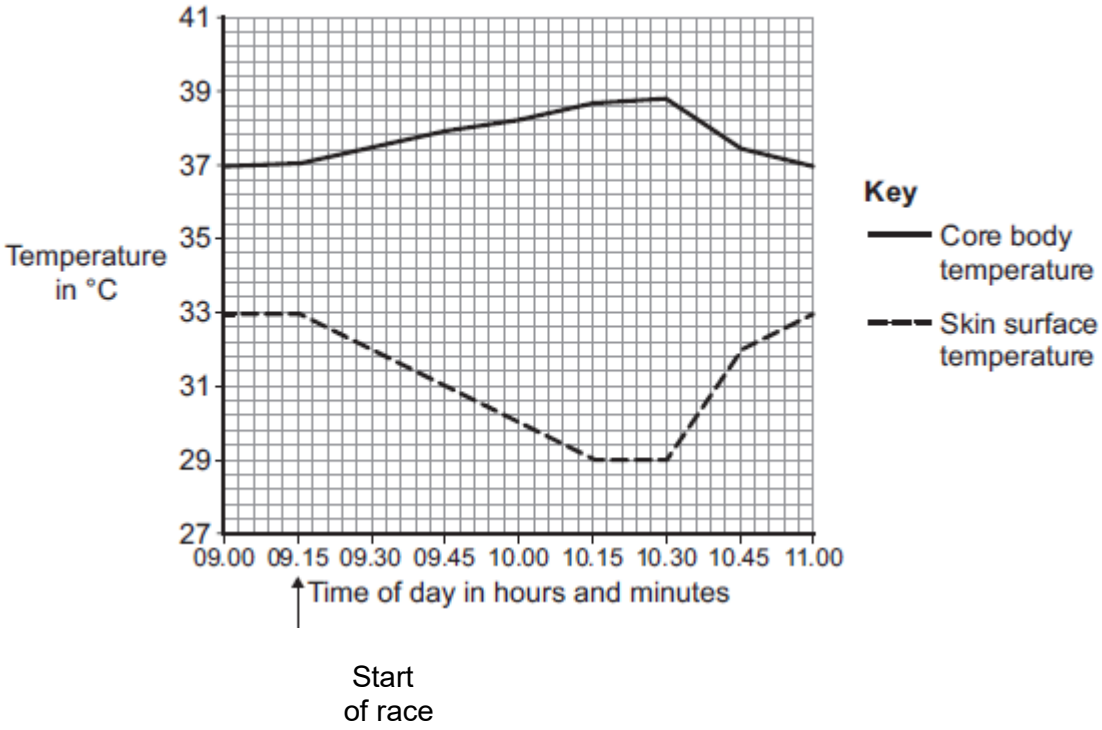
.....

**(3)**
**(Total 4 marks)**

**Q3.** The graph shows the core body temperature and the skin surface temperature of a cyclist before, during and after a race.




(a) (i) When the cyclist finished the race, his core body temperature started to decrease.

How long did the race last?

.....

**(1)**

(ii) Describe and explain the different patterns shown in the core body temperature and skin surface temperature between 09.15 and 10.15.

.....

.....

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.....

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.....

.....

**(6)**

(iii) After 10.30, the core body temperature decreased.

Explain how changes in the blood vessels supplying the skin caused the skin surface temperature to increase.

.....

.....

.....

.....

.....

.....

**(2)**

(b) During the race, the cyclist's blood glucose concentration began to decrease.

Describe how the body responds when the blood glucose concentration begins to decrease.

.....

.....

.....

.....

.....

.....

.....

.....

**(3)**
**(Total 12 marks)**

**Q4.** *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.

Describe how the water content of the blood is controlled.

.....

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**(Total 6 marks)**

**Q5.**It is important to remove waste products from our bodies.

Healthy kidneys help to keep our internal environment constant.

(a) Describe how a healthy kidney produces urine.

.....

.....

.....

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.....

.....

.....

.....

.....

.....

**(5)**

(b) A child has kidney failure and is treated with dialysis.

Before the dialysis starts, the doctor measures the concentration of urea and glucose in the child's blood.

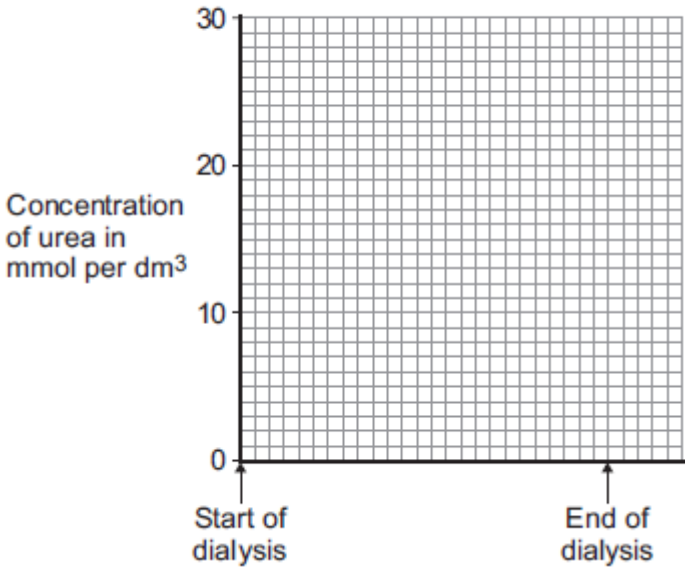
The table shows the results.

| | **Concentration in the blood before dialysis starts in mmol per $dm^3$** |
|---|---|
| **Urea** | 28 |
| **Glucose** | 6 |

The child has a normal blood glucose concentration.

(i) Sketch a graph on **Figure 1** to suggest what will happen to the concentration of urea in the blood during dialysis.

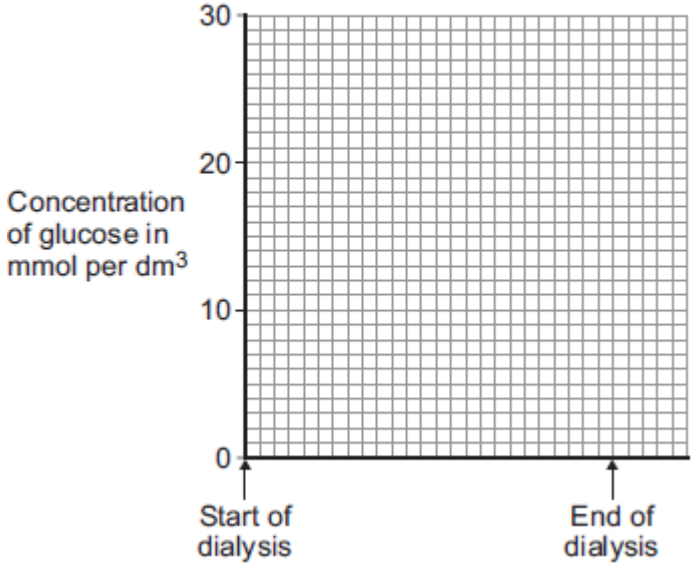
**Figure 1**




**(1)**

(ii) Sketch a graph on **Figure 2** to suggest what will happen to the concentration of glucose in the blood during dialysis.

**Figure 2**




**(1)**

(c) (i) Another way of treating kidney failure is with a kidney transplant.

A transplanted kidney can be rejected.

Explain why the new kidney may be rejected.

.....

.....

.....

.....

.....

.....

**(3)**

(ii) Describe **one** way in which doctors try to prevent kidney rejection.

.....

.....

**(1)**

**(Total 11 marks)**

**Q6.**Endocrine glands produce hormones.

(a) Hyperthyroidism is caused by an overactive thyroid gland.

Suggest what would happen in the body of a person with hyperthyroidism.

.....

.....

.....

.....

.....

.....

**(3)**

(b) Describe the roles of FSH and LH in the menstrual cycle.

.....

.....

.....

.....

**(2)**

(c) The combined pill is a contraceptive that contains progesterone **and** oestrogen.

The 'mini-pill':

- is a contraceptive that **only contains** the progesterone hormone
- has to be taken at the same time each day to prevent pregnancy.

The success rate of the mini-pill in preventing pregnancy is lower than that of the combined pill.

