Questions

Q1.

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

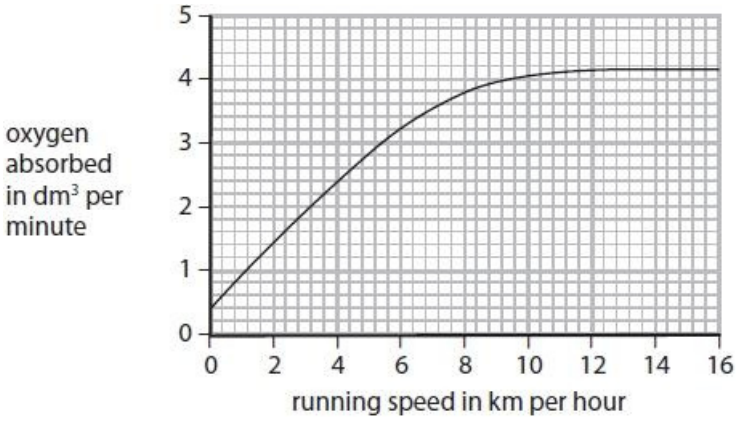

Figure 4

(i) Describe the trend shown in Figure 4.

(2)

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(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)

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(Total for question = 5 marks)

Q2.

Figure 5 shows equipment used to investigate the rate of respiration in maggots.

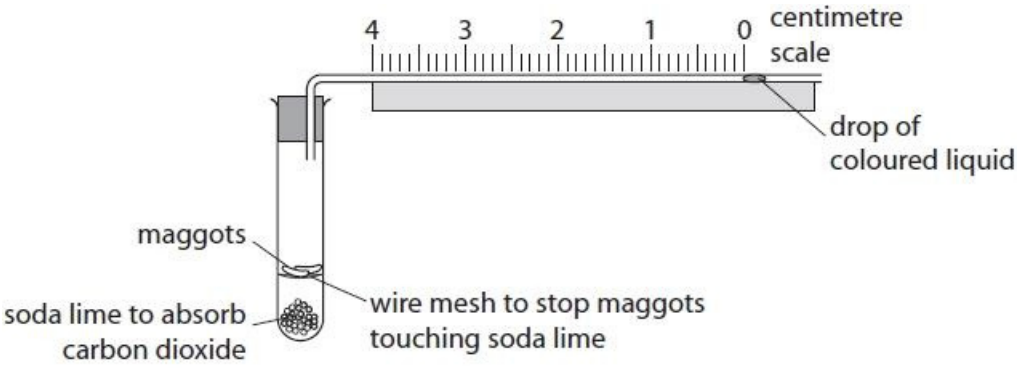

Figure 5

As the maggots respire, the drop of coloured liquid moves towards the test tube.

Figure 6 shows the position of the drop of coloured liquid after ten minutes.

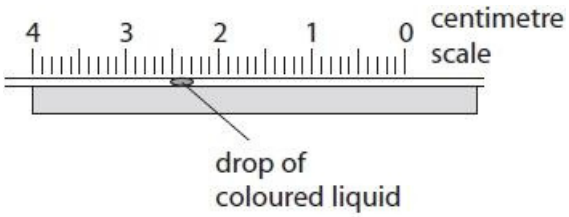

Figure 6

(i) Use information from Figures 5 and 6 to calculate the mean rate of respiration of the maggots in mm per minute.

(2)

..... mm per minute

(ii) Describe a control for this investigation.

(2)

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(Total for question = 4 marks)

Q3.

A human body has 5 dm3 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)

..... dm3

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

(2)

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(Total for question = 4 marks)

Q4.

Exercise causes changes in the circulation of the blood.

In an investigation, the change in blood flow to different parts of the body during exercise was measured.
All the volunteers used in the study were healthy females of the same age.

Figure 13 shows the results of this investigation.

