



Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2025

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

FRIDAY 30 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 questions in black ink and use a dark HB pencil for drawings and graphs.

Do not write with a gel pen.

Answer **all seven** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.

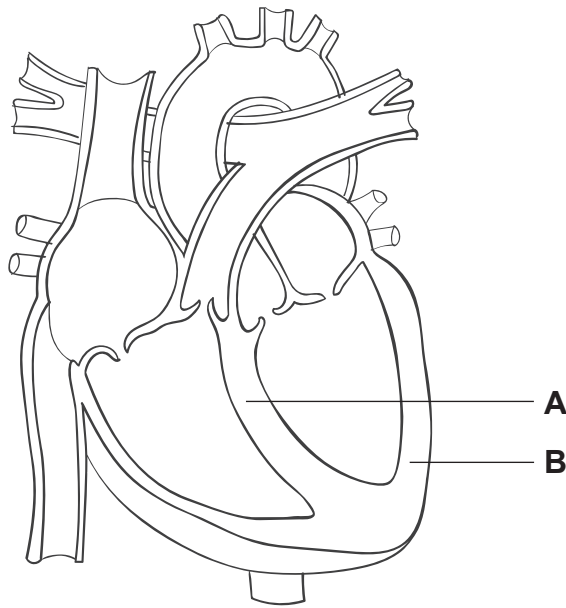
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

You may use a scientific calculator.

Quality of written communication will be assessed in Question **6(c)**.



1 The diagram below shows a cross-section through a human heart.



Source: © Getty images

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

A _____

B _____

[2]

(ii) Explain how the adaptations of the heart provided below enable it to carry out its function.

Adaptation: Valves

Explanation _____

Adaptation: Electrical activity

Explanation _____

[2]



The typical resting pulse (heart) rate is between 60–100 beats per minute.

(b) Describe how you would measure resting pulse rate at the wrist.

[4]

[Turn over



2 Most people get the vitamin E they need from their diet.

Vitamin E is a fat-soluble vitamin.

(a) (i) State the daily reference nutrient intake for vitamin E.

_____ mg [1]

(ii) Name **two** dietary sources of vitamin E.

_____ [2]

Vitamin E deficiency is very rare.

Vitamin E is absorbed in dietary fats from the digestive system.

(b) Suggest **one** reason why a person may develop a vitamin E deficiency.

_____ [1]

Vitamin D is also a fat-soluble vitamin.

The body creates vitamin D from direct sunlight on the skin when outdoors.

(c) State the main function of vitamin D in the body.

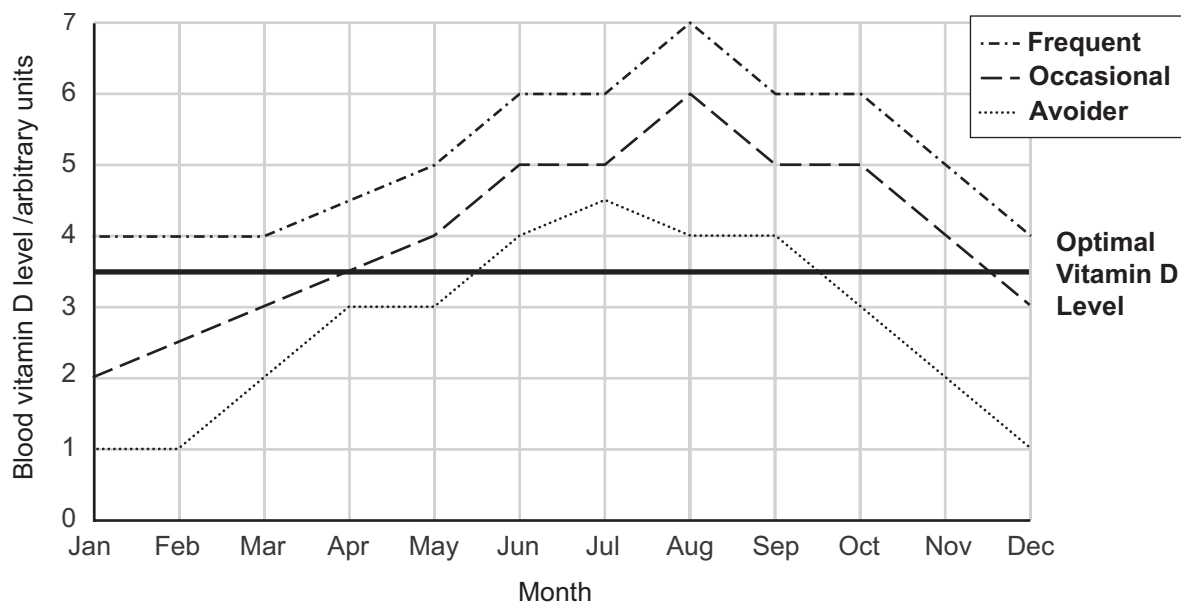
_____ [1]



