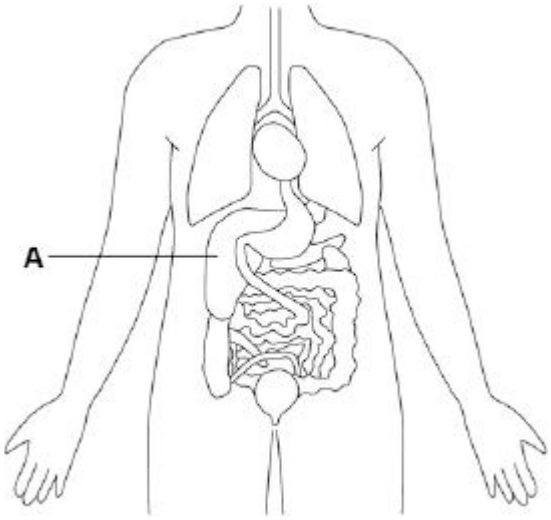
1 Humans control their internal environment in many ways.

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.

.....

.....

.....

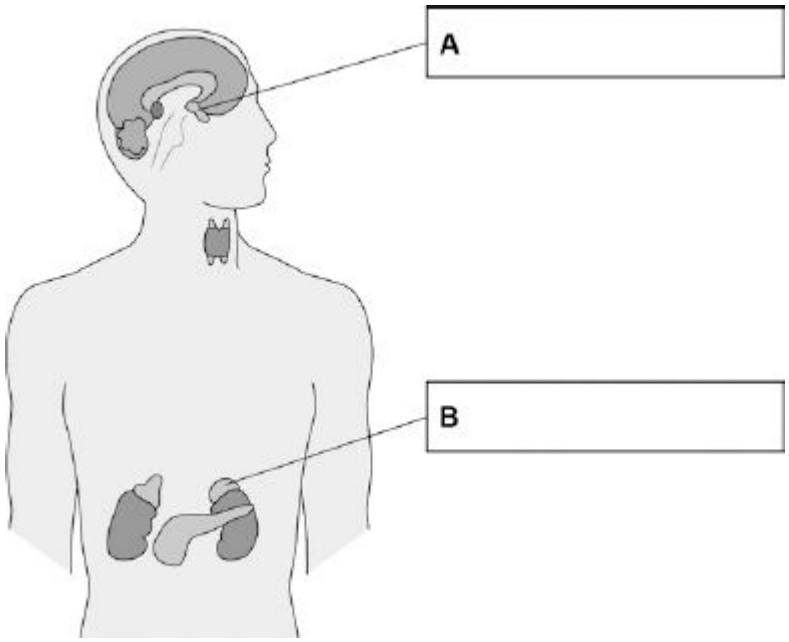
.....

(2)
(Total 5 marks)

2 Glands in the body produce hormones.

(a) Use words from the box to label gland **A** and gland **B** on the diagram below.

Adrenal	Pancreas	Pituitary	Testis	Thyroid



(2)

(b) Which gland produces oestrogen?

Tick **one** box.

Ovary ☐

Pancreas ☐

Testis ☐

Thyroid ☐

(1)

(c) **Table 1** shows some methods of contraception.

Table 1

Type of contraception	Percentage (%) of pregnancies prevented
Oral pill	>99
Implant	99
Condom	98
Diaphragm	<96

Which method of contraception in **Table 1** is **least** effective at preventing pregnancy?

.....

(1)

(d) Which method of contraception in **Table 1** will protect against sexually transmitted diseases like HIV?

.....

(1)

(e) Another method of contraception is called the intrauterine device (IUD).

There are two main types of IUD:

- copper
- plastic.

Both types of IUD are more than 99% effective.

Look at **Table 2**.

Table 2

	Copper IUD	**Plastic IUD**
How the IUD works	• releases copper • copper changes the fluids in the uterus to kill sperm	• releases a hormone • hormone thickens mucus from the cervix so the sperm have more difficulty swimming to the egg
Benefits	• prevents pregnancy for up to 10 years • can be removed at any time • can be used as emergency contraception	• prevents pregnancy for up to 5 years • can be removed at any time
Possible side effects	• very painful periods • heavy periods or periods which last for a long time • feeling sick, back pain	• painful periods • light periods or no periods • feeling sick, headaches, breast pain, acne • hormones may affect mood • ovarian cysts

Evaluate the use of the plastic IUD as a contraceptive compared to the copper IUD.

Use the information in **Table 2**.

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(4)
(Total 9 marks)

3 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.

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(4)

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

Suggest how each type of diabetes can be treated.

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(4)

(c) Look at the table below.

Population of UK in 2015	6.5×10^7
Number of people diagnosed with diabetes	3.45×10^6
Estimated number of people with undiagnosed diabetes	5.49×10^5

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.

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.....

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.

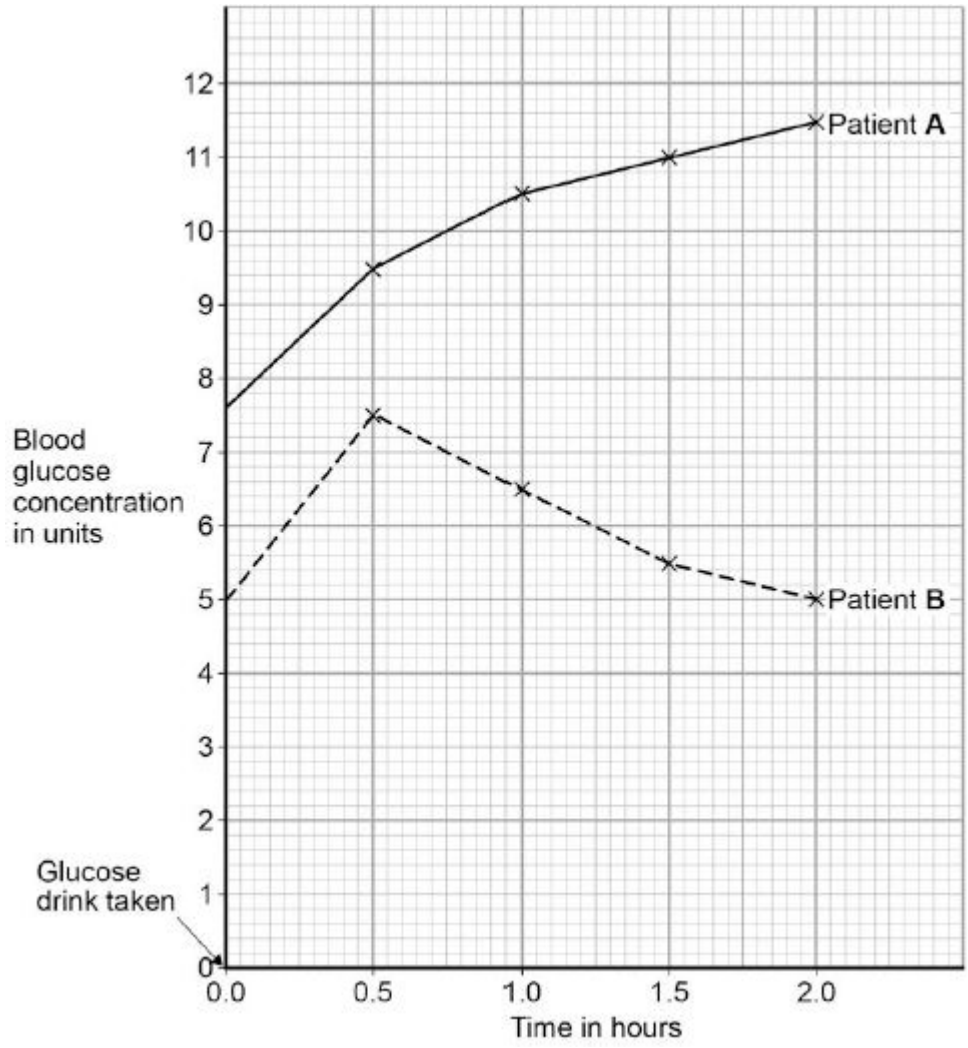
Suggest why patients are **not** allowed to eat for 8 hours before the test.

.....

.....

(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)

4 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.

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(3)

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

.....

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.....

.....

(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.

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(4)
(Total 9 marks)

5 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.

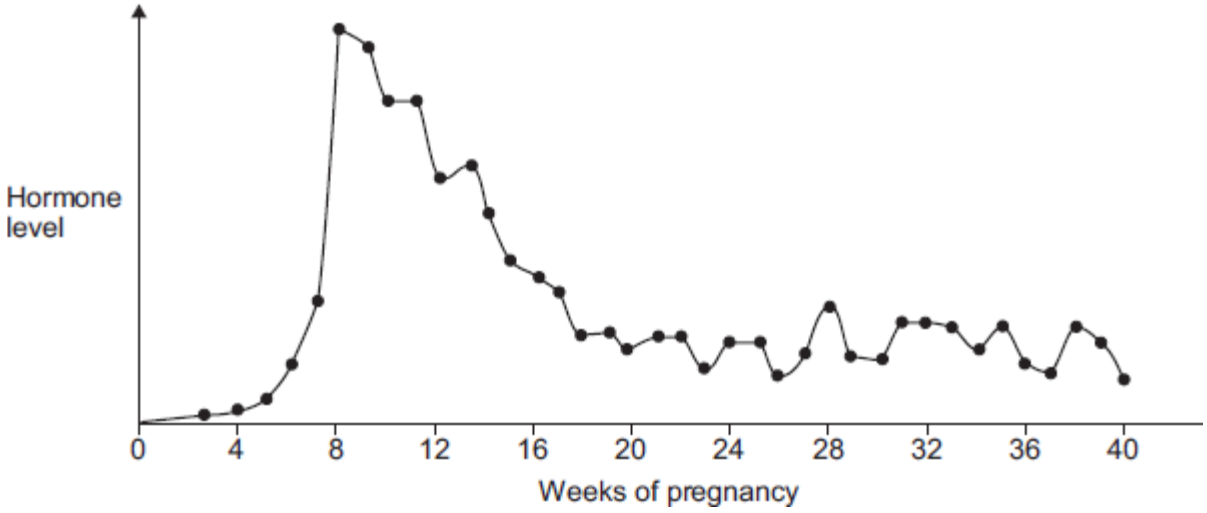
cerebellum **medulla** **pituitary gland**

(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**.

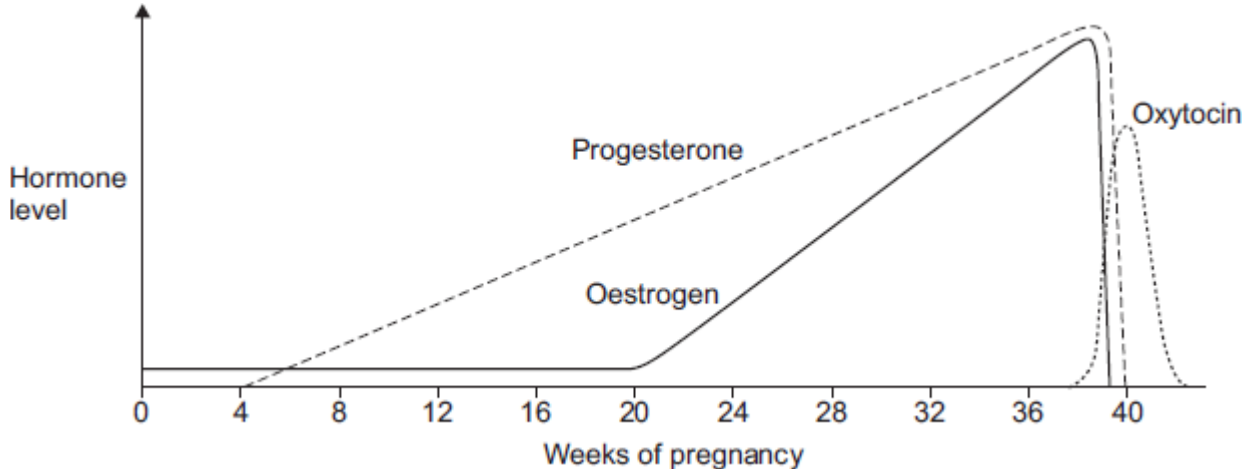
Write the correct answer in the box.

(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.

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(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.

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(2)

(Total 9 marks)

6 (a) Control systems help to keep conditions in the human body relatively constant.

What is the general name for the processes that keep body conditions relatively constant?

Draw a ring around the correct answer.

eutrophication **homeostasis** **hydrotropism**

(1)

(b) The concentration of glucose in the blood is controlled by hormones.

Use the correct answer from the box to complete each sentence.

glucagon	**glycerol**	**glycogen**
kidney	**liver**	**pancreas**

When the blood glucose concentration increases, an organ called

the ..... releases the hormone insulin.

Insulin causes glucose to move from the blood into the cells of the muscles

and the ..... .

Inside these organs, the glucose is changed into a carbohydrate called

..... , which can be stored.

When the blood glucose concentration falls, another hormone is released,

which causes the storage carbohydrate to break down into glucose again.

This hormone is called ..... .

(4)

(c) A person with Type 1 diabetes does not make enough insulin.

The person needs to test their blood at intervals throughout the day.

If the concentration of glucose in their blood is too high, the diabetic person needs to inject insulin.

(i) Insulin is a protein.

It must be injected and cannot be taken by mouth.

Explain why.

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(2)

(ii) Apart from injecting insulin, give **one other** way that a diabetic person could help to control the concentration of glucose in their blood.

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(1)

(d) Pet dogs have been trained to detect if the concentration of glucose in the blood of their diabetic owners is outside the normal healthy range. These dogs are called 'medical response dogs'.
The dogs respond in different ways. They may bark, jump up, or stare at their owners.They may even fetch a blood-testing kit.

(i) Suggest what stimulus the dogs might be responding to when they behave like this.

.....

.....

(1)

(ii) **Table 1** shows how the concentration of glucose varied in blood samples from five diabetic people. Measurements were made both before and after getting a medical response dog.

Table 1

		Mean percentage of blood samples with different concentrations of glucose from the five diabetic people		
	Number of blood samples measured	**Low glucose**	**Within normal range of glucose**	**High glucose**
Before getting a dog	1704	32.6	54.8	12.6
After getting a dog	1724	18.6	61.6	19.8

A survey was made of the effect of a medical response dog on the lives of 16 diabetic people.

Table 2 shows how well these diabetic people agreed with each statement in the survey.

Table 2

Statement in survey	**Totally agree**	**Somewhat agree**	**Neither agree nor disagree**	**Somewhat disagree**	**Totally disagree**
I am more independent since getting my dog.	12	2	2	0	0
There are disadvantages to having a medical response dog.	0	0	4	4	8

I trust my dog to alert me when my sugar levels are low.	11	3	1	0	1
I trust my dog to alert me when my sugar levels are high.	6	7	0	1	2

Evaluate how useful medical response dogs are for warning diabetic people that the concentration of glucose in their blood is outside the normal range.