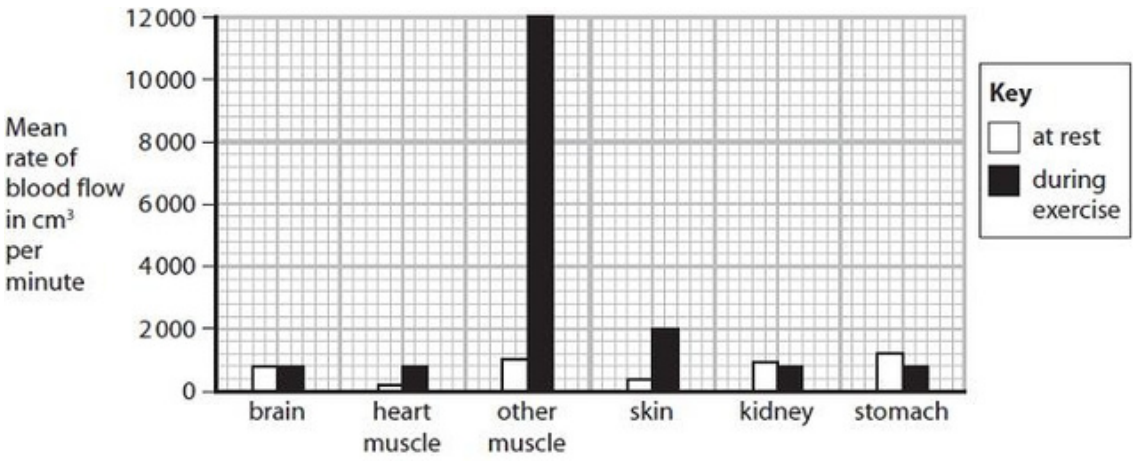

Figure 13

(i) During exercise, the blood flow to the stomach changes.

Calculate the percentage change in blood flow to the stomach in response to exercise.
Give your answer to the nearest whole number

(3)

..... %

(ii) Suggest two other variables that should be controlled in this investigation.

(2)

1 .....

2 .....

*(iii) Explain the changes in blood flow, shown in Figure 13, that are caused by exercise.

(6)

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(Total for question = 11 marks)

Q5.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

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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(Total for question = 7 marks)

Q6.

Figure 10 shows the estimated blood flow through some parts of the body when a person is at rest and during exercise.

part of the body	estimated rate of blood flow in cm^3 per minute	
	at rest	during exercise
brain	750	748
heart muscle	350	1 150
digestive system	2 500	1 200
other muscles	1 200	14 500
all other organs (except lungs)	1 423	1 420

Figure 10

Compare the rate of blood flow through the body when this person is at rest and during exercise.

(3)

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(Total for question = 3 marks)

Q7.

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 .....

(Total for question = 2 marks)

Q8.

Figure 11 shows the movement of molecules across a membrane.

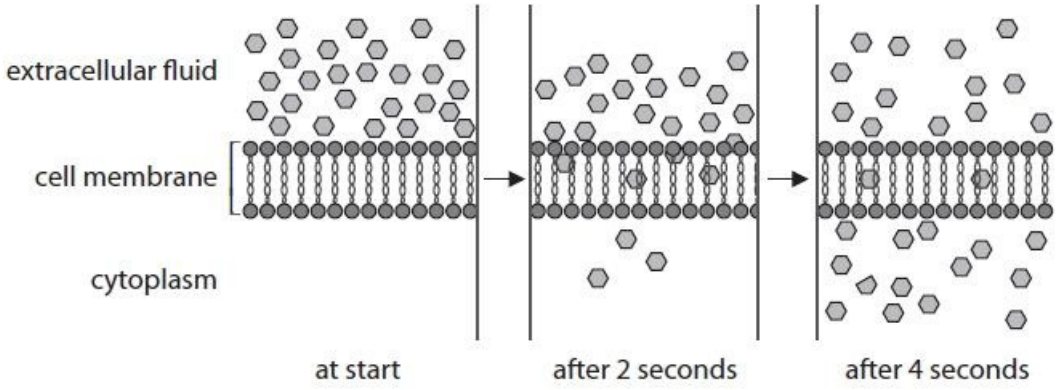

Figure 11

Describe how Figure 11 illustrates movement of molecules across a membrane.