The graph below shows blood vitamin D levels for residents of a UK town for each month of a year.

The horizontal line represents optimal blood levels of vitamin D.

Residents were placed into one of three groups according to whether they were exposed frequently, occasionally, or avoided being exposed to sunlight.



Source: © Principal Examiner

(d) (i) State which months of the year individuals who avoided being exposed to sunlight do **not** need to take vitamin D supplements and explain why.

Explanation _____ to _____
 _____ [2]

(ii) Identify two differences between the group who are exposed to sunlight **frequently** and both other groups.

1. _____

 2. _____
 _____ [2]

[Turn over



3 Thyroxine is a hormone.

One of the actions of thyroxine is to increase the basal metabolic rate (BMR).

(a) (i) Define what is meant by **basal metabolic rate (BMR)**.

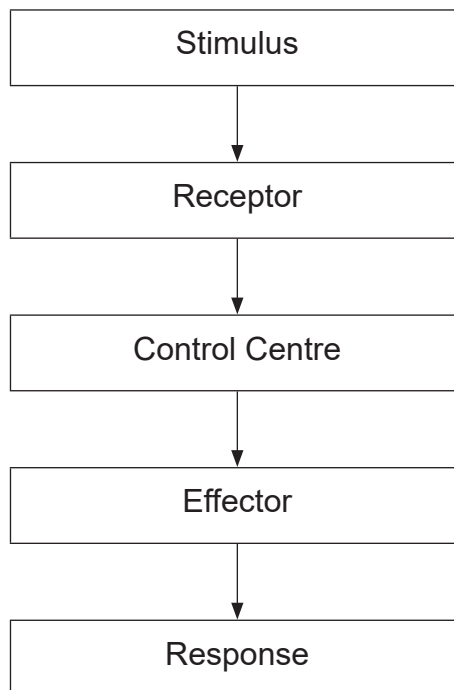
[1]

(ii) State **two** features of hormones.

[2]

Homeostasis is the maintenance of a constant steady internal environment in the body.

The diagram below shows the components of the homeostatic mechanism.



Thyroxine levels are maintained at their normal level (set point) by a homeostatic mechanism.

(b) Identify the control centre and effector for the thyroxine homeostatic mechanism.

Control Centre

Effector

[2]

The response in the homeostatic mechanism uses **corrective mechanisms** to return the factor to its set point.

(c) (i) State **how the corrective mechanism** acts to lower thyroxine levels when these rise above their set point.

[2]

(ii) Suggest why these corrective mechanisms are turned off **when the set point is reached**.

[1]

[Turn over



4 The UK government recommends that each person should eat five portions of fruit and vegetables each day (5-a-day).

(a) State **two** micronutrients that are found in fruit and vegetables.

[2]

The table below gives information from a UK dietary survey **on the daily intake of fruit and vegetables** for females and males aged 11–18, 19–64, and >65 years old.

