



Rewarding Learning

**ADVANCED SUBSIDIARY (AS)**  
**General Certificate of Education**  
**2024**

Centre Number

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Candidate Number

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# Life and Health Sciences

Assessment Unit AS 2  
assessing  
Human Body Systems



**[SZ021]**

\*SZ021\*

**WEDNESDAY 29 MAY, AFTERNOON**

## TIME

1 hour 30 minutes.

## INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

**You must answer the questions in the spaces provided.**

**Do not write outside the boxed area on each page or on blank pages.**

Complete in black ink only. **Do not write with a gel pen.**

Answer **all seven** questions.

## INFORMATION FOR CANDIDATES

The total mark for this paper is 75.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

You may use an electronic calculator.

Quality of written communication will be assessed in Question 5.

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\*24SZ02101\*

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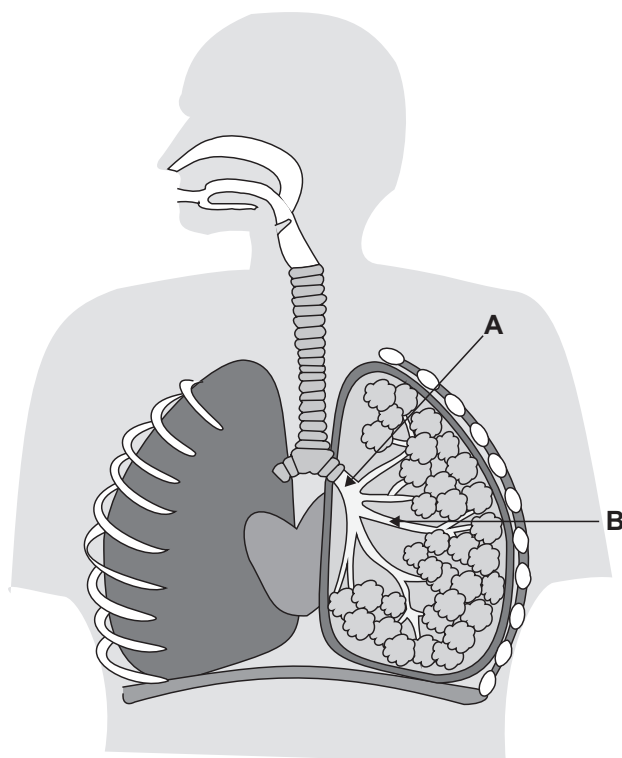
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\*24SZ02102\*



1 The diagram below shows the human respiratory system.



(a) Identify structures **A** and **B**.

**A** \_\_\_\_\_ [1]

**B** \_\_\_\_\_ [1]

(b) The rate (speed) of blood flow in the capillary surrounding the alveoli is  $0.2 \text{ mm s}^{-1}$ .

Using the equation  $\text{speed} = \text{distance}/\text{time}$ , calculate the time it takes for blood to travel a distance of  $20 \mu\text{m}$  in the capillary.

**You are advised to show your working.**

\_\_\_\_\_ s [2]

**[Turn over**



- (c) A nurse measured the volume of air in the lungs of two patients over a period of ten seconds.

The results are shown in the table below.

Time /s	Volume of air in lungs /L	
	Patient 1	Patient 2
0	6.5	7.0
1	4.0	6.5
2	3.5	6.0
3	3.0	5.6
4	2.3	5.1
5	2.0	4.8
6	1.7	4.5
7	1.5	4.2
8	1.5	3.9
9	1.5	3.5
10	1.5	3.4

- (i) What evidence in the table indicates that the two patients were exhaling during the measurement?

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[1]



(ii) State **one** piece of evidence from the table that shows that Patient 2 has emphysema.

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[1]

(iii) Explain how emphysema reduces gas exchange in the alveoli of the lungs.