(2)

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(Total for question = 2 marks)

Q9.

A scientist investigated the relationship between exercise and the ability to run at 3 metres per second for 20 minutes.

The scientist collected data from six groups of people.

Each group exercised for a different number of hours per week for six months.

There were 100 people in each group.

Figure 7 shows their results.

group	number of hours of exercise per week	number of people who could run at 3 metres per second for 20 minutes
A	0	9
B	2	20
C	4	33
D	6	52
E	8	61
F	10	62

Figure 7

(i) Describe the relationship shown by this data.

(2)

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(ii) Explain why some people's leg muscles tired quickly and developed cramp when they were running.

(3)

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(Total for question = 5 marks)

Q10.

Figure 10 shows alveoli from a lung.

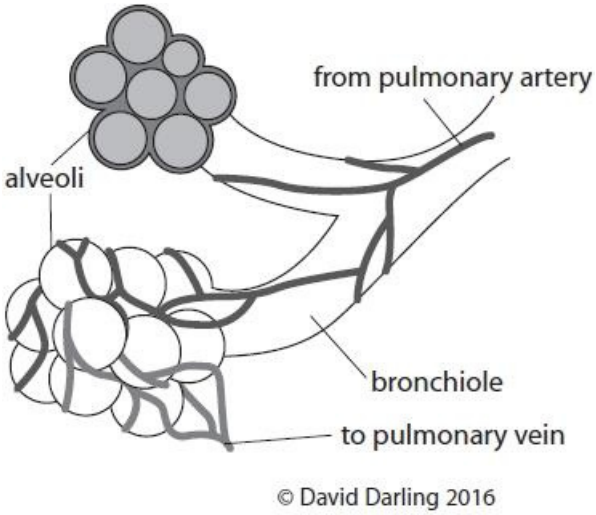

Figure 10

(i) Explain why these alveoli have the internal structure shown in Figure 10.

(3)

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(ii) How does oxygen move across the alveolar membrane into the capillary?

(1)

☒ A by osmosis

☒ B by active transport

☒ C by diffusion

☒ D by respiration

(Total for question = 4 marks)

Q11.

* Explain how alveoli in human lungs are adapted for gas exchange.

Include the names of the gases that are being exchanged.

(6)

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(Total for question = 6 marks)

Q12.

Explain, using Fick's law, the factors that affect the diffusion rate of molecules into and out of cells.

(6)

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(Total for question = 6 marks)

Q13.

Figure 10 shows the estimated blood flow through some parts of the body when a person is at rest and during exercise.

part of the body	estimated rate of blood flow in cm^3 per minute	
	at rest	during exercise
brain	750	748
heart muscle	350	1 150
digestive system	2 500	1 200
other muscles	1 200	14 500
all other organs (except lungs)	1 423	1 420

Figure 10

Explain why there is a change in the rate of blood flow through the digestive system during exercise.

(2)

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(Total for question = 2 marks)

Q14.

Explain why cellular respiration is essential for living organisms.

(2)

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(Total for question = 2 marks)

Q15.

A student investigated respiration in three different organisms.

Red hydrogencarbonate indicator was placed in each of three test tubes.

Gauze was placed in each test tube to hold the organisms.

In test tube 1 the student placed four germinating peas.

In test tube 2 the student placed four dried peas.

In test tube 3 the student placed four mealworms.

Bungs were added to each of the test tubes.

The three test tubes were left for one hour.

The equipment used is shown in Figure 16.