Use information from **Tables 1** and **2**.

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(5)

(e) **Table 3** shows the concentrations of some substances in the urine of a non-diabetic person and in the urine of a diabetic person.

Table 3

	Concentration of substance in urine in g per dm^3	
Substance	**Non-diabetic person**	**Diabetic person**
Protein	0	0
Glucose	0	2.0
Urea	20.0	19.5
Sodium ions	6.0	5.8

Compare the results for the non-diabetic person and the diabetic person.
Give reasons for any differences.

Use your knowledge of how the kidney works.

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(5)
(Total 19 marks)

7 (a) Humans need to remove waste products from their bodies.

Which organ removes waste carbon dioxide from the body?

Tick (✓) **one** box.

Liver ☐

Lung ☐

Skin ☐

(1)

(b) Kidneys make urine. Urine is stored in the bladder.

Which **one** of the following stages is involved in making urine in a healthy kidney?

Tick (✓) **one** box.

Filtering the blood ☐

Reabsorbing **all** of the ions ☐

Reabsorbing **all** of the water ☐

(1)

(c) A healthy kidney keeps the correct amount of water in the blood.

If there is too much water in the blood, what might happen to the blood cells?

Tick (✓) **one** box.

They will take in water and burst. ☐

There will be no change. ☐

They will lose water and shrink. ☐

(1)

(d) A child has kidney failure.

A doctor recommends dialysis to treat the kidney failure.

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

The concentration of glucose in the dialysis fluid is 6 mmol per dm^3.

The results are shown below in the table.

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

(i) Suggest what the concentration of glucose in the blood will be **after** the dialysis treatment.

Draw a ring around the correct answer.

less than 6 **6** **more than 6**

(1)

(ii) Suggest what the concentration of urea in the blood will be **after** the dialysis treatment.

Draw a ring around the correct answer.

less than 28 **28** **more than 28**

(1)

(iii) Give a reason for your answer to part **(d)(ii)**.

.....

.....

(1)

(e) (i) Some patients have kidney transplants. Transplanted kidneys may be rejected by the body.

Use the correct answer from the box to complete the sentence.

antibodies	**hormones**	**tissues**

Transplanted kidneys have proteins on the surface of the cells. These proteins may be

attacked by the patient's ..... .

(1)

(ii) It is important to prevent rejection of a new kidney.

Which **one** of the following helps to prevent the kidney from being rejected?

Tick (✓) **one** box.

Giving the patient antibodies ☐

Giving the patient painkillers ☐

Tissue typing the donor kidney ☐

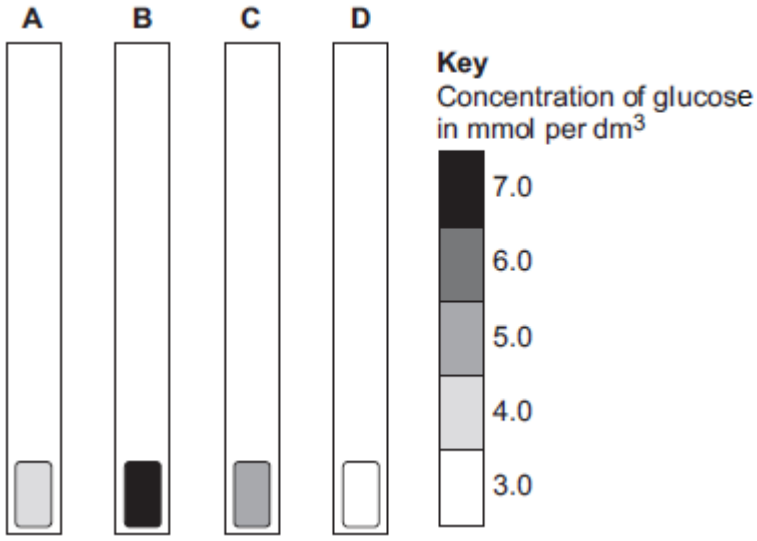
(1)

(Total 8 marks)

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

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

The diagram shows the results of their tests and the key from the test strip bottle.



(a) (i) Which student, **A**, **B**, **C** or **D**, has diabetes and has eaten a large piece of cake?

(1)

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

(1)

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

(1)

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

.....

(1)

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

Which organ monitors blood glucose concentration?

Draw a ring around the correct answer.

brain **liver** **pancreas**

(1)
(Total 5 marks)

9 Many runners drink sports drinks to improve their performance in races.

A group of students investigated the effects of three brands of sports drink, **A**, **B** and **C**, on the performance of three runners on a running machine. One of the runners is shown in the image below.

Table 1 gives information for each drink.

Table 1

	Brand of sports drink		
Nutrient per dm^3	**A**	**B**	**C**
Glucose in g	63	31	72
Fat in g	9	0	2
Ions in mg	312	332	495

(a) (i) In the investigation, performance was measured as the time taken to reach the point of exhaustion.

Exhaustion is when the runners could not run anymore.

All three runners:

- ran on a running machine until the point of exhaustion
- each drank 500 cm^3 of a different brand of sports drink
- rested for 4 hours to recover
- ran on the running machine again and recorded how much time they ran until the point of exhaustion.

The speed at which the runners ran was the same and all other variables were controlled.

The students predicted that the runner drinking brand **B** would run for the shortest time on the second run before reaching the point of exhaustion.

Use information from **Table 1** to suggest an explanation for the students' prediction.

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.....

.....

(2)

(ii) If the balance between ions and water in a runner's body is not correct, the runner's body cells will be affected.

Describe **one** possible effect on the cells if the balance between ions and water is **not** correct.

.....

.....

(1)

(b) When running, a runner's body temperature increases.

Describe how the brain monitors body temperature.

.....

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(3)

(c) (i) **Table 2** is repeated here to help you answer this question.

Table 2

	Brand of sports drink		
Nutrient per dm^3	**A**	**B**	**C**
Glucose in g	63	31	72
Fat in g	9	0	2
Ions in mg	312	332	495

People with diabetes need to be careful about drinking too much sports drink.

Use information from **Table 2** to explain why drinking too much sports drink could make people with diabetes ill.

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(3)

(ii) Other than paying attention to diet, how do people with diabetes control their diabetes?

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(1)
(Total 10 marks)

10 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.

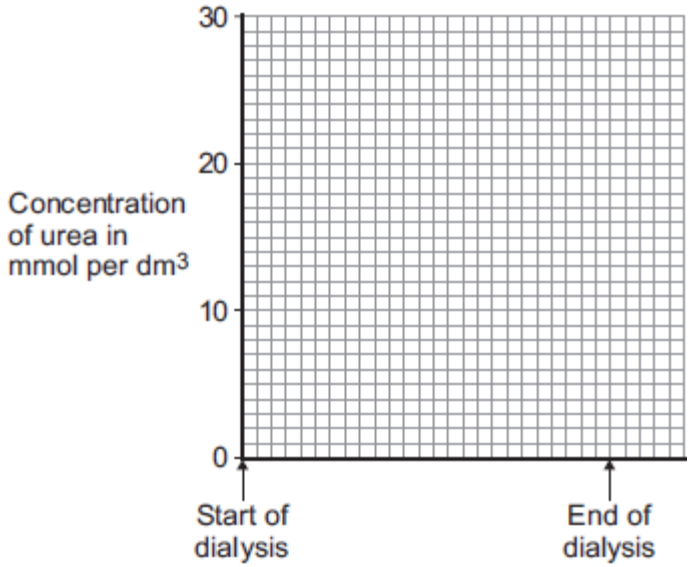
The table shows the results.

	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.

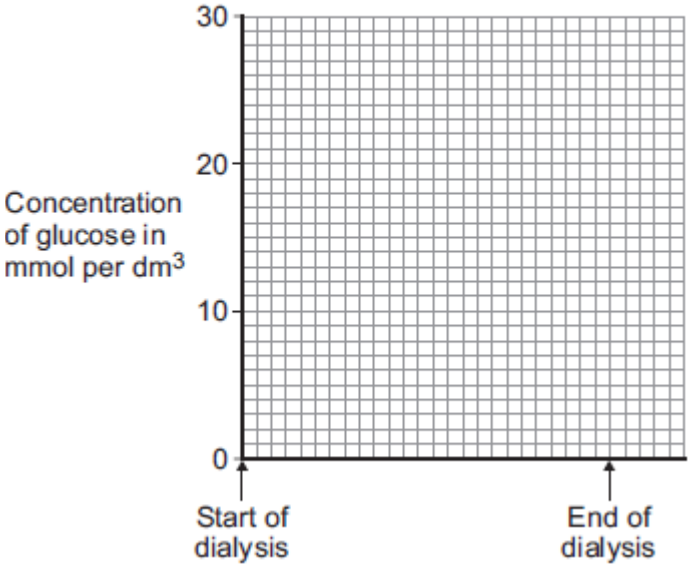
Figure 1



(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.

.....

.....

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(3)

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

.....

.....

(1)
(Total 11 marks)

11 *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)

12 (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.

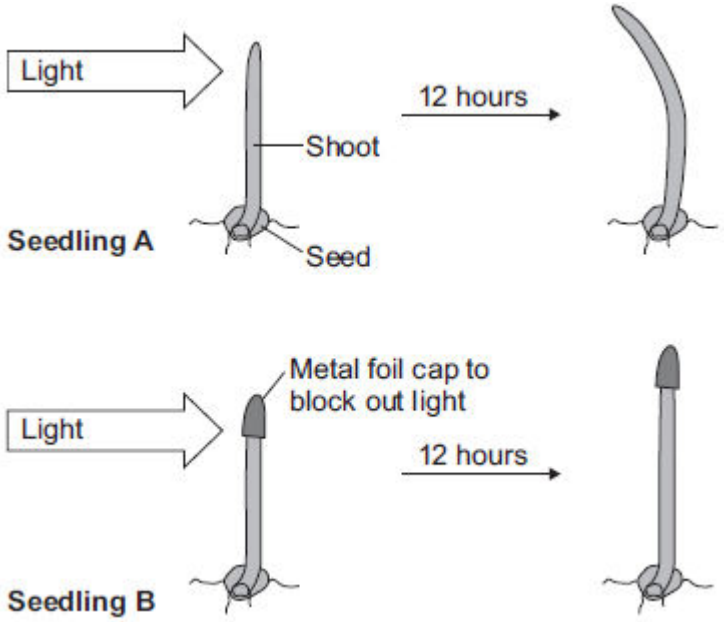
Taking cuttings to produce new plants is an example of

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?

.....

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(4)

(Total 12 marks)

13 It is important that the amount of water in the body is controlled.

(a) The table below shows the main ways that a person takes in and loses water in one day.

Water taken in		Water lost	
Method	**Volume in cm^3**	**Method**	**Volume in cm^3**
Drink	1450	Urine	1500
Food	800	Sweat	600
Metabolic water	350	Breath	
		Faeces	100
Total	**2600**	**Total**	**2600**

(i) Calculate the volume of water lost from the body through breathing.

Use information from the table above.

Volume of water lost through breathing = ... cm^3

(2)

(ii) Metabolic water is water produced by aerobic respiration.

Complete the equation for aerobic respiration.

..... + oxygen ⟶ .....+ water (+ energy)

(2)

(iii) If the water intake stays the same, what will happen to the volumes of sweat and urine lost from the body on a much hotter day?

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

The volume of sweat will

decrease.
increase.
stay the same.

The volume of urine will

decrease.
increase.
stay the same.

(2)

(b) The kidneys help to control the water content of the body and the concentrations of substances dissolved in the body fluids. The kidneys do this by filtering the blood and then reabsorbing back into the blood the substances needed by the body.

The table above shows typical concentrations of some of the substances dissolved in a person's blood plasma, in the kidney filtrate, and in the urine.

Substance	**Blood plasma in g per dm^3**	**Kidney filtrate in g per dm^3**	**Urine in g per dm^3**
Protein	70	0	0
Glucose	1	1	0
Urea	0.3	0.3	20
Sodium ions	3	3	6

(i) The table below shows that sodium ions are twice as concentrated in the urine as in the blood plasma.

Calculate how many times more concentrated **urea** is in the urine compared to the blood plasma.

Use information from the table.

.....

.....

Answer = ... times more concentrated

(2)

(ii) What is the main cause of this increase in concentration of urea between the blood plasma and the urine?

Tick (✓) **one** box.

Increased urea production by the kidney ☐

Reabsorption of water by the kidney ☐

Increased deamination of amino acids by the liver ☐

(1)

(iii) The table shows that both protein and glucose are found in the blood plasma but **not** in the urine.

Use your knowledge of kidney functioning to explain why.

Protein .....

.....

.....

.....

Glucose .....

.....

.....

.....

(4)

(c) Some people have kidney failure.

The two main types of treatment for kidney failure are dialysis and a kidney transplant operation.

Suggest reasons why most doctors think that a kidney transplant is better than dialysis treatment.

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(4)
(Total 17 marks)

14 Phenylketonuria (PKU) is an inherited condition. PKU makes people ill.

(a) PKU is caused by a recessive allele.

(i) What is an allele?

.....

.....

(1)

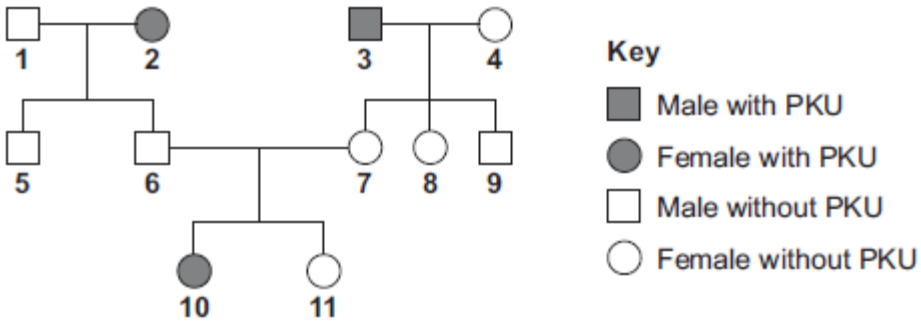
(ii) What is meant by recessive?

.....

.....

(1)

(b) The diagram below shows the inheritance of PKU in one family.



(i) Give **one** piece of evidence from the diagram that PKU is caused by a recessive allele.

.....

.....

(1)

(ii) Persons **6** and **7** are planning to have another child.
Use a genetic diagram to find the probability that the new child will have PKU.

Use the following symbols in your answer:

N = the dominant allele for **not** having PKU

n = the recessive allele for PKU.