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[4]



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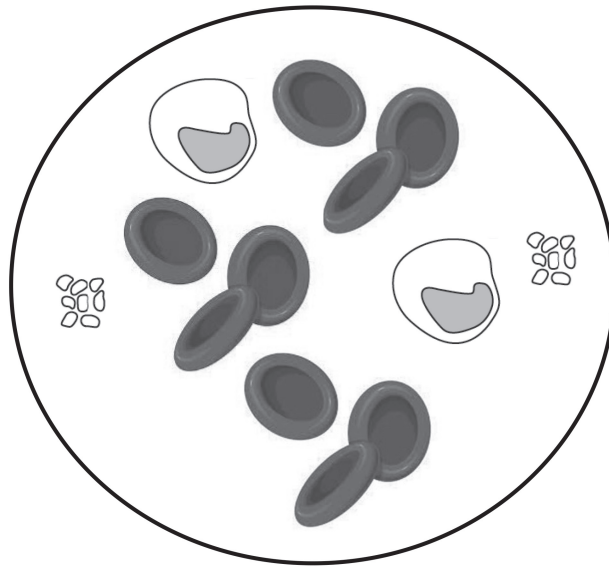
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- 2 The diagram below shows a sample of human blood from a healthy person viewed under a microscope (blood smear).



- (a) Draw a **circle** around the type of blood cell whose number would increase if a person had a bacterial infection and explain why.

Explanation \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [2]

The left ventricle of the heart contains a maximum volume of blood before it contracts and pumps blood into the blood vessels.

The time between contractions is one beat of the heart.

- (b) State a feature of the left ventricle which allows it to carry out its function.

\_\_\_\_\_  
\_\_\_\_\_ [1]

[Turn over



- (c) Two individuals, A and B, undertook a period of **intense** physical activity during which their heart rate (beats per minute, BPM) and stroke volume were measured and recorded.

Stroke volume is the volume of blood pumped out of the left ventricle during one cardiac cycle.

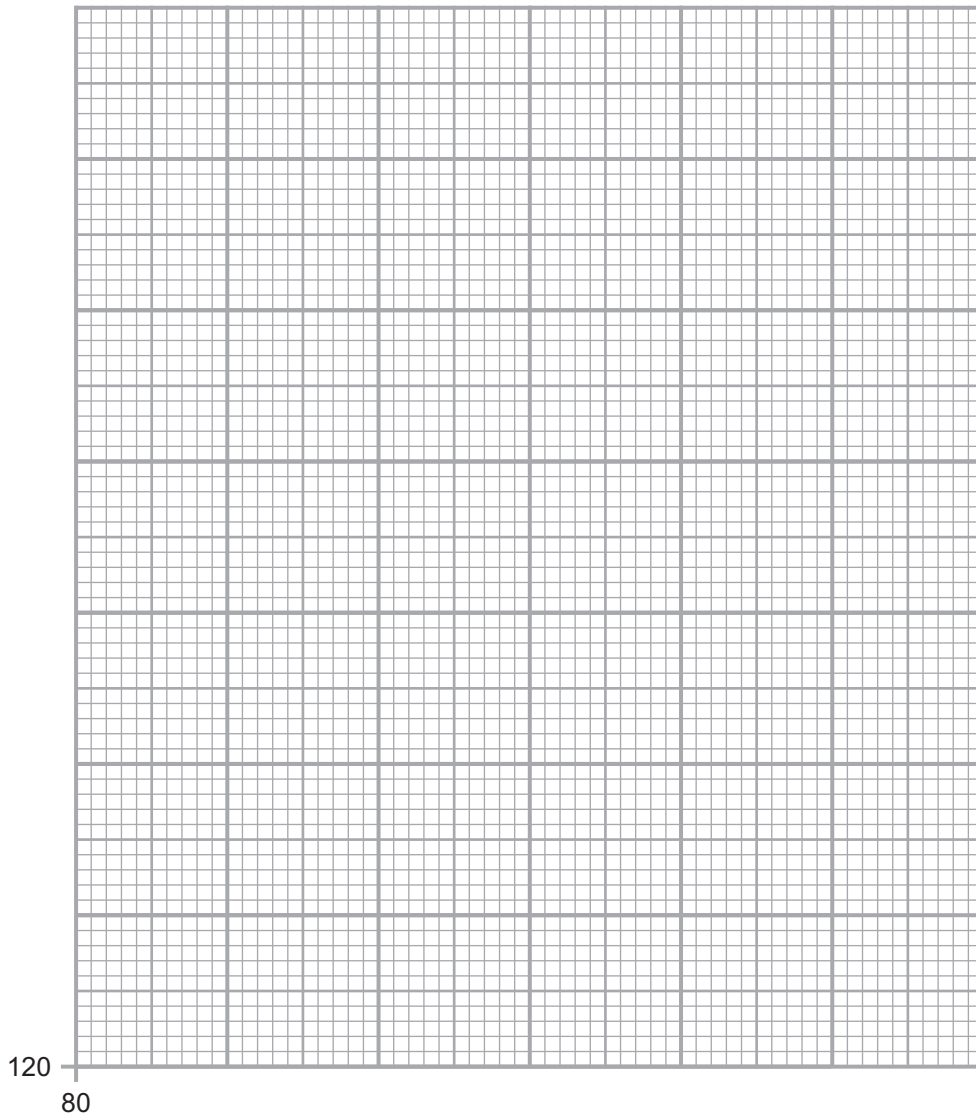
The table below shows the stroke volume at different heart rates of person A and person B.