Age /years	Gender	Fruit and vegetable portions per day	Percentage achieving '5-a-day' /%
11–18	Female	2.9	9
	Male	2.8	12
19–64	Female	3.9	24
	Male	3.5	23
>65	Female	4.7	44
	Male	4.4	37

(b) (i) Using the data in the table, analyse and evaluate the **fruit and vegetable portions per day** for both genders in all age groups.



5 Human blood is buffered.

(a) (i) What is the role of a buffer in the blood?

[1]

(ii) What is the normal pH range of the blood?

_____ to _____ [1]

(iii) State how an increase in carbon dioxide levels in the blood affects blood pH.

[1]

(iv) Describe how the body **detects and responds** to an increase in carbon dioxide levels.

[3]



Haemoglobin is a globular protein responsible for oxygen transport.

One molecule of haemoglobin can carry up to four molecules of oxygen to form oxyhaemoglobin.

(b) (i) State which type of blood vessel contains the highest percentage of oxyhaemoglobin.

_____ [1]

(ii) Define oxygen saturation.

_____ [1]

[Turn over

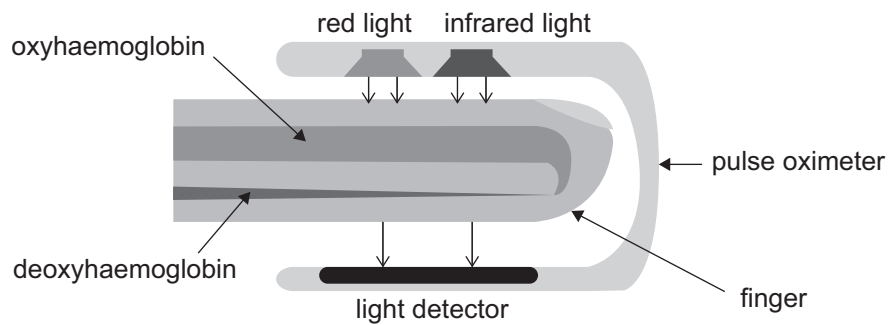


Oxygen saturation is often monitored using a pulse oximeter.
The diagram below shows a pulse oximeter attached to an individual's finger.

Two different types of light, red and infrared, pass through the individual's finger and are absorbed by oxyhaemoglobin and deoxyhaemoglobin in the blood vessels.

Red light and infrared light which are not absorbed pass through the finger and are detected by a light detector.

The table below shows the percentage of red light and percentage of infrared light detected by the light detector after passing through oxyhaemoglobin and deoxyhaemoglobin.



	Percentage of light detected by light detector /%	
	red light	infrared light
oxyhaemoglobin	73	25
deoxyhaemoglobin	27	75

(c) (i) State and explain, using data in the table, which type of light is more **absorbed** by oxyhaemoglobin.

Type of light _____

Explanation _____

_____ [2]

(ii) State **one** condition which may lead to reduced oxygen saturation levels.