Probability = ...

(4)

(c) Persons **6** and **7** wish to avoid having another child with PKU.

A genetic counsellor advises that they could produce several embryos by IVF treatment.

(i) During IVF treatment, each fertilised egg cell forms an embryo by cell division.

Name this type of cell division.

.....

(1)

(ii) An embryo screening technique could be used to find the genotype of each embryo.

An unaffected embryo could then be placed in person **7**s uterus.

The screening technique is carried out on a cell from an embryo after just three cell divisions of the fertilised egg.

How many cells will there be in an embryo after the fertilised egg has

divided three times? ☐

(1)

(iii) During embryo screening, a technician tests the genetic material of the embryo to find out which alleles are present.

The genetic material is made up of large molecules of a chemical substance.

Name this chemical substance.

.....

(1)

(d) Some people have ethical objections to embryo screening.

(i) Give **one** ethical objection to embryo screening.

.....

(1)

(ii) Give **one** reason in favour of embryo screening.

.....

(1)

(Total 12 marks)

15 Human body temperature must be kept within narrow limits.

The image shows a cyclist in a race.

(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?

.....

.....

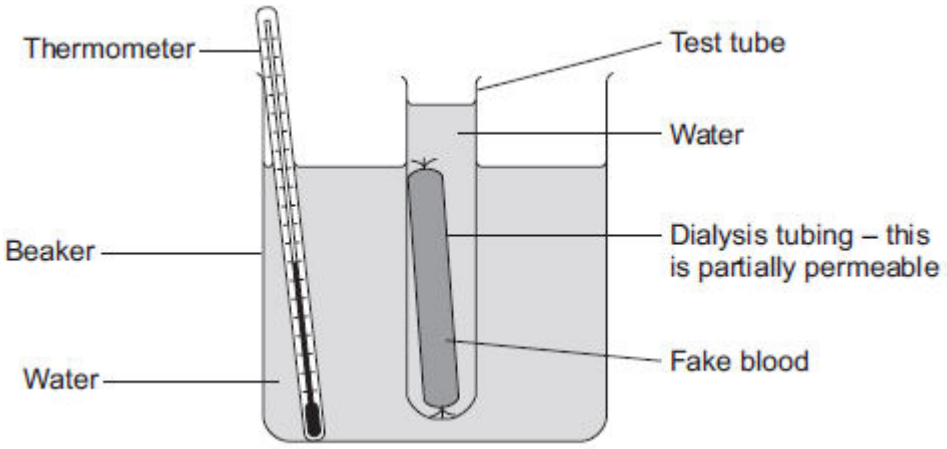
(1)
(Total 6 marks)

16 A person's kidneys stop working. The person may be treated using a dialysis machine.

Some students made a model of a dialysis machine.

Figure 1 shows the students' model.

Figure 1



The fake blood contained:

- water
- sodium ions
- urea
- glucose
- protein.

(a) (i) Suggest why the students kept the water in the beaker at 37 °C.

.....

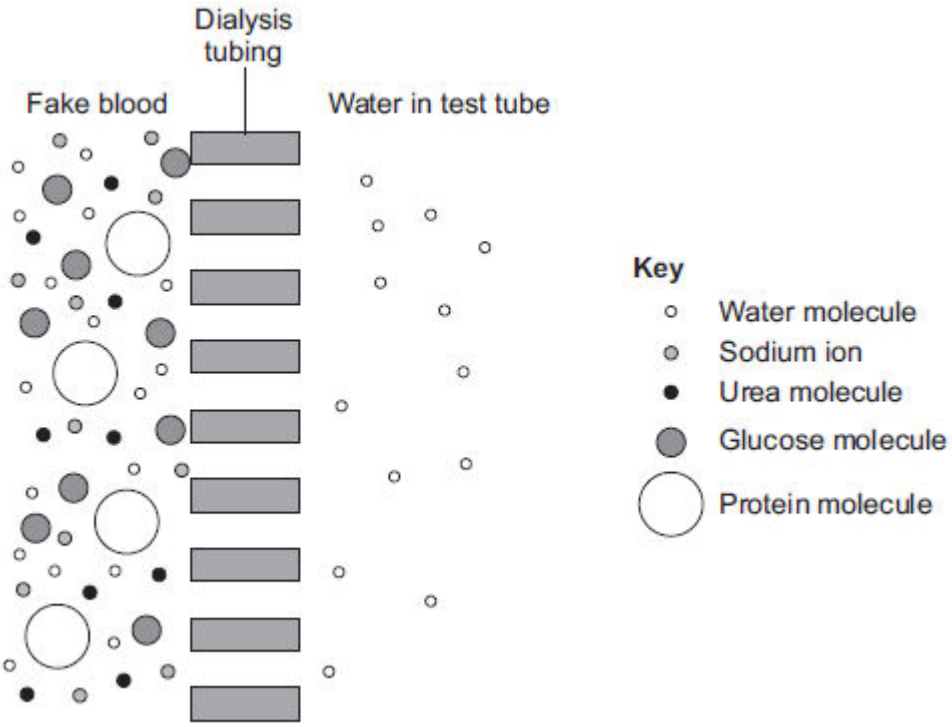
.....

(1)

(ii) The dialysis tubing separates the fake blood from the water in the test tube.

Figure 2 shows the fake blood, the dialysis tubing and the water in the test tube.

Figure 2



After 1 hour, the students tested the water in the test tube to see which substances had filtered through from the fake blood.

Name **one** substance that the students would find in the water in the test tube after 1 hour.

.....

(1)

(iii) Give a reason for your answer to part **(a)(ii)**.

.....

.....

.....

(1)

(iv) In hospitals, dialysis machines use dialysis fluid, not pure water.

Dialysis fluid contains the same concentration of useful substances as the blood.

Which substance is at the same concentration in dialysis fluid as in blood?

Tick (✓) **one** box.

Glucose ☐

Insulin ☐

Oxygen ☐

(1)

(b) When the kidneys stop working, the person can be treated by a continuous process called CPD.

In CPD:

- dialysis fluid is put into the abdomen
- the fluid is changed four times a day at home
- changing the fluid takes about 45 minutes.

Suggest **two** advantages of having CPD instead of treatment on a dialysis machine.

1 .....

.....

2 .....

.....

(2)
(Total 6 marks)

17 Blood is part of the circulatory system.

(a) (i) Give **one** function of white blood cells.

.....

.....

(1)

(ii) Which of the following is a feature of platelets?

Tick (✓) **one** box.

They have a nucleus. ☐

They contain haemoglobin. ☐

They are small fragments of cells. ☐

(1)

(b) Urea is transported by the blood plasma from where it is made to where the urea is excreted.

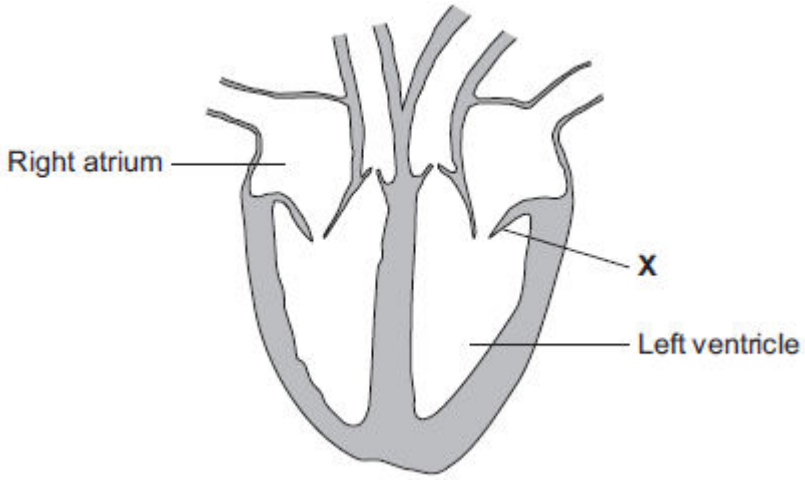
Complete the following sentence.

Blood plasma carries urea from where it is made in the .....

to the ..... where the urea is removed from the blood.

(2)

(c) The illustration shows a section through the human heart.



Structure **X** is a valve. If valve **X** stops working, it may need to be replaced.

A scientist is designing a new heart valve. The scientist knows that the valve must be the correct size to fit in the heart.

Suggest **two** other factors the scientist needs to consider so that the newly designed valve works effectively in the heart.

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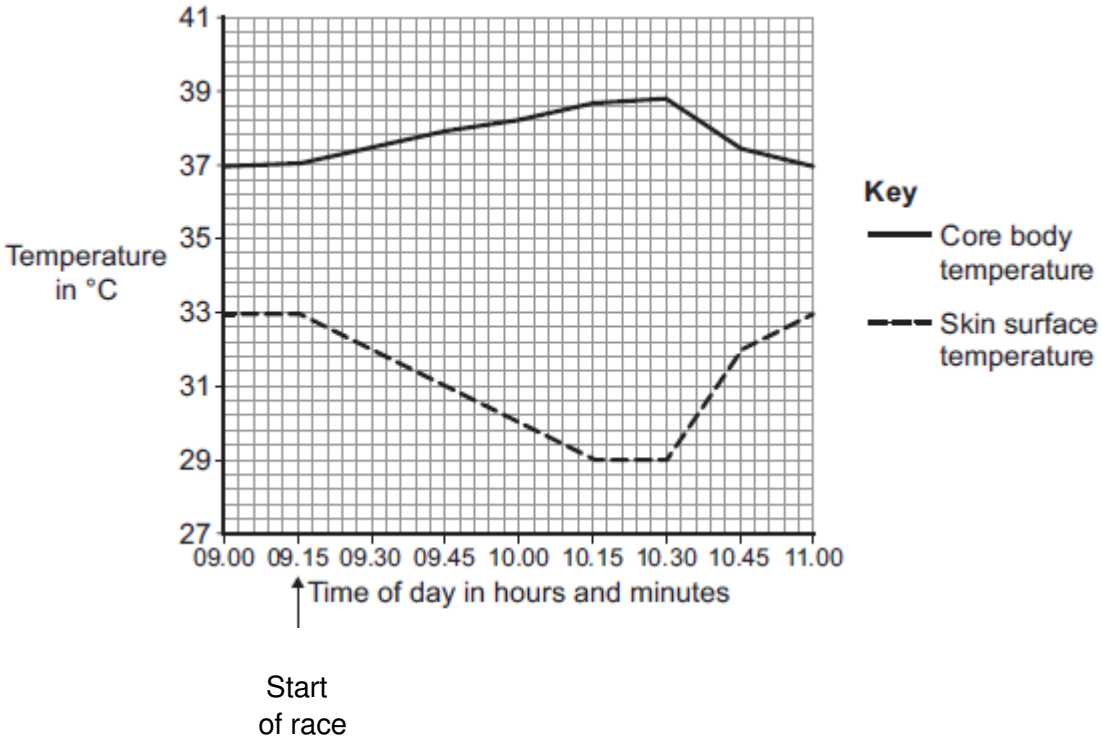
(2)
(Total 6 marks)

18 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)

19 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 .....

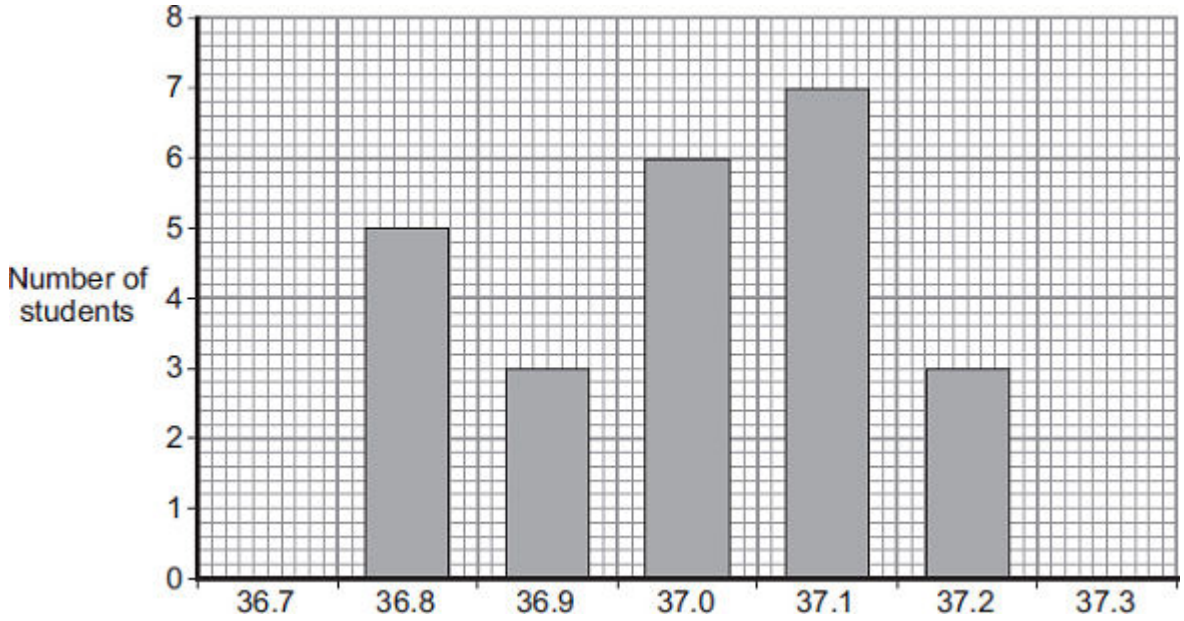
(1)

(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.

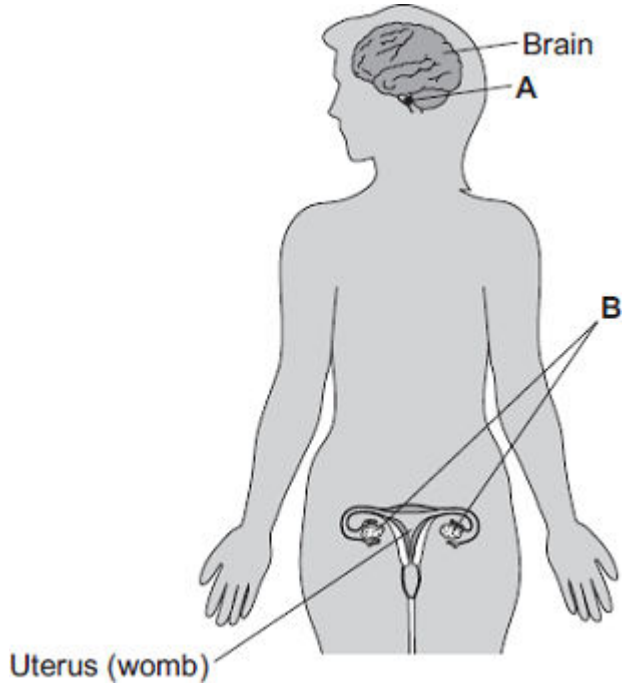
Why?

