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EDEXCEL GCSE BIOLOGY: QUESTIONS BY TOPIC

Exchange and Transport in Animals (8)

GCSE Biology (Foundation) Topic 8

17 questions · 167 marks · Mark schemes included

Pearson Edexcel GCSE (9-1) Biology 1BI0, Foundation Tier, June 2018 - June 2025

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HOW TO USE THIS BOOKLET

Questions run from the lowest mark tariff to the highest, so similar questions sit together.

Click any row below to jump straight to that question.

On every question page, click ANSWER in the top-right corner to jump to its mark scheme.

Diagrams, graphs, tables and data are printed exactly as they appeared in the original papers.

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QUESTIONS

17 questions · 167 marks · lowest tariff first



7-MARK QUESTIONS

3 questions in this booklet



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DO NOT WRITE IN THIS AREA

- 2 (a) Figure 2 shows alveoli from a healthy lung.

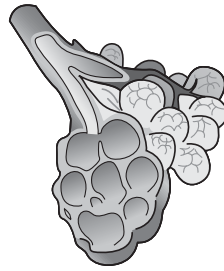


Figure 2

Smoking can cause a condition called emphysema.

Figure 3 shows alveoli from a person with emphysema.

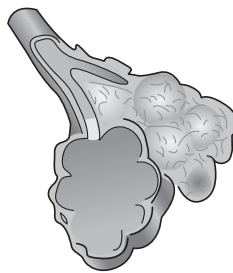


Figure 3

Use words from the box to complete the following sentences.

(2)

breathing	diffusion	larger
osmosis	smaller	thicker

The alveoli from the person with emphysema have a surface area than the alveoli from a healthy lung.

The surface area of the alveoli will affect how much oxygen moves into the blood by the process of



(b) The graph in Figure 4 shows the volume of oxygen an athlete absorbs at different running speeds.

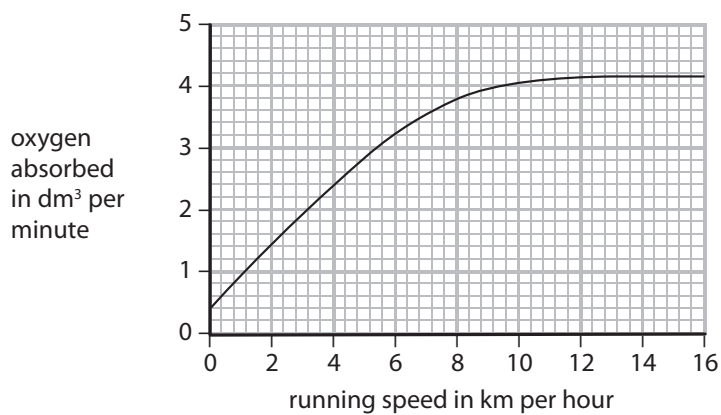


Figure 4

(i) Describe the trend shown in Figure 4.

(2)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



DO NOT WRITE IN THIS AREA

THIS AREA

(ii) Which uses more oxygen when the running speed of the athlete changes from 4 to 6 km per hour?

(1)

- ☐ A increasing aerobic respiration
- ☐ B increasing anaerobic respiration
- ☐ C decreasing aerobic respiration
- ☐ D decreasing anaerobic respiration

(iii) Explain why the athlete produces lactic acid when running at 14 km per hour.

(2)

(Total for Question 2 = 7 marks)



1 (a) Some foods contain starch.

Which chemical is used to test for starch?

(1)

- ☐ A amylase
- ☐ B ethanol
- ☐ C iodine solution
- ☐ D hydrochloric acid

(b) Benedict's solution is used to test for reducing sugars in food.

Figure 1 shows part of the method for this test.

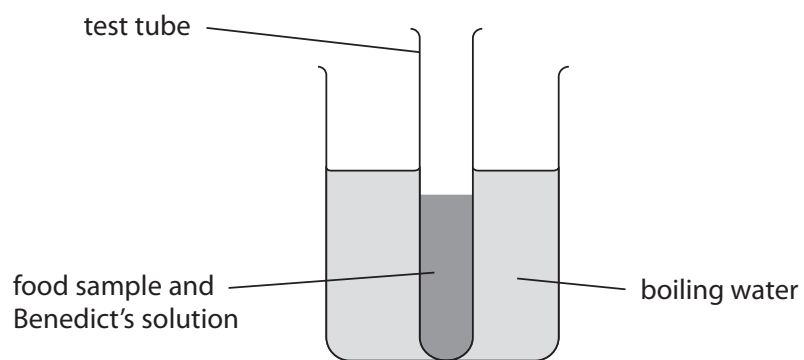


Figure 1

(i) Give **two** safety precautions needed when doing this test.

(2)

1

.....

2

.....

(ii) Give **one** reason for placing the test tube in boiling water.

(1)

.....

.....



(c) Figure 2 shows some information about the results of the test for reducing sugar.

colour of Benedict's solution after testing food sample	concentration of reducing sugar
blue	zero
green	low
yellow	↓
orange	
brick red	high

Figure 2

A student wanted to compare the amount of reducing sugar in three types of biscuit.

(i) Give **one** variable the student should control.

(1)

Figure 3 shows the student's results.

type of biscuit	colour with Benedict's solution
A	green
B	brick red
C	orange

Figure 3

(ii) State **two** conclusions that can be made from the data in Figure 3.

(2)

1

.....

2

.....

(Total for Question 1 = 7 marks)



1 Figure 1 shows a diagram of the heart.

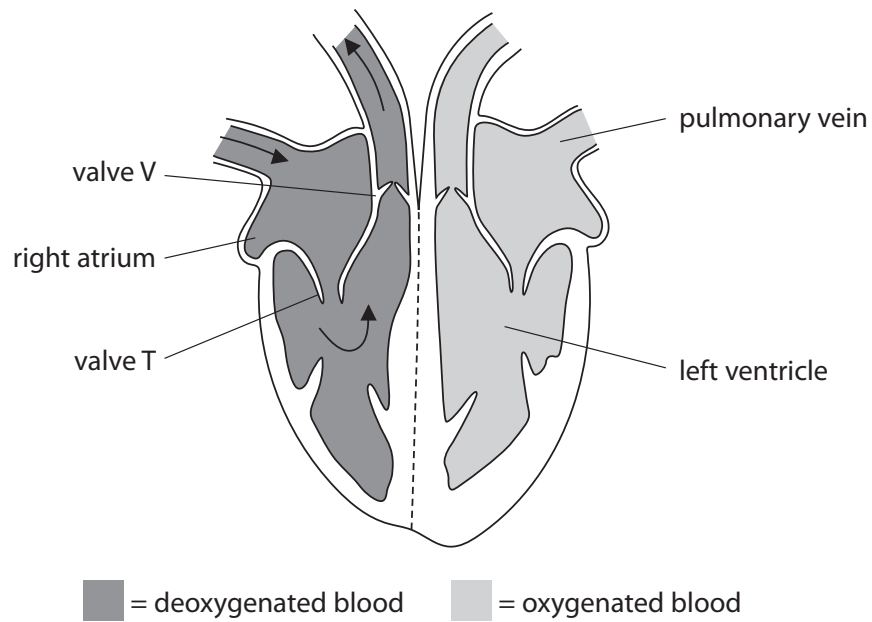


Figure 1

(a) (i) Draw arrows on Figure 1 to show how oxygenated blood moves through the heart. (1)

(ii) What happens when the right ventricle contracts?

(1)

- ☐ A valve T opens
- ☐ B valve T closes
- ☐ C blood is forced into the left atrium
- ☐ D blood is forced into the pulmonary vein

(iii) Draw **one** straight line from each structure to its function.

(2)

structure	function
pulmonary vein	carries deoxygenated blood
	forces blood towards body organs
	carries blood from the lungs to the heart
left ventricle	takes blood to the right side of the heart
	forces blood towards the lungs

(b) Figure 2 shows a dissected vein.

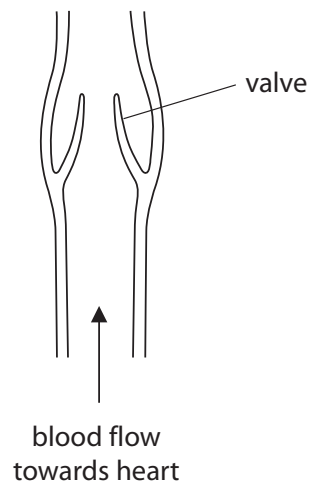


Figure 2

- (i) Explain how the valves in veins help the blood, at low pressure, flow towards the heart.

(2)

.....

.....

.....

.....

- (ii) The equipment used to dissect the vein was cleaned and put into disinfectant.

State why this equipment was put into disinfectant.

(1)

.....

.....

(Total for Question 1 = 7 marks)

8-MARK QUESTIONS

2 questions in this booklet



1 Figure 1 shows human blood seen using a light microscope.

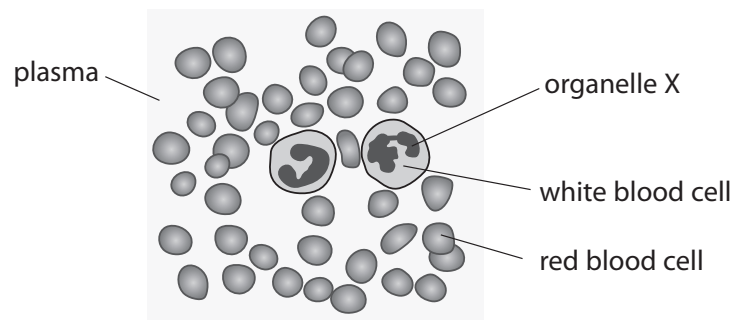


Figure 1

(a) (i) The organelle labelled X controls the activities of the white blood cell.