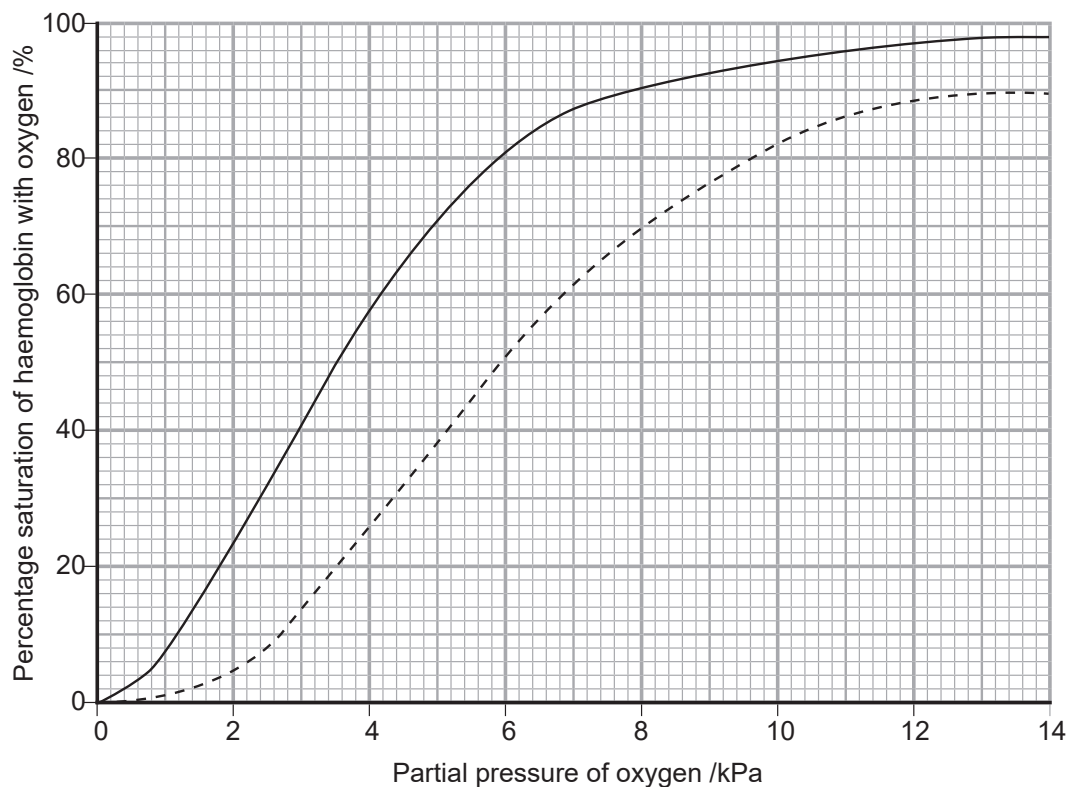
_____ [1]



The graph below shows how the percentage saturation of haemoglobin with oxygen changes with different partial pressures of oxygen (kPa).

The dashed line shows how increased carbon dioxide levels affect the percentage saturation of haemoglobin at different partial pressures of oxygen (kPa).

This is known as the **Bohr shift** (or Bohr effect).



Source: Principal Examiner

(d) (i) State under what circumstances the Bohr shift would occur.

[1]

(ii) Describe the Bohr shift and its effect on the tissues of the body.

[2]

[Turn over



- 6 The UK government guidelines state that children aged 5–16 years should carry out moderate to vigorous physical activity for a minimum of 60 minutes each day.

The table below shows data collected over a two-year period on the percentage of children and young people aged 5–16 years old taking part in a **range of different physical activities**.

Year	Percentage taking part in physical activity /%					
	Team sports	Athletics	Walking to school or shops	Dance	Going for a walk	Riding a scooter
2018/19	61	36	40	30	32	17
2019/20	53	33	50	30	36	17

