



Percentage	
Grade	

# Homeostasis

Duration: 1 hour and 20 min

Total Marks: 80

- Use black or blue ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional paper is used, the question number(s) must be clearly shown
- The number of marks is given in brackets [ ] at the end of each question or part question.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.

[illegible]

4 The human body produces many hormones.

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

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(1 mark)

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

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(1 mark)

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

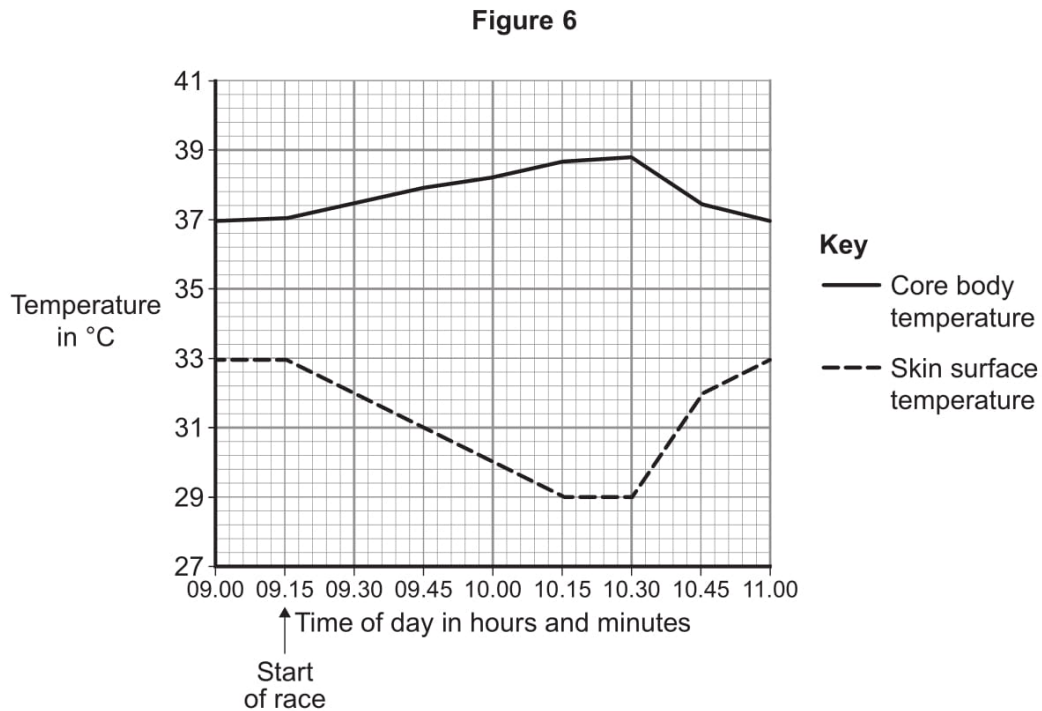
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(1 mark)

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

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(3 marks)



- 6** **Figure 6** shows the core body temperature and the skin surface temperature of a cyclist before, during and after a race.



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

How long did the race last?

**[1 mark]**

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

**[6 marks]**

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**6 (a) (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 marks]**

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**6 (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 marks]**

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

Healthy kidneys help to keep our internal environment constant.

**7 (a)** Describe how a healthy kidney produces urine.

**[5 marks]**

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**7 (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.

**Table 3** shows the results.

**Table 3**

	Concentration in the blood before dialysis starts in mmol per dm <sup>3</sup>
<b>Urea</b>	28
<b>Glucose</b>	6

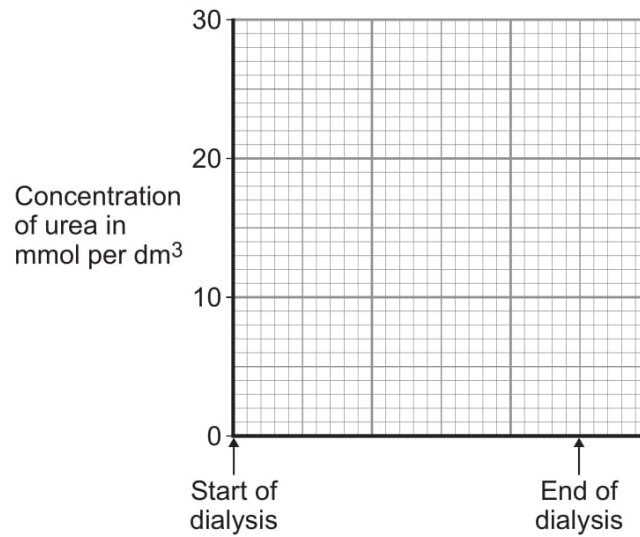
The child has a normal blood glucose concentration.



- 7 (b) (i)** Sketch a graph on **Figure 7** to suggest what will happen to the concentration of urea in the blood during dialysis.