Heart rate /BPM	Stroke volume /ml	
	Person A	Person B
88	120	132
120	122	148
140	122	160
160	122	170
180	124	174
200	124	188



(i) Construct a line graph for both sets of results on the grid below, with stroke volume /ml on the y axis.

Label both axes.



[6]

[Turn over

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Cardiac output is calculated as **heart rate x stroke volume**.

(ii) Calculate the **maximum** cardiac output for person A and person B.

**You are advised to show your working.**

Person A

\_\_\_\_\_ ml min<sup>-1</sup>

Person B

\_\_\_\_\_ ml min<sup>-1</sup> [2]

(iii) Using the information in (ii) above, suggest whether person A or person B undertakes regular **intense** physical activity. Explain your answer.

Person \_\_\_\_\_

Explanation \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ [3]





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**(Questions continue overleaf)**

**[Turn over**

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**\*24SZ02111\***

3 The table below gives information on the nutritional content of cow's milk and almond milk.

Milk	Energy / kcal/100g	Total fat / g/100g	Saturated fat / g/100g	Carbohydrate / g/100g	Protein / g/100g	Lactose / g/100g	Calcium / mg/100g
Cow's milk (semi-skimmed)	47	1.6	1.0	4.6	3.6	4.7	124
Almond milk (fortified and unsweetened)	13	1.1	0.1	0.0	0.4	0.0	120

(a) Compare the amounts of **total fat**, **carbohydrate** and **lactose** in the cow's milk with the amounts in the almond milk.

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[3]

(b) The almond milk contains 0.4 g/100g of protein, and the cow's milk contains 3.6 g/100g of protein.

(i) State the **main** function of protein in the diet.

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[1]

(ii) Suggest **one** example of a health problem that is linked to not having the required amount of protein in the diet.

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[1]





4 Sodium chloride contains sodium ions and chloride ions which are essential in the human body.

(a) State **three** functions of these ions.

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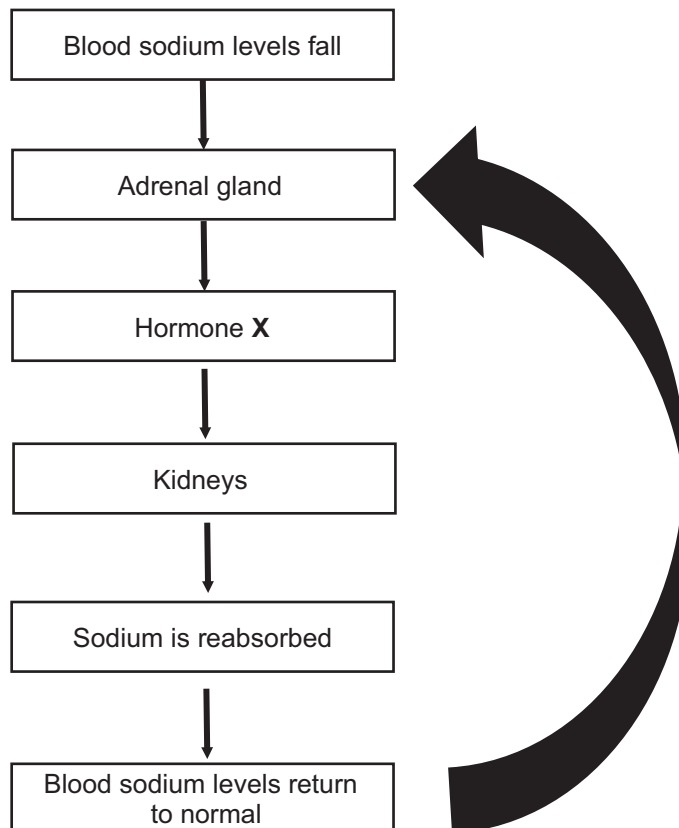
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[3]

It is essential for a healthy body that blood sodium levels are kept at a constant level.