What is the name of organelle X?

(1)

- ☐ A mitochondrion
- ☐ B ribosome
- ☐ C chromosome
- ☐ D nucleus

(ii) Use words from the box to complete the sentences.

(2)

gas	haemoglobin	hormone
liquid	platelet	solid

Red blood cells contain the substance

Blood plasma is a

(iii) Describe **two** ways that white blood cells protect the body from disease.

(2)

1

2

(b) Figure 2 shows a white blood cell on a 100 μm scale.

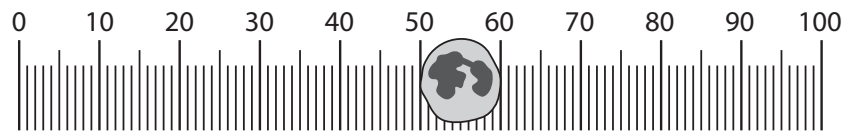


Figure 2

State the width of the white blood cell.

(1)

..... μm

(c) Figure 1 shows human blood seen using a light microscope.

Explain why using an electron microscope shows the structures in the white blood cells more clearly.

(2)

.....

.....

.....

.....

.....

(Total for Question 1 = 8 marks)

2 (a) Blood contains red blood cells, white blood cells, plasma and platelets.

(i) Draw **one** straight line from each part of the blood to its function.

(2)

part of the blood	function
plasma	produces oestrogen
	transports dissolved urea
	contains haemoglobin
red blood cell	produces antibodies
	surrounds and digests foreign cells

Figure 2 shows some red blood cells.



(Source: © SciePro/Shutterstock)

Figure 2

(ii) State **two** features that can be seen in the red blood cells in Figure 2.

(2)

1

.....

2

.....

(b) Lymphocytes are white blood cells that produce large amounts of protein.

(i) Which organelle is needed to produce large amounts of protein?

(1)

- ☐ **A** ribosome
- ☐ **B** vacuole
- ☐ **C** chloroplast
- ☐ **D** flagellum

A small lymphocyte has a diameter of $10\text{ }\mu\text{m}$ (micrometres).

A microscope magnifies this lymphocyte 400 times.

(ii) Calculate the diameter of the image of the lymphocyte seen using this microscope.

(2)

image size μm

(iii) How many micrometres are in 1 mm (millimetre)?

(1)

- ☐ **A** 10
- ☐ **B** 100
- ☐ **C** 1 000
- ☐ **D** 10 000

(Total for Question 2 = 8 marks)



9-MARK QUESTIONS

3 questions in this booklet



- 2 The animal shown in Figure 3 is a tick burrowing into the skin of a human.



© IanRedding/Shutterstock

Figure 3

- (a) Use words from the box to complete the sentences.

(2)

enzymes	food	herbivores
parasites	producers	prey

- (i) The tick burrows into the skin to obtain
- (ii) When a tick burrows into human skin the tick benefits but the human is harmed.

This means that ticks are classed as

- (b) When skin is cut a blood clot forms.

Which part of the blood starts the clotting process?

(1)

- ☒ **A** red blood cells
- ☒ **B** water
- ☒ **C** platelets
- ☒ **D** white blood cells

(c) Figure 4 shows a bird called an oxpecker eating ticks that are living on a zebra.



© MartinMaritz/Shutterstock

Figure 4

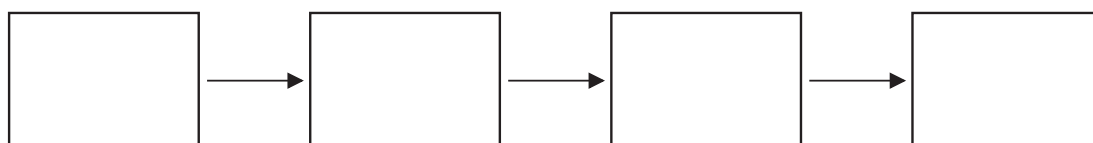
(i) Name the type of relationship where both the oxpecker and the zebra benefit.

(1)

(ii) Zebras eat grass.

Complete the food chain that includes zebras, ticks, oxpeckers and grass.

(2)



(d) Figure 5 shows the maximum numbers of oxpeckers observed on four types of mammal.

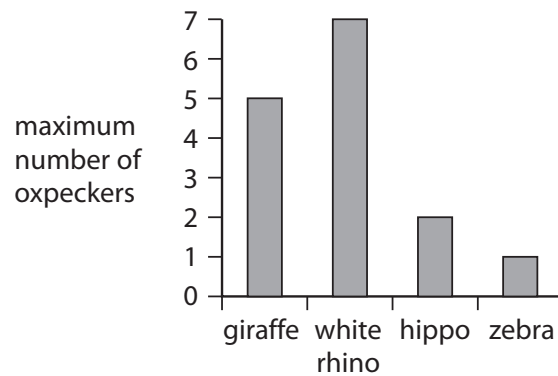


Figure 5

(i) Describe the difference in the maximum number of oxpeckers on the white rhino and on the hippo.

(2)

.....

.....

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.....

.....

(ii) Give **one** reason why more oxpeckers were observed on giraffes than on zebras.

(1)

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(Total for Question 2 = 9 marks)

3 Figure 5 shows a diagram of the human blood system.

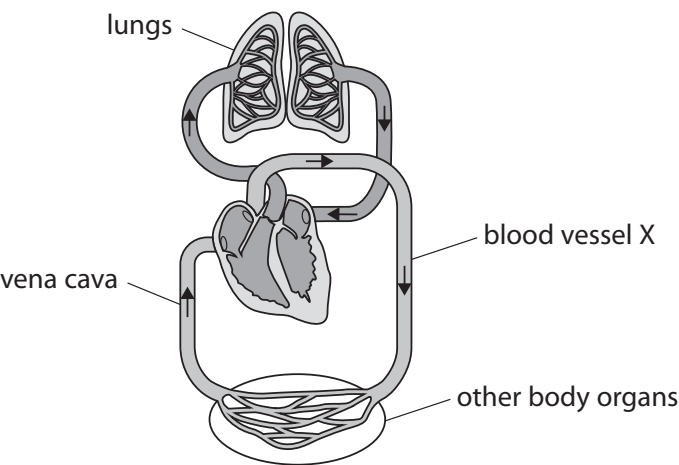


Figure 5

(a) (i) Name blood vessel X. (1)

(ii) Which row of the table shows the width of the wall and blood pressure in blood vessel X? (1)

	width of wall	blood pressure
☐ A	thick	high
☐ B	thick	low
☐ C	thin	high
☐ D	thin	low

(b) Figure 6 shows the pressure of blood flowing through the arteries, capillaries and veins of a person.

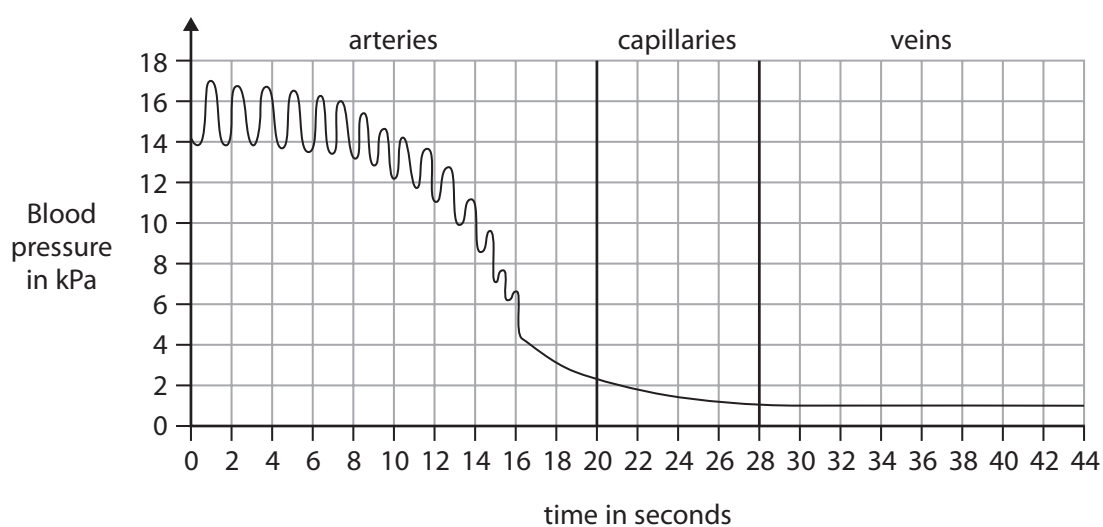


Figure 6

Calculate the difference in blood pressure from the maximum in the arteries to the minimum in the veins.

(2)

..... kPa

(c) Figure 7 shows a diagram of a vein with blood cells.

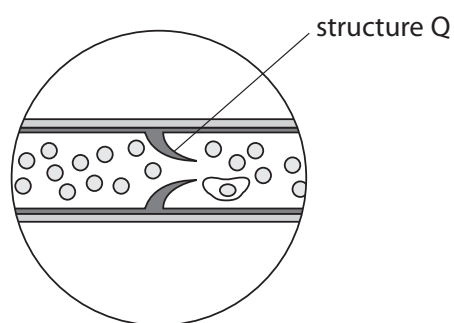


Figure 7

(i) Identify structure Q.

(1)

(ii) State the function of structure Q.

(1)

(d) Describe how the heart causes blood to move to the lungs.

(3)

(Total for Question 3 = 9 marks)

- 5 The calorimeter shown in Figure 7 can be used to investigate the energy content of food.

Heat energy is released when a small sample of food is burnt, causing the water temperature to increase.