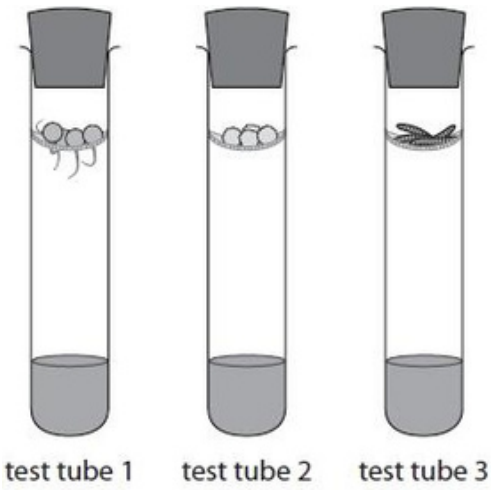

Figure 16

Hydrogencarbonate indicator changes from red to yellow when more carbon dioxide is present.

The results for this investigation are shown in Figure 17.

organisms	colour of hydrogencarbonate indicator
germinating peas	yellow
dried peas	red
mealworms	yellow

Figure 17

(i) Explain why the result for the germinating peas is different from the result for the dried peas.

(2)

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(ii) How was the carbon dioxide produced in this investigation?

(1)

- ☒ A by photosynthesis
- ☒ B when glucose is broken down in the presence of oxygen
- ☒ C when glucose is broken down in the absence of oxygen
- ☒ D by the reaction between oxygen and water

(Total for question = 3 marks)

Q16.

After high intensity exercise, the pH of muscles can decrease from pH 7.0 to pH 6.3.

Explain this change in pH.

(2)

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(Total for question = 2 marks)

Q17.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

(i) Which row of the table shows the type or types of respiration that use glucose?

(1)

		aerobic respiration	anaerobic respiration
☐	**A**	yes	yes
☐	**B**	yes	no
☐	**C**	no	yes
☐	**D**	no	no

(ii) A scientist measured the rate of respiration in a person when sleeping and then running at different speeds.

Figure 12 shows the results.

activity	speed in km per hour	respiration rate in kJ per minute
sleeping	0	3
running slowly	8	90
running quickly	12	130

Figure 12

Explain the trend shown in Figure 12.

(3)

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(Total for question = 4 marks)

Q18.

Bloodworms in a pond indicate that the water is polluted.

(i) Which species also indicates that the water is polluted?

(1)

- ☒ A fertiliser
- ☒ B lichen
- ☒ C stonefly
- ☒ D sludgeworm

(ii) Bloodworms have a high level of haemoglobin in their blood.
Give a reason why this helps them survive in polluted water.

(1)

.....

.....

(iii) Carbon dioxide diffuses from the body of the bloodworm into the water.
Give two factors that affect the rate of diffusion.

(2)

1 .....

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2 .....

.....

(Total for question = 4 marks)

Q19.

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 = 1 mark)

Q20.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

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

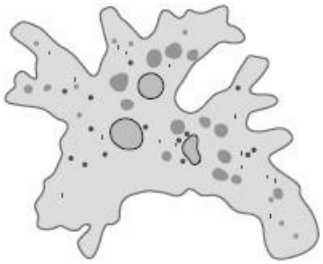

Figure 10

(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 *Amoeba proteus* 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)

(Total for question = 2 marks)

Q21.

A student investigated respiration in three different organisms.
Red hydrogencarbonate indicator was placed in each of three test tubes.
Gauze was placed in each test tube to hold the organisms.
In test tube 1 the student placed four germinating peas.
In test tube 2 the student placed four dried peas.
In test tube 3 the student placed four mealworms.
Bungs were added to each of the test tubes.
The three test tubes were left for one hour.
The equipment used is shown in Figure 16.