The flow diagram below shows how blood sodium levels are regulated by homeostasis.



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(b) (i) Name hormone **X**.

\_\_\_\_\_ [1]

(ii) State what part of the homeostatic mechanism the arrow represents and explain how this acts to maintain sodium ions in the blood at a constant level.

Arrow \_\_\_\_\_

How it acts \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ [2]

(c) It is recommended that an adult eats no more than 6g of added salt (sodium chloride) each day.

(i) State **one** consequence of **low** sodium levels in the body.

\_\_\_\_\_

\_\_\_\_\_ [1]

(ii) State **one** consequence of **high** sodium levels in the body.

\_\_\_\_\_

\_\_\_\_\_ [1]

[Turn over

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\*24SZ02115\*





6 The table below shows the daily diet of three adult females.

	Emma	Katie	Lucy
<b>Breakfast</b>	Two slices of white bread with chocolate spread and a cup of tea	Bowl of porridge with fruit and a cup of coffee	Two slices of wholegrain bread and a glass of orange juice
<b>Lunch</b>	Sausage roll and a bottle of cola	Chicken, a salad and a glass of milk	Chicken, a salad, an apple and a glass of milk
<b>Dinner</b>	Chicken, mashed potatoes, carrots, broccoli and a glass of cola	Steak, chips, mushrooms, peas, carrots and a glass of water	Spaghetti bolognese with carrots, onions and mushrooms, with wholegrain pasta, a glass of water and a bowl of strawberries
<b>Snacks</b>	Two chocolate bars and a bag of crisps	A chocolate bar and a packet of plain mixed nuts	A banana and a packet of plain mixed nuts
<b>Daily energy intake /kcal</b>	2650	2000	2000

(a) (i) State the UK recommendations for daily fruit and vegetable intake.

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[1]

(ii) Compare the daily fruit and vegetable intake of the three adult females and evaluate if any of them are meeting these recommendations.

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(c) (i) State **two** foods in Lucy's daily diet which contain complex carbohydrates.

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[2]

(ii) Explain how complex carbohydrates are beneficial in the regulation of blood glucose.

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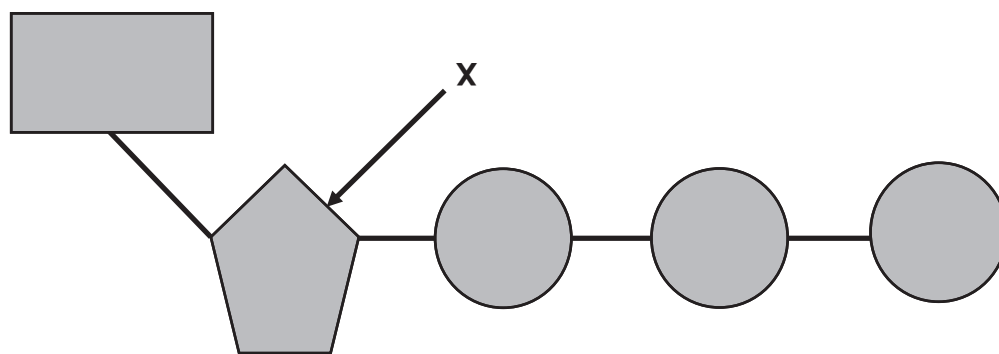
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[2]



7 (a) The structure of an ATP molecule is represented in the diagram below.



(i) Identify the part of the molecule labelled **X** in the diagram.

**X** \_\_\_\_\_ [1]

(ii) Explain what happens to the ATP molecule when it is hydrolysed to ADP.