.....

.....

(1)
(Total 7 marks)

20 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)

21 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**

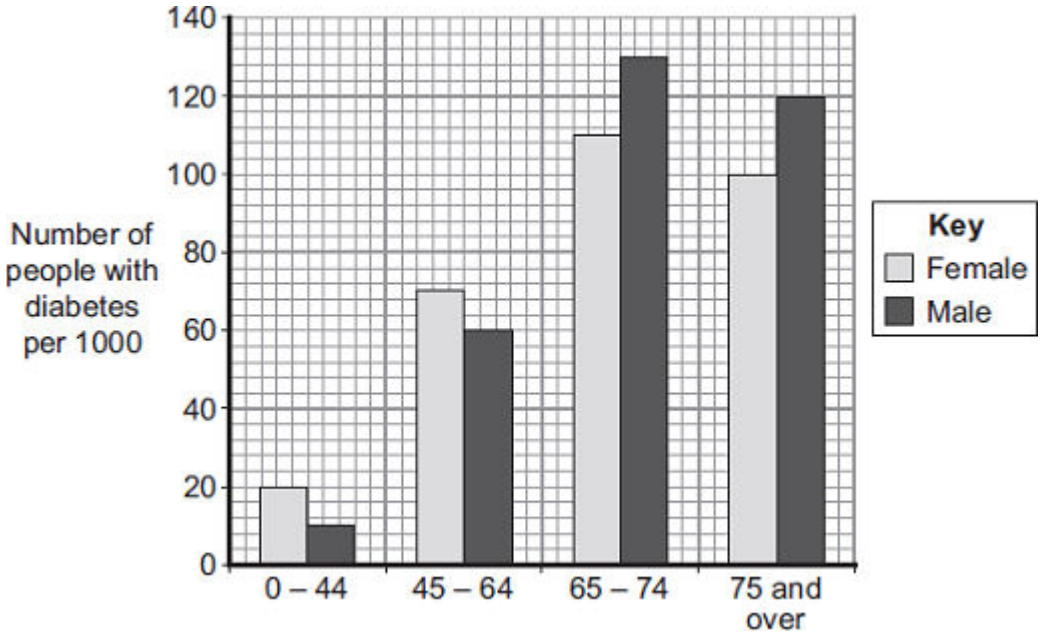
(1)

(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.

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(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)

22 (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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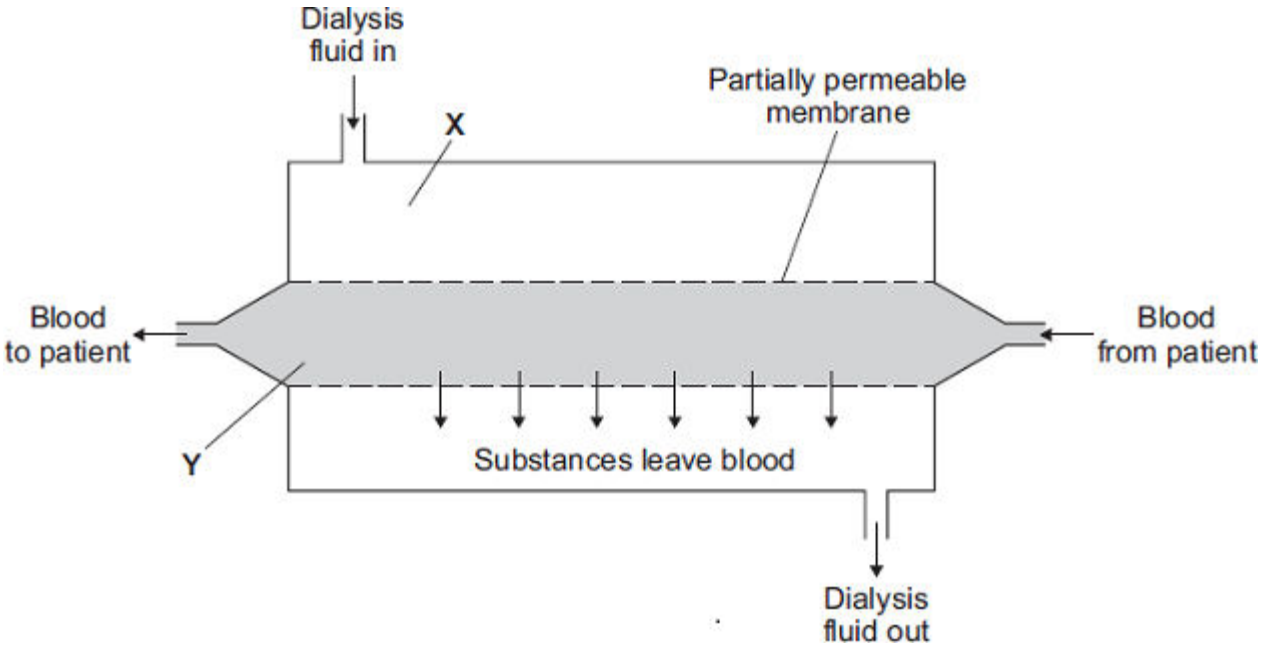
(3)
(Total 4 marks)

23 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 patient 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)

24 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.

.....

.....

.....

.....

.....

.....

(2)

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

.....

.....

.....

.....

.....

.....

(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)

25 The number of cases of Type 2 diabetes in the UK is increasing rapidly.

(a) Describe how insulin and glucagon help control the blood sugar concentration in a healthy person.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(6)

(b) What is Type 2 diabetes?

.....

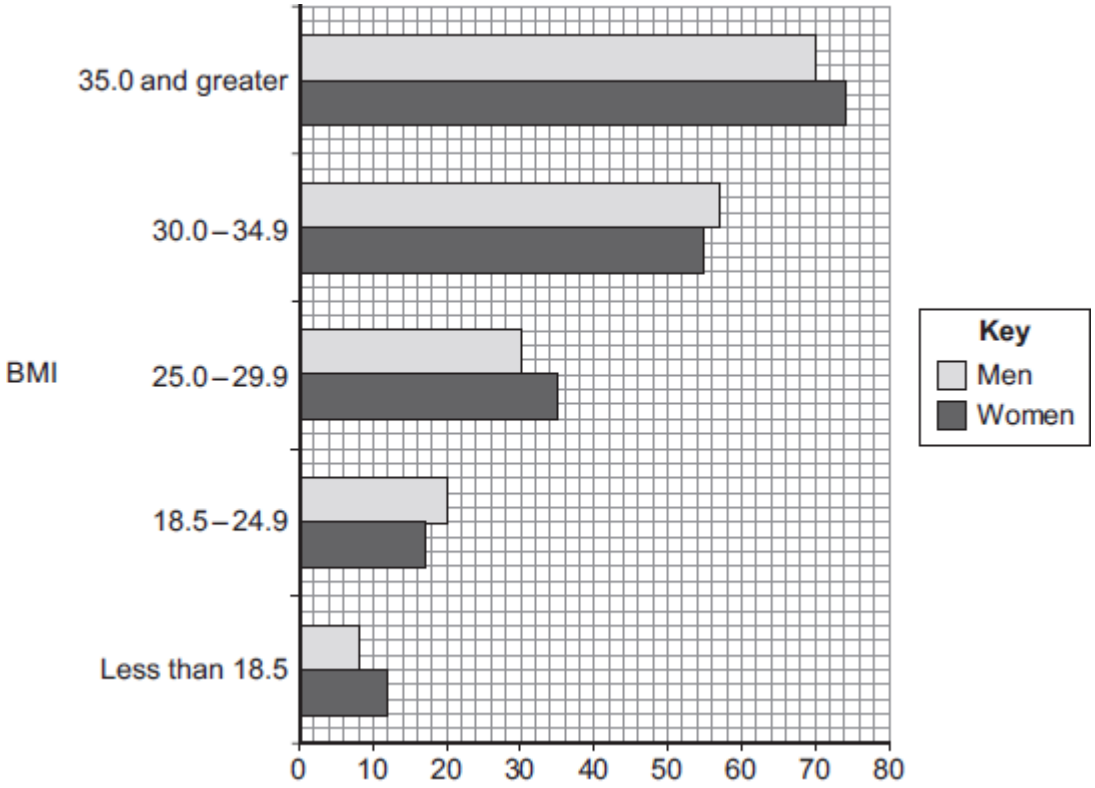
.....

(1)

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

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

Graph 1



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

.....

.....

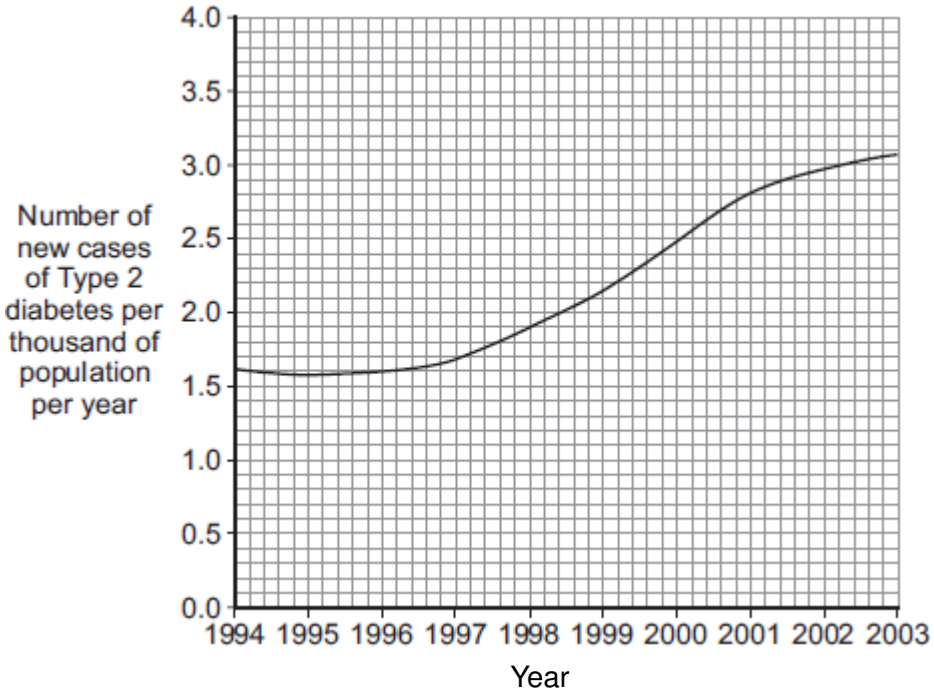
.....

.....

(2)

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

Graph 2



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

.....

.....

.....

.....

.....

.....

(3)

(Total 12 marks)

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

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

.....

.....

(1)

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

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

1.....

.....

2.....

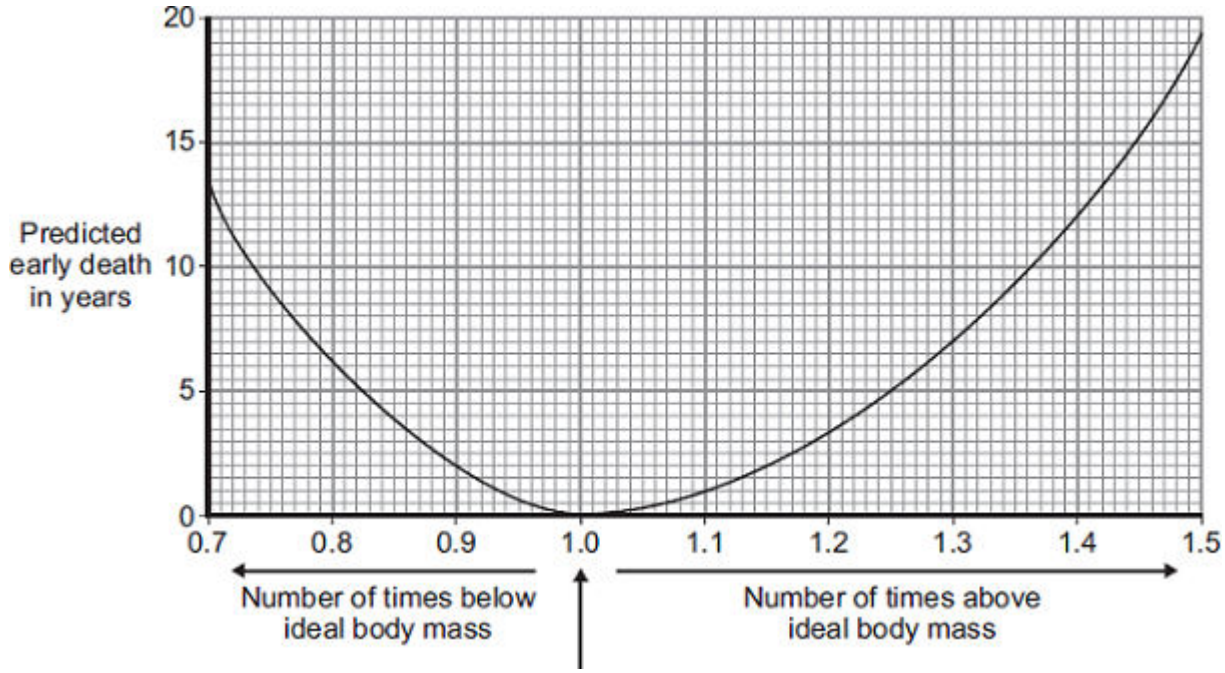
.....

(2)

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

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

The graph shows the results of the scientists' calculations.



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

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

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

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

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

.....

.....

.....

Age at death = ... years

(2)

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

Give **two** changes she should make.

1.....

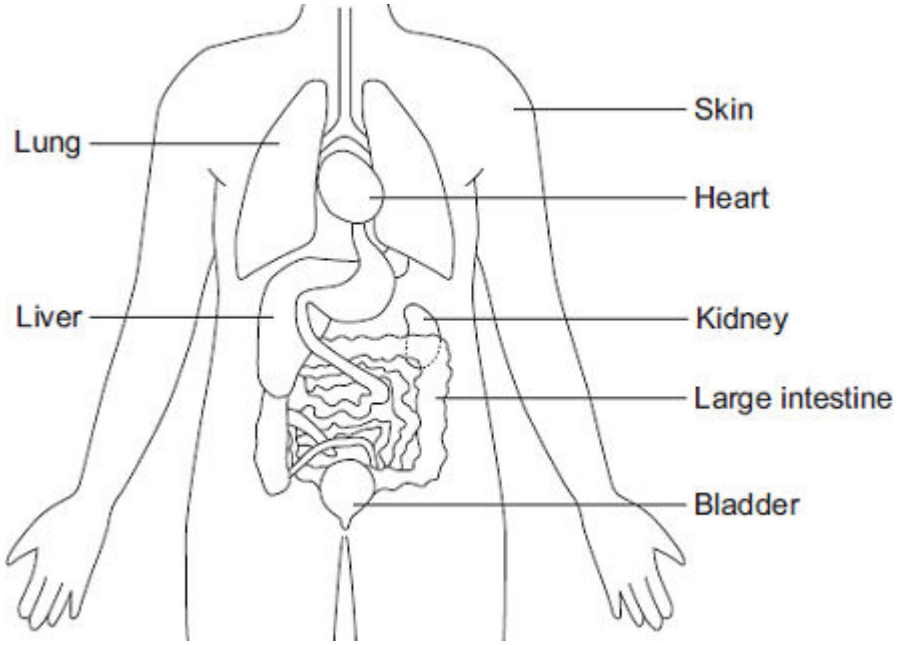
.....