Explain why missing a dose of the mini-pill would reduce the success rate of the mini-pill.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

**(4)**
**(Total 9 marks)**

**M1.** (a) any **two** from:

- drop the ruler from the same height
- use the same / dominant hand each time
- thumb same distance from ruler at the start
- use same type / weight of ruler
- drop the ruler without any force each time
- keep arm resting on the edge of the table

**2**

(b) 8

*allow 8.0*

**1**

(c) 2 (in test number 2)

**1**

(d) 12

**1**

(e) (12 + 13 + 13 + 9 + 8 / 5 =) 11

**1**

(f) 0.15 − 0.12 (s)

**1**

0.03 (s)

*allow 0.03 (s) with no working shown for **2** marks*

**1**

(g) carry out more repeats

**1**

(h) caffeine speeds up reflex actions
**or**
reduces reaction time

**1**

**[10]**

**M2.** (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]

**M3.** (a) (i) skin

1

(ii) kidneys

*accept kidney*

1

(iii) lungs

*accept lung*

1

(b) (i) multiply temperature by number of students at that temperature and add them up

*allow (36.8 5) + (36.9 3) + (37.0 6) + (37.1 7) + (37.2 3)*

*allow 888*

1

divide by number of students

*allow divide by 24*

1

(ii) 10 / ten

1

(iii) so <u>enzymes</u> work (well)

*ignore death / overheating / hypothermia*

*allow body <u>reactions</u> work (well)*

1

[7]

**M4.**(a) brain

*in correct order only*

**1**

blood

**1**

sweat

**1**

(b) (i) A

**1**

(ii) to replace ions lost (in sweat)

*accept salts*

*allow named examples, eg. prevent cramps*

**1**

(iii) any **one** from:

- there is too much glucose / sugar in the sports drink
- they shouldn't have too much glucose / blood sugar
- it would cause their blood glucose / sugar to rise (too high)

**1**

**[6]**

**M5.**(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]**

**M6.** (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]**

**M7.**(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]**

**Q1.** Two students investigated reflex action times.

This is the method used.

1. Student **A** sits with his elbow resting on the edge of a table.

2. Student **B** holds a ruler with the bottom of the ruler level with the thumb of Student **A**.

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

4. Student **A** catches the ruler and records the distance.

5. Steps **1** to **4** are then repeated.

The same method was also used with Student **A** dropping the ruler and Student **B** catching the ruler.

(a) Give **two** variables the students controlled in their investigation.

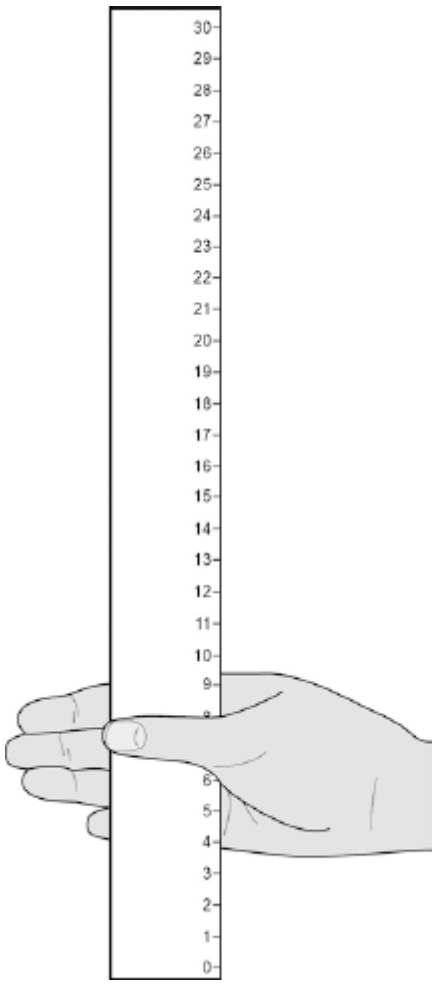
1 .....

2 .....

**(2)**

(b) **Figure 1** shows one of the results for the Student **A**.

**Figure 1**



What is the reading shown in **Figure 1**?

.....

Reading on ruler = ..... cm

**(1)**

(c) **Table 1** shows the students' results.

**Table 1**

| Test number | Distance ruler dropped in cm | |
|---|---|---|
| | **Student A** | **Student B** |
| 1 | 9 | 12 |
| 2 | 2 | 13 |

| | | |
|---|---|---|
| 3 | 6 | 13 |
| 4 | 7 | 9 |
| 5 | 7 | 8 |
| **Mean** | **7** | **X** |

**Circle** the anomalous result in **Table 1** for Student **A**.

**(1)**

(d) What is the **median** result for Student **B**?

Tick **one** box.

8 ☐

11 ☐

12 ☐

13 ☐

**(1)**

(e) Calculate the value of **X** in **Table 1**.

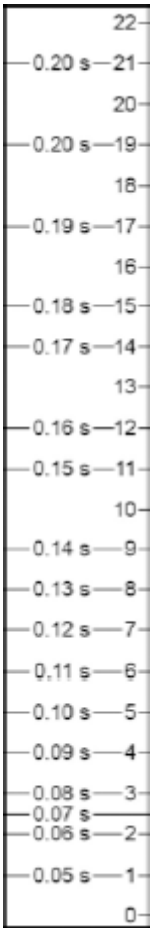
.....

Mean distance ruler dropped = ..... cm

**(1)**

(f) **Figure 2** shows the scale used to convert distance of the ruler drop to reaction time.

**Figure 2**




Calculate how much faster the reaction time of Student **A** was compared to Student **B**.

Use **Figure 2** and **Table 1**.

.....

Answer = ..... s

**(2)**

(g) What improvement could the students make to the method so the results are more valid?

Tick **one** box.

Use alternate hands when catching the ruler ☐

Carry out more repeats ☐

Use a longer ruler for catching ☐

Use more than two students to collect results ☐

**(1)**

(h) Student **A** carried out a second investigation to see the effect of caffeine on the reflex action.

**Table 2** shows his results.

**Table 2**

| Test number | Distance ruler dropped in cm | |
|---|---|---|
| | Without caffeine | With caffeine |
| 1 | 9 | 5 |
| 2 | 6 | 5 |
| 3 | 9 | 4 |
| 4 | 6 | 7 |
| 5 | 10 | 4 |
| **Mean** | **8** | **5** |

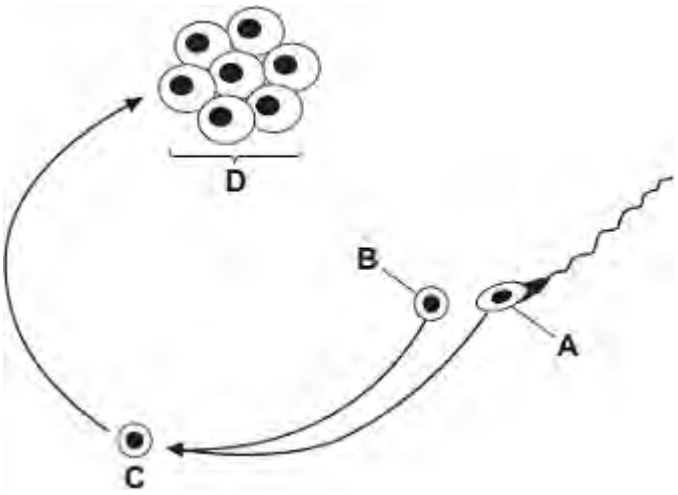
Give **one** conclusion about the effect of caffeine on reflex actions.

.....

.....

**(1)**
**(Total 10 marks)**

**Q2.**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)**

**Q3.** The body controls internal conditions.

(a) Use words from the box to complete the sentences about water loss from the body.

| | | | |
|---|---|---|---|
| **kidneys** | **liver** | **lungs** | **skin** |

(i) Water is lost in sweat via the .....

**(1)**

(ii) Water is lost in urine via the .....

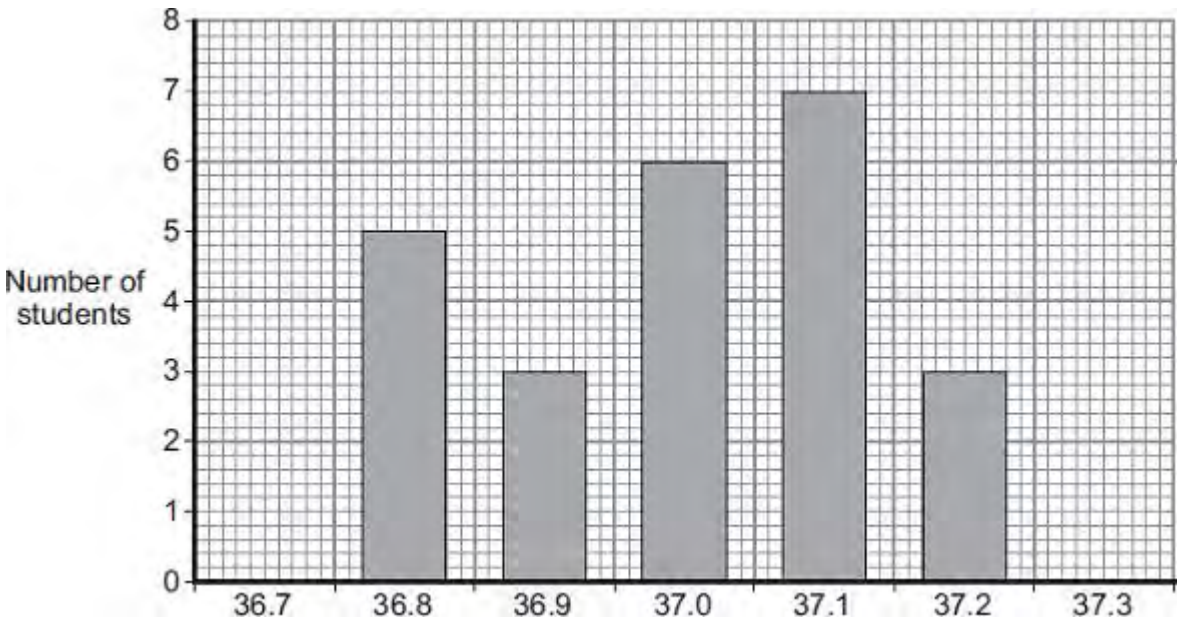
**(1)**

(iii) Water is lost in the breath via the .....