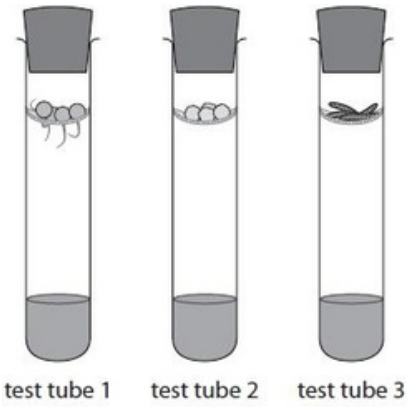

Figure 16

(i) State two ways this method could be improved to make the results for these three organisms more comparable.

(2)

1 .....

.....

2 .....

.....

(ii) Describe a suitable control for this investigation.

(2)

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.....

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(Total for question = 4 marks)

Q22.

Athletes often eat a high protein diet.

(i) Which is the test and result for a food containing protein?

(1)

☒ A Benedict's reagent is used and the solution turns brick red

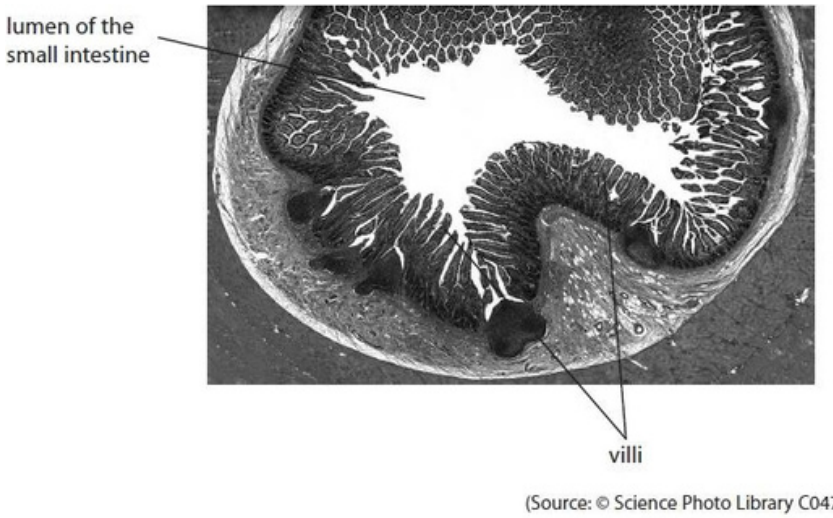
☒ B Benedict's reagent is used and the solution stays blue

☒ C biuret solution is used and the solution stays blue

☒ D biuret solution is used and the solution turns purple

(ii) Digested protein is absorbed in the small intestine by diffusion.

Figure 15 shows part of the small intestine.



(Source: © Science Photo Library C047/6177)

Figure 15

Using Figure 15 and Fick's law, explain the effect of the villi on the rate of diffusion.

(3)

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(iii) Digested protein enters the blood as amino acids.

State which component of the blood transports amino acids.

(1)

.....

(Total for question = 5 marks)

Mark Scheme

Q1.

Question number	Answer	Additional guidance	Mark
(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 dm^3 (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
(ii)	A increasing aerobic respiration **1. The only correct answer is A** ***B*** *is not correct because increasing anaerobic respiration does use more oxygen* ***C*** *is not correct because decreasing aerobic respiration does use more oxygen* ***D*** *is not correct because decreasing anaerobic respiration does use more oxygen*	**(1)** AO 2 1

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

Q2.

Question Number	Answer	Additional guidance	Mark
(i)	measurement (2.5 – 0 =) 2.5 (cm) (1) calculation (25 ÷ 10 =) 2.5 (mm per minute)	accept 25 (mm) ecf for incorrect reading divided by 10 award full marks for correct answer with no working	**(2)** **AO1 1**

Question Number	Answer	Additional guidance	Mark
(ii)	A description including: • apparatus set up as the initial investigation (1) • using {no living organisms / glass beads} instead of living organisms (1)	accept alternatives to glass beads / non living	**(2)** **AO1 1**

Q3.

