

Centre Number						Candidate Number				
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For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
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8	
TOTAL	



General Certificate of Education
Advanced Level Examination
January 2013

Applied Science

SC14

Unit 14 The Healthy Body

Thursday 24 January 2013 9.00 am to 10.30 am

<p>For this paper you must have:</p> <ul style="list-style-type: none"> • a pencil • a ruler • a calculator.
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Time allowed

- 1 hour 30 minutes

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.
- Show the working of your calculations.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You will be marked on your ability to
 - use good English
 - organise information clearly
 - use specialist vocabulary where appropriate.
- You are expected to use a calculator where appropriate.

A

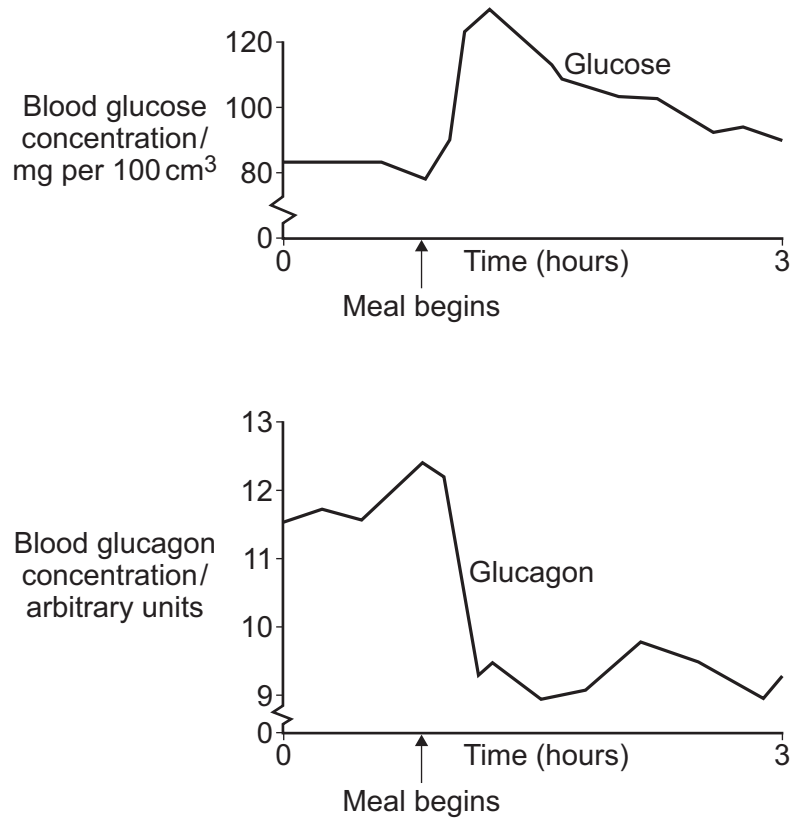


J A N 1 3 S C 1 4 0 1

Answer **all** questions in the spaces provided.

- 1** In a hospital, tests are performed on patients to diagnose diabetes. **Figure 1** shows the blood glucose and glucagon concentrations in a healthy person before, during and after eating a meal.

Figure 1



- 1 (a) (i)** **Figure 1** shows the changes that occur in the blood glucagon concentration over a three hour period. Explain why these changes happen.

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(3 marks)



1 (a) (ii) Explain how the information shown in **Figure 1** provides an example of negative feedback.

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(2 marks)

1 (b) Name the part of the body where glucagon is secreted.