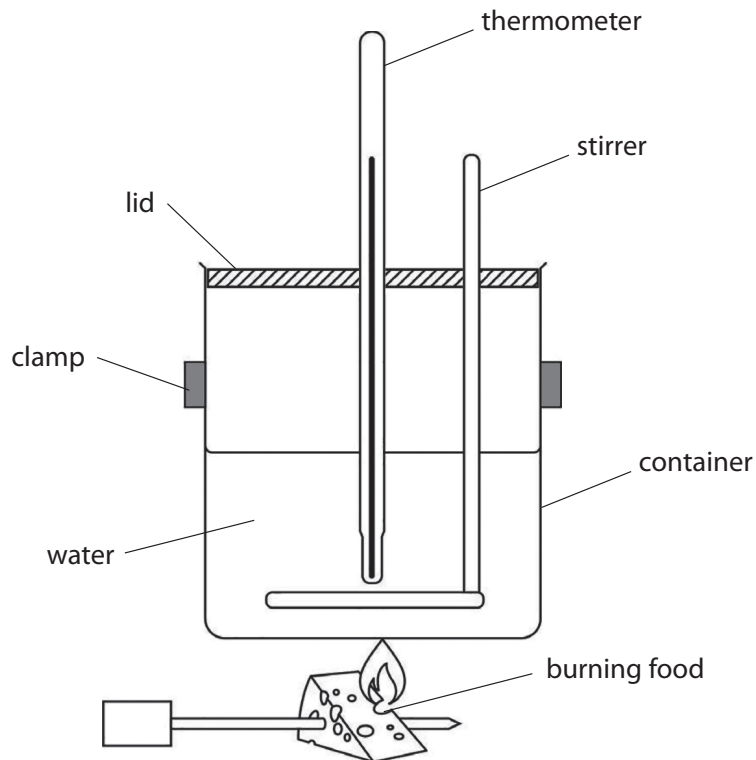


Figure 7

- (a) (i) Give **one** function of the lid.

(1)

.....

.....

- (ii) Describe how the increase in the temperature of the water could be measured.

(2)

.....

.....

.....

.....

.....

(b) A student used this calorimeter to investigate the energy content of a food.

The results are shown in Figure 8.

temperature change in °C	mass of water in g
30	50

Figure 8

(i) Calculate the energy content of the food.

Use the equation

energy in joules (J) = mass of water $\times$ 4.2 $\times$ temperature change

(2)

energy content = ... J

(ii) The student repeated the investigation using a different food.

The results are shown in Figure 9.

temperature change in °C	mass of water in g	energy content in J
64	25	6720

Figure 9

State **two** ways the student could improve the investigation so that the energy content of the two different foods can be compared.

(2)

1

.....

2

.....



(c) Figure 10 shows some facts about two foods.

food	carbohydrate in g	fat in g	energy in kJ
100 g of apple	14.0	0.2	220
100 g of avocado	9.0	15.0	669

Figure 10

Explain the difference in the energy values of these two foods.

(2)

(Total for Question 5 = 9 marks)

10-MARK QUESTIONS

1 question in this booklet



- 6 (a) Figure 10 shows a single-celled pond organism (*Amoeba proteus*).

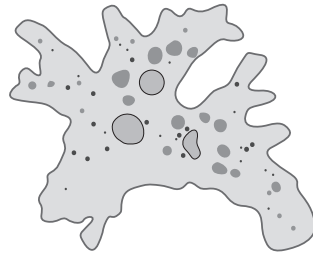


Figure 10

- (i) Which row of the table allows the net diffusion of oxygen into *Amoeba proteus*? (1)

	concentration of oxygen in water in ppm	concentration of oxygen in <i>Amoeba proteus</i> in ppm
☐ A	4	4
☐ B	10	10
☐ C	4	10
☐ D	10	4

- (ii) *Amoeba proteus* uses oxygen for aerobic respiration.

Complete the equation for aerobic respiration.

(1)

glucose + oxygen → + ... (+ energy is released)

(b) Humans breathe faster when they exercise.

(i) Which **two** changes allow the rate of respiration in the muscle to increase?

(1)

	heart rate	amount of glucose delivered to the muscles
☐ A	increases	increases
☐ B	increases	decreases
☐ C	decreases	increases
☐ D	decreases	decreases

(ii) Figure 11 shows breathing data for a human at rest and when running at 5 metres per second on a running machine.

activity	mean number of breaths per minute	mean volume of air in one breath in dm ³	mean volume of air breathed in dm ³ per minute
at rest	5.0	0.8	4.0
running at 5 metres per second	24.7	2.7	?

Figure 11

Calculate the mean volume of air breathed per minute when running at 5 metres per second.

Give your answer to one decimal place.

(2)

..... dm³ per minute



(iii) Devise an investigation to compare the mean number of breaths per minute for men, with the mean number of breaths per minute for women, when running at 5 metres per second on a running machine.

(4)

.....

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.....

(c) Whilst running, the leg muscles of an athlete tightened up, causing cramp.

Name the product of anaerobic respiration that can cause cramp.

(1)

.....

(Total for Question 6 = 10 marks)



11-MARK QUESTIONS

5 questions in this booklet



- 4 (a) A calorimeter can be used to measure the energy content of food.

Figure 6 shows a simple calorimeter.

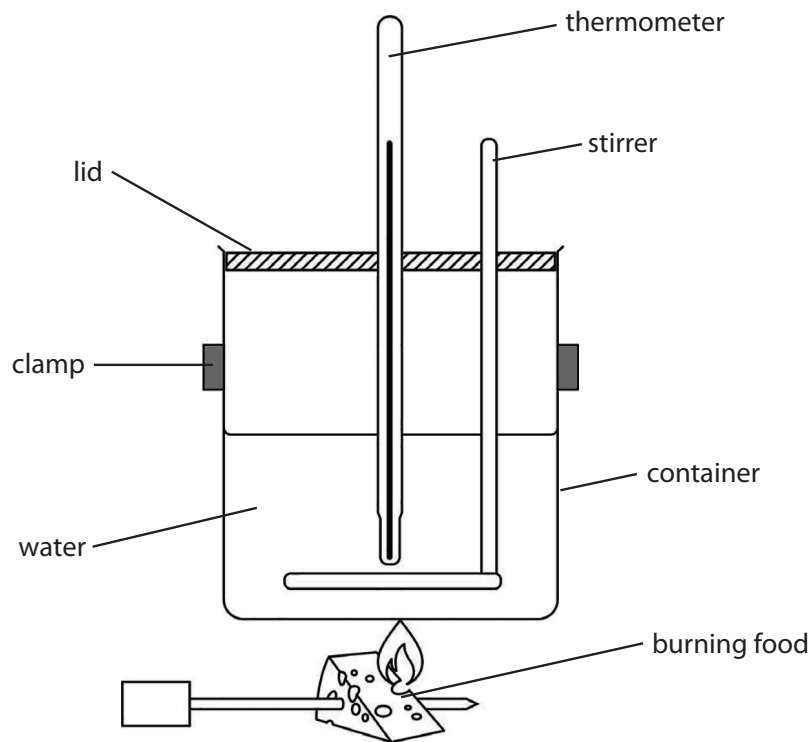


Figure 6

- (i) Use words from the box to complete the sentences.

(2)

air

clamp

food

lid

thermometer

water.

The stirrer distributes heat evenly in the

The calorimeter has a to prevent the loss of heat.

- (ii) This calorimeter was used to measure the energy content of a piece of cheese.

Figure 7 shows some of the results.

mass of water in grams	starting temperature of water in °C	final temperature of water in °C
25	21	85

Figure 7

Calculate the energy content of this piece of cheese.

(2)

Use the equation

energy in joules (J) = mass of water $\times$ 4.2 $\times$ temperature change

energy content of the piece of cheese = ... J

- (iii) The same method was used to calculate the energy content of a different type of cheese.

The results are shown in Figure 8.

mass of water in grams	starting temperature of water in °C	final temperature of water in °C	temperature change in °C
25	21	76	55

Figure 8

Explain **one** reason why the results are different for this type of cheese.

(2)

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.....

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.....

(b) Body mass index (BMI) is calculated using the equation:

$$\text{BMI} = \frac{\text{mass (kg)}}{(\text{height (m)})^2}$$

(i) Person A is 1.8 m tall and has a mass of 64.8 kg.

Calculate the BMI of person A.

(2)

BMI = ...

(ii) Figure 9 shows some information about BMI.

BMI	BMI category
less than 18.5	underweight
18.5 to 24.9	healthy weight
25 to 29.9	overweight
more than 29.9	obese

Figure 9

Person B has a BMI of 18.5.

Which category is correct for person B?

(1)

- ☐ **A** underweight
- ☐ **B** healthy weight
- ☐ **C** overweight
- ☐ **D** obese

(iii) Person C has a BMI of 28.5.

Explain **one** way person C could change their lifestyle to reach a healthy weight.

(2)

(Total for Question 4 = 11 marks)



6 In humans, gas exchange occurs in the alveoli of the lungs.

Figure 9 shows the structure of an alveolus and its blood supply.

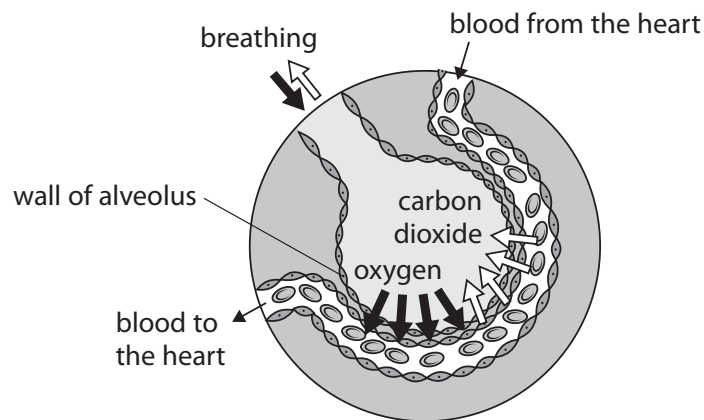


Figure 9

(a) Which process moves carbon dioxide from the blood into the alveolus?