2.....

.....

(2)
(Total 7 marks)

27 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 .....

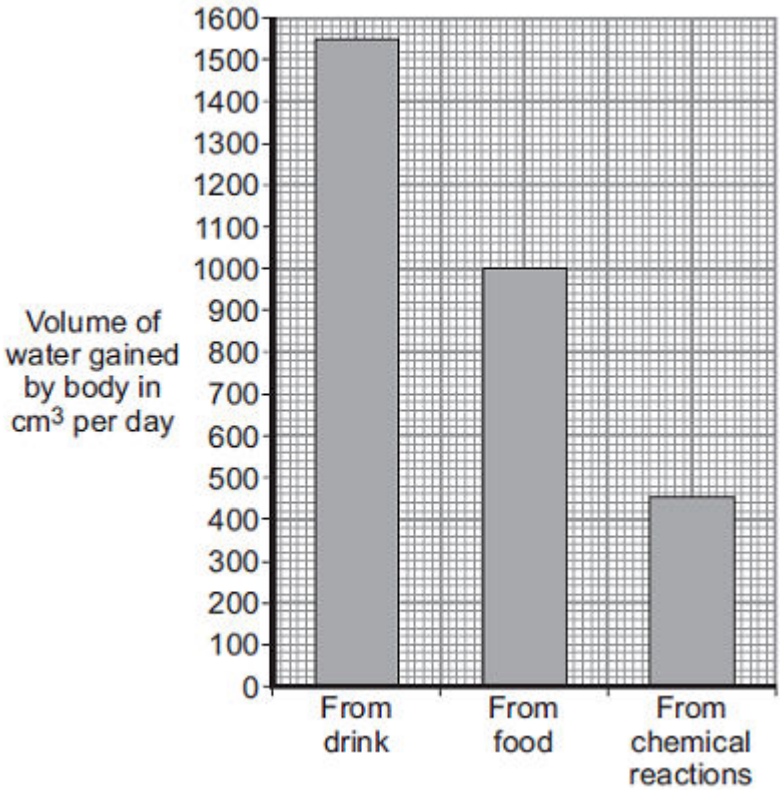
(1)

(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



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

.....

.....

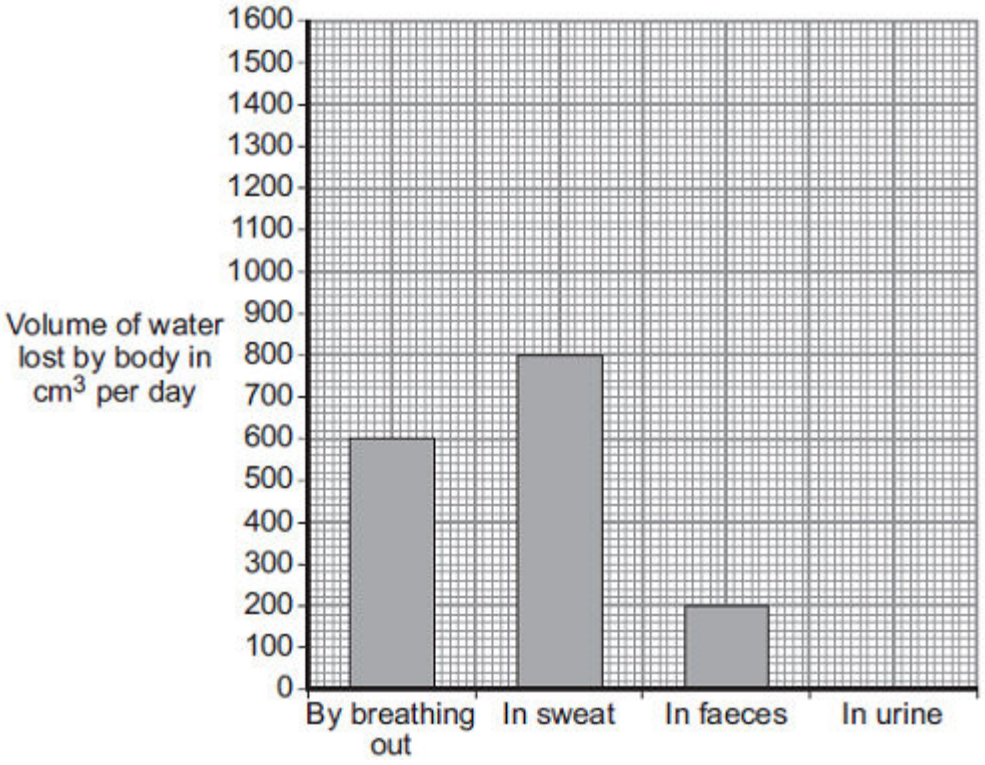
.....

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)

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

(a) Which organ produces insulin?

.....

(1)

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

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

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

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

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

.....

Give the reason for your answer.

.....

.....

(2)

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

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

.....

Give the reason for your answer.

.....

.....

(2)

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

.....

(1)
(Total 6 marks)

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

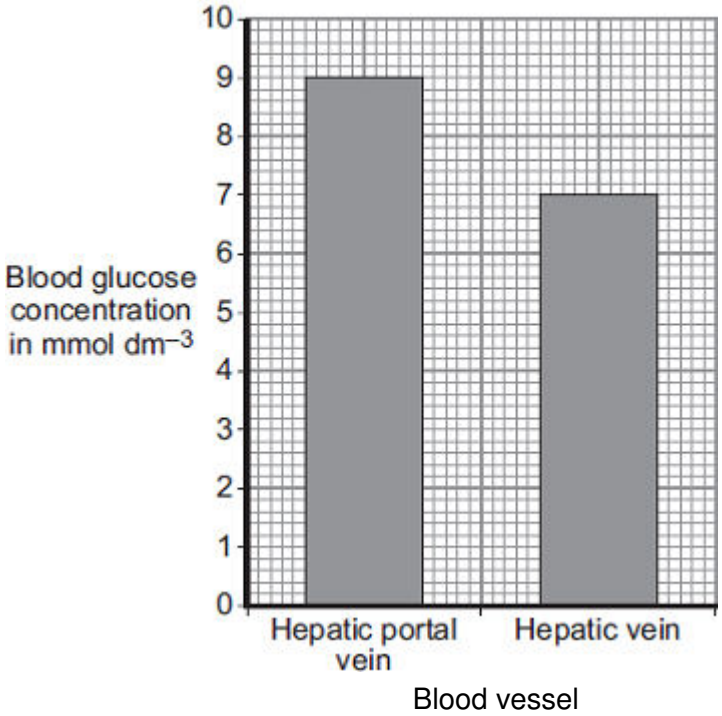
The liver has two veins:

- 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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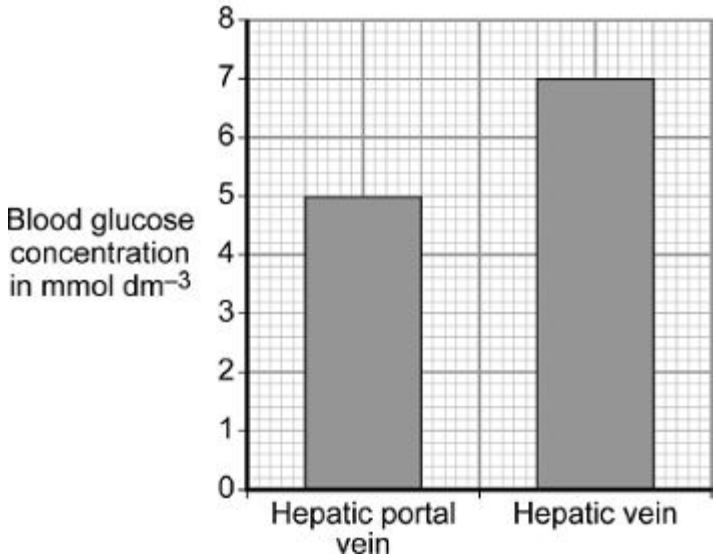
.....

(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)

30 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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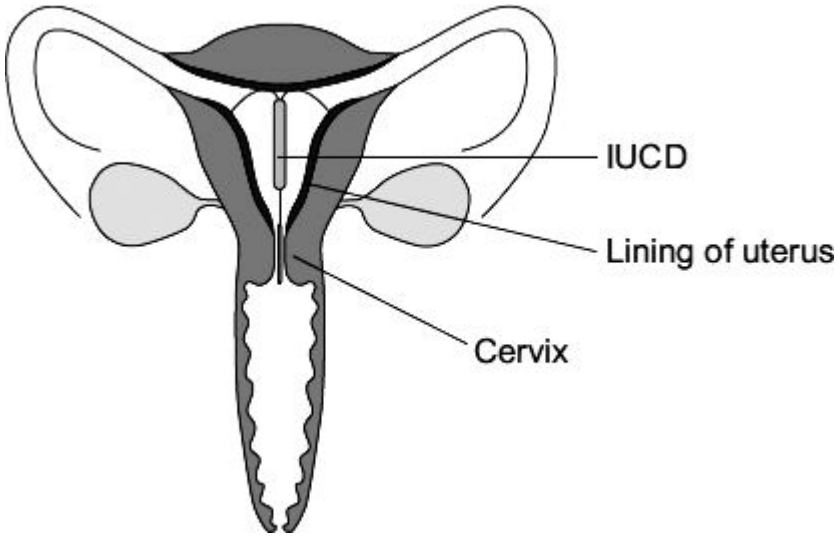
(3)
(Total 6 marks)

31 The diagram shows an intra-uterine contraceptive device (IUCD).



The IUCD is put inside the uterus (womb). The IUCD contains a hormone. The hormone diffuses directly into the uterus. The supply of hormone in the IUCD lasts for about five years.

The hormone works by:

- causing the cervix to produce a thick plug of mucus
- causing the lining of the uterus to become very thin.

For every 1000 women using the IUCD for one year about 2 women become pregnant. There are about 10 pregnancies for every 1000 women using the contraceptive pill for one year.

Evaluate the use of the IUCD compared with the contraceptive pill.

Use the information in this question and your own knowledge and understanding.

Remember to give a conclusion to your evaluation.

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(4)
(Total 4 marks)

32 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 Liver, kidney and heart damage Feeling of sickness
B	Weight gain Damage to some cells in pancreas
C	More water is kept in the body Weight gain Increased chance of bone breakage in women
Insulin	A little more water is kept in the body Weight gain Increased 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)

33 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

- impermeable.
- 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 .....

.....

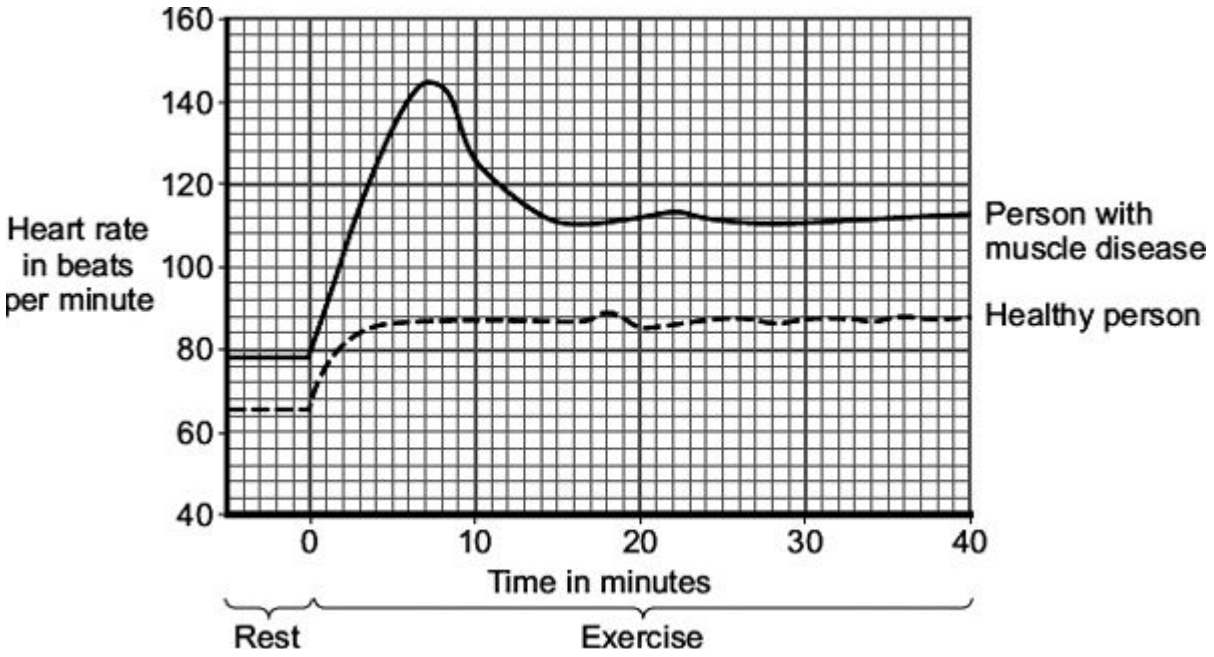
2 .....

.....

(2)
(Total 6 marks)

34 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)

35 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.

.....

.....

.....

.....

.....

.....

.....

.....

(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.

.....

.....

.....

.....

.....

.....

.....

.....

(4)
(Total 8 marks)

36 Thalidomide is a drug that was developed in the 1950s.
In the 1950s some pregnant women took thalidomide to prevent morning sickness during pregnancy.

Today, thalidomide is **not** used to prevent morning sickness.

(a) (i) Give **one** medical use of thalidomide, today.

.....

.....

(1)

(ii) Today, before a woman is given thalidomide, she is

- checked to see if she is pregnant
- told to use two different methods of contraception at the same time.

Give the reason why:

the woman is checked to see if she is pregnant

.....

.....

the woman is told to use two different methods of contraception at the same time

.....