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(1 mark)

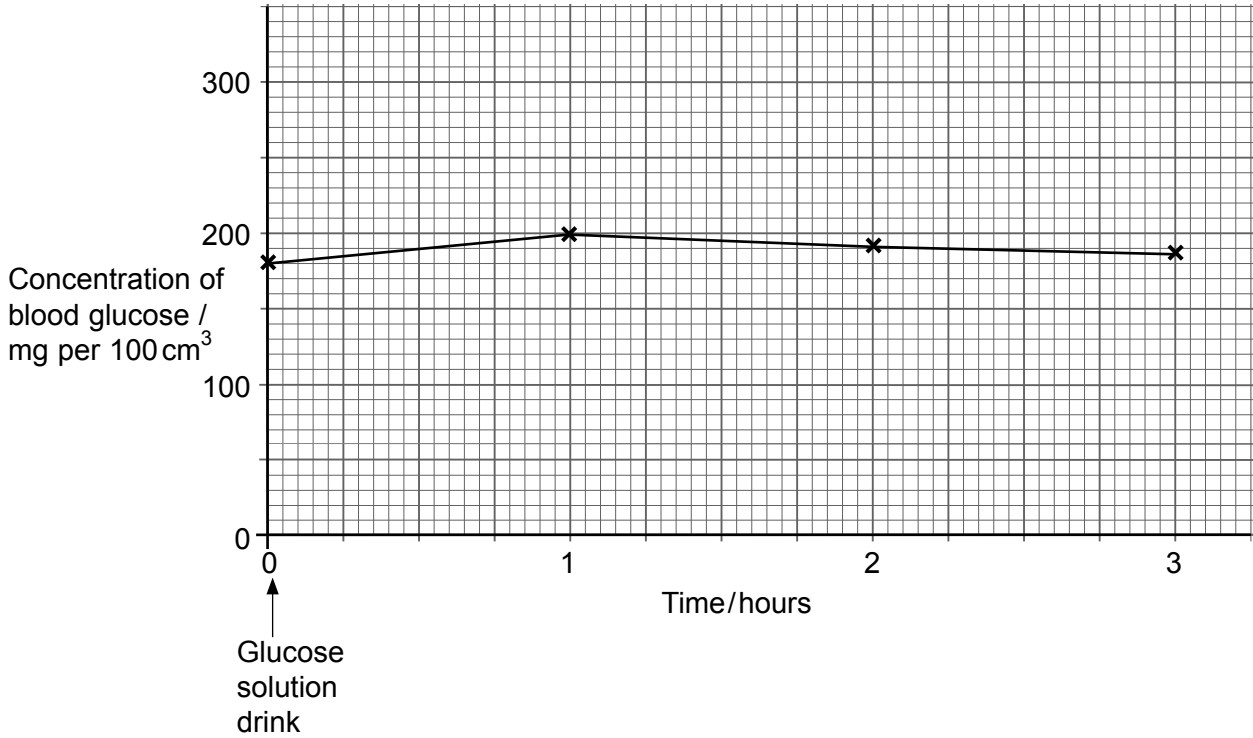
Question 1 continues on the next page

Turn over ▶



1 (c) People who suffer from diabetes cannot produce the insulin they need. In a hospital investigation, a woman with diabetes drank some glucose solution. The concentration of glucose in her blood was then measured at regular intervals. The results are shown in **Figure 2**.

Figure 2



Suggest **two** reasons why the concentration of glucose decreased after 1 hour even though this woman's blood contained no insulin.

Reason 1

.....

Reason 2

.....

(2 marks)



1 (d) The investigation was repeated with another woman who did not have diabetes. The concentration of glucose in her blood before drinking the glucose solution was 80 mg per 100 cm³.

Sketch a line on **Figure 2** to show the results you would expect. (1 mark)

1 (e) The woman with diabetes adopted a daily routine to stabilise her blood glucose levels within narrow limits. She ate three meals a day – breakfast, lunch and an evening meal. She injected insulin once before breakfast and once before the evening meal.

The injection she used before breakfast was a mixture of two types of insulin. The mixture contained slow-acting insulin and fast-acting insulin.

1 (e) (i) Suggest the advantage of injecting each type of insulin before breakfast.

Slow-acting

.....

Fast-acting

.....

(2 marks)

1 (e) (ii) One day, the woman missed her lunch. Suggest why her blood glucose concentration did not fall to a dangerously low level even though she had injected herself with the mixture of insulin before breakfast.