**(1)**

(b) Students investigated body temperature in the class.

The bar chart shows the results.




(i) One student used the bar chart to calculate the mean body temperature of the

class.
The student calculated the mean body temperature as 37.0 °C.

How did the student use the bar chart to calculate the mean?

.....

.....

.....

.....

**(2)**

(ii) How many students had a body temperature higher than the mean of 37.0 °C

.....

**(1)**

(iii) Body temperature must be kept within a narrow range.

Why?

.....

.....

**(1)**

**(Total 7 marks)**

**Q4.**Human body temperature must be kept within narrow limits.

The image shows a cyclist in a race.

© Ljupco/iStock/Thinkstock

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

| | | | | |
|---|---|---|---|---|
| **blood** | **brain** | **kidney** | **sweat** | **urine** |

The cyclist's body temperature is monitored by a centre in the ..... .

This centre is sensitive to the temperature of the cyclist's ..... .

If the cyclist's body temperature increases, his body increases

the production of ..... .

**(3)**

(b) (i) Cyclists drink sports drinks after a race.

The table below shows the ratio of glucose to ions in three sports drinks, **A**, **B** and **C**.

| | **Sports drink** | | |
|---|---|---|---|
| | **A** | **B** | **C** |
| **Ratio of glucose (g per dm3) to ions (mg per $dm^3$)** | 15:14 | 12:1 | 2:7 |

The closer this ratio of glucose to ions is to 1:1 in a sports drink, the faster the body replaces water.

Which sports drink, **A**, **B** or **C**, would replace water fastest in an athlete? ☐

**(1)**

(ii) Why should sports drinks contain ions?

.....

.....

**(1)**

(iii) Why should a person with diabetes **not** drink too much sports drink?

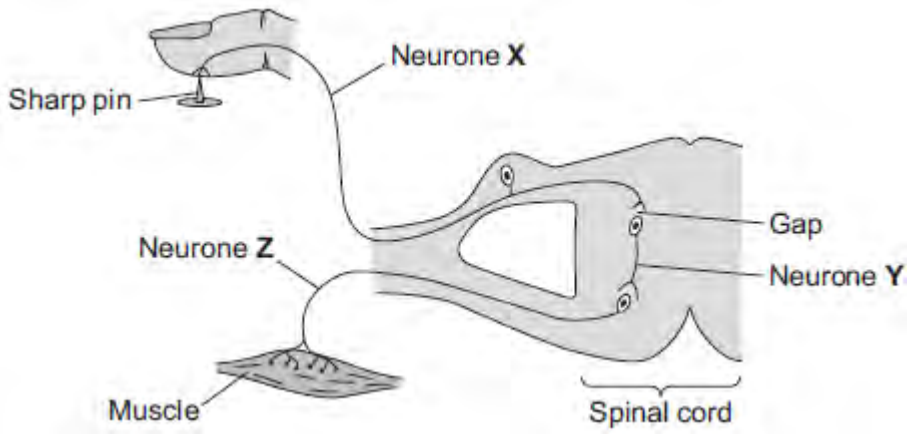
.....

.....

**(1)**

**(Total 6 marks)**

**Q5.**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)**

**Q6.** Humans use the nervous system to react to changes in the environment.

(a) (i) Which word means a change in the environment?

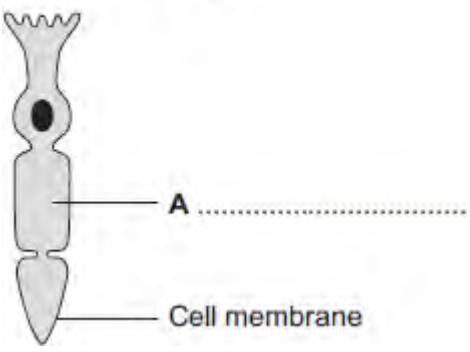
Draw a ring around the correct answer.

**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 | |

**(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 ☐

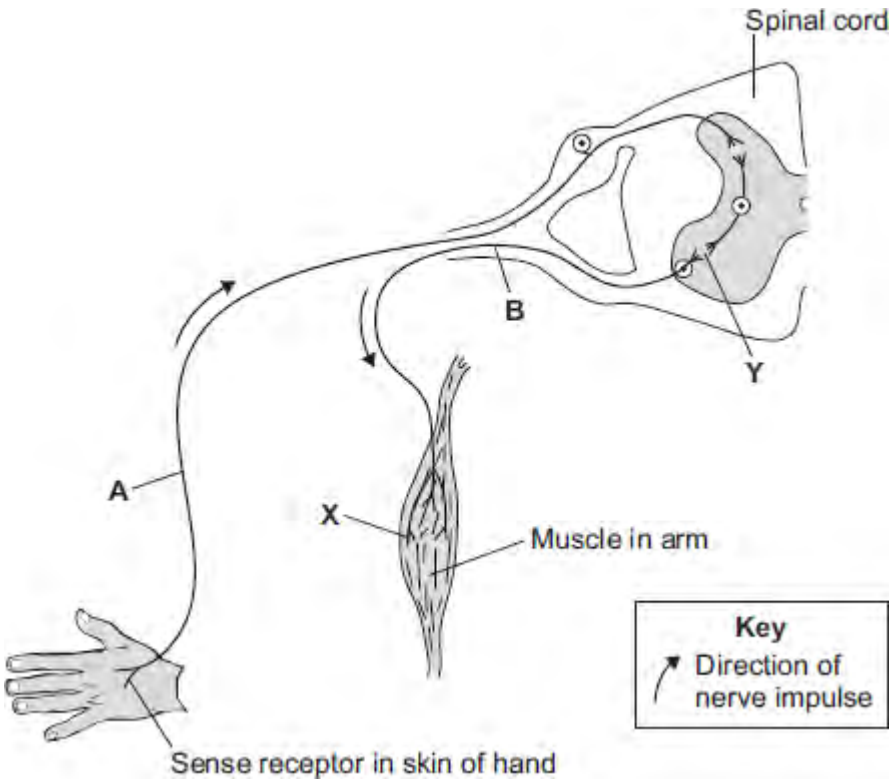
A muscle ☐

A synapse 

**(1)**
**(Total 6 marks)**

**Q7.**(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.

.....

.....

.....

.....

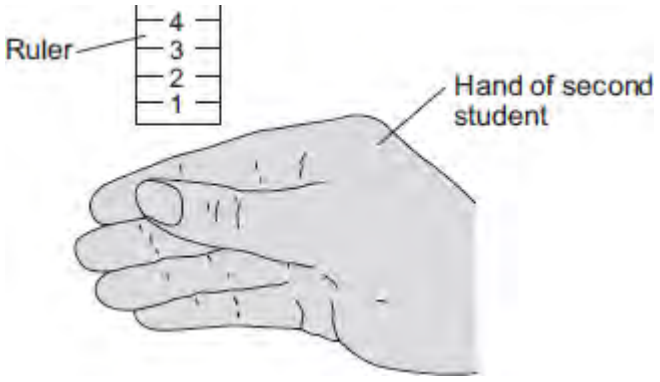
**(2)**

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

The students used the following steps.

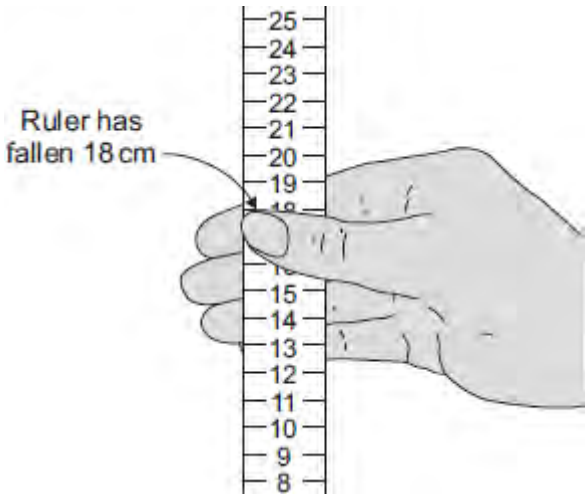
1. One student held a ruler just above a second student's hand, as shown in **Diagram 2**.

**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 |

**Table 2**

| **Distance ruler fell before it was caught in cm** |
|---|
| **After drinking coffee** |
| 8 |
| 13 |
| 11 |
| 17 |
| 10 |
| 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?

.....

.....