Question Number	Answer	Additional guidance	Mark
(i)	5 x 60 = 300 (1) OR 60 ÷ 100 = 0.6 (1) (300 ÷ 100) = 3 (dm^3)	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
(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**

Q4.

Question Number	**Answer**	**Additional guidance**	**Mark**
(i)	selection (1200 - 800 =) 400 (1) calculation 400 ÷ 1200 = 33.33 (1) significant figures (-) 33%	 ecf for incorrect calculation rounded to a whole number award full marks for correct answer with no working	**(3)** **AO2 1**

Question Number	Answer	Additional guidance	Mark
(ii)	Any **two** from: • length of exercise (1) • intensity of exercise (1) • type of exercise (1) • BMI of volunteer / body mass of volunteer (1) • diet / food intake (1) • fitness levels (1)	accept weight / height accept lifestyle similarities	**(2)** **AO2 2**

Question number	Indicative content	Mark
* (iii)	**AO2** **increased blood flow** • pump more blood • increased blood flow to the heart muscle • increased blood flow to the other muscles • to deliver more oxygen and glucose • for increased respiration • releasing more energy for exercise • to remove more carbon dioxide • to remove more lactic acid • increased blood flow to the skin • to help cool the body **decreased blood flow** • decreased blood flow to the kidney • decreased blood flow to the stomach • to allow more blood to flow to the working muscles **same blood flow** • blood flow to the brain remains the same • as the brain needs a constant amount of oxygen and glucose to function	(6)

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic consequences connections made between elements in the context of the question. The lines of reasoning are unsupported or unclear.
Level 2	3–4	The explanation is mostly supported throughout by linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. Lines of reasoning are mostly supported through the application of relevant evidence.
Level 3	5–6	The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. Lines of reasoning are supported by sustained application of relevant knowledge.

Level	Mark	
	0	No rewardable material.
Level 1	1–2	A simple statement, referencing whether the blood through an organ is increased, decreased **OR** remained the same. Linked to a simple explanation.
Level 2	3–4	References to whether blood flow is increased, decreased or remained the same for **TWO** scenarios. Linked to two or more reasons.
Level 3	5–6	References to the blood through organs where it has increased, decreased **AND** remained the same. Linked to the need for more oxygen and glucose to the muscles / heart for increased respiration.

Q5.

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

Question Number	Answer	Additional guidance	Mark
(ii)	Evaluation (24.7 x 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
(iii)	An investigation including **four** from: • a factor to control about the groups e.g. same age / same BMI (range) (1) • a factor to control about the environment where the test takes place e.g. in the same room / same type of running machine (1) • measure breathing rate / count breaths in set time (1) • calculations of means (1) • repeat investigation (1)	**(4)** **AO1.2**

Q6.

Question number	Answer	Additional guidance	Mark
	A description including the following: • the blood flow through the {brain/other organs} stays the same (1) • the blood flow through the {muscles /heart} is increased during exercise (1) • the blood flow through the digestive system is decreased during exercise (1)	accept the blood flow through the brain decreases a small amount	**(3)** AO 3 1a AO 3 1b

Q7.

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

Q8.

Question number	Answer	Additional guidance	Mark
	A description including: • the molecules are moving from where they are in high concentration (in the extracellular fluid) to a low concentration (in the cytoplasm) (1) • until there are equal concentrations of molecules on either side (1)	accept down a concentration gradient accept no **net** movement of molecules	**(2)** AO3 1ab

Q9.

Question number	Answer	Additional Guidance	Mark
(i)	A description including: • The more exercise you do the more likely you are able to run at 3 metres per second for 20 minutes (1) • A comparison of the data of 2 groups (1)	Ignore just quoting data from the table	(2) AO31a 1b

Question number	Answer	Additional Guidance	Mark
(ii)	an explanation linking three from: • They had not warmed up / stretched (muscles before exercise) (1) • not enough blood / oxygen (gets to muscles / legs / around body) (1) • **anaerobic** respiration occurs (1) • lactic acid (produced / builds up) (1)		(3) AO2.1

Q10.