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(3 marks)

14

Turn over for the next question

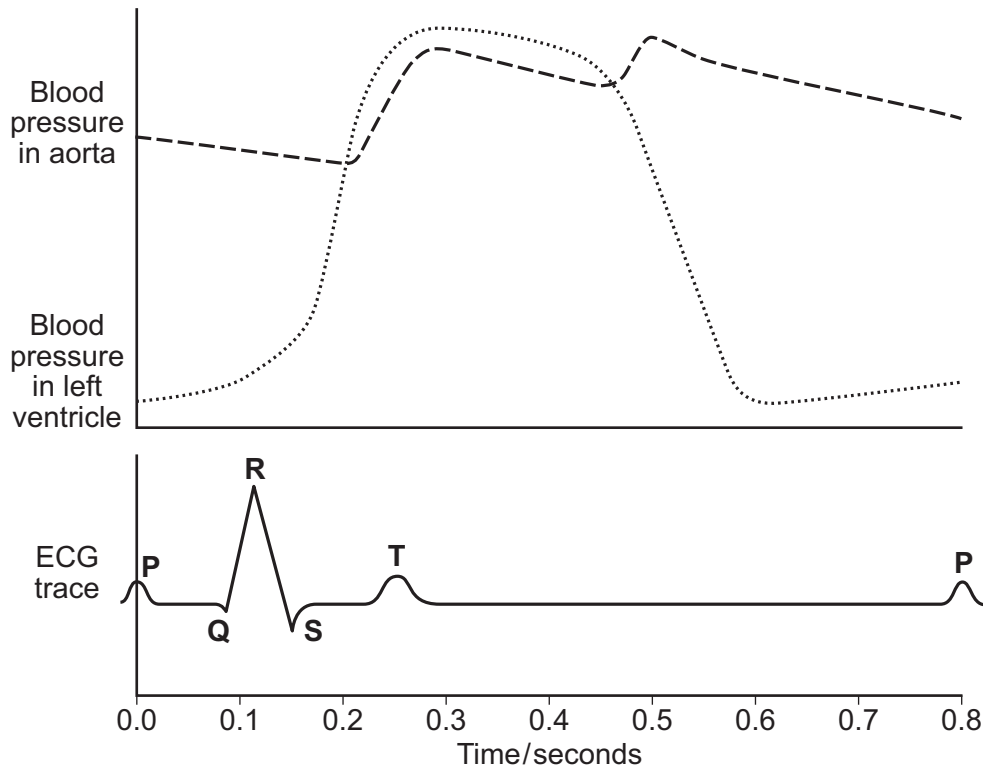
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2 An electrocardiogram (ECG) detects electrical changes in the heart. It is produced by placing electrodes on the chest to detect electrical changes in the heart. An ECG was used to monitor a man on his fitness induction at the gym.

Figure 3 shows the man's ECG and the blood pressure changes in his heart during a single cardiac cycle. All results were within the normal ranges. Both graphs are drawn to the same time scale and start at the same point in the cycle.

Figure 3



2 (a) (i) The **QRS** wave is associated with the spread of electrical activity over the ventricle. Explain the evidence in **Figure 3** which supports this.

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(2 marks)

2 (a) (ii) Explain why there is no change in the electrical activity of the man's heart between 0.30 seconds and 0.79 seconds.

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(1 mark)



2 (b) (i) At what time in the cardiac cycle does the aortic semilunar valve open?

.....
.....

(1 mark)

2 (b) (ii) The blood pressure changes shown in **Figure 3** are on the left side of the heart.
Sketch a curve on **Figure 3** to show the blood pressure changes in the right ventricle.

(2 marks)

6

Turn over for the next question

Turn over ▶



3 A man is admitted to hospital suffering from a pneumonia infection. A nurse tests some of his body functions.

3 (a) (i) Name the machine that the nurse would use to measure his blood oxygen saturation.