**(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)**

**M1.**(a) (i) cerebral cortex

*accept cerebrum / cerebral hemisphere*

**1**

(ii) MRI (scan)

*allow CAT / CT scan*
*do **not** accept MIR*

**or**

electrode stimulation

*allow electrical stimulation*

**1**

(b) (i) sharp point stimulates (pain) receptor (in the skin)

*must be in correct order*

**1**

to send (nerve) impulse

*ignore information and messages*

**1**

via sensory neurone

**1**

to spinal cord

*do **not** accept spine, ignore CNS*

**1**

crosses synapse

*allow synapse in any correct context*

**1**

to other (relay) neurones / to brain

*do **not** accept motor neurone*
*allow explanation in a flow diagram*

**1**

(ii) damage must be between arms and legs / below arms

*accept below the waist*

**1**

since information from nerves in arms still reaches the brain / information from the legs doesn't reach the brain

1

**[10]**

**M2.** (a) Y - spinal cord / central nervous system / CNS

*do **not** accept spine*

*ignore nerve / nervous system / coordinator*

*ignore grey / white matter*

**1**

W - receptor / nerve ending

*ignore sensory / neurone / stimulus*

**1**

X - effector / muscle

*allow gland*

**1**

(b) any **two** from: eg

*accept reverse argument for each marking point*

- reflex action quicker
- effect of reflex action over shorter period
- hormone involves blood system and reflex involves neurones / nerve cells

  *ignore nervous system / nerves*
- reflex involves impulses and hormone involves chemicals
- reflex action affects only one part of the body

  *ignore involves brain*

  *ignore outside / inside stimuli*

**2**

**[5]**

**M3.** (a) any **three** from:

- streamlined shape enables it to swim quickly (to catch fish)
- wings (provide power) to move quickly (to catch fish)

  *allow 'flippers'*
- wings used for steering
- white underside / dark top acts as camouflage (so prey less likely to see it)
- long / sharp beak to catch fish

**3**

(b) any **three** from:

- reduces (total) surface area of penguins exposed to wind / cold atmosphere
- reduced number of penguins exposed (to wind / cold)

  *accept reference to movement in or out of the huddle*

  *accept outer ones insulate / act as barrier*
- reducing heat loss

  *allow reduced cooling*
- 'share' body warmth / heat

**3**

(c) (i) any **two** from:

- size of tubes
- volume of (hot) water

  *accept amount of (hot) water*
- left for same length of time

  *allow measured at same time intervals*
- starting temperature

**2**

(ii) any **two** from:

- tube alone (**C**) lost heat most (rapidly)
- tube **B** intermediate
- tube **A** least (rapidly)

  *allow correct use of figures for all 3 tubes*

  *ignore just quoting final temperature*

**2**

(iii) confirms suggestion

*no mark awarded*

*accept correct answers referring to other suggestions in **(b)***

since (both outer and inner) tubes in bundle lost heat less rapidly (than 'stand − alone' tube)

*comparison needed*

**1**

penguins in a huddle lose less heat (than single ones)

*accept 'it is the same for penguins'*

**1**

(d) **if the core body temperature is too high**

blood vessels supplying the skin (capillaries) dilate / widen

*accept reference to arteries / arterioles but **not** veins / capillaries*

*do **not** accept references to movement of blood vessels*

*ignore enlarge / expand*

*reference to skin / surface required only once*

**1**

so that more blood flows through the (capillaries) in skin / near surface

*reference to 'more' needed at least once to gain **2** marks*

**1**

and more heat is lost

*reference to 'more' needed at least once to gain **2** marks*

**1**

**if the core body temperature is too low**

blood vessels supplying the skin (capillaries) constrict / narrow

*allow full marks if 'too low' given first*

*if no other marks awarded, allow vasodilation when too warm **and** vasoconstriction when too cold for **1** mark*

**1**

(e) (i) wings move to provide movement for diving

*allow muscles contract / work*

**1**

energy (for movement) comes from respiration

*do **not** allow produces / makes / creates energy*
*allow energy comes from / is supplied by / is released by respiration*

**1**

respiration / muscle contraction also releases heat

*allow produces heat*

**1**

(ii) any **three** from:

- feet not / less used **or** no muscle contraction in feet
  *allow little energy / heat released through respiration in feet*
  *do **not** allow veins / capillaries*
- vessels supplying feet constrict / less blood to feet
- so temperature in feet cools / decreases
- more heat loss from large surface area or rapid flow of cold water over foot

**3**

**[22]**

**M4.** (a) tissue → organ → organ system

*one right for **1** mark*

*three right for **2** marks*

**2**

(b) **Epithelial tissue** → covers the outside and the inside of the stomach

*more than one line from a tissue = no mark*

**1**

**Glandular tissue** → produces digestive juices

**1**

**Muscular tissue** → allows food to be churned around the stomach

**1**

(c) (i) light

*ignore dark*

**1**

(ii) moving (to the dark)

**1**

(iii) any **two** from:

- use more woodlice
- repeat the experiment
- run for a longer time

**2**

**[9]**

**M5.** (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]**

**M6.** 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 apply a 'best-fit' approach to the marking.

**0 marks**
No relevant content.

**Level 1 (1 – 2 marks)**
There is a description of thermoregulation **or** at least one correct mechanism (skin, sweat glands or muscles) but roles may be confused.

**Level 2 (3 – 4 marks)**
There is a description of thermoregulation **or** some correct mechanisms (sweating, shivering, blood flow in the skin).

**Level 3 (5 – 6 marks)**
There is a clear description of thermoregulation by TC or skin **and** some correct control mechanisms.

**examples of biology points made in the response:**

*full marks may be awarded for detailed description of what happens if the core temperature is <u>either</u> too high <u>or</u> too low*

- temperature receptors in TC
- the TC detects (core) body / blood temperature
- temperature receptors in the skin send impulses to the TC, giving information about skin temperature
- if the core body temperature is too high: blood vessels / arterioles supplying the skin capillaries dilate / vasodilation

  ***do not** accept refs to veins instead of arterioles or answers that imply blood vessels have moved up / down through the skin.*

- so that more blood flows (through the skin) and more heat is lost
- sweat glands release more sweat to cool the body
- by evaporation
- if the core body temperature is too low: blood vessels supplying the skin capillaries constrict
- to reduce the flow of blood (through the skin) and less heat is lost

  *allow idea of blood diverted to vital organs in extreme cold*
- muscles may shiver to release (heat) energy
- from respiration, some of which is lost as heat

**[6]**

**Q1.**A man hurt his head in an accident.
Doctors found that he could not remember anything that had happened on the day of the accident.

(a) (i) Name the part of the brain concerned with memory.

.....

**(1)**

(ii) Name **one** method the doctors could use to find out how much the brain was damaged.

.....

**(1)**

(b) The doctors were worried that the man might also have injured his spine.
They touched different areas of his skin with a sharp point.
They asked him to tell them each time if he could feel the sharp point.

(i) Explain how the information about the sharp point touching the skin reaches the man's brain.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

**(6)**

(ii) The doctors found that the man could feel the sharp point when the point touched his arms but not when the point touched his legs.

Suggest what this information could tell the doctors about the damage to the man's spinal cord. Explain your answer.

.....

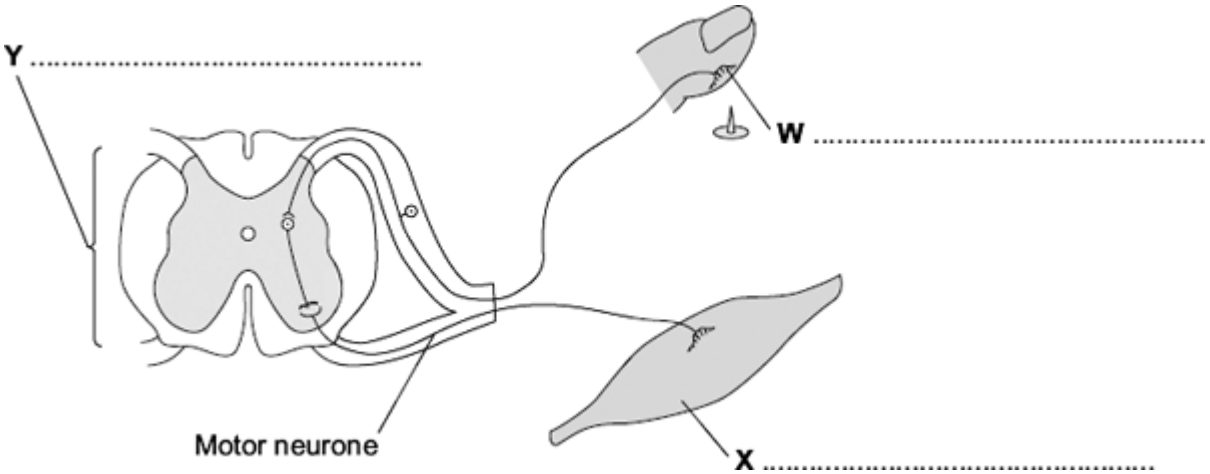
.....

.....

.....

**(2)**
**(Total 10 marks)**

**Q2.** The diagram shows the structures involved in a reflex action.




(a) On the diagram, name the structures labelled **W**, **X** and **Y**.