(1)

- ☐ A diffusion
- ☐ B osmosis
- ☐ C active transport
- ☐ D transpiration

(b) State **one** adaptation of an alveolus that increases the rate of gas exchange.

(1)

.....

.....

(c) Describe how blood is moved from the heart to the lungs.

(2)

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.....

.....

.....

(d) Figure 10 shows the heart rate of a person before, during and after exercise.

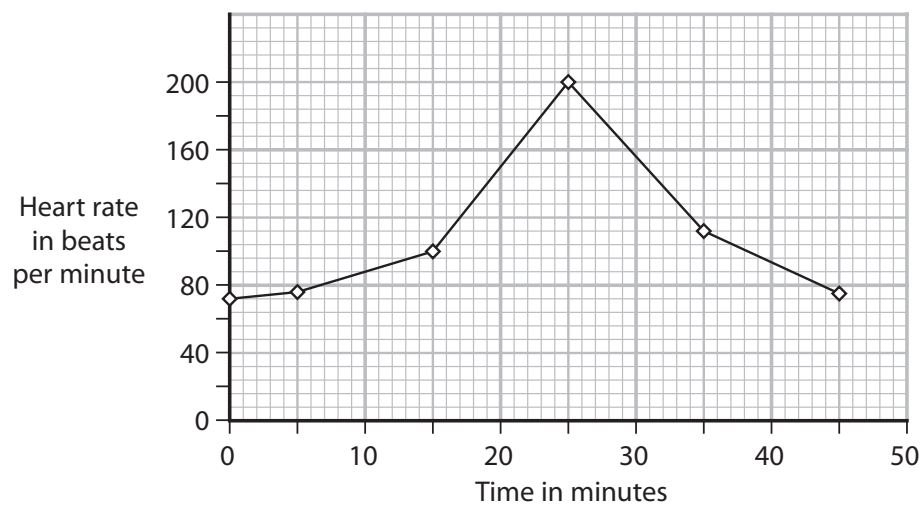


Figure 10

(i) Describe the trend shown in Figure 10.

Use data from Figure 10 to support your answer.

(2)

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.....

.....

.....

.....

(ii) Explain the trend shown in Figure 10 from 5 minutes to 25 minutes.

(2)

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.....

- (iii) The stroke volume is the volume of blood pumped during one beat of the heart.

At 25 minutes the stroke volume was 0.13 dm^3 .

Calculate the cardiac output of the heart of this person at 25 minutes.

Use the equation

$$\text{cardiac output} = \text{stroke volume} \times \text{heart rate}$$

(3)

..... dm^3 per minute

(Total for Question 6 = 11 marks)



8 (a) The heart pumps blood.

Explain why the wall of the left ventricle of the heart is thicker than the wall of the right ventricle of the heart.

(2)

(b) A centrifuge can be used to separate the different parts of human blood.

Figure 12 shows blood separated into different parts.

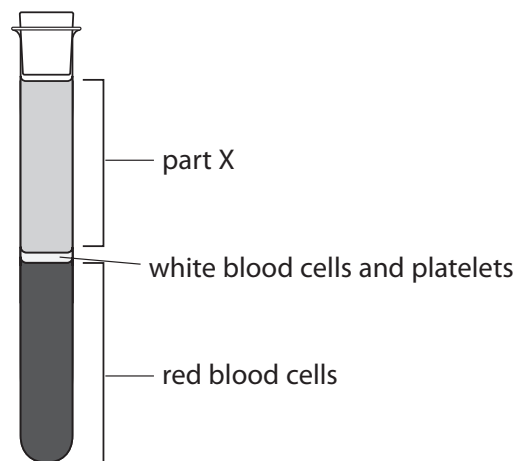


Figure 12

(i) Name part X.

(1)

(ii) Which substance, needed for cellular respiration, is carried by red blood cells?

(1)

- ☐ A carbon dioxide
- ☐ B urea
- ☐ C amino acids
- ☐ D oxygen

(iii) Name **two** types of white blood cell.

(2)

1

2

(c) (i) When a person donates blood, 470 cm^3 of blood is removed from their body.

Red blood cells make up 44% by volume of the blood.

Calculate the volume of red blood cells in 470 cm^3 of donated blood.

Give your answer to the nearest whole number.

(3)

..... cm^3

(ii) Before donating blood, a person has a small blood sample taken to check that the blood is healthy.

State **two** precautions a doctor should take when collecting this sample.

(2)

1

.....

2

.....

(Total for Question 8 = 11 marks)

6 Figure 12 shows the structure of the human heart and the direction of blood flow.

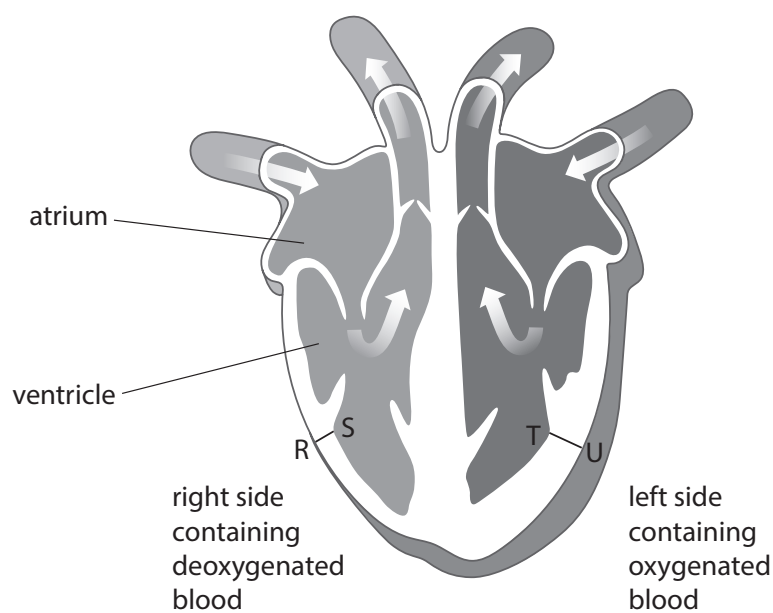


Figure 12

(a) (i) Measure the thickness of the left ventricle wall between points T and U.

(1)

T-U = ... mm

(ii) Describe how deoxygenated blood leaves the right side of the heart and becomes oxygenated.

(2)

.....

.....

.....

.....

(iii) Which blood vessel returns deoxygenated blood to the right side of the heart?

(1)

- ☐ A aorta
- ☐ B pulmonary artery
- ☐ C pulmonary vein
- ☐ D vena cava

(b) Figure 12 shows the valves that stop blood from flowing in the wrong direction.

State the number of valves in the right side of the human heart shown in Figure 12.

(1)

(c) The heart is part of the circulatory system.

Describe what happens to the blood when the left ventricle contracts.

(3)

(d) Figure 13 shows information about three types of blood vessel.

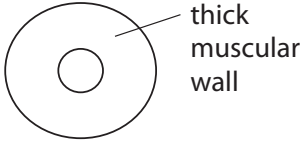
blood vessel	A	B	C
type of blood vessel	artery	capillary	?
cross-section of blood vessel	 thick muscular wall		 thin muscular wall

Figure 13

(i) State the type of blood vessel shown as C in Figure 13. (1)

(ii) Describe how the structure of a capillary helps gas exchange in the lungs. (2)

(Total for Question 6 = 11 marks)

- 8 (a) Explain why a person's heart rate increases when they are running compared with when they are at rest.

(2)

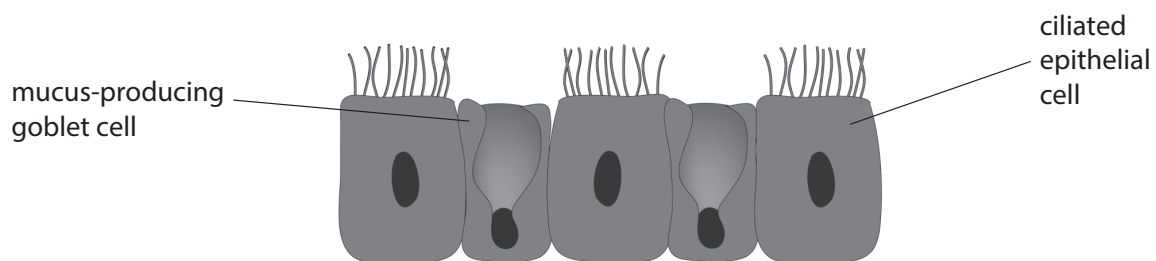
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- (b) Figure 16 shows a diagram of mucus-producing goblet cells and ciliated epithelial cells in the airways of the lungs.



(Source: © K.K.T Madhusanka/Shutterstock)

Figure 16

Describe how pathogens are removed from the airways by ciliated epithelial cells.

(2)

.....

.....

.....

.....

.....

(c) During a race, athletes respire aerobically and anaerobically.

Figure 17 shows an athlete after a race.



(Source: © voronaman/Shutterstock)

Figure 17

Explain how aerobic respiration provides energy for running.

(2)

.....

.....

.....

.....

.....

- (d) The rate of respiration of maggots was investigated using the equipment shown in Figure 18.