Question number	Answer	Additional guidance	Mark
(i)	An explanation linking: • the structure shows many chambers/circles/alveoli (1) • which increase the surface area (of the alveoli) (1) • to maximise diffusion (from the alveoli into the capillaries) (1)	 accept air sacs accept surface area to volume ratio accept more efficient gas exchange accept have thin walls / membranes (1) so short diffusion distance (1)	**(3)** AO2 1

Question number	Answer	Mark
(ii)	C by diffusion **A.** *is not correct because osmosis is the passive movement of water* ***B*** *is not correct because oxygen does not need active transport to travel from high to low concentrations* ***C*** **The only correct answer is C** ***D*** *is not correct because respiration uses respiration but it is not the method of movement*	**(1)** AO2 1

Q11.

Question Number	Indicative content	Mark
*	**AO1** General points about gas exchange • air is breathed in and out of the lungs • oxygen is absorbed (into blood) • carbon dioxide is released (from blood) • by diffusion Adaptations of alveoli for gas exchange • breathing maintains high concentration of oxygen in alveoli / lungs. • breathing maintains low concentration of carbon dioxide in alveoli / lungs. • many alveoli • large surface area • so that more oxygen is absorbed / more carbon dioxide is released • are moist • so oxygen /carbon dioxide can dissolve / is able to move across into the blood • surrounded by (network of) capillaries blood vessels • has a (good) blood supply / (many) red blood cells • keeps oxygen concentration low in blood • keeps carbon dioxide concentration high in blood • to absorb oxygen (quickly) • to remove carbon dioxide (quickly) • membranes / alveolar walls / cells are thin • membranes / alveolar walls / cells are permeable • allows oxygen / carbon dioxide to move through	**(6)** **Exp** **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.

Level	Mark	Additional Guidance
	0	No rewardable material.
Level 1	1–2	• Makes a simple reference to a feature of alveoli, oxygen or carbon dioxide • Linked to gas exchange
Level 2	3–4	• Explains an adaptation of alveoli • Linked to a reference to oxygen or carbon dioxide
Level 3	5–6	• explains more than one adaptation of alveoli • linked to oxygen and carbon dioxide

Q12.

Question number	Answer	Mark
*	**AO2 (6 marks)** **Fick's law** • rate of diffusion is proportional to surface area and concentration difference • and inversely proportional to the thickness of the membrane **Surface area** • as surface area increases the rate of diffusion also increases • as there are more places for diffusion to happen faster **Concentration difference** • the larger the difference in concentration inside the cell to outside the cell • the faster the rate of diffusion **Thickness of the membrane** • the thicker the membrane • the slower the rate of diffusion as the diffusion distance is greater	**(6)** AO2 1

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. • Lines of reasoning are unsupported or unclear
Level 2	3–4	• The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question • Line of reasoning mostly supported through the application of relevant evidence
Level 3	5–6	• The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question • Line of reasoning are supported by sustained application of relevant evidence

Q13.

Question number	Answer	Additional guidance	Mark
	An explanation that links **two** of the following: • there is increased blood flow to the muscles (1) • to allow for { respiration/ release of energy} (in the muscles) (1)	accept heart for muscle accept there is a {reduced /restricted} blood flow through the digestive system accept to supply oxygen/glucose to the muscles/remove carbon dioxide	**(2)** AO 2 1

Q14.

Question number	Answer	Additional guidance	Mark
	An explanation linking: • to release energy (1) • for metabolic processes / chemical reactions (1)	 accept named metabolic process e.g. movement	**(2)** AO1 1

Q15.