**(3)**

(b) The control of blood sugar level is an example of an action controlled by hormones.

Give **two** ways in which a reflex action is different from an action controlled by hormones.

1 .....

.....

.....

2 .....

.....

.....

**(2)**
**(Total 5 marks)**

**Q3.**Penguins live mainly in the Antarctic. Penguins eat mainly fish.
**Photograph 1** shows a penguin swimming underwater.

**Photograph 1**

© raywoo/iStock

(a) Use information from **Photograph 1** to suggest **three** ways the penguin is adapted for catching fish.

1 .....

.....

2 .....

.....

3 .....

.....

**(3)**

(b) The Antarctic winter is very cold. In the winter some species of penguin huddle together as shown in **Photograph 2**.

**Photograph 2**

© Fuse

Suggest how the behaviour shown in **Photograph 2** helps the penguins to survive the Antarctic winter.

.....

.....

.....

.....

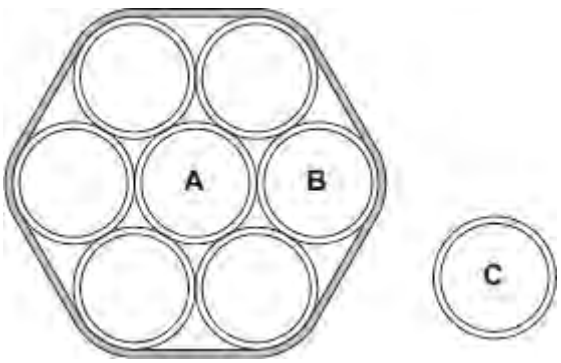
.....

.....

**(3)**

(c) A student did an investigation to model the behaviour of the penguins shown in **Photograph 2**.

The diagram shows the apparatus the student used.



The student:

- held seven similar test tubes together with elastic bands as shown in the diagram
- stood a similar eighth tube in a test tube rack
- filled each of the eight tubes with hot water to the same level
- measured the temperature of the water in tubes **A**, **B** and **C** every 2 minutes for 20 minutes.

The table shows the student's results.

| Time in Minutes | Temperature in °C | | |
|---|---|---|---|
| | Tube A | Tube B | Tube C |
| 0 | 65 | 65 | 65 |
| 2 | 65 | 65 | 64 |
| 4 | 65 | 64 | 63 |
| 6 | 64 | 64 | 62 |
| 8 | 64 | 63 | 61 |
| 10 | 64 | 63 | 60 |
| 12 | 63 | 62 | 59 |
| 14 | 63 | 62 | 58 |
| 16 | 63 | 61 | 57 |
| 18 | 62 | 61 | 56 |
| 20 | 62 | 60 | 55 |

(i) Give **two** variables that were controlled in the investigation.

1 .....

2 .....

**(2)**

(ii) Describe the patterns the data shows.

.....

.....

.....

.....

**(2)**

(iii) How far does the data from the model support the suggestion you made in part **(b)**?

.....

.....

.....

.....

**(2)**

(d) Describe how blood vessels help control human body temperature.

.....

.....

.....

.....

.....

.....

.....

.....

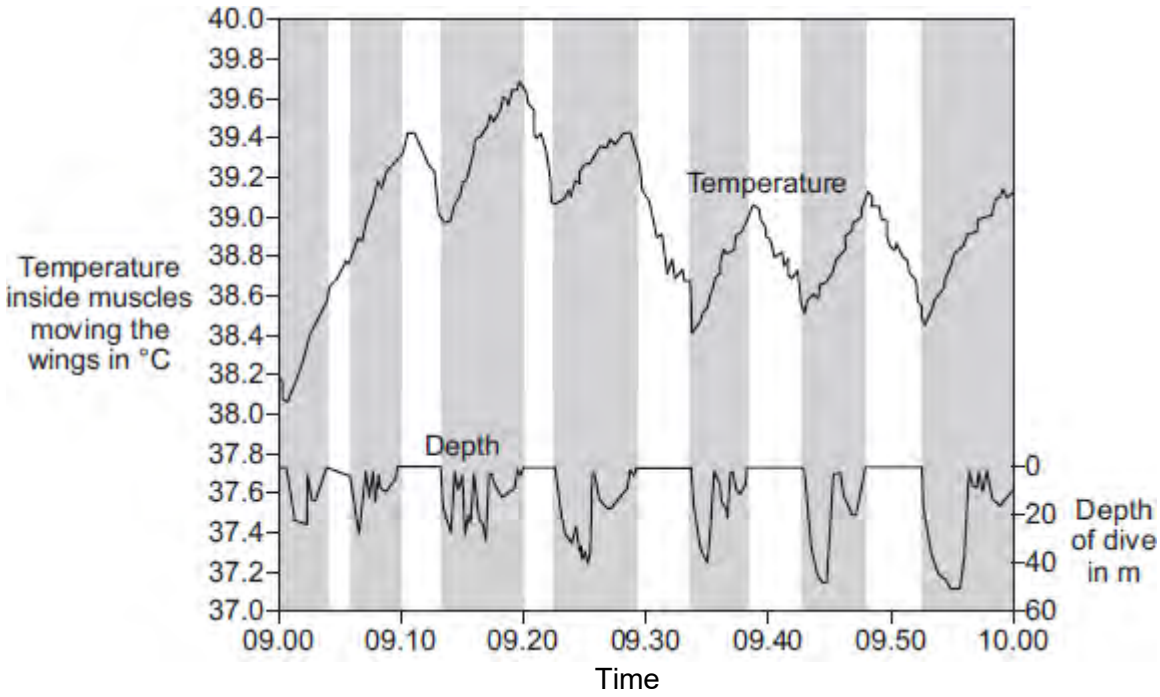
**(4)**

(e) Penguins control their body temperature in similar ways to humans.
Scientists investigated changes in body temperature of penguins when the penguins were diving to catch fish.

(i) **Graph 1** shows the relationship between the temperature of the muscles moving a penguin's wings and diving.

The shaded areas show when the penguin was diving.

**Graph 1**






Suggest an explanation for the changes in temperature inside the muscles moving the penguin's wings.

.....

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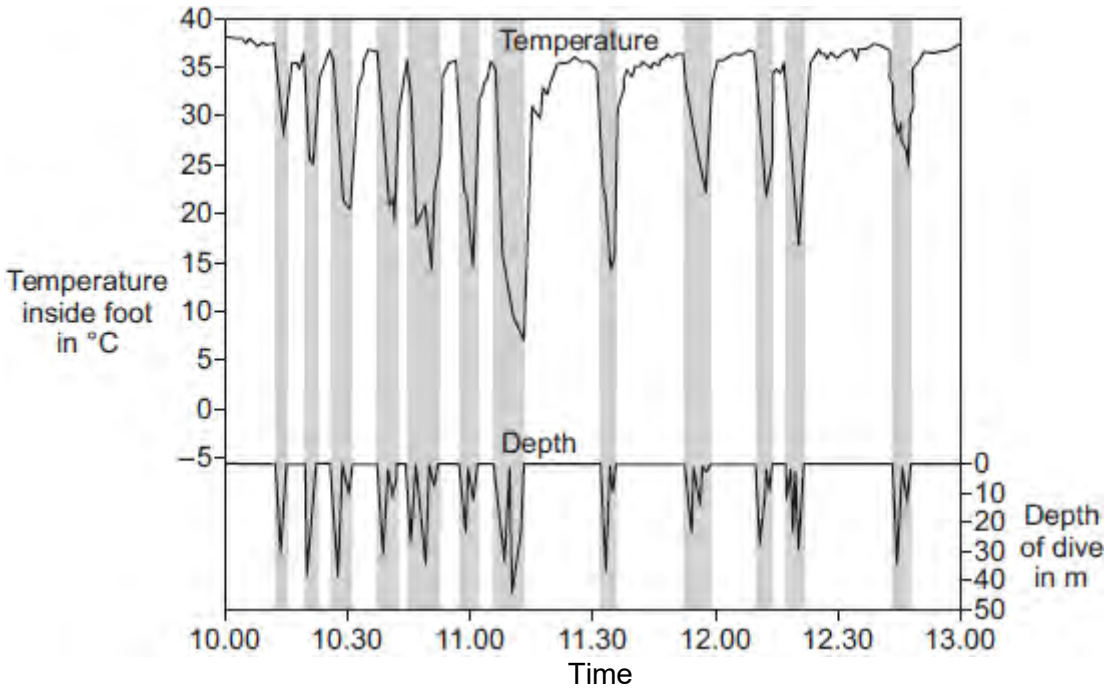
**(3)**

(ii) **Graph 2** shows the relationship between the temperature inside a penguin's foot and diving.

The shaded areas show when the penguin was diving.

**Graph 2**






Suggest an explanation for the changes in temperature inside the penguin's foot as it dives.

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.....