[1 mark]

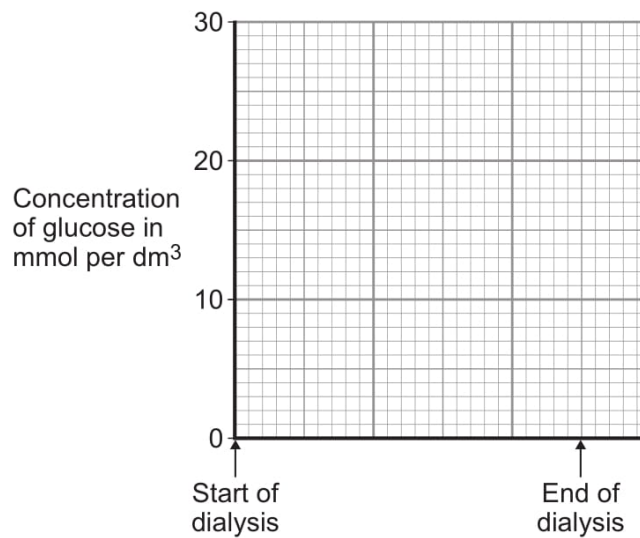
**Figure 7**



- 7 (b) (ii)** Sketch a graph on **Figure 8** to suggest what will happen to the concentration of glucose in the blood during dialysis.

[1 mark]

**Figure 8**



**Question 7 continues on the next page**

**Turn over ►**



**7 (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 marks]**

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

**[1 mark]**

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11

**END OF QUESTIONS**

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Question 5, Figure 4: © Thinkstock

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3

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

Humans need to remove (excrete) waste products from the bloodstream.

Describe the processes that produce waste products **and** how the products are removed from the body.

In your answer you should include the names of the organs involved in producing waste products and those involved in removing the waste products.

You should **not** refer to faeces in your answer.

**[6 marks]**

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**Turn over ►**





**7** A climber falls down a mountain slope into a small pool of cold water.  
He is injured and cannot move.  
He starts to get cold.

**7 (a)** How does the body detect a decrease in blood temperature?

**[1 mark]**

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**7 (b)** The man starts shivering.

Explain how shivering helps to raise his body temperature.

**[3 marks]**

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**7 (c)** Apart from shivering, explain how the man's body responds to raise his core body temperature.

**[3 marks]**

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Endocrine glands produce hormones.

**1 0**

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Hyperthyroidism is caused by an overactive thyroid gland.

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

**[3 marks]**

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Describe the roles of FSH and LH in the menstrual cycle.

**[2 marks]**

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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 marks]**

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**END OF QUESTIONS**

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

Healthy kidneys help to keep our internal environment constant.

**8 (a)** Describe how a healthy kidney produces urine.

**[5 marks]**

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**8 (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.

**Table 2** shows the results.

**Table 2**

	Concentration in the blood before dialysis starts in mmol per dm <sup>3</sup>
Urea	28
Glucose	6

The child has a normal blood glucose concentration.

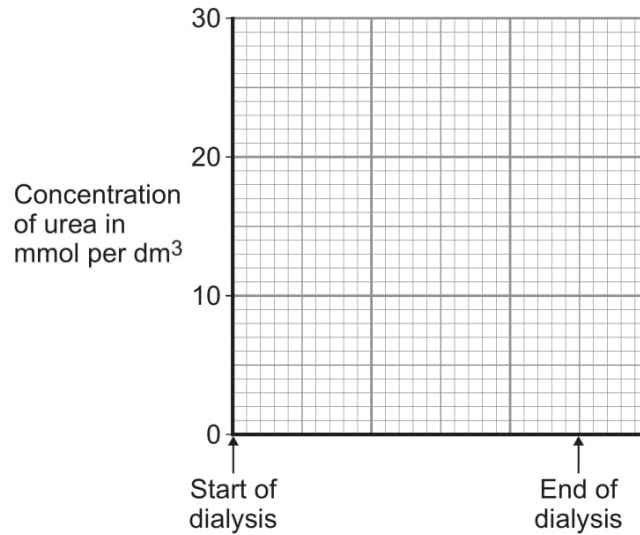


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- 8 (b) (i)** Sketch a graph on **Figure 7** to suggest what will happen to the concentration of urea in the blood during dialysis.

[1 mark]

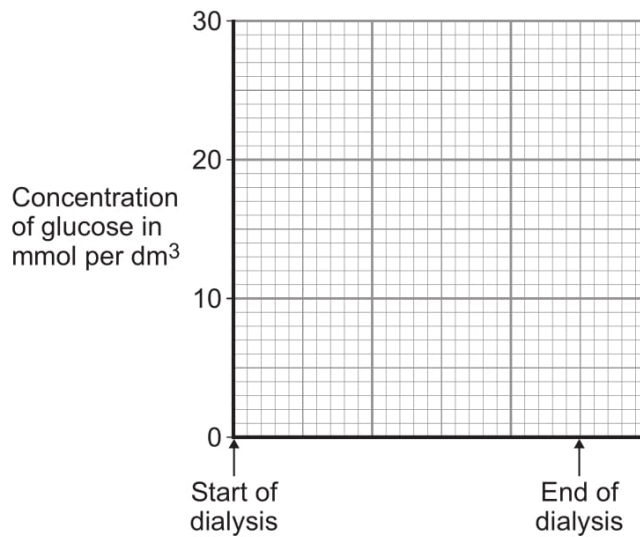
**Figure 7**



- 8 (b) (ii)** Sketch a graph on **Figure 8** to suggest what will happen to the concentration of glucose in the blood during dialysis.