.....

(2)

(b) The information is about two types of contraceptive pill used by women.

Combined pill

- contains two hormones
- is taken for 21 days, then no pills are taken for 7 days
- > 99 % effective at preventing pregnancy
- increases chance of headaches
- increases chance of breast cancer
- decreases chance of cancer of the ovary

Mini-pill

- contains one hormone
- must be taken at the same time every day
- < 99 % effective at preventing pregnancy
- increases chance of breast cancer

(i) Which **two** hormones does the combined pill contain?

Draw a ring around **two** answers.

LH **oestrogen** **progesterone** **FSH**

(2)

(ii) Give **two** advantages of taking the combined pill and **not** the mini-pill.

.....

.....

.....

.....

(2)

(iii) Give **one** advantage of taking the mini-pill and **not** the combined pill.

.....

.....

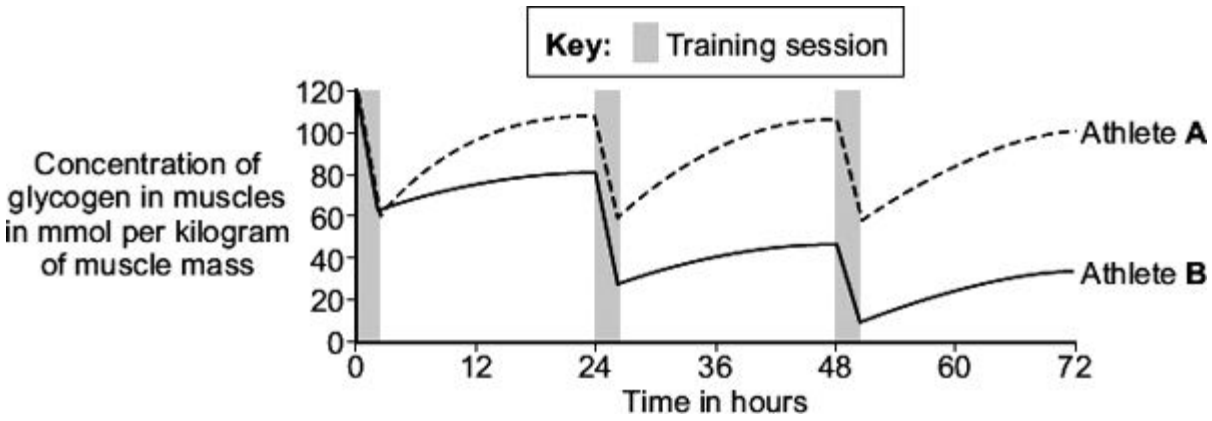
(1)
(Total 8 marks)

37 Glycogen is stored in the muscles.

Scientists investigated changes in the amount of glycogen stored in the muscles of two 20-year-old male athletes, **A** and **B**.
Athlete **A** ate a high-carbohydrate diet. Athlete **B** ate a low-carbohydrate diet.

Each athlete did one 2-hour training session each day.

The graph shows the results for the first 3 days.



(a) (i) Give **three** variables that the scientists controlled in this investigation.

.....

.....

.....

.....

.....

.....

(3)

(ii) Suggest **two** variables that would be difficult to control in this investigation.

.....

.....

.....

.....

(2)

(iii) Describe **one** way in which the results of Athlete **B** were different from the results of Athlete **A**.

.....

.....

(1)

(b) Both athletes were training to run a marathon.

Which athlete, **A** or **B**, would be more likely to complete the marathon?

Use information from the graph to explain your answer.

.....

.....

.....

.....

.....

.....

.....

.....

(4)
(Total 10 marks)

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

List B gives information about the three hormones.

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

List A **Hormone**	**List B** **Information**
	Used in some contraceptive pills to stop eggs maturing
FSH	
	Used as a fertility drug to make eggs mature
LH	
	Causes the lining of the womb to break down
Oestrogen	
	Stimulates the release of eggs in IVF

(3)

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

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

Use the information in the table to answer these questions.

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

.....

(1)

(ii) Explain why you chose this method.

.....

.....

(1)

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

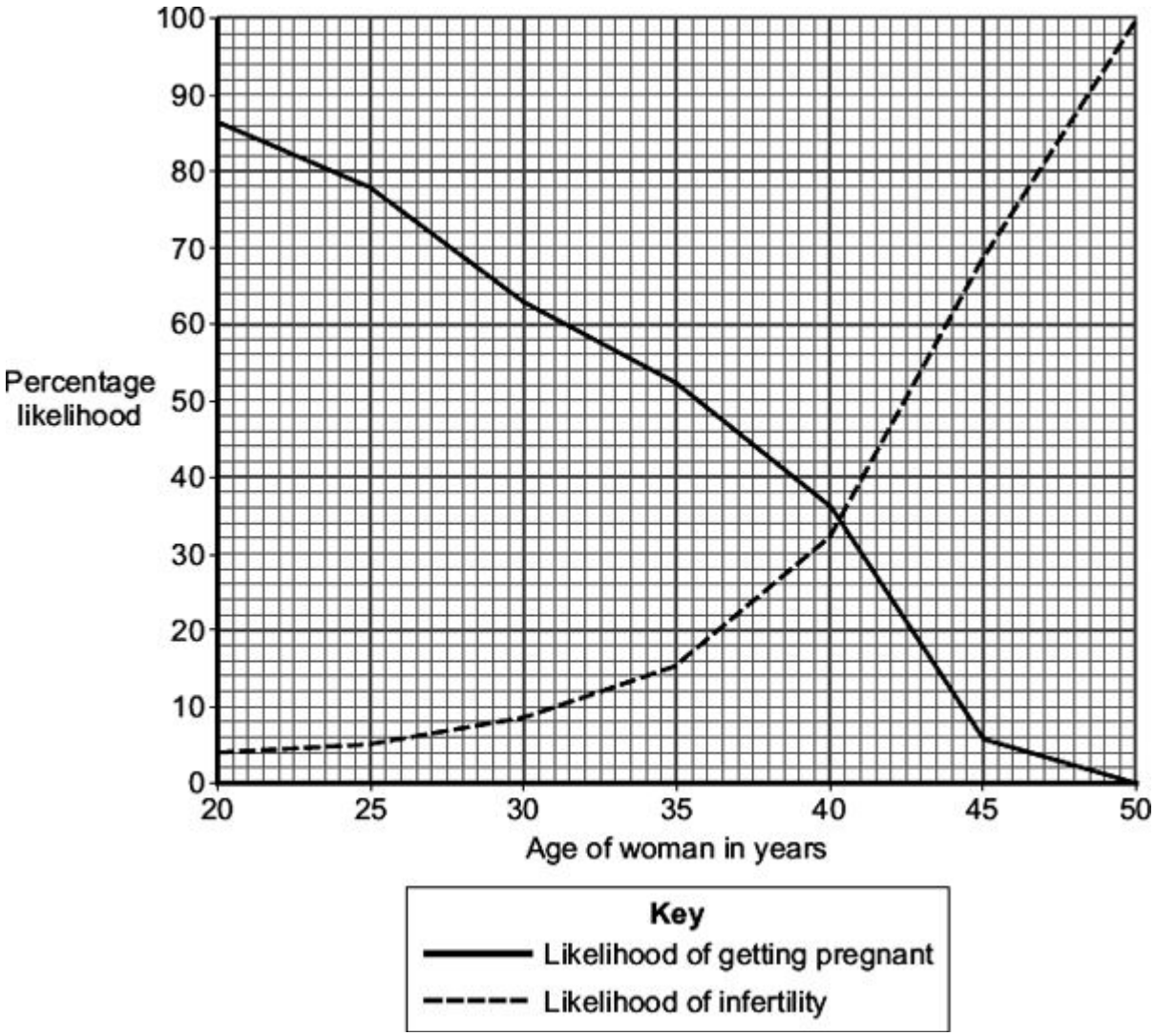
.....

(1)

(Total 6 marks)

39 The graph shows how the likelihood of getting pregnant and the likelihood of infertility change with a woman's age.

The data is for healthy women who have unprotected sexual intercourse during one year.



(a) Use information from the graph to answer this question.

A woman in her mid-twenties is thinking about waiting until her late-thirties before she has children.
A doctor advises the woman not to wait.

Explain why the doctor gives this advice.

.....

.....

.....

.....

.....

(2)

(b) The hormones FSH and LH are used in fertility treatment.

Give the function in fertility treatment of:

(i) FSH

.....

.....

(1)

(ii) LH.

.....

.....

(1)

(c) In the first stage of in-vitro fertilisation (IVF), eggs from the mother are fertilised with sperm from the father.

Describe the next stages of IVF.

.....

.....

.....

.....

(2)
(Total 6 marks)

40 The volume of water the body needs depends on a number of factors.

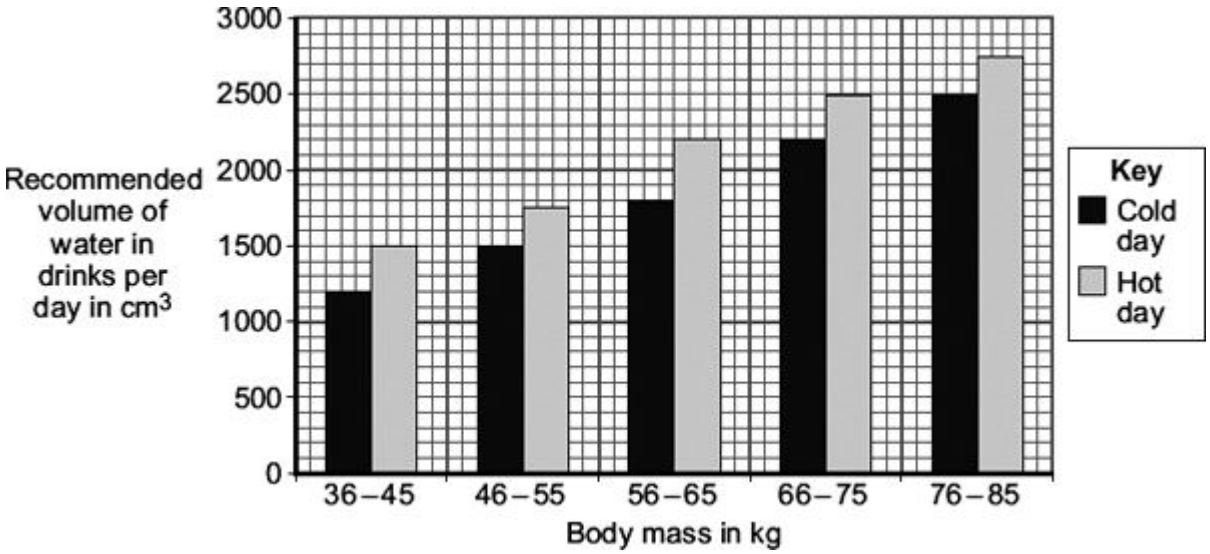
(a) Water enters the body in drinks.

Give **one** other way the body can get water.

.....

(1)

(b) The chart shows the recommended volume of water that women of different body masses should drink, on a cold day and on a hot day.



(i) Describe the relationship between body mass and the recommended volume of water that a woman should drink.

.....

.....

(1)

(ii) What is the recommended volume of water that a 70 kg woman should drink on a cold day?

..... cm^3

(1)

(iii) While following a diet, the 70 kg woman loses 10 kg of body mass.

Calculate how much less water she is recommended to drink on a cold day.

Use information from the chart.

Show clearly how you work out your answer.

.....

.....

.....

Answer = ... cm^3

(2)

(c) It is recommended that women should drink more water on a hot day than on a cold day.

Why?

.....

.....

.....

.....

(2)

(d) Excess water is lost from the body in urine.

Name the organ that produces urine.

.....

(1)
(Total 8 marks)

41 It is important that the concentration of glucose (sugar) in the blood is controlled.

(a) (i) Which hormone controls the concentration of glucose in the blood?

.....

(1)

(ii) Which organ produces this hormone?

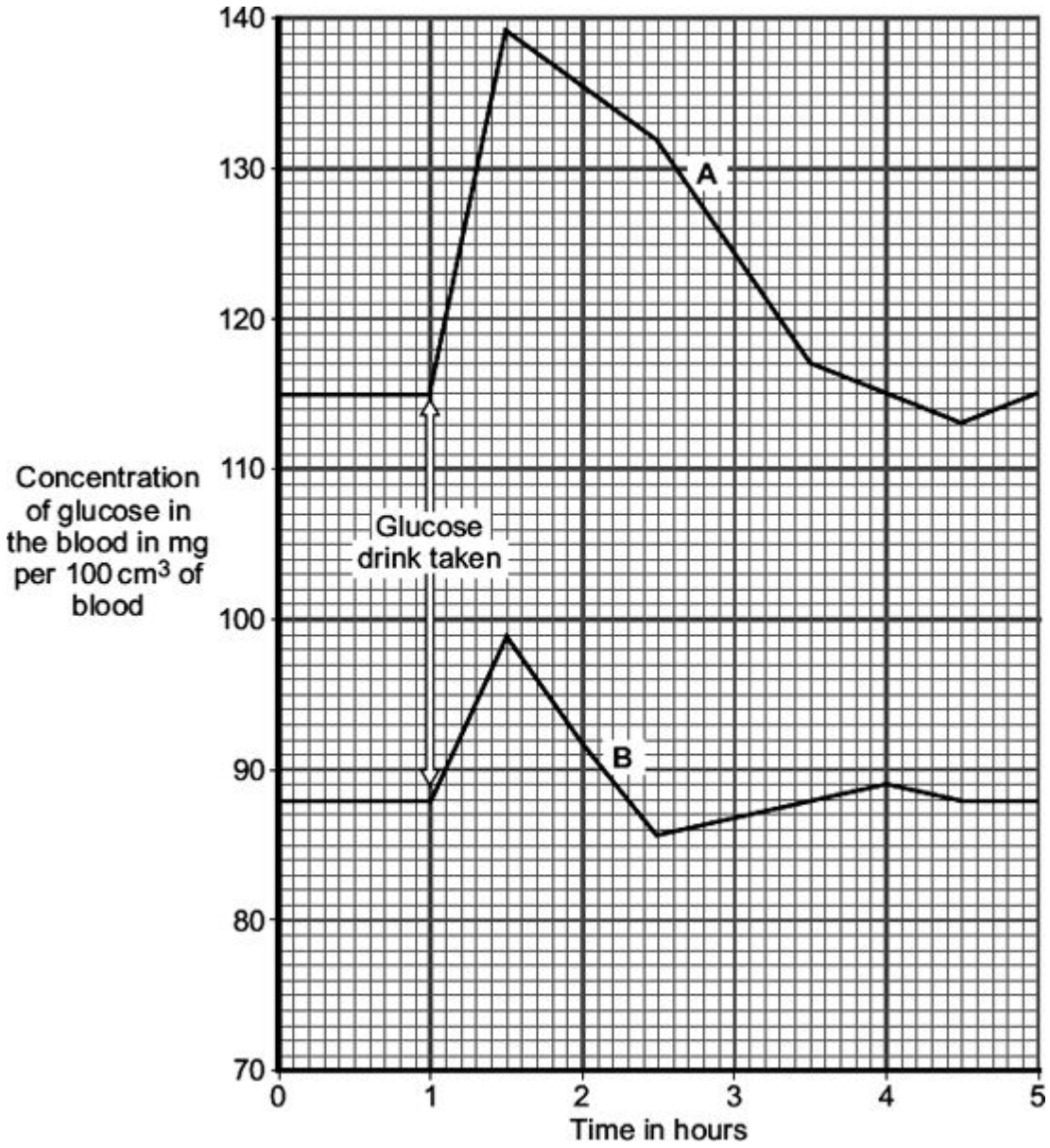
.....