**(3)**
**(Total 22 marks)**

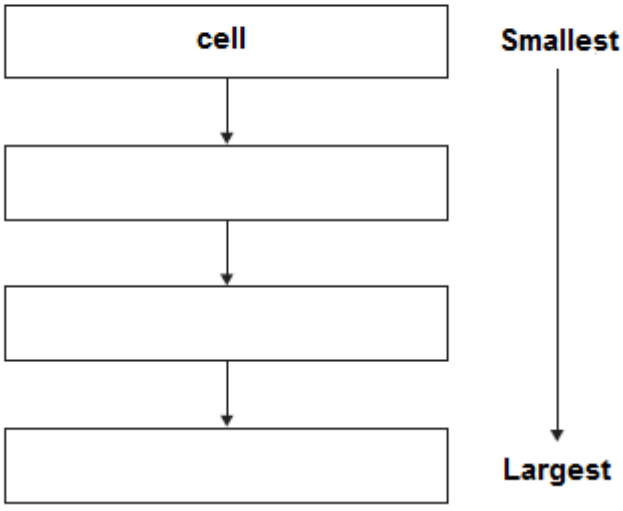
**Q4.** The human body is organised to carry out many different functions.

(a) Use words from the box to complete **Figure 1** by putting the parts of the body in order of size from smallest to largest.

The smallest one has been done for you.

| | | | |
|---|---|---|---|
| **cell** | **organ system** | **organ** | **tissue** |

**Figure 1**




**(2)**

(b) The stomach is made of different types of tissue.

Draw **one** line from each type of stomach tissue to the correct description.

| | |
|---|---|
| Epithelial tissue | Allows food to be churned around the stomach |
| Glandular tissue | Covers the outside and the inside of the stomach |
| Muscular tissue | Produces digestive juices |
| | Coordinates nerve impulses |

**(3)**

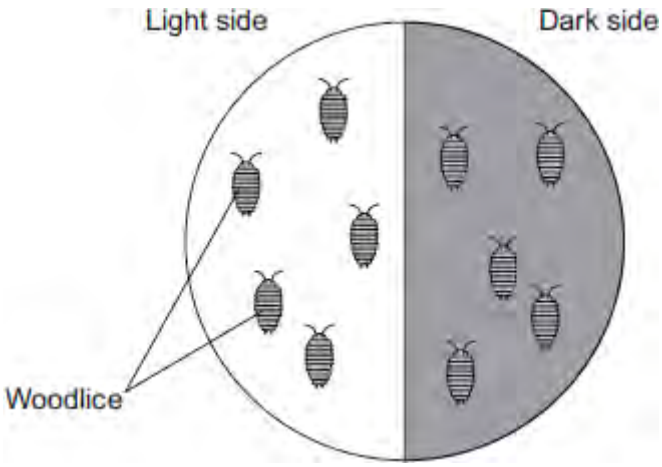
(c) Animals can react to their surroundings because they have nervous systems.

A student investigated the behaviour of small animals called woodlice.

The student set up the investigation as shown in **Figure 2.**

- The student covered one half of a Petri dish with black paper to make that side of the Petri dish dark.
- The other side had no cover.
- The student put five woodlice into each side of the dish and then put the clear Petri dish lid back on the dish.

**Figure 2**




After 30 minutes, all the woodlice had moved to the dark side of the Petri dish.

(i) In this investigation, what is the **stimulus** that the woodlice responded to?

.....

**(1)**

(ii) In this investigation, what is the **response** that the woodlice made?

.....

**(1)**

(iii) The student concluded that woodlice prefer dark conditions.

Give **two** ways in which the student could improve the investigation to be sure that his conclusion was correct.

1.....

.....

2.....

.....

**(2)**
**(Total 9 marks)**

**Q5.** 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 ..... | ..... <br> ..... |
| 2 ..... | ..... <br> ..... |

**(4)**

(ii) Some effectors help to control body temperature.

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

.....

.....

**(1)**
**(Total 7 marks)**

**Q6.In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

The human body is kept at a constant internal temperature of about 37 °C.

Body temperature is monitored and controlled by the thermoregulatory centre in the brain.

Describe what happens in the body to keep the body temperature constant.

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Extra space .....

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**(Total 6 marks)**

**M1.** (a) pupils dilated (at **B**)

*allow converse for **A***

**1**

in dim light / low light levels

**1**

because circular muscles (in iris) relax

**1**

(and) radial muscles contract

**1**

(b) figure 2 shows myopia where light does not focus on the retina

*allow refraction*

**1**

in figure 3 the lens bends the light so that light focuses on the retina

**1**

**[6]**

**M2.** (a) if body temperature too high blood vessels supplying skin (capillaries) dilate / widen

*do **not** accept capillaries / veins dilate/constrict*

**1**

if body temperature is too low blood vessels supplying skin (capillaries) constrict / narrow

*do **not** accept idea of blood vessels moving (through skin)*

**1**

*ignore expand*

*accept arteries / arterioles for 'blood vessels'*

*if no reference to skin allow blood vessels dilate and blood vessels constrict for one mark*

so more / less blood flows through skin (capillaries) or near<u>er</u> the surface of the skin

*must correctly relate to dilation or constriction*

**1**

so more / less heat is lost (from the skin by radiation)

*must correctly relate to dilation or constriction*

**1**

(b) sweat <u>released</u>

**1**

cannot evaporate because of high humidity / all the water vapour in the air

**1**

so less heat lost / less cooling

**or**

it is evaporation of sweat that cools the body

**1**

**[7]**

**M3.** (a) **A** cytoplasm

*in this order only*

**1**

**B** (cell) membrane

*do **not** accept (cell) wall*

**1**

(b) (i) synapse

**1**

(ii) (as) chemical

*accept neurotransmitter or named*

*ignore references to how the chemical is passed*

*do **not** accept electrical*

**1**

(c) (from light-sensitive cell to connecting neurone) to sensory neurone

*ignore references to synapses accept 'nerve cell' for neuron(e) throughout penalise 'nerve' for neurone once only*

**1**

(sensory neurone) to brain / CNS

*allow (sensory neurone) to relay neurone / spinal cord*

**1**

(brain / CNS) to motor neurone

*allow (relay neurone / spinal cord) to motor neurone*

**1**

(motor neurone) to (eyelid) muscle

*ignore effector*

**1**

**[8]**

**M4.** (a) **A** sensory (neurone)

*ignore nerve*

**1**

**B** motor (neurone)

*ignore nerve*

**1**

**C** spinal cord / central nervous system / white matter

*accept grey matter*

**1**

(b) by chemical / substance

*allow transmitter*

**1**

(c) muscle

*allow extensor*

*ignore muscle names*

**1**

**[5]**

**M5.** (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]**

**M6.** (a) (i) 1 hour 15 mins / 1.25 hours / 75 mins

*allow 1:15*

*ignore 1.15 hours*

**1**

(ii) increase in (core / body) temperature

*ignore numbers*

**1**

(due to an) increase in <u>respiration</u> **or** more <u>muscle</u> contraction

**1**

releasing energy (as a waste product)

*allow produces 'heat'*

*do **not** allow making energy*

**1**

skin temperature decreases

**1**

(because there is) sweating

**1**

(which) evaporates and cools the skin

*ignore references to vasodilation or vasoconstriction*

**1**

(iii) (there is) dilation of vessels (supplying skin capillaries)

*allow vasodilation*

*allow blood vessels widen*

*ignore expand*

*do **not** accept dilating capillaries or moving vessels*

**1**

(so) more blood flows (near skin) (surface) **or** blood is closer (to the skin)

*ignore ref to heat*

**1**

(c) pancreas detects (low) blood glucose

**1**

produces glucagon

*do **not** allow glucagon made in the liver*

**1**

(so) glycogen is converted to glucose

*allow adrenaline released which increases conversion of glycogen to glucose*

***or***

*reduced insulin production so less glucose into cells / less glucose converted to glycogen*

*for 1 mark*

**1**

**[12]**

**M7.** (a) any **two** from:

- drop the ruler from the same height each time
- let the ruler drop without using any force
- same type / weight of ruler
- thumb should be same distance from the ruler each time at the start
- use the same hand to catch the ruler each time
- carry out the experiment with the lower arm resting in the same way on the table

*allow description of holding bottom edge of ruler opposite the catcher's thumb*

**2**

(b) 117

**1**

(c) $\sqrt{\frac{11.6}{490}}$

**1**

0.1539

*allow 01539 with no working shown for **2** marks*

**1**

0.154

*allow 0.154 with no working shown for **3** marks*

**1**

*allow ecf as appropriate*

(d) no indication beforehand when the colour will change
**or**
you might be able to tell when the person is about to drop the ruler

**1**

measurement of time is more precise (than reading from a ruler)
**or**
resolution (of computer timer) is higher

**1**

(e) cerebral cortex

*allow cerebrum*

**1**

*ignore identified lobes*

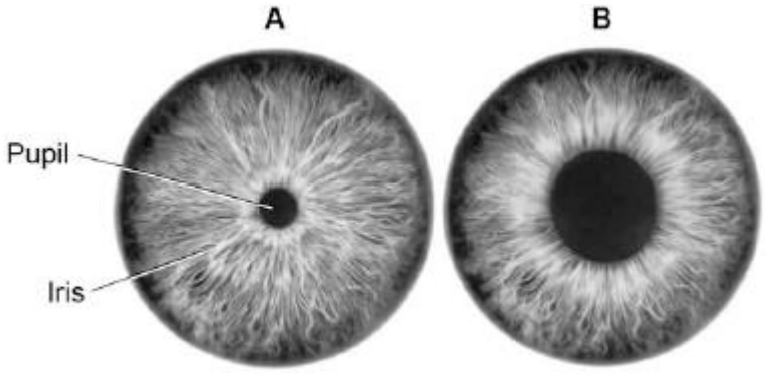
(f) cerebellum

**1**

**[10]**

**Q1.Figure 1** shows a reflex in the iris of the human eye in response to changes in light levels.

**Figure 1**




@ Gandee Vasan/Stone/Getty Images

(a) Describe the changes in the pupil and iris going from **A** to **B** in **Figure 1**.