[1 mark]

**Figure 8**



**Question 8 continues on the next page**

**Turn over ►**



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**8 (c)** 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 marks]**

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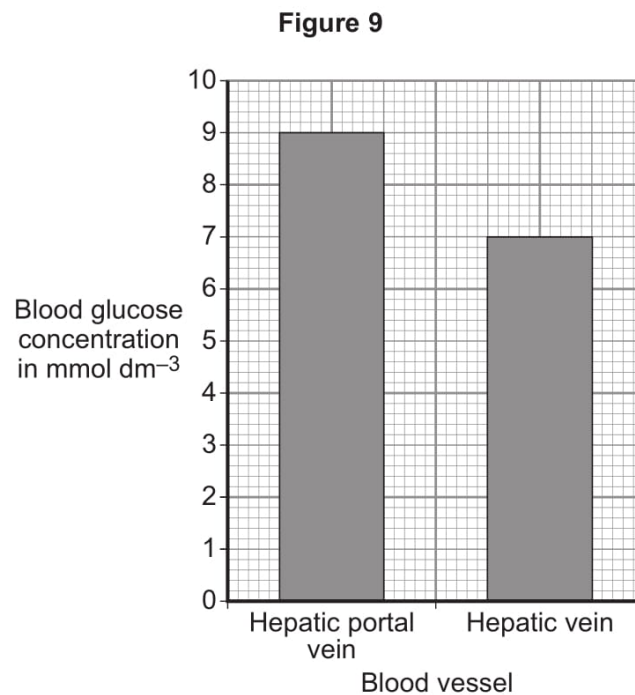
The pancreas and the liver are both involved in the control of the concentration of glucose in the blood.

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.

**Figure 9** shows the concentration of glucose in the two blood vessels 1 hour after the meal.



9 (a)

The concentration of glucose in the blood of the two vessels is different.

Explain why.

[3 marks]

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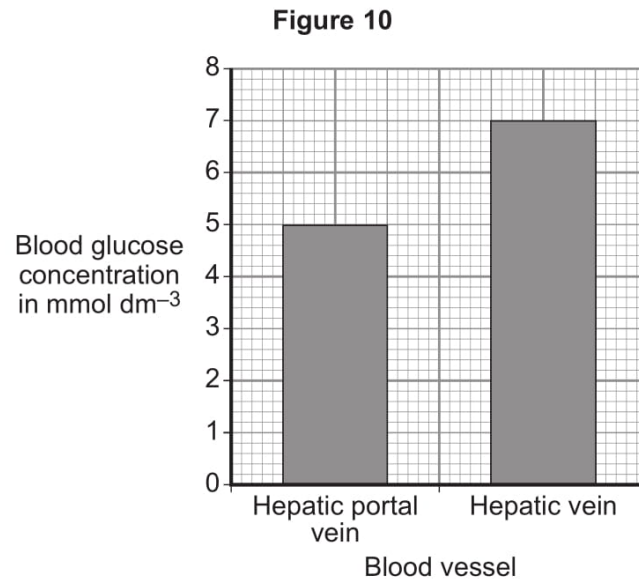
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Turn over ►



1 7

- 9 (b) **Figure 10** shows the concentration of glucose in the two blood vessels 6 hours after the meal.



- 9 (b) (i) The concentration of glucose in the hepatic portal vein has decreased after 6 hours.

Why?

[1 mark]

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

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

Explain why.

[3 marks]

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END OF QUESTIONS





- 9 The kangaroo rat is a mammal that can survive in desert environments and can tolerate much higher concentrations of sodium ions in their bloodstream than humans.

Figure 16 shows an image of the kangaroo rat.



(Source: Richard R. Hansen/Science Photo Library)

**Figure 16**

- (a) The name of the process that controls water levels in the body is

(1)

- ☐ A diffusion
- ☐ B osmosis
- ☐ C osmoregulation
- ☐ D thermoregulation

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- (b) (i) Explain how the blood entering the nephron of the kangaroo rat is filtered to remove excess sodium ions and water.

(3)

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The kangaroo rat has a longer loop of Henle than most mammals.

- (ii) Explain why this adaptation is beneficial to the kangaroo rat.

(2)

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The volume of ADH stored in the pituitary gland of the kangaroo rat was measured.

Figure 17 shows the average results for 500 kangaroo rats.

concentration of sodium chloride fed to kangaroo rats ( $\text{mol dm}^{-3}$ )	volume of ADH stored in the pituitary gland (arbitrary units)
0.00	45
0.25	40
0.50	10
0.75	8
1.00	8

**Figure 17**

\*(iii) Explain how ADH helps to control the levels of water and sodium ions in the bloodstream.

(6)

**(Total for Question 9 = 12 marks)**