(1)

(b) The concentration of glucose in the blood of two people, **A** and **B**, was measured every half an hour.

One hour after the start, both people drank a solution containing 50 g of glucose.

The graph shows the result.



(i) By how much did the blood glucose concentration in person **B** rise after drinking the glucose drink?

..... mg per 100 cm^3 of blood

(1)

(ii) A doctor suggests that person **A** has diabetes.

Give **two** pieces of evidence from the graph to support this suggestion.

1 .....

.....

2 .....

.....

(2)

(iii) Give **one** reason for the fall in blood glucose concentration in person **B**, shown in the graph.

.....

(1)
(Total 6 marks)

42 The kidneys produce urine.

The table shows the composition of a sample of urine from one person.

Substance	Percentage
Ions	2.5
Urea	2.6
Water	

(a) (i) Calculate the percentage of water in this sample of urine.

Show clearly how you work out your answer.

.....

.....

Percentage of water = ... %

(2)

(ii) The urine of a healthy person does **not** contain protein.

What is the reason for this?

Tick (✓) **one** box.

Protein molecules in the plasma cannot pass through the filter in the kidney. ☐

Protein molecules in the plasma can pass through the filter in the kidney and are then reabsorbed. ☐

There are no protein molecules in the plasma. ☐

(1)

(b) Dialysis can be used to treat a person with kidney disease.

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

(i) The dialysis machine contains membranes that are

fully permeable.

impermeable.

partially permeable.

(1)

(ii) At the end of a dialysis session, the concentration of substances in the blood would be

higher than

lower than

the same as

the concentration of substances in the dialysis fluid.

(1)

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

Kidney transplants have some disadvantages.

Give **one** disadvantage of a kidney transplant.

.....

.....

(1)

(Total 6 marks)

43 Blood plasma is a solution of glucose, and many other substances, in water.

The urine of a healthy person contains water but does not contain glucose.

(a) Name **two** more substances found in the urine of a healthy person.

1 .....

2 .....

(2)

(b) (i) Describe what happens to the glucose in the blood of a healthy person when the blood enters the kidney.

.....

.....

.....

.....

.....

.....

.....

(3)

(ii) A diabetic person's blood often contains a high concentration of glucose.

The urine of a diabetic person may contain glucose.

Suggest an explanation why.

.....

.....

.....

.....

(2)
(Total 7 marks)

44 In-vitro fertilisation (IVF) is used to help some women get pregnant.

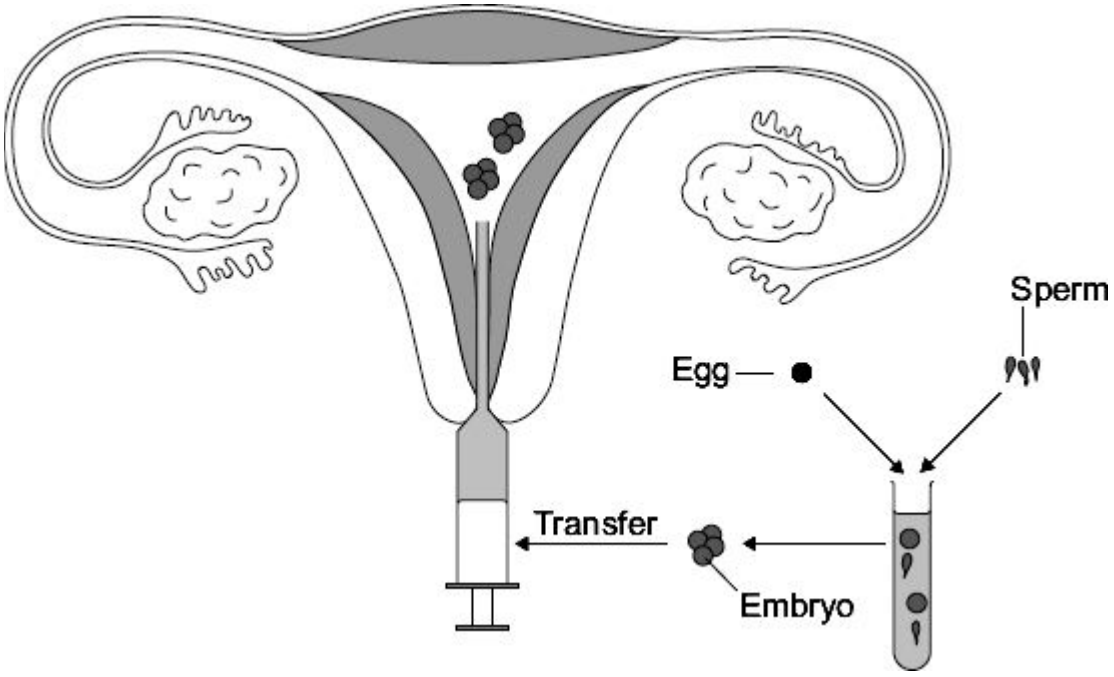
(a) Name the **two** hormones used in IVF treatment.

1 .....

2 .....

(2)

(b) The diagram shows the process of IVF.



Describe the process of IVF. Use information from the diagram to help you.

.....

.....

.....

.....

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.....

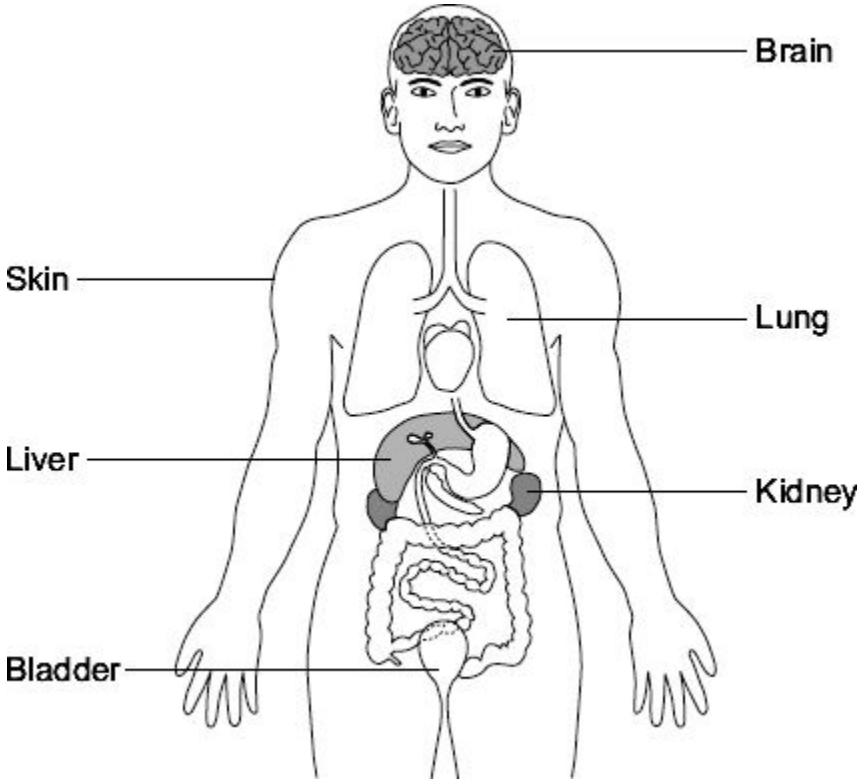
.....

.....

.....

(4)
(Total 6 marks)

45 (a) The diagram shows organs which help to control conditions inside the body.



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

(i) Carbon dioxide is removed from the body by the

kidney.
lung.
skin.

(1)

(ii) Urine is made in the

kidney.
lung.
skin.

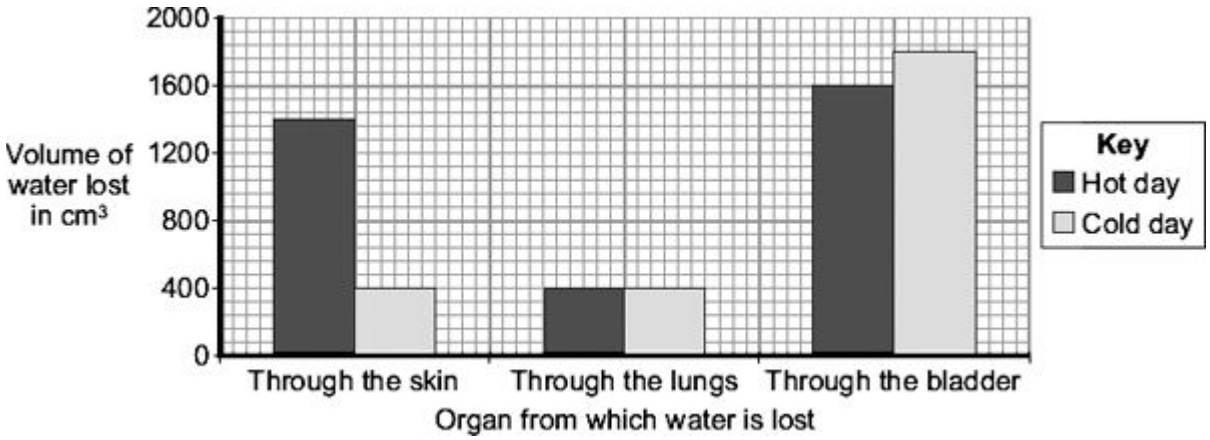
(1)

(iii) Urine is stored in the

bladder.
liver.
skin.

(1)

(b) The bar chart shows the volume of water lost from different organs of the body. The information is shown for a hot day and for a cold day.



(i) Look at the bar chart.

How does the volume of water lost on the hot day compare with the volume of water lost on the cold day for each organ?

Complete the table using words from the box.

the same	**less**	**more**

Organ	**Volume of water lost on a hot day compared with volume of water lost on a cold day**
Skin	
Lungs	
Bladder	

(3)

(ii) In total, more water is lost on the hot day than on the cold day.

How does the increase in the volume of water lost on the hot day help to control the body temperature?

.....

.....

(1)

(Total 7 marks)

46 In diabetics blood glucose concentrations are sometimes abnormal.

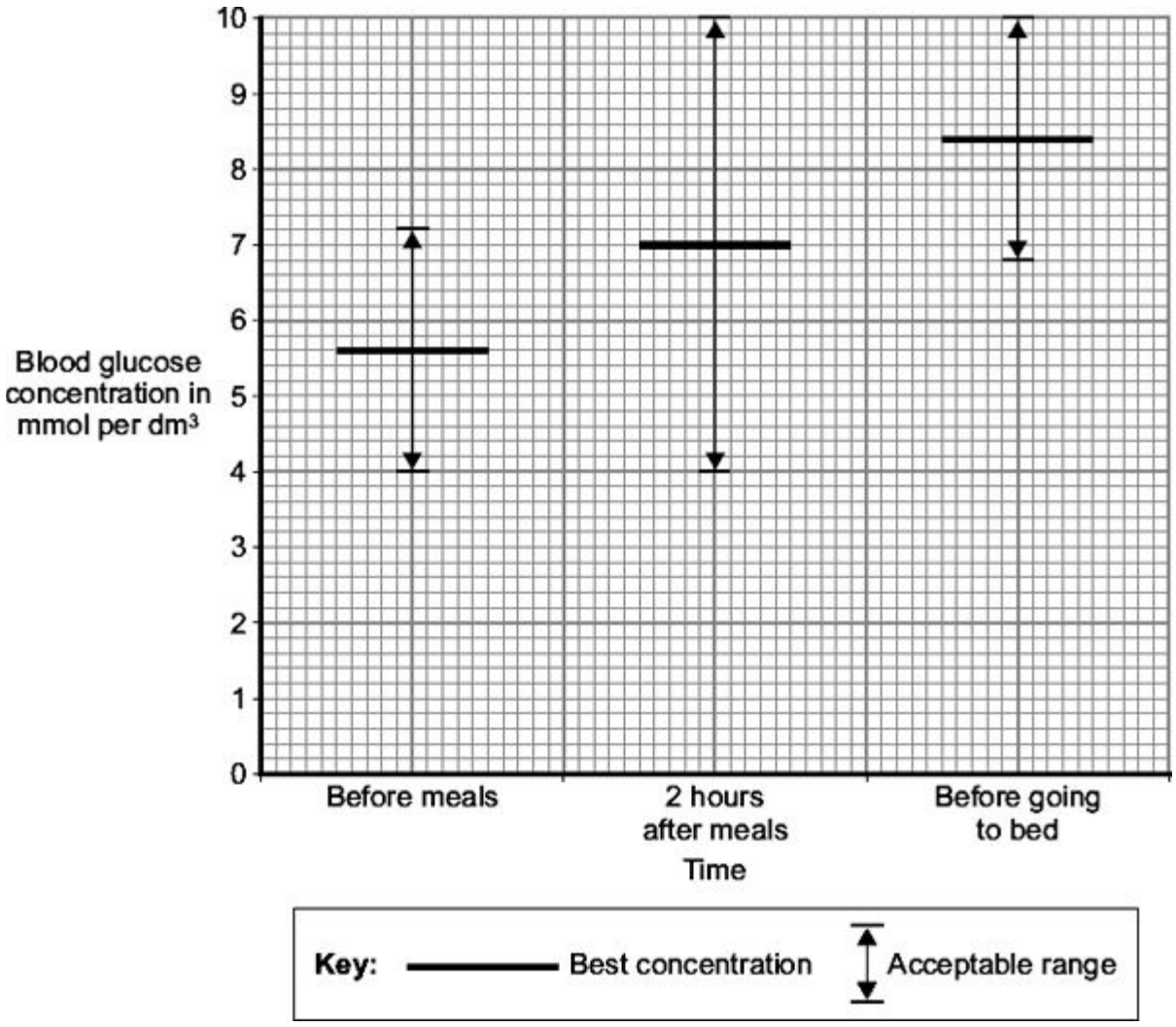
(a) Name the organ that monitors the concentration of glucose in the blood.