Question number	Answer:	Additional guidance	Mark
(i)	An explanation linking • germinating peas **produce** carbon dioxide (1) • because germinating peas were respiring (aerobically) (1)	accept dried peas did not **produce** carbon dioxide accept because dried peas **do not** respire	**(2)** AO3 1ab

Question number	Answer	Mark
(ii)	**B** when glucose is broken down in the presence of oxygen **The only correct answer is B** **A** *is not correct because the carbon dioxide was not produced by photosynthesis in this investigation.* **C** *is not correct because the carbon dioxide was not produced when glucose is broken down in the absence of oxygen in this investigation.* **D** *is not correct because the carbon dioxide was not produced by the reaction between oxygen and water in this investigation.*	**(1)** AO3 1ab

Q16.

Question Number	Answer	Additional Guidance	Mark
	An explanation linking: • because of lactic acid (1) • from **anaerobic** respiration (1)		**(2)** **AO2**

Q17.

Question number	**Answer**	**Mark**
(i)	A aerobic respiration and anaerobic respiration. The only correct answer is **A** aerobic respiration and anaerobic respiration B is incorrect because anaerobic respiration uses glucose. C is incorrect because aerobic respiration uses glucose. D is incorrect because aerobic respiration and anaerobic respiration use glucose.	**(1)** AO1.1

Question number	**Answer**	**Mark**
(ii)	An explanation linking **three** of: • as activity / speed increases, the respiration rate increases (1) • because respiration supplies energy (to muscles / cells) (1) • when sleeping you are not moving / using muscles very much (1) • the faster you run / the more you use muscles (1) • so more energy is required. (1)	**(3)** AO3.2

Q18.

Question Number	Answer	Mark
(i)	D sludgeworm **The only correct answer is D** ***A*** *is not correct because fertiliser is not an indicator species* ***B*** *is not correct because lichen is an air pollution indicator* ***C*** *is not correct because stonefly are clean water indicators*	**(1)** **AO1 1**

Question Number	Answer	Additional Guidance	Mark
(ii)	haemoglobin binds oxygen / increases the rate of diffusion / polluted water is low in oxygen	accept allows them to get more oxygen	**(1)** **AO2 1**

Question Number	Answer	Additional Guidance	Mark
(iii)	Any **two** from: • concentration **gradient** (1) • diffusion distance (1) • surface area (1)	 accept thickness of membrane accept temperature (1)	**(2)** **AO1 1**

Q19.

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

Q20.

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

Question Number	Answer	Additional guidance	Mark
(ii)	carbon dioxide + water	accept CO_2 for carbon dioxide H_2O for water reject CO2, CO^2. H20 and H^2O products can be in either order.	**(1)** **AO1.1**

Q21.

Question number	Answer	Additional Guidance	Mark
(i)	Any two from: • same concentration of indicator (1) • same mass of organisms (1) • same volume of indicator (1) • same temperature (1) • same volume / size of test tube (1) • repeat the experiment (1) • use a control (1)	accept weight for mass accept mass/weight ignore references to time as this is in the stem of the question	(2) AO3.3b

Question number	Answer	Additional guidance	Mark
(ii)	A description including: • same test tube, gauze and bung with (hydrogencarbonate) indicator (1) • without any live organisms / with a mass of inert object e.g.stones /dead peas/glass beads(1)	accept set up the same {apparatus/equipment}	(2) Ao2 2

Q22.

Question Number	Answer	Mark
(i)	**D biuret solution is used and the solution turns purple** **The only correct answer is D** ***A*** *is not correct because Benedict's is not used to test for protein* ***B*** *is not correct because Benedict's is not used to test for protein* ***C*** *is not correct because biuret solution does not stay blue with protein*	**(1)** **AO1 2**

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation linking: • (Fick's law states) the rate of diffusion is proportional to surface area x concentration gradient (1) • and inversely proportional to the thickness if the membrane (1) • increased rate of diffusion (1) • because the villi increase surface area / because the membrane is thinner (1)	accept equation accept shorter diffusion distance for membrane is thinner	**(3)** **AO2 1**

Question Number	Answer	Mark
(iii)	(blood) plasma	**(1)** **AO1 1**