Explain how these changes occur.

Refer to the changes in light level in your answer.

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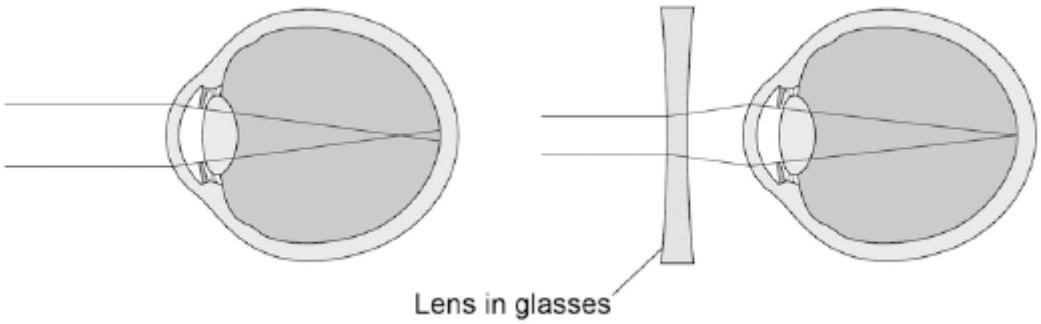
**(4)**

(b) Some people wear glasses to improve their vision.

**Figure 2** shows light entering the eye in a person with blurred vision.

**Figure 3** shows how this condition is corrected with glasses.

**Figure 2** **Figure 3**




Compare **Figure 2** and **Figure 3**.

Explain how the blurred vision is corrected.

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**(2)**

**(Total 6 marks)**

**Q2.**Humans maintain an almost constant body temperature.

(a) Describe the role of blood vessels in the control of body temperature.

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**(4)**

(b) An athlete can run a marathon in 2 hours 15 minutes on a dry day in outside temperatures up to 35 °C.

If the air is dry, his body will **not** overheat.

In humid conditions the same athlete can run the marathon in the same time. However, in humid conditions, if the outside temperature goes over 18 °C then his body **will** overheat.

Suggest an explanation for the athlete overheating in humid conditions.

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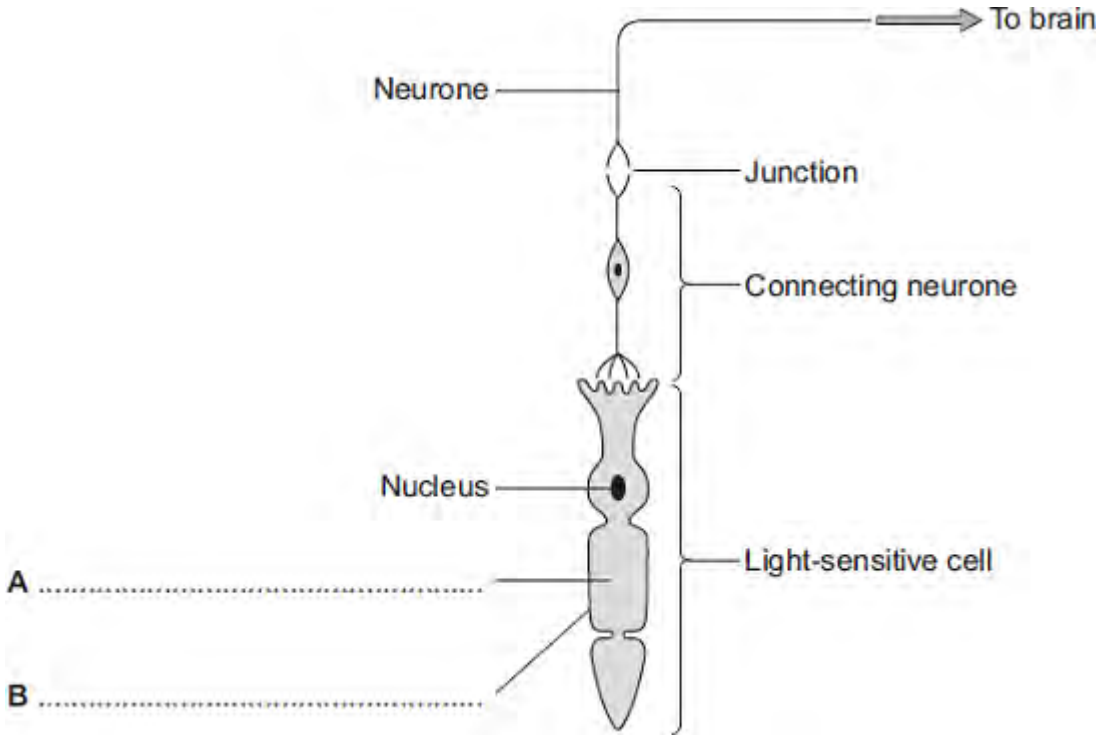
**(3)**
**(Total 7 marks)**

**Q3.Diagram 1** shows cells from the light-sensitive layer in the eye.

**Diagram 1**




(a) On **Diagram 1**, add labels to name part **A** and part **B** of the light-sensitive cell.

**(2)**

(b) There is a junction between the connecting neurone and the neurone carrying the impulse to the brain.

(i) What name is given to the junction?

.....

**(1)**

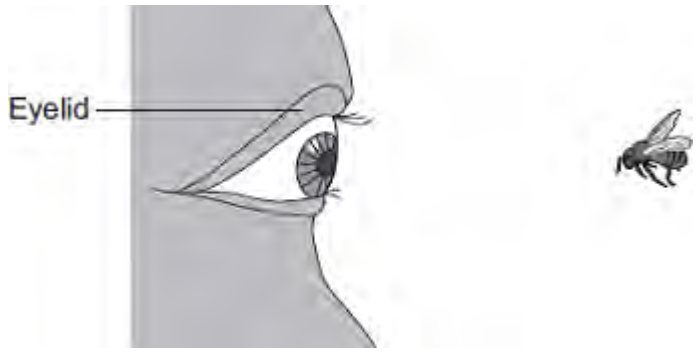
(ii) In what form is information passed across the junction?

.....

.....

**(1)**

(c) Diagram **2** shows a bee flying towards a man's eye.




In the *blink reflex* , light from the bee reaches the light-sensitive cell in the eye. The muscles in the eyelid shut the man's eye before the bee hits the eye.

Describe the pathway taken by the nerve impulse in the *blink reflex*.

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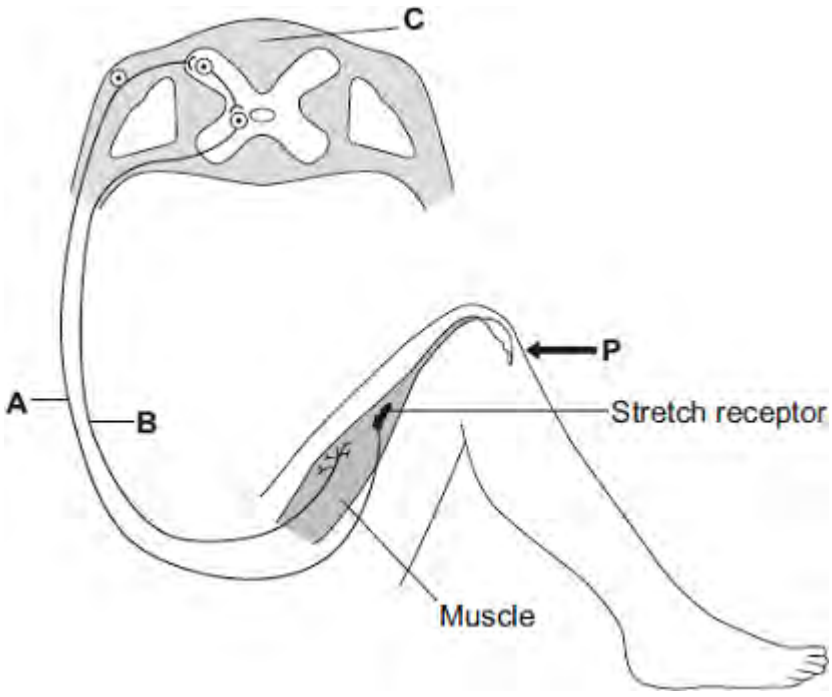
**(4)**
**(Total 8 marks)**

**Q4.** The diagram shows the structures involved in the knee-jerk reflex. When the person is hit at point **P**, the lower leg is suddenly raised.