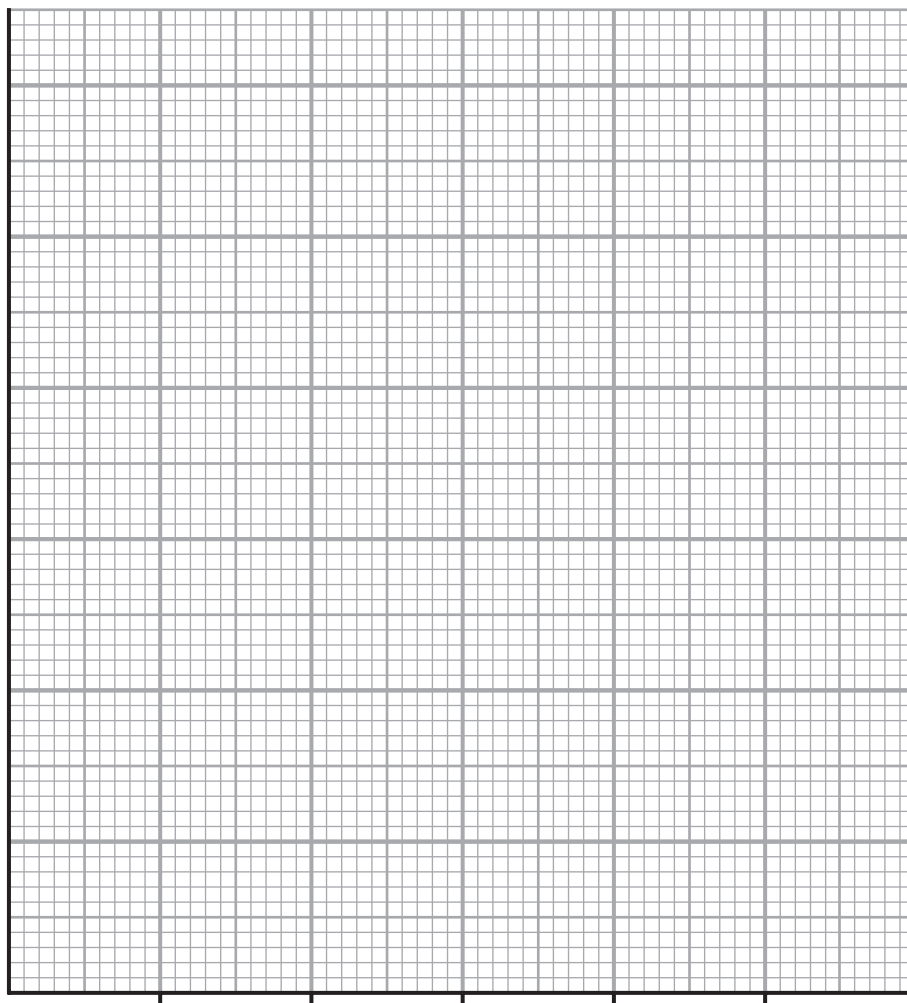


(a) Construct a bar graph for the **2018/19** and **2019/20** results on the grid below, with the percentage of children and young people taking part in physical activity on the y-axis.

Label both axes.

Shade the bars.

[6]



Over two years there was an increase of 4.0% (350,000 individuals) in the number of children and young people going for a walk.

There was also an increase of 10.0% in children and young people walking to get to school or shops.

- (b) (i) Calculate how many children and young people this increase of 10.0% represents.

Show your working out.

_____ [2]

- (ii) Suggest **one** reason why children and young people have been walking more.

_____ [1]



7 Aerobic respiration is composed of four stages.

The word equation for aerobic respiration is shown below.



- (a) State a stage of aerobic respiration in which carbon dioxide is produced and the location **where** this occurs in the cell.

Stage _____

Location _____

[2]

Glycolysis is the only stage of aerobic respiration that can occur if oxygen is **not** present.

The word equation for glycolysis is shown below.



- (b) Explain why one molecule of glucose produces two molecules of pyruvate.

[1]

Glycolysis actually produces four molecules of ATP. However, only two are shown in the word equation directly above.

- (c) (i) Using the word equation for glycolysis, explain why **only two molecules of ATP are produced overall**.

[2]



(ii) State what happens to pyruvate if oxygen is absent and if oxygen is present.

Oxygen absent

Oxygen present

[2]

Cyanide is a poison which inhibits the movement of electrons along the electron transport chain.

(d) Using your knowledge of aerobic respiration and the information provided, suggest why cyanide is a rapid and deadly poison.

[3]

THIS IS THE END OF THE QUESTION PAPER



Sources

Q1.....© Getty images

Q4a.....© Crown copyright 2021. NDNS: Diet and physical activity – a follow-up study during COVID-19 - GOV.UK

Q6.....Source: Adapted and based on figures from “Active Lives Children and Young People Survey”, Sport England

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Question Number	Marks
1	
2	
3	
4	
5	
6	
7	

Total Marks	
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Examiner Number

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