.....
(1 mark)

3 (a) (ii) Circle the normal blood oxygen saturation level for a healthy man.

35%

45%

75%

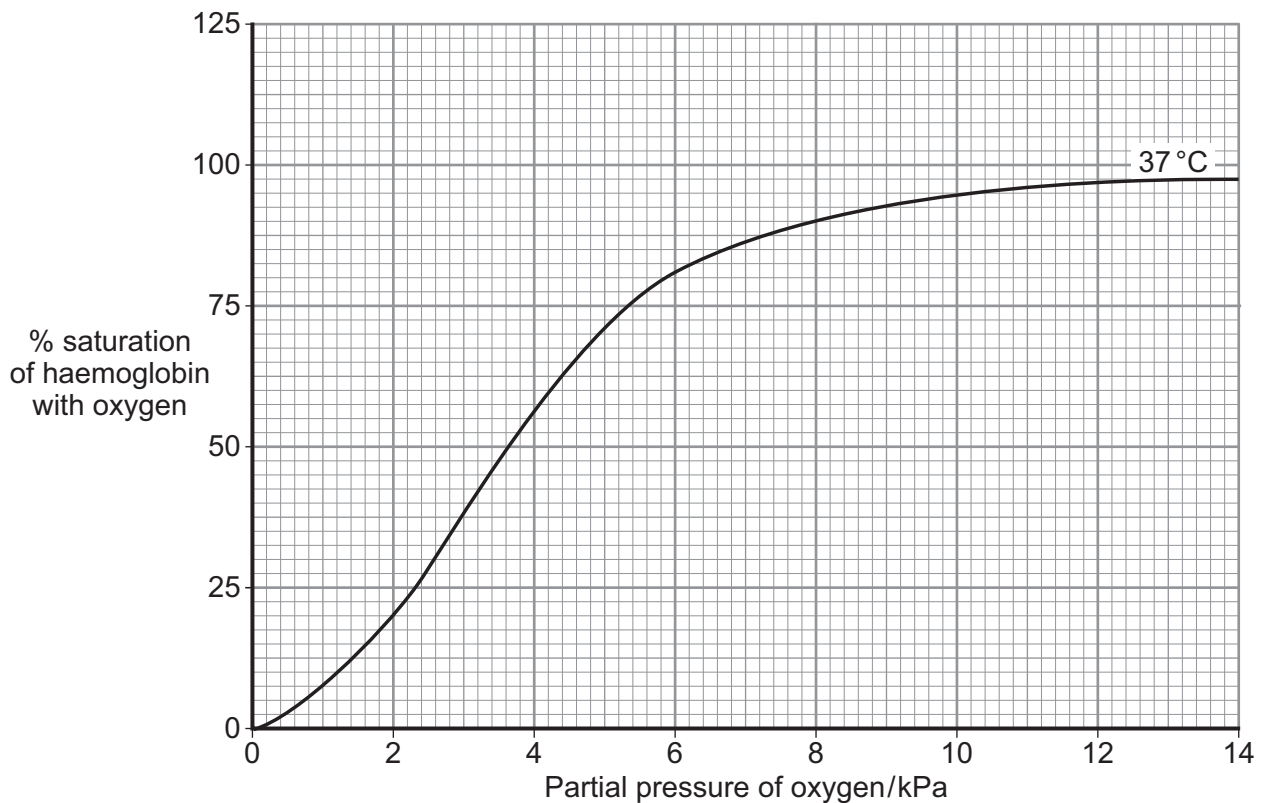
95%

(1 mark)

3 (b) **Figure 4** shows a normal oxygen dissociation curve at a body temperature of 37 °C. The man suffering from pneumonia was found to have a raised body temperature.

Draw a line on the graph in **Figure 4** to show the effect of raised body temperature on the oxygen dissociation curve.

Figure 4



(2 marks)



3 (c) The man's blood pH was also monitored. Describe, in detail, what would happen in his body if he had increased levels of carbon dioxide in his blood.