(a) Name the structures labelled **A**, **B** and **C**.

**A** .....

**B** .....

**C** .....

**(3)**

(b) How is information passed across a synapse?

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**(1)**

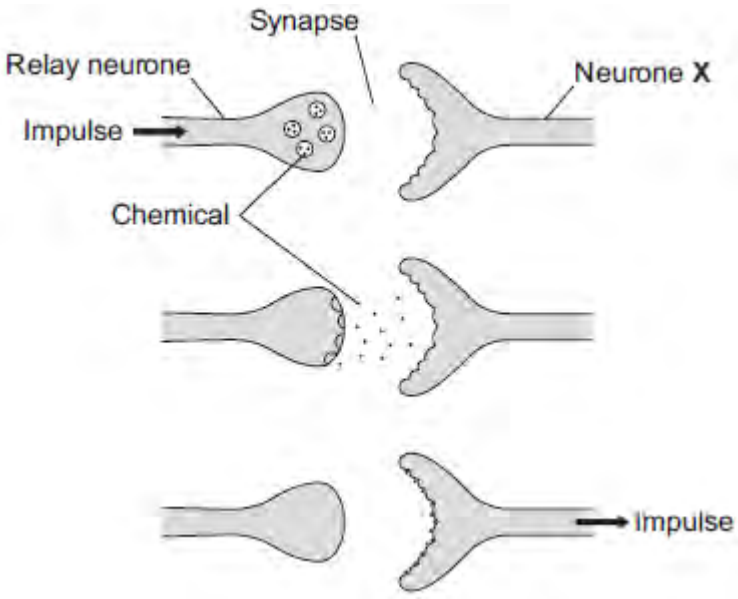
(c) What is the effector in this response?

.....

**(1)**

**(Total 5 marks)**

**Q5.** 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.

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.....

**(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 .....

.....

.....

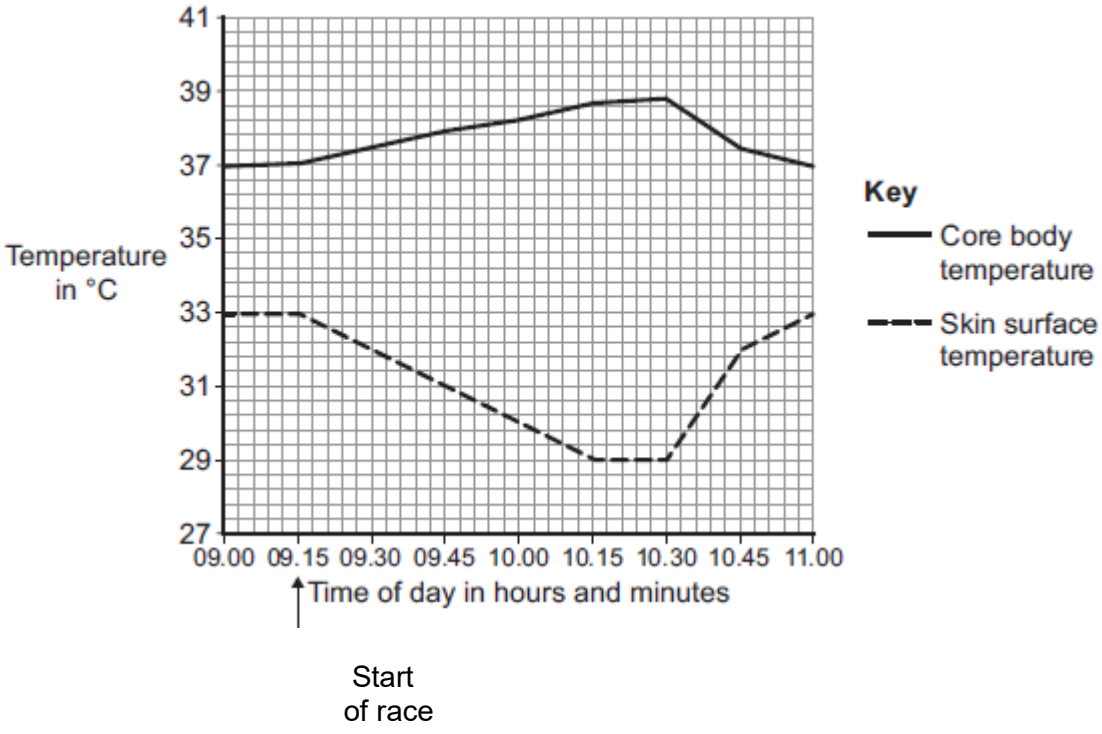
Strychnine .....

.....

.....

**(2)**
**(Total 6 marks)**

**Q6.** The graph shows the core body temperature and the skin surface temperature of a cyclist before, during and after a race.




(a) (i) When the cyclist finished the race, his core body temperature started to decrease.

How long did the race last?

.....

**(1)**

(ii) Describe and explain the different patterns shown in the core body temperature and skin surface temperature between 09.15 and 10.15.

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**(6)**

(iii) After 10.30, the core body temperature decreased.

Explain how changes in the blood vessels supplying the skin caused the skin surface temperature to increase.

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**(2)**

(b) During the race, the cyclist's blood glucose concentration began to decrease.

Describe how the body responds when the blood glucose concentration begins to decrease.

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**(3)**
**(Total 12 marks)**

**Q7.**Two students investigated reflex action times.

This is the method used.

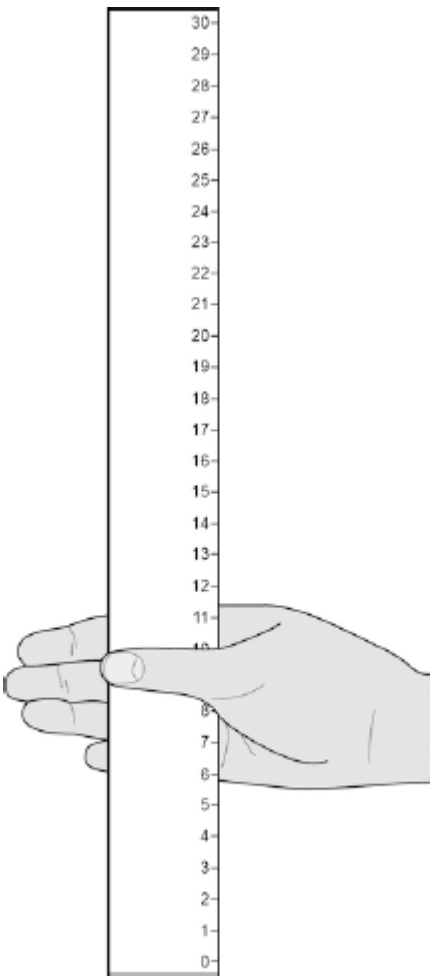
1. Student **A** sits with her elbow resting on the edge of a table.

2. Student **B** holds a ruler with the bottom of the ruler level with the thumb of Student **A**.

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

4. Student **A** catches the ruler and records the distance, as shown in the diagram below.

5. Steps **1** to **4** were then repeated.




(a) Suggest **two** ways the students could improve the method to make sure the test would give valid results.

1 .....

.....

2 .....

.....

**(2)**

(b) The table below shows Student **A**'s results.

| Test Number | Distance ruler dropped in mm |
|---|---|
| 1 | 117 |
| 2 | 120 |
| 3 | 115 |
| 4 | 106 |
| 5 | 123 |
| 6 | 125 |
| 7 | 106 |

What is the **median** result?

Tick **one** box.

106 ☐

115 ☐

116 ☐

117 ☐

123 ☐

**(1)**

(c) The mean distance the ruler was dropped is 116 mm.

Calculate the mean reaction time.

Use the equation:

**reaction time in s =** $\sqrt{\frac{\text{mean drop distance in cm}}{490}}$

Give your answer to 3 significant figures

.....

.....

.....

Mean reaction time = ..... s

**(3)**

(d) The students then measured Student **A**'s reaction time using a computer program.

This is the method used.

1. The computer shows a red box at the start.

2. As soon as the box turns green the student has to press a key on the keyboard as fast as possible.

3. The test is repeated five times and a mean reaction time is displayed.

Student **A**'s mean reaction time was 110 ms.

Using a computer program to measure reaction times is likely to be more valid than the method using a dropped ruler.

Give **two** reasons why.

1 .....

.....

2 .....

.....

**(2)**

(e) A woman has a head injury.

Her symptoms include:

- finding it difficult to name familiar objects
- not being able to remember recent events.

Suggest which part of her brain has been damaged.

.....

**(1)**

(f) A man has a head injury.

He staggers and sways as he walks.

Suggest which part of his brain has been damaged.

.....

**(1)**

**(Total 10 marks)**