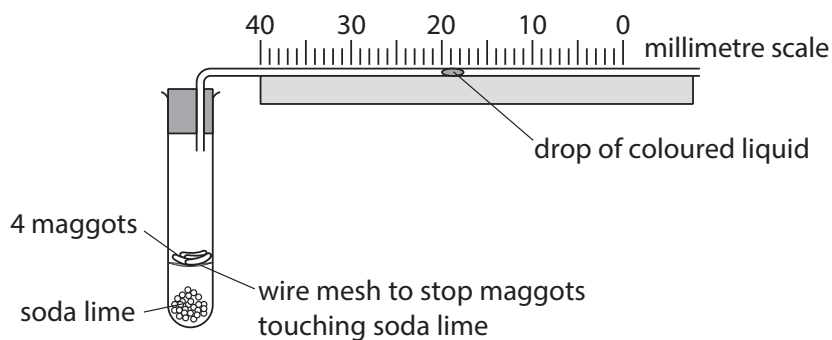


Figure 18

- (i) State the reason why the soda lime is placed in the test tube.

(1)

- (ii) The drop of liquid in Figure 18 is at 20 mm.

The drop of coloured liquid moved at a mean rate of 2 mm per minute.

Draw, on Figure 19, the new position of the bubble after the five minutes.

(1)

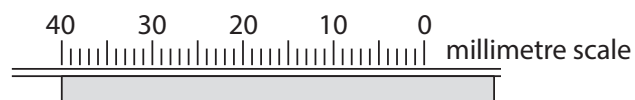


Figure 19

(iii) The investigation was repeated with two maggots.

Explain how the movement of the drop of coloured liquid would be affected if the investigation was repeated using fewer maggots.

(2)

(iv) State **one** way this investigation can be improved to obtain more reliable results.

(1)

(Total for Question 8 = 11 marks)



12-MARK QUESTIONS

1 question in this booklet



- 8 (a) Figure 19 shows a diagram of a red blood cell from a turtle and a diagram of a red blood cell from a human.

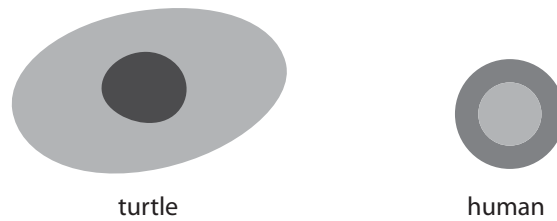


Figure 19

- (i) These cells are animal cells.

Animal cells do not have

- ☐ A cytoplasm
☐ B a cell membrane
☐ C a cell wall
☐ D mitochondria

(1)

- (ii) The actual length of the red blood cell from a turtle is $20.5\ \mu\text{m}$.

Calculate the length of the magnified image of the red blood cell of the turtle when magnified $400\times$.

(2)

..... μm

- (iii) The width of the human red blood cell, when magnified $400\times$, is $3.08\ \text{mm}$.

Calculate the actual width of the cell and show your answer in standard form.

(2)

..... mm



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(b) Red blood cells are carried in veins and arteries.

Figure 20 shows the equipment used to measure the elasticity of an artery.

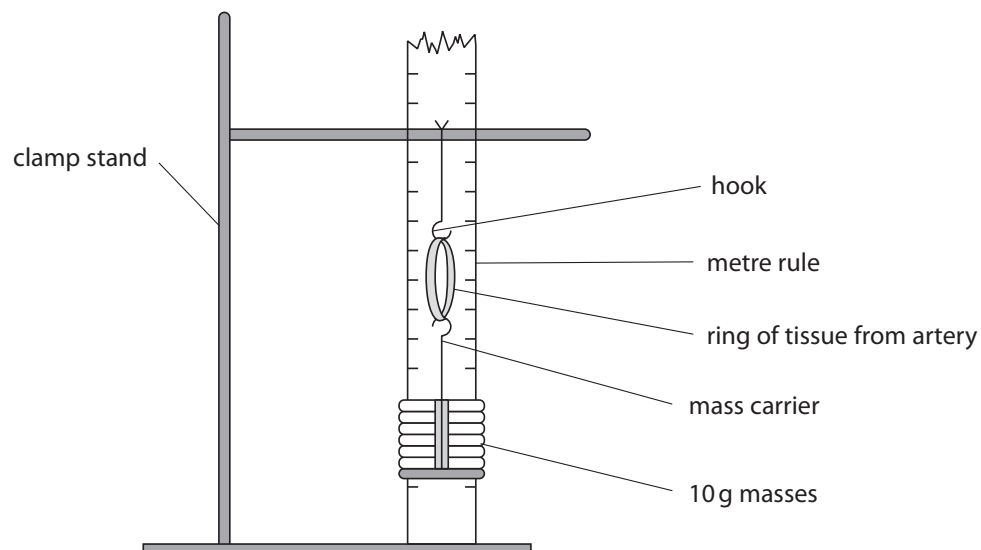


Figure 20

(i) Describe a method you could use to see how much the ring of tissue from an artery could stretch before it no longer returned to its original size.

(3)

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(ii) Give **one** safety precaution you need to take when handling animal tissue such as blood vessels.

(1)

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(c) Figure 21 shows the circulatory system of a frog.

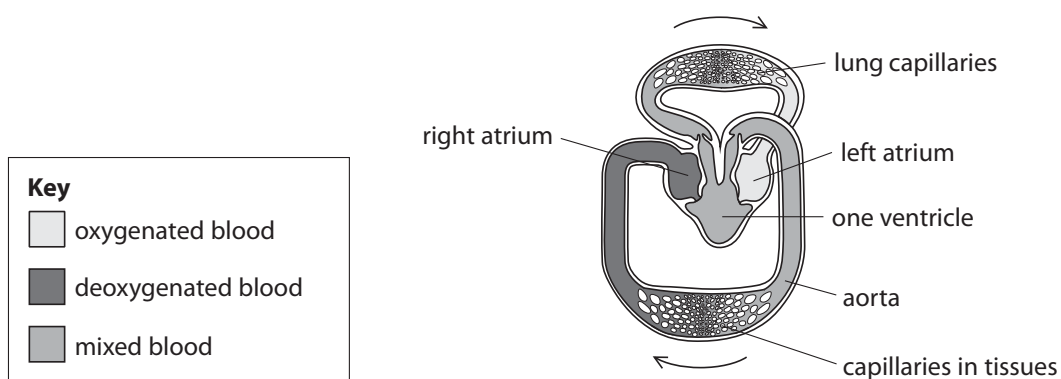


Figure 21

Explain why the circulatory system of a frog is less efficient at carrying oxygen to the tissues than the circulatory system of a human.

(3)

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(Total for Question 8 = 12 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

13-MARK QUESTIONS

2 questions in this booklet



- 9 (a) Figure 17 shows a cross-section of an artery and a vein.



(Source: © The University of Kansas Medical Center)

Figure 17

- (i) Explain **one** difference between the artery wall and the vein wall shown in Figure 17.

(2)

.....

.....

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.....

.....

- (ii) Name **one** structure that is found in veins but not found in arteries.

(1)

.....

(b) A human body has 5 dm^3 of blood.

At rest 20% of the blood travels to the muscles.

During exercise 60% of the blood travels to the muscles.

(i) Calculate the volume of blood travelling to the muscles during exercise.

(2)

..... dm^3

(ii) Explain **one** reason why there is an increase in blood flow to muscles during exercise.

(2)

.....

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.....

.....



*(c) Figure 18 shows the structure of the human heart.

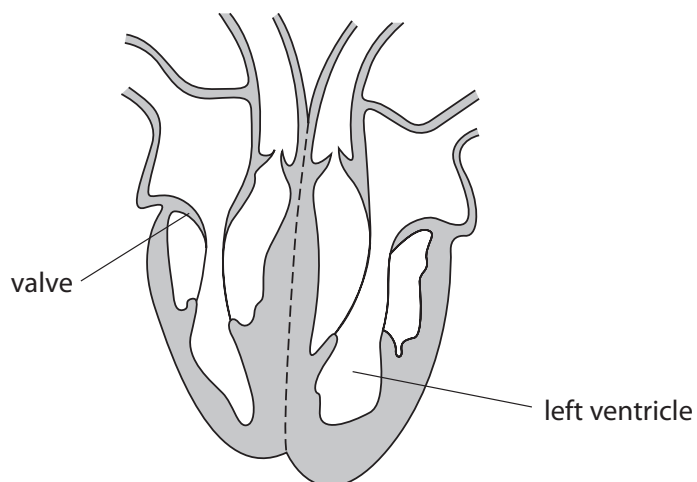


Figure 18

Explain how the structure of the heart is related to its function.

(6)

(Total for Question 9 = 13 marks)

9 Respiration occurs in cells.

(a) Why do cells respire?

(1)

- ☐ **A** to produce nitrogen
- ☐ **B** to release oxygen
- ☐ **C** to produce glucose
- ☐ **D** to release energy

(b) An athlete runs every day as part of their training.

(i) Explain why the breathing rate of the athlete increases when running.

(2)

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(ii) When the athlete is running, their muscle cells use both aerobic respiration and anaerobic respiration.

State **two** differences between aerobic respiration and anaerobic respiration.

(2)

1

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2

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(c) Bromothymol blue (BTB) solution is an indicator of pH.

Figure 16 shows the colour of BTB at different pH levels.

pH	4	5	6	7 (neutral)	8
colour	yellow	yellowy green	light green	green	blue

Figure 16

When air is passed through green BTB, for one minute, the solution stays green.

When a person breathes out through a straw into BTB for one minute the solution turns yellow.

(i) Explain why the air breathed out turns the BTB solution yellow.

(2)

*(ii) Devise a plan, using green BTB solution, to investigate the amount of carbon dioxide in the air athletes breathe out after they have been running at different speeds.

Include:

- how you would use green BTB solution.
- how you would control at least two variables.