\_\_\_\_\_  
\_\_\_\_\_ [1]

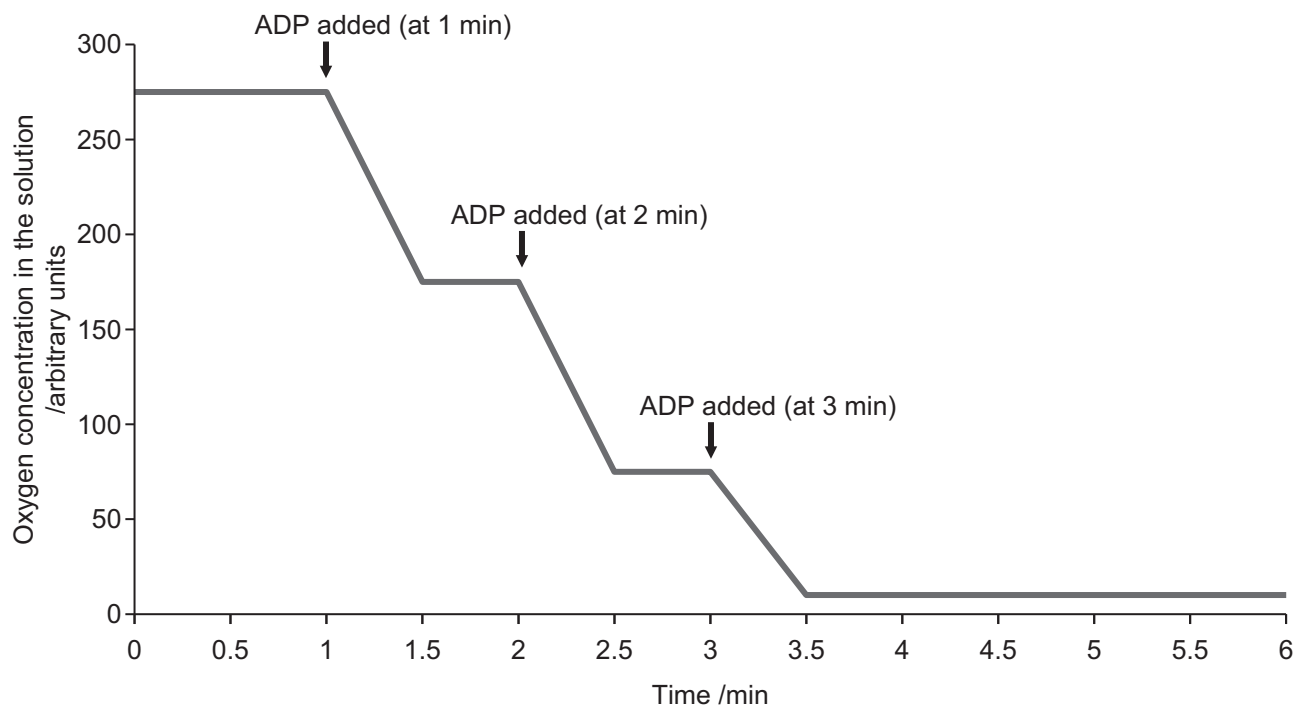


(b) A scientist, investigating aerobic respiration, added mitochondria taken from muscle cells to a solution containing **pyruvate** and phosphate.

The scientist then bubbled oxygen gas into the solution for ten minutes before the start of the experiment.

After the start of the experiment, the scientist added ADP to the solution at one-minute intervals for three minutes, and measurements were taken of the oxygen concentration in the solution.

The graph below shows the results.



(i) Explain why phosphate was added to the solution.

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[1]



(ii) Explain why the oxygen concentration in the solution decreased after adding ADP at one minute and at two minutes.

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[1]

(iii) Suggest why the oxygen concentration in the solution **decreased less** after adding ADP at three minutes.

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[1]

(c) The scientist carried out a second investigation in which mitochondria taken from muscle cells were added to a solution containing **glucose** and phosphate but with **no other parts of the cell present**.

The scientist then bubbled oxygen gas into the solution for ten minutes before the start of the experiment.

After the start of the experiment, the scientist then added ADP to the solution at one-minute intervals for three minutes, and measurements were taken of the oxygen concentration in the solution.

Suggest what would happen to the oxygen concentration in the solution and explain your answer.

Suggestion \_\_\_\_\_

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Explanation \_\_\_\_\_

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[2]

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Sources  
All images CCEA unless otherwise stated

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For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
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7	

<b>Total Marks</b>	
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Examiner Number

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