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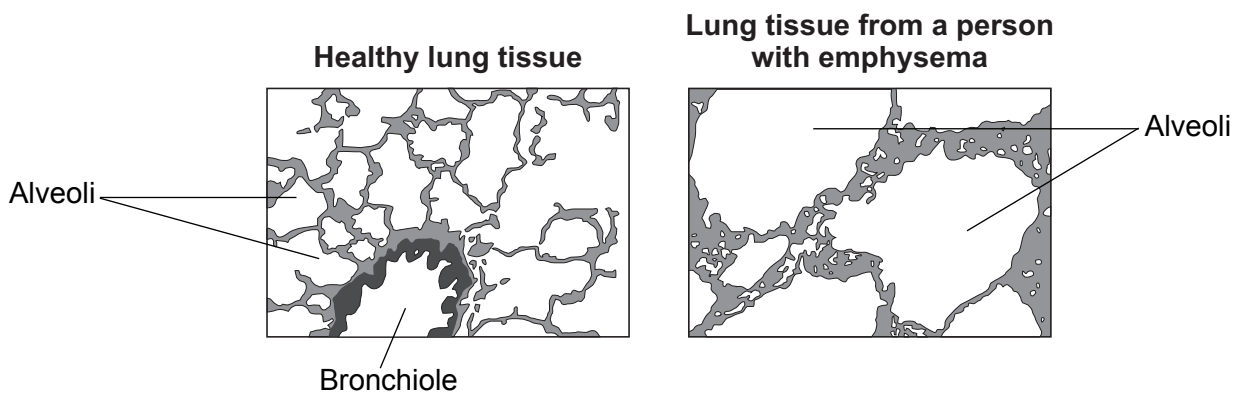
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(3 marks)

3 (d) On the next ward, a patient was suffering from emphysema. **Figure 5** shows sections through alveoli of healthy lung tissue and also alveoli of lung tissue from the person with emphysema. Both diagrams are at the same magnification.

Figure 5



Give **two** differences that can be seen between the healthy lung tissue and the lung tissue from the person with emphysema.

Difference 1

.....

Difference 2

.....

(2 marks)

Question 3 continues on the next page

Turn over ▶



3 (e) People suffering from emphysema may find it difficult to walk uphill. Explain why.

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(2 marks)

11



4 A baker uses wheat flour to bake bread. The wheat flour contains a high proportion of starch.

4 (a) Describe how starch is digested to glucose in the small intestine.

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(3 marks)

4 (b) Wheat flour also contains a protein called gluten. People with coeliac disease are intolerant to gluten.

In coeliac disease, gluten causes the destruction of villi in the gut.
Suggest why this will result in weight loss.

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(3 marks)

Turn over for the next question

6

Turn over ▶



5 Some babies can suffer discomfort of the digestive system. This is known as colic. Many of the symptoms are due to a temporary inability to produce the enzyme lactase. As a result, lactose, the main sugar in milk, remains undigested in the gut and can lead to excess gas, abdominal discomfort and in some cases diarrhoea.

In an investigation, babies suffering from colic were divided into two groups.

Those in group **A** had a solution of lactase added to their bottled milk and those in group **B** had distilled water added to their bottled milk. In both cases, each baby was given 1 cm³ of lactase solution per kilogram of bodyweight or 1 cm³ of distilled water per kilogram of bodyweight. The results of this investigation were analysed.

5 (a) Explain why distilled water was added to the milk of group **B**.

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(2 marks)

5 (b) **Table 1** shows the results of the investigation.

Table 1

	Mean duration of colic symptoms / minutes	
	Before investigation	After investigation
Group A (given lactase)	124.5	65.7
Group B (given distilled water)	121.0	113.8

Give **three** factors that should have been considered when selecting babies for the investigation so that the data obtained would be as reliable as possible.

Factor 1.....

.....

Factor 2.....

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Factor 3.....

.....

(3 marks)



5 (c) Why did the babies in group **A** each receive 1 cm³ of lactase solution per kilogram of bodyweight, rather than drinking the same volume?