(6)

(Total for Question 9 = 13 marks)



MARK SCHEMES

official Pearson Edexcel mark schemes



Question number	Answer	Mark
2(a)	smaller (1) diffusion (1) must be in correct order accept any reasonable spellings.	(2) AO 1 1 AO 2 1

Question number	Answer	Additional guidance	Mark
2(b)(i)	A description which includes two from: - as running speed increases, oxygen absorbed increases (1) - then levels off (1) - at 12 km per hour / 4.1 to 4.2 dm³ (of oxygen per minute) (1)	accept any value between 10 and 13 km per hour	(2) AO 3 1a AO 3 1b

Question number	Answer	Mark
2(b)(ii)	A increasing aerobic respiration 1. The only correct answer is A <i>B is not correct because increasing anaerobic respiration does use more oxygen</i> <i>C is not correct because decreasing aerobic respiration does use more oxygen</i> <i>D is not correct because decreasing anaerobic respiration does use more oxygen</i>	(1) AO 2 1

Question number	Answer	Mark
2(b)(iii)	An explanation including: - will respire anaerobically (more) (1) - because there is not enough oxygen (in the muscles) (1)	(2) AO 2 1

Total for Question 2 = 7 marks



Question number	Answer	Mark
1(a)	C iodine solution The only correct answer is C <i>A is not correct because amylase is not used to test for starch</i> <i>B is not correct because ethanol is not used to test for starch</i> <i>D is not correct because hydrochloric acid is not used to test for starch</i>	(1)

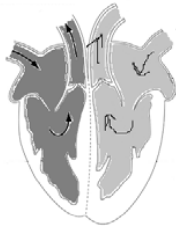
Question number	Answer	Additional guidance	Mark
1(b)(i)	Two from: • wear goggles (1) • wear gloves (Benedict's solution is an irritant to skin) (1) • use tongs to handle test tube (1)	accept other relevant safety precautions (1) ignore PPE without additional detail	(2)

Question number	Answer	Additional guidance	Mark
1(b)(ii)	heat up contents of the tube / allow a reaction to take place (between food sample and Benedict's solution)	accept speed up the reaction / safer than using a Bunsen burner	(1)

Question number	Answer	Additional guidance	Mark
1(c)(i)	One from: • mass of biscuit • volume of Benedict's solution • temperature of water (bath) • time left in water (bath)	accept weight of biscuit. ignore references to 'amount' ignore references to 'amount'	(1)

Question number	Answer	Additional guidance	Mark
1(c)(ii)	Two from: • all biscuits contain (reducing) sugar /glucose (1) • most in biscuit B (1) • least in biscuit A (1)	accept high in B accept low in A accept B is greater than C is greater than A for 2 marks	(2)

(Total for question 1 = 7 marks)

Question number	Answer	Additional guidance	Mark
1(a)(i)	All three arrows in correct direction (1) 	accept any number of arrows showing the correct route	(1)

Question number	Answer	Mark
1(a)(ii)	B valve T closes The only correct answer is B valve T closes A is incorrect because valve T does not open. C is incorrect because blood is not forced into the left atrium. D is incorrect because blood is not forced into the pulmonary vein.	(1)

Question number	Answer	Mark												
1(a)(iii)	<table><thead><tr><th>structure</th><th>function</th></tr></thead><tbody><tr><td></td><td>● carries deoxygenated blood</td></tr><tr><td>pulmonary vein</td><td>● forces blood towards body organs</td></tr><tr><td></td><td>● carries blood from the lungs to the heart</td></tr><tr><td>left ventricle</td><td>● takes blood to the right side of the heart</td></tr><tr><td></td><td>● forces blood towards the lungs</td></tr></tbody></table>	structure	function		● carries deoxygenated blood	pulmonary vein	● forces blood towards body organs		● carries blood from the lungs to the heart	left ventricle	● takes blood to the right side of the heart		● forces blood towards the lungs	(2)
structure	function													
	● carries deoxygenated blood													
pulmonary vein	● forces blood towards body organs													
	● carries blood from the lungs to the heart													
left ventricle	● takes blood to the right side of the heart													
	● forces blood towards the lungs													

Question number	Answer	Mark
1(b)(i)	An explanation linking the following: - the valve closes (1) (therefore) it prevents backflow (1)	(2)

Question number	Answer	Additional guidance	Mark
1(b)(ii)	To kill bacteria / pathogens / microorganisms /	accept to sterilise equipment ignore disinfect / clean equipment	(1)

Total for question 1 = 7 marks

Question Number	Answer	Mark
1(a) (i)	D nucleus The only correct answer is D <i>A is not correct because mitochondria do not control the white blood cell</i> <i>B is not correct because ribosomes do not control the white blood cell</i> <i>C is not correct because chromosomes are only part of organelle X</i>	(1) AO1.1a

Question Number	Answer	Additional guidance	Mark
1(a) (ii)	haemoglobin (1) liquid (1)	answers must be in correct order	(2) AO2.1

Question Number	Answer	Additional guidance	Mark
1(a) (iii)	A description including two from: • make antibodies • {surround / engulf / digest} {pathogens / bacteria / viruses} • remembers pathogens / bacteria / viruses (so can react quickly to secondary infection)	accept produce memory cells	(2) AO1.1

Question Number	Answer	Mark
1(b)	10 (µm)	(1) AO2.2

Question Number	Answer	Additional guidance	Mark
1(c)	An explanation including any two from: • greater resolution (1) • so greater magnification is possible (1) • so smaller structures can be seen / identified (1)	accept more detail of cell structures can be seen accept electrons (with a shorter wavelength) are used (instead of light) (1)	(2) AO1.1

(Total for question 1 = 8 marks)

Question Number	Answer	Mark
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Question Number	Answer	Mark
2(a)(i)	part of the blood plasma red blood cell function • produces oestrogen transports dissolved urea contains haemoglobin • produces antibodies • surrounds and digests foreign cells	(2) AO1 1

Question Number	Answer	Mark
2(a)(ii)	Any two from: • round (1) • disc shaped (1) • biconcave / dimple / indented on each side / large surface area (1) • smooth (1)	(2) AO2 1

Question Number	Answer	Mark
2(b)(i)	A ribosomes The only correct answer is A <i>B is not correct because vacuoles, although important in secreting the proteins do not produce them.</i> <i>C is not correct because lymphocytes do not contain chloroplasts</i> <i>D is not correct because lymphocytes do not have flagella</i>	(1) AO2 1

Question Number	Answer	Additional guidance	Mark
2(b)(ii)	10 x 400 (1) 4000 (μm)	award full marks for correct answer with no working	(2) AO2 2

Question Number	Answer	Mark
2(b)(iii)	C 1000 The only correct answer is C <i>A is not correct because there are 1000 μm in 1 mm</i> <i>B is not correct because there are 1000 μm in 1 mm</i> <i>D is not correct because there are 1000 μm in 1 mm</i>	(1) AO1 1

(Total for Question 2 = 8 marks)



Question number	Answer	Mark
2(a)(i)	food reject if more than one word is used from the box	(1)

Question number	Answer	Mark
2a(ii)	parasites reject if more than one word is used from the box	(1)

Question number	Answer	Mark
2(b)	C platelets The only correct answer is C platelets A is incorrect because red blood cells do not start the clotting process. B is incorrect because water does not start the clotting process. D is incorrect because white blood cells do not start the clotting process.	(1)

Question number	Answer	Additional guidance	Mark
2(c)(i)	mutualism / mutualist / mutualistic	accept mutual accept symbiotic / symbiosis / symbionts	(1)

Question number	Answer	Additional guidance	Mark
2(c)(ii)	- grass (in first box) (1) - zebra, tick, oxpecker (in correct order in boxes 2,3 and 4) (1)	Award one mark if grass, zebra, tick and oxpecker are in the correct order but written from right to left.	(2)

Question number	Answer	Additional guidance	Mark
2(d)(i)	A description including: - there are more oxpeckers on the (white) rhinos (than hippos) (1) - manipulated data (1)	Manipulated data could include: $7 - 2 =$ difference of 5 $7 \div 2 = 3.5$ times more oxpeckers (2 marks)	(2)

Question number	Answer	Additional guidance	Mark
2(d)(ii)	There are more ticks / food (on the giraffes than the zebras)	accept other reasons such as (giraffes are) larger / thinner skinned / more tolerant of oxpeckers	(1)

Total for question 2 = 9 marks

Question number	Answer	Mark
3(a)(i)	aorta	(1)

Question number	Answer	Mark
3(a)(ii)	The only correct answer is A thick high B is incorrect because blood pressure is not low C is incorrect because width of wall is not thin D is incorrect because width of wall is not thin and blood pressure is not low	(1)

Question number	Answer	Additional guidance	Mark
3(b)	readings from graph 17 and 1 (1) evaluation (17 - 1 =) 16 (kPa)	award full marks for correct answer no working award 1 mark for (14 - 1) = 13	(2)

Question number	Answer	Mark
3(c)(i)	valve(s)	(1)

Question number	Answer	Mark
3(c)(ii)	to prevent backflow (of blood) / to keep blood flowing {towards the heart / in one direction} (1)	(1)

Question number	Answer	Mark
3(d)	A description including three from: - the muscular walls / muscles (1) - of the right ventricle / right hand side of the heart (1) - contract (1) - putting pressure on the blood / {pumping / pushing} blood (out of the heart) (1) - into the pulmonary artery (to the lungs) (1)	(3)

Total marks for question 3 = 9 marks

Question number	Answer	Mark
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5(a)(i)	stops heat loss / evaporation of water	ignore stops unwanted substances getting in	(1) A02 2
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Question number	Answer	Additional guidance	Mark
5(a)(ii)	A description including: use the thermometer (1) measure initial temperature and final temperature (1) subtract initial temperature from final temperature (1)	 accept measure / take the temperature before and after accept an equation	(2) A03 3a