.....

(1)

(b) Diabetics can measure their blood glucose concentration.

The graph shows the best blood glucose concentration and the acceptable range of blood glucose concentration at different times.



What is the acceptable range for the blood glucose concentration before meals?

From ..... to ..... mmol per dm^3

(1)

(c) The amount of insulin a diabetic injects can be changed so that blood glucose concentration is kept near to the best level.

Two hours after eating breakfast a diabetic measures his blood glucose concentration.
His blood glucose concentration is 13 mmol per dm^3.

He reads these instructions:

- for every 2 mmol per dm^3 of blood glucose *above* the best concentration, inject 1 unit *more* of insulin
- for every 2 mmol per dm^3 of blood glucose *below* the best concentration, inject 1 unit *less* of insulin.

How should he change his normal insulin injection to bring his blood glucose level to the best concentration?

Show clearly how you work out your answer.

.....

.....

.....

.....

.....

.....

.....

.....

Answer = ...

(3)
(Total 5 marks)

47 (a) Urine contains mineral ions, and other substances, dissolved in water.

What effect will each of the activities in **Table 1** have on the concentration of mineral ions in the urine?

Use words from the box to complete **Table 1**.

increase	**decrease**	**stay the same**

Table 1

Activity	Concentration of mineral ions in urine
Drinking a large bottle of water	
Eating salty foods such as potato crisps	

(2)

(b) A person with kidney disease may be treated by having a kidney transplant.

Table 2 shows the effect of a person's age on the success of a kidney transplant.

Table 2

	Age of patient	
	50-59 years	**Over 60 years**
Percentage of kidneys rejected	38	23
Percentage of kidneys which continued to work for at least 5 years	82	87
Percentage of patients who survived for at least 10 years	82	76

Some doctors think that people over 60 years of age should not be given transplants.

From the data in the table, do you agree with these doctors?

Draw a ring around your answer. **Yes** / **No**

Give **two** reasons for your answer.

1 .....

.....

2 .....

.....

(2)
(Total 4 marks)

48 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	1.0
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) Explain why protein is **not** found in the urine of a healthy person.

.....

.....

(1)

(b) 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 can be found in the urine of a person with haemolytic anaemia.

Explain why.

.....

.....

.....

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.....

.....

.....

.....

(3)
(Total 5 marks)

49 Hormones control the menstrual cycle.

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

1 .....

2 .....

(2)

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

Complete the sentence.

When used as contraceptives, hormones stop ..... becoming mature.

(1)

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

These include:

- taking a contraceptive pill each day for 21 days of the menstrual cycle
- using a contraceptive implant.

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

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

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

.....

.....

(1)

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

.....

.....

(1)
(Total 5 marks)

50 Hormones can be used as contraceptives.

(a) Explain **one** way in which a hormone can prevent conception (pregnancy).

.....

.....

.....

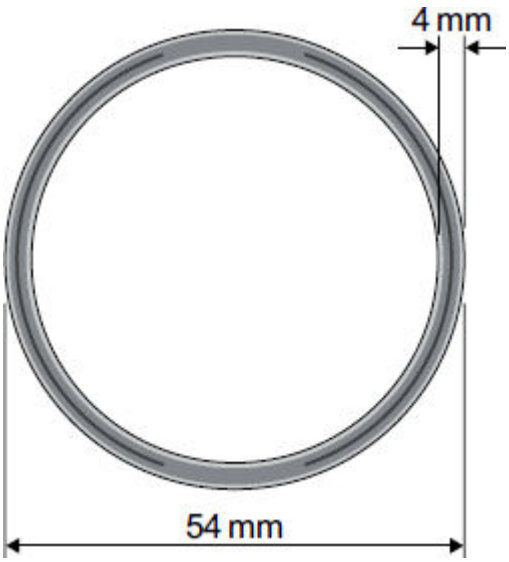
.....

(2)

(b) Two methods of giving contraceptive hormones to a woman are the vaginal ring and the hormone implant.

Vaginal ring

The vaginal ring is a flexible ring 54 mm in diameter containing hormones.



The woman puts in and takes out the vaginal ring herself; there is no 'wrong' way to put the ring in.
Each ring is designed for one cycle of use, which is three weeks of continuous ring use, followed by one week without the ring.
About 0.3 % of women become pregnant in the first year of ring use.
4 % of women stop using the ring because of vaginal discomfort.

Hormone implant

A health professional puts the hormone implant under the skin of the woman's arm.
The implant releases contraceptive hormones for three years before the implant needs to be replaced.
The hormone implant is 100 % effective.
About 2 % of women stop using the hormone implant, mainly because of irregular menstrual bleeding.

Evaluate the use of the vaginal ring compared with the hormone implant.

Remember to give a conclusion to your evaluation.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(4)
(Total 6 marks)

51 Our bodies control the concentration of glucose in the blood.

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

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

hormone called

- carbohydrase.
- insulin.
- protease.

(1)

(b) This hormone is produced by the

- intestine.
- stomach.
- pancreas.

(1)

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

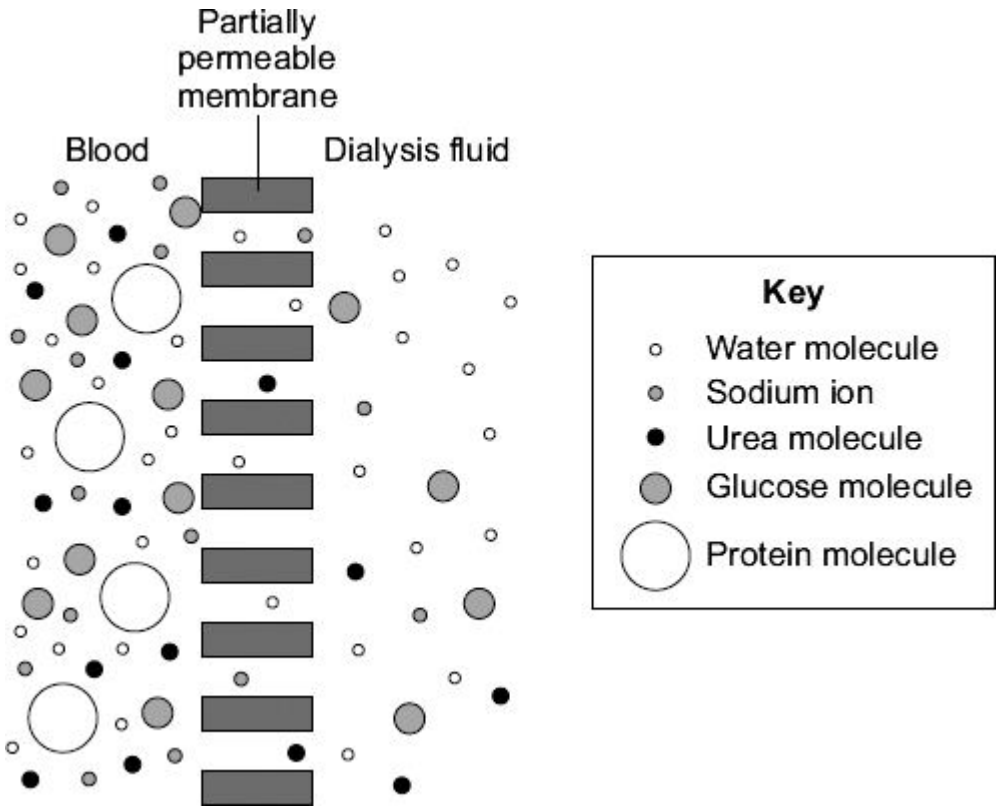
the person develops

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

(1)
(Total 3 marks)

52 Dialysis can be used to treat a person with kidney disease.

The diagram shows blood and dialysis fluid separated by a partially permeable membrane.



Blood plasma and dialysis fluid contain several substances dissolved in water.

The table shows the concentrations of some of these substances in dialysis fluid and in the blood plasma of a person with kidney disease immediately before dialysis.

Substance	Concentration of substance in grams per dm^3	
	Blood plasma of person with kidney disease	**Dialysis fluid**
Sodium ions	3.26	3.15
Urea	0.45	0.00
Glucose	0.90	0.99
Protein	60.00	0.00

(a) Protein molecules are **not** able to move from the blood to the dialysis fluid.
Use information from the diagram to explain why.

.....

.....

(1)

(b) Urea molecules move from the blood into the dialysis fluid.

(i) Give the name of this type of movement. .....

(1)

(ii) Why do the urea molecules move in this direction?

Use information from the table to help you to answer this question.

.....

.....

(1)

(c) The concentration of sodium ions in the blood plasma will change during dialysis.

Suggest a value for the concentration of sodium ions in the plasma at the end of dialysis.

Use information from the table.

Concentration of sodium ions = ... grams per dm^3

(1)

(d) For most patients a kidney transplant is better than continued treatment by dialysis.

(i) Give **two** advantages of having a kidney transplant rather than treatment by dialysis.

1 .....

.....

2 .....

.....

(2)

(ii) Give **two** possible disadvantages of having a kidney transplant.

1 .....

.....

2 .....

.....

(2)

(Total 8 marks)

53 The human menstrual cycle is controlled by hormones.

Name the gland which produces:

(i) FSH

.....

(1)

(ii) oestrogen.

.....

(1)
(Total 2 marks)

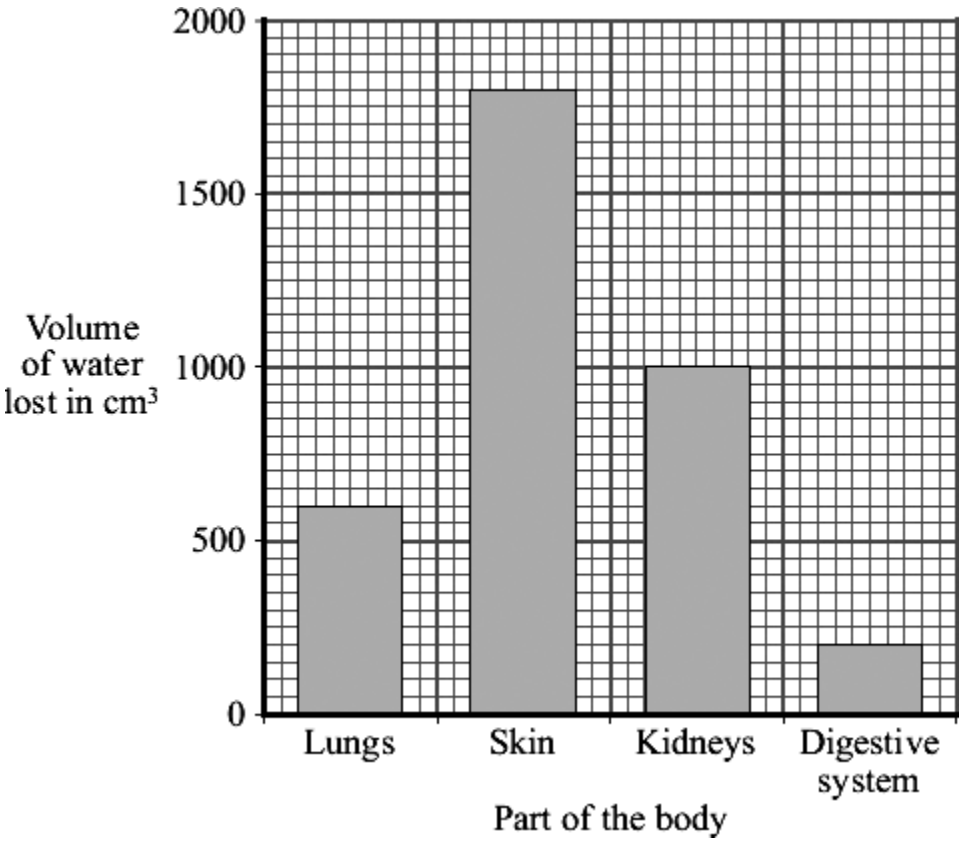
54 Water is lost from several parts of the body.

(a) Draw **one** line from each body part to the substance in which water is lost.

Body Part	**Substance**
	Urine
Kidneys	
	Faeces
Lungs	
	Sweat
Skin	
	Breath

(3)

(b) The bar chart shows the volume of water a person lost from different parts of the body during a warm day.



(i) What volume of water was lost through the skin on the warm day?

Tick (✓) **one** box.

600 cm^3 ☐

1600 cm^3 ☐

1800 cm^3 ☐

(1)

(ii) What effect would colder weather have on the amount of water lost through the skin?

Draw a ring around your answer.

decreases **increases** **stays the same**

(1)

(iii) Give a reason for your answer.

.....

.....

(1)

(c) What effect does cold weather generally have on the amount of urine produced?

Draw a ring around your answer.

decreases **increases** **stays the same**

(1)
(Total 7 marks)

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

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

Draw a ring around your answer.

liver **pancreas** **stomach**

(1)

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

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

Chart 2 shows a diet for a person without diabetes.

Chart 1 Person with diabetes

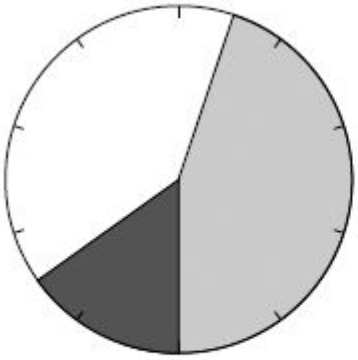
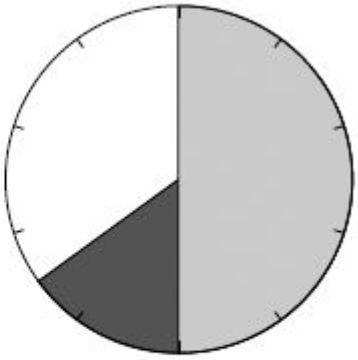
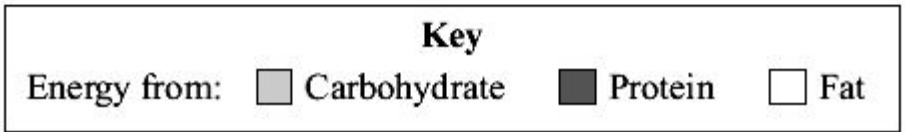


Chart 2 Person without diabetes





How is the recommended diet of a person with diabetes different from the diet of a person without diabetes?

Use information from the charts.

Tick (✓) **two** box.

The diabetic should get more energy from fat. ☐

The diabetic should get more energy from protein. ☐

The diabetic should get less energy from carbohydrate. ☐

The diabetic should get less energy from protein. ☐

(2)

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

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(1)
(Total 4 marks)