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(2 marks)

5 (d) Give **three** conclusions that can be drawn from this investigation.

Conclusion 1

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Conclusion 2

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Conclusion 3

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(3 marks)

5 (e) It was suggested that the results might have been more accurate if the lactase solution had been injected, rather than being ingested. Explain why injecting the lactase solution would have given more accurate results.

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(2 marks)

5 (f) State **two** ethical issues that could be considered when conducting any investigations involving humans.

Issue 1

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Issue 2

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(2 marks)

Turn over ▶



6 (a) Angina is a condition caused by a narrowing of the coronary arteries.
A woman suffering from angina is taken into hospital. She asks a student nurse to explain why she is suffering from fatigue and chest pain. What should the nurse say?

You will be assessed on the quality of written communication in your answer.

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(5 marks)



6 (b) The woman was tested using a cholesterol meter and was found to have a fasting cholesterol level of 8.4 mmol/litre.

6 (b) (i) How does this value compare with the normal level?

.....
.....

(1 mark)

6 (b) (ii) State the normal range for fasting cholesterol in the blood.

.....mmol/litre

(1 mark)

6 (c) The woman was clinically obese. Apart from an increased risk of cardiovascular disease, how might being clinically obese affect her health?

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(3 marks)

6 (d) The woman also consumed too much salt in her diet.

Suggest what effect the excess salt could have.

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(2 marks)