Question number	Answer	Additional guidance	Mark
5(b)(i)	50 x 4.2 x 30 (1) 6300 (J)	award full marks for correct answer with no working	(2) A02 1

Question number	Answer	Additional guidance	Mark
5(b)(ii)	Any two from: • use the same {mass / volume} of water (1) • use the same mass of food (1) • distance of the burning food from the calorimeter (1) • use the same starting temperature of water (1) • ensure the food is burnt completely (1)	accept repeat with each food (1)	(2) AO3 3b

Question number	Answer	Additional guidance	Mark
5(c)	An explanation including:	ignore values taken from the table unless comparative ignore stated	(2) AO3 2ab

	• apple has {less / lowerer} energy / avocado has {more / higherer} energy (1) • (because) apple contains less fat / avocado contains more fat (1)	differences	
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Total marks for question 5 = 9 marks

Question Number	Answer	Additional guidance	Mark
6a(i)	D 10 4 The only correct answer is D <i>A is not correct because for oxygen to diffuse into the Amoeba the concentration must be lower than in the water.</i> <i>B is not correct because for oxygen to diffuse into the Amoeba the concentration must be lower than in the water.</i> <i>C is not correct because for oxygen to diffuse into the Amoeba the concentration must be lower than in the water.</i>		(1) AO2.1

Question Number	Answer	Additional guidance	Mark
6(aii)	carbon dioxide + water	accept CO ₂ for carbon dioxide H ₂ O for water	(1) AO1.1

Question Number	Answer	Mark
6(b)(i)	A increases increases The only correct answer is A <i>B is not correct because a decrease in blood glucose concentration would decrease the rate of respiration</i> <i>C is not correct because a decrease in heart rate would decrease the rate of respiration</i> <i>D is not correct because a decrease in heart rate and blood glucose concentration would decrease the rate of respiration</i>	(1) AO1.1

Question Number	Answer	Additional guidance	Mark
6(b)(ii)	Evaluation $(24.7 \times 2.7) = 66.69$ (1) rounded to one decimal place: 66.7	award 1 mark for correctly rounding an incorrectly calculated answer award full marks for correct answer with no working shown.	(2) AO1.1

Question Number	Answer	Mark
6(b)(iii)	An investigation including four from:	(4) AO1.2

Question Number	Answer	Additional guidance	Mark
6(c)	lactic acid	accept lactate	(1) AO1.1

(Total for question 6 = 10 marks)

Question Number	Answer	Mark
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Question Number	Answer	Additional guidance	Mark
4(a)(i)	water (1) lid (1)	answers must be in the correct order	(2) AO2 2

Question Number	Answer	Additional guidance	Mark
4(a)(ii)	interpretation (85 – 21) = 64 (1) calculation (25 x 4.2 x 64) 6720 (J)	full marks for correct answer without any working award one mark for an answer correctly calculated from an incorrect temperature change	(2) AO2 1

Question Number	Answer	Additional guidance	Mark
4(a)(iii)	An explanation including two from: - the {temperature change / rise in temperature} was smaller (1) - this type of cheese contained less {energy / fat} / the piece of cheese had a smaller mass / a smaller mass of the cheese burned / the cheese was held further away from the container (1) - therefore less energy was transferred to the water (1)	accept other valid variables	(2) AO3 2a 2b

Question Number	Answer	Additional guidance	Mark
4(b)(i)	substitution $64.8 \div 1.8 \times 1.8$ (1) OR $64.8 \div 3.24$ (1) 20	full marks for correct answer without any working	(2) AO2 1

Question Number	Answer	Mark
4(b)(ii)	B healthy weight The only correct answer is B <i>A is not correct because person B is not underweight</i> <i>C is not correct because person B is not overweight</i> <i>D is not correct because person B is not obese</i>	(1) AO2 1

Question Number	Answer	Additional guidance	Mark
4(b)(iii)	An explanation including: - do more exercise /named exercise (1) - so more energy is used up (1) OR - reduce fat / carbohydrate intake (1) - so energy intake is reduced (1)	accept eat less	(2) AO2 1

(Total for question 4 = 11 marks)

Question Number	Answer	Mark
6(a)	A diffusion The only correct answer is A B is incorrect because osmosis only relates to water molecules C is incorrect because the movement of carbon dioxide from the blood into the alveolus does not involve using ATP D is incorrect because transpiration is the evaporation of water from leaf cells.	(1)

Question Number	Answer	Additional guidance	Mark
6(b)	Any one from - walls that are {thin / flattened / one cell thick} (1) - a large surface area (1) - a good blood supply / many capillaries (1)	reject cell walls ignore references to high / low concentrations of oxygen / carbon dioxide	(1)

Question Number	Answer	Additional guidance	Mark
6(c)	A description including two from: - heart muscle contracts / heart pumps blood (1) (putting blood) under pressure (1) - through the pulmonary artery (1)	accept right ventricle for heart muscle accept through an artery reject aorta	(2)

Question Number	Answer	Mark
6(d) (i)	A description including: - the heart rate increases then decreases (1) - credit any correct reference to data e.g. it goes up {to 200 bpm / until 25 minutes} (1)	(2)



Question Number	Answer	Additional guidance	Mark
6(d) (ii)	An explanation including two from: - the person is exercising / using their muscles more (1) - so need more oxygen / glucose (1) - for more respiration (1)	accept remove more carbon dioxide more only has to be written once for more oxygen / more glucose / more respiration	(2)

Question Number	Answer	Additional guidance	Mark
6(d) (iii)	200 (reading from graph) (1) 0.13×200 (1) 26 (dm³ per minute)	accept correct answer on answer line for 3 marks	(3)

Total for question 6 = 11 marks

Question Number	Answer	Additional guidance	Mark
8(a)	An explanation linking: • (the left ventricle) is more muscular / provides more pressure (1) • because the (left ventricle) pumps blood {around more of the body / through more organs / through more blood vessels} (1)	ignore to withstand higher pressure accept pushes blood for pumps blood accept the blood is pumped further/around the body (other than the lungs)	(2)

Question Number	Answer	Mark
8(b)(i)	plasma (accept phonetic spellings)	(1)

Question Number	Answer	Mark
8(b)(ii)	The only correct answer is D oxygen A is incorrect because carbon dioxide is not needed for respiration B is incorrect because urea is not carried by red blood cells or needed for respiration C is not correct because amino acids are not needed for respiration	(1)

Question Number	Answer	Additional guidance	Mark
8(b)(iii)	- phagocytes (1) - lymphocytes /B cells / memory cells (1)	answers can be in either order accept T cells accept other correctly named white blood cells (1)	(2)

Question Number	Answer	Additional guidance	Mark
8(c)(ii)	Any two from: • wear gloves / wash hands (1) • sterilise skin (of donor) (1) • sterilise needle/use sterile needle (1) • cover the wound after taking blood (1)	accept wear mask accept use hand gel accept doctor covers any open wounds/cuts accept clean the skin accept sterilise equipment	(2)

Total for question 8 = 11 marks



Question number	Answer	Additional guidance	Mark
6(a)(i)	measurements: (T-U =) 5 mm (1)	allow a thickness from 4 to 6mm	(1)

Question number	Answer	Additional guidance	Mark
6(a)(ii)	A description including two from: • (right) ventricle / heart contracts (1) • (blood leaves through the) pulmonary artery (1) • to the lungs (1) • absorbs oxygen (by diffusion) (1)	accept pushes / pumps for contracts	(2)

Question number	Answer	Mark
6(a)(iii)	The only correct answer is D vena cava A is incorrect because the aorta does not carry deoxygenated blood B is incorrect because pulmonary artery carries blood away from the heart C is incorrect because the pulmonary vein does not carry deoxygenated blood	(1)

Question number	Answer	Additional guidance	Mark
6(b)	two / 2		(1)

Question number	Answer	Additional guidance	Mark
6(c)	A description including three from: • blood is put under pressure (1) • (blood flows) through the valve (1) • into the aorta (1) • to the body (1)	accept blood is pumped / pushed	(3)

Question number	Answer	Mark
6(d)(i)	vein	(1)

Question number	Answer	Additional guidance	Mark
6(d)(ii)	A description including 2 from: • large surface area (to volume ratio) (1) • (very) thin wall (1) • has {gaps / holes} in (wall) / it is permeable (1) • (the structure) increases the rate of diffusion / causes faster diffusion / shorter diffusion pathway (1)	accept (wall) is one cell thick accept it is leaky accept shorter diffusion distance	(2)

Total for Question 6 = 11 marks



Question number	Answer	Additional guidance	Mark
8(a)	An explanation linking two from: • blood pumped faster (around the body) (1) • because more {oxygen / glucose} is needed (by the muscles) (1) • because more {respiration / energy is needed} (when running) (1)	accept remove more carbon dioxide more only has to be written once for more oxygen / more glucose / more respiration	(2)

Question number	Answer	Additional guidance	Mark
8(b)	A description including: • (pathogens) get stuck in mucus (1) • cilia {move / waft} the {pathogens / mucus} (1) • to the throat / up the {trachea / bronchiole} / to be swallowed (1)	accept micro-organisms for pathogens accept hairs for cilia	(2)

Question number	Answer	Additional guidance	Mark
8(c)	An explanation linking two from: - glucose and oxygen (1) (to form) carbon dioxide and water (1) - in an exothermic reaction (1) - which takes place in the mitochondria (1)	accept $C_6H_{12}O_6 + O_2$ accept $CO_2 + H_2O$ accept correct equation for aerobic respiration for 2 marks	(2)

Question number	Answer	Additional guidance	Mark
8(d) (i)	to absorb the carbon dioxide	accept CO_2	(1)

Question number	Answer	Additional guidance	Mark
8(d) (ii)			(1)

Question number	Answer	Additional guidance	Mark
8(d)(iii)	An explanation linking two from: • (the drop) would move more slowly / shorter distance (1) • as less oxygen would be used • so less respiration would occur (1)	accept less carbon dioxide {produced / absorbed}	(2)

Question number	Answer	Mark
8(d)(iv)	repeat the investigation / calculate a mean	(1)

Total for Question 8 = 11 marks



Question number	Answer	Mark
8(a)(i)	C a cell wall 1. The only correct answer is C <i>A is not correct because both plant and animal cells have cytoplasm</i> <i>B is not correct because both plant and animal cells have a cell membrane</i> <i>D is not correct because both plant and animal cells have mitochondria</i>	(1) AO 1 1

Question number	Answer	Additional guidance	Mark
8(a)(ii)	substitution 20.5 x 400 (1) evaluation 8 200 μm	award full marks for correct answer with no working	(2) AO 1 2

Question number	Answer	Additional guidance	Mark
8(a)(iii)	substitution (3.08 $\div$ 400) = 0.0077 (1) evaluation 7.7 x 10⁻³	award full marks for correct answer with no working accept 0.008 accept 8 x 10⁻³	(2) AO 2 2

Question number	Answer	Additional guidance	Mark
8(b)(i)	An answer that combines three of the following points to provide a method: • measure the length of the tissue (1) • add masses / mass (1) • remove the mass and measure length of the tissue (1) • repeat until the tissue no longer returns to its original length (1)	accept remove the mass and see if the tissue returns to its original size	(3) AO 3 3a

Question number	Answer	Additional guidance	Mark
8(b)(ii)	Any one from: • wash hands (1) • wear gloves (1) • sterilise the apparatus after use / disinfect working area (1)	ignore standard lab rules accept cover open wounds	(1) AO 2 2

Question number	Answer	Additional guidance	Mark
8(c)	An explanation including any three from: • (frogs) have one ventricle / three chambers (1) • (whereas) humans have two ventricles/ four chambers (1) • no wall / septum separating ventricles (1) • oxygenated and deoxygenated blood mix (in the ventricle / heart) (1)	accept some blood going to the lungs is already oxygenated (1)	(3) AO 2 1

Total for Question 8 = 12 marks

Question Number	Answer	Additional guidance	Mark
9(a)(i)	An explanation linking: - artery has a {thicker /more muscular} wall (1) - because of the (blood) pressure (higher in artery than in vein) (1)	accept prevent the artery bursting / maintain blood pressure	(2) AO2 1

Question Number	Answer		Mark
9(a)(ii)	valve/valves		(1) AO1 1

Question Number	Answer	Additional guidance	Mark
9(b)(i)	$5 \times 60 = 300$ (1) or $60 \div 100 = 0.6$ (1) $(300 \div 100) = 3 \text{ (dm}^3\text{)}$	award full marks for correct answer with no working accept other correct methods of calculation which is a percentage calculation	(2) AO2 1



Question Number	Answer	Mark
9(b)(ii)	An explanation linking: • because (during exercise muscles) require more {oxygen / glucose} (1) • for respiration / to release energy (1) OR • to remove more carbon dioxide / to remove lactic acid (1) • as this is a product of respiration (1)	(2) AO2 1



Question Number	Indicative content	Mark
9(c)*	Functions linked to structures - walls contract / the heart pumps blood - atria push blood down into the ventricles - ventricles pumps blood out of heart - left ventricle / side pumps {blood to the body / oxygenated blood} - right ventricle/ side pumps {blood to the lungs / deoxygenated blood} - left ventricle wall thicker (than right ventricle wall) / produces more pressure to pump blood - right ventricle is thinner / produces less pressure to pump blood - valves prevent backflow /named valves prevent backflow between specific parts of the heart - the muscles can contract faster / harder so that blood is pushed around the body faster - the septum stops (oxygenated blood mixing with deoxygenated blood) - named arteries / veins related to where blood is going to / coming from	(6) AO1 1



Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1-2	- Demonstrates elements of biological understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. - Presents an explanation with some structure and coherence.
Level 2	3-4	- Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and /or developed. - Presents an explanation that has a structure which is mostly clear, coherent and logical.
Level 3	5-6	- Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas is detailed and fully developed. - Presents an explanation that has a well-developed structure which is clear, coherent and logical.



Additional Guidance

Level	Mark	Additional Guidance	General additional guidance The level is determined by the functions covered in the response The mark within the level is determined by linking the functions to their related structures
	0	No rewardable material	<u>Possible candidate responses</u>
Level 1	1–2	- An isolated function is identified - the function is linked to a relevant structure	- the heart pumps blood around the body - the heart pumps blood around the body when the muscles contract.
Level 2	3–4	- more than one function is identified - the functions are linked to their relevant structures	- when the heart contracts, blood is forced into the arteries. The blood on the left side does not mix with the blood on the right side. - the left ventricle has thicker walls that push blood out through the aorta to the body under high pressure.
Level 3	5–6	- at least three functions are identified - the functions are linked to their relevant structures	- the atria push the blood into the ventricles. This can only go this way blood can't go back up into the atria. When the ventricles contract the left walls are thicker than the right so put the blood under more pressure. - The two sides are separated by a wall of muscle which stops the oxygenated and the deoxygenated blood mixing. Blood flows back to the heart in veins. This flows into the atria which contract pushing blood into the ventricles.

(Total for question 9 = 13 marks)



Question number	Answer	Additional guidance	Mark
9(a)	The only correct answer is D to release energy A is incorrect because nitrogen is not involved in respiration. B is incorrect because oxygen is used during respiration, not released C is incorrect because glucose is used during respiration, not produced		(1)



Question number	Answer	Additional guidance	Mark
9(b)(i)	An explanation linking two from: - to absorb more oxygen (into the blood / body) (1) - so that more respiration can occur / more energy is released (1) OR - to remove more carbon dioxide (from the blood / body) (1) - from more respiration / because carbon dioxide makes the blood more acidic (1)	accept to absorb oxygen (into the blood) more quickly accept so that respiration can occur more quickly / energy is released more quickly	(2)



Question number	Answer	Additional guidance	Mark
9(b)(ii)	An answer including two from: - aerobic respiration uses oxygen / anaerobic does not use oxygen (1) - aerobic respiration releases more energy / anaerobic releases less energy (1) - aerobic produces {carbon dioxide / water} / anaerobic respiration produces lactic acid (1)	accept ATP for energy accept lactate for lactic acid accept aerobic respiration takes place in the mitochondria / anaerobic respiration takes place in the cytoplasm (1) ignore references to types of exercise / when the types of respiration occur	(2)

Question number	Answer	Additional guidance	Mark
9(c)(i)	An explanation linking: - you breathe out (air with a high concentration of) carbon dioxide (1) - which forms a (weak) acid (when it dissolves) (1)	accept it contains carbon dioxide accept lowers the pH	(2)



Question number	Indicative content	Mark
9(c)(ii)*	Plan: Running • athletes run at different speeds • method to vary speed, e.g. distance covered in a fixed time / use of treadmill BTB • breathe (out) through green BTB (at the end of each run and note the colour / time how long BTB takes to get to a set colour) • relate the results (colour of BTB / time it takes to get to a set colour) to the pH or to how much carbon dioxide is being breathed out Controlled variables include • same age range, same sex balance, same lifestyle (of different athletes) • length of time / distance run for each 'running speed' • use of a treadmill to standardise speed • volume / concentration of green BTB • ensure colour of green BTB is the same at the start • standardised recovery times between running speeds (if the same athletes are running at each different speed) Control: • include the colour change of green BTB at rest	(6)



Level	Mark	Descriptor
	0	No awardable content
Level 1	1–2	- The plan attempts to link and apply knowledge and understanding of scientific enquiry, techniques and procedures, flawed or simplistic connections made between elements in the context of the question. (AO2) - Analyses the scientific information but understanding and connections are flawed. An incomplete plan that provides limited synthesis of understanding. (AO3)
Level 2	3–4	- The plan is mostly supported through linkage and application of knowledge and understanding of scientific enquiry, techniques and procedures, some logical connections made between elements in the context of the question. (AO2) - Analyses the scientific information and provides some logical connections between scientific enquiry, techniques and procedures. A partially completed plan that synthesises mostly relevant understanding, but not entirely coherently. (AO3)
Level 3	5–6	- The plan is supported throughout by linkage and application of knowledge and understanding of scientific enquiry, techniques and procedures, logical connections made between elements in the context of the question. (AO2) - Analyses the scientific information and provide logical connections between scientific concepts throughout. A well-developed plan that synthesises relevant understanding coherently. (AO3)



Level	Mark	Additional guidance	General additional guidance The level is driven by the workability of the plan. The mark within the level is determined by the control of variables.
	0	No rewardable material.	
Level 1	1–2	States a relevant part of a plan or states a variable to control	<u>Possible candidate responses</u> - Get athletes to run at different speeds - Get athletes to run the same distance at different speeds
Level 2	3–4	States parts of a plan including a reference to BTB Controls one variable or includes a control	<u>Possible candidate responses</u> - Get athletes to run at different speeds then breathe out through BTB - As above + use the same volume of BTB each time
Level 3	5–6	Produces a workable plan including the use of BTB to measure the pH or carbon dioxide concentration Controls variables or controls one variable and includes a control	<u>Possible candidate responses</u> - Get athletes to run at different speeds. The athletes then breathe into BTB and relate the colour change to pH / CO₂ concentration. - As above + the athletes need to be the same age and run the same distance

Total for question 9 = 13 marks