Turn over for the next question

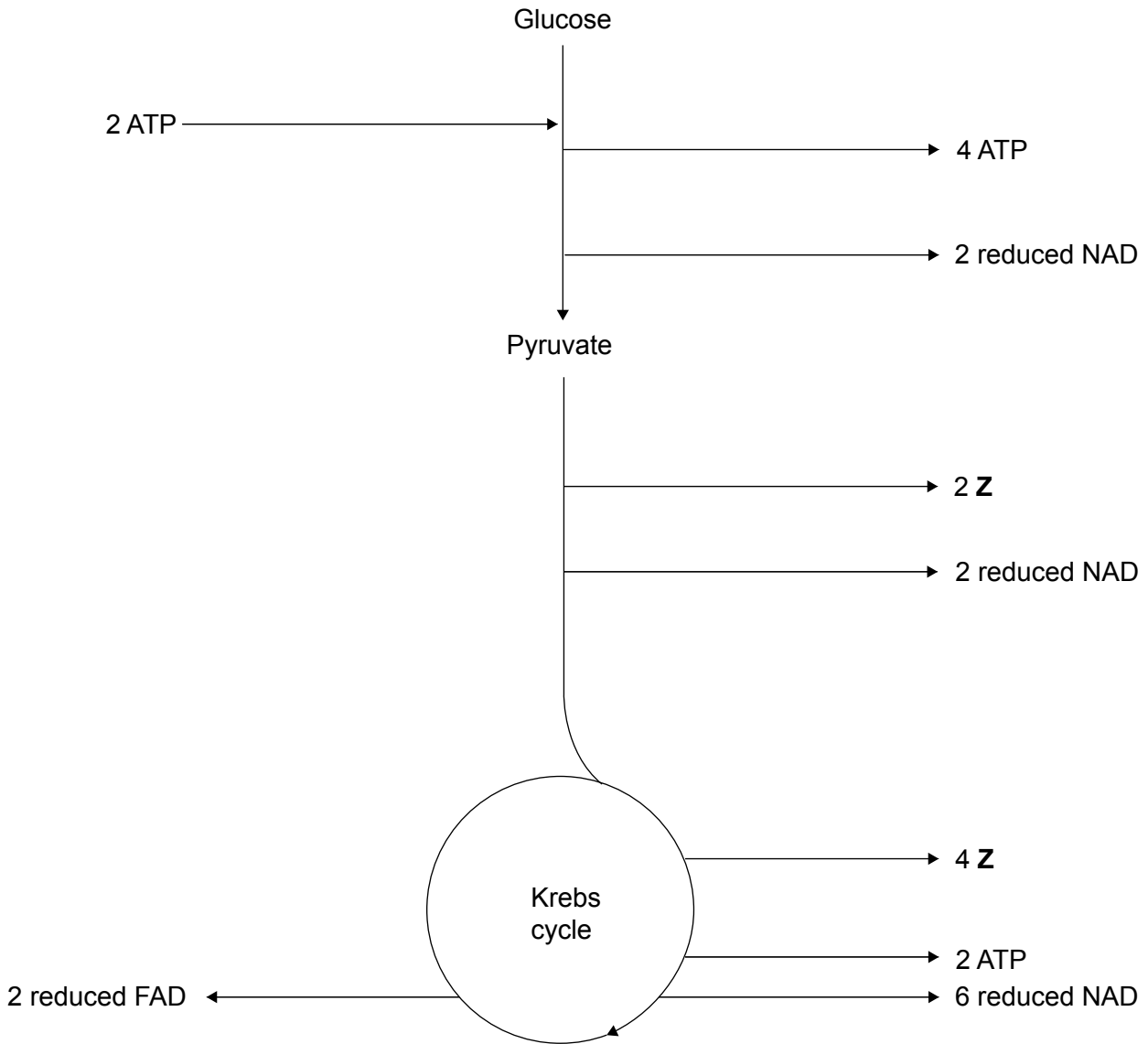
12

Turn over ▶



- 7 A fitness instructor was revising for an exam. She drew the diagram shown in **Figure 6** to help her. The diagram shows the biochemical pathway involved when one molecule of glucose undergoes aerobic respiration.

Figure 6



Each reduced NAD molecule leads to the production of 3 ATP molecules.
Each reduced FAD molecule leads to the production of 2 ATP molecules.

- 7 (a) (i) What compound is represented by the letter **Z** in **Figure 6**?

.....
.....

(1 mark)



7 (a) (ii) Where in a cell does the Krebs cycle take place?

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.....
(1 mark)

7 (b) Using the information given in **Figure 6**, calculate the net number of ATP molecules produced from one molecule of glucose during aerobic respiration.

.....
Net number of molecules =
(1 mark)

7 (c) (i) Describe the part played by oxygen in the process of aerobic respiration.

.....
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.....
(2 marks)

7 (c) (ii) In a gym, a man is training to increase his muscle mass. He lifts weights until his muscles use up all the available oxygen in his body. In the absence of oxygen, anaerobic respiration occurs. This involves the conversion of pyruvate into lactate without the production of any more ATP molecules.

How many molecules of ATP are produced from each glucose molecule in anaerobic respiration?

.....
Number of molecules =
(1 mark)

6

Turn over for the next question

Turn over ▶



8 A personal trainer was assessing one of her clients in the gym. Part of the assessment included recommending ways to improve the client’s general health and well-being.

8 (a) The client asked the personal trainer why she did not need to urinate during her exercise sessions, despite drinking an extra 1 litre of water. The trainer explained that this was due to hormonal control.

Explain, by naming the relevant hormone and describing its action, why the client did not need to urinate during the exercise session.

You will be assessed on the quality of written communication in your answer.

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Extra space (if needed)

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(5 marks)



8 (b) The client kept a food diary for a week. On analysing this, the personal trainer was concerned that the client was not getting enough micronutrients, especially vitamin C and iron.

Describe **two** symptoms that could suggest iron deficiency.

Symptom 1.....
.....

Symptom 2.....
.....

(2 marks)

8 (c) How could the client's diet be adjusted to include more foods containing iron and vitamin C?

Iron.....
.....

Vitamin C.....
.....

(2 marks)

8 (d) The personal trainer also recommended that a supplement of vitamin D should be taken during winter.

Why was the vitamin D supplement only recommended in winter?

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(2 marks)

11

END OF QUESTIONS



There are no questions printed on this page

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