PEARSON EDEXCEL GCSE COMBINED SCIENCE (HIGHER) · 1SC0

BIOLOGY



MARK SCHEME

TOPIC 8: EXCHANGE AND TRANSPORT IN ANIMALS (PAPER 2)

SCORE	PERCENTAGE
/113	%

STEMUP

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Mark Scheme

Q1.

Question Number	Answer	Additional guidance	Mark
(i)	An explanation linking: • artery has {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
(ii)	valve / valves	**(1)** **AO1 1**

Q2.

Question number	Answer	Additional guidance	Mark
(i)	Substitution (50 – 30 =) 20 (1) (20 ÷ 50 x 100 =) - 40(%)	 Accept 40% award full marks for answer without working	(2) AO2.1

Question number	Answer	Additional guidance	Mark
(ii)	Any **two** from: • variety of potato (1) • mass of potato (1) • age of potato (1) • temperature (1) • storage conditions/humidity (1)	 accept type / species accept weight/size accept potato cells taken from the same part of each potato	(2) AO2.2

Question number	Indicative content	Additional guidance	Mark
(iii)	for energy / respiration	ignore make / produce energy accept to produce ATP	(1) **AO2.1**

Question number	Indicative content	Additional guidance	Mark
(iv)	Any two from: • enzyme / amylase / carbohydrase (1) • starch fits into the **active site** (1) • bonds (between glucose molecules in starch) broken (1)	 accept maltase accept polymer broken down into monomers	(2) **AO2 1**

Q3.

Question number	Answer	Mark
	An explanation that combines identification - knowledge (1 mark) and reasoning/justification - understanding (1 mark): • less oxygen available for aerobic respiration (1) • so start to respire anaerobically more quickly to release the energy needed to complete the same intensity of exercise (1)	**(2)**

Q4.

Question number	Answer	Mark
(i)	**B** 3.1×10^{-3} m	**(1)**

Question number	Answer	Mark
(ii)	**D** vena cava	**(1)**

Question number	Answer	Mark
(iii)	An explanation that combines identification – understanding (1 mark) and reasoning / justification – understanding (1 mark): • thin walls allow maximum diffusion (of substances into and out of the capillaries) (1) • shorter diffusion distance (1) • small lumen slows blood flow so more substances diffuse (1)	**(2)**

Q5.

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.

Q6.

Question number	Answer	Mark
(i)	B	**(1)**

Question Number	Indicative content	Mark
* (ii)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant. **AO1 (6 marks)** • the thyroid gland produces thyroxine • thyroxine helps to regulate metabolic rate • low levels of thyroxine should stimulate the production of TRH • TSH being produced and more thyroxine being released • an underactive thyroid would cause less thyroxine to be produced • metabolic rate to drops • less energy (calories) are available for tasks • more fat storage so the person gains body mass	**(6)**

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. (AO1) • Presents an explanation with some structure and coherence. (AO1)
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. (AO1) • Presents an explanation that has a structure which is mostly clear, coherent and logical. (AO1)
Level 3	5–6	• Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) • Presents an explanation that has a well-developed structure which is clear, coherent and logical. (AO1)

Q7.

Question Number	Answer	Additional guidance	Mark
(i)	calculation (7.5 x 400 =) 3000 (1) conversion (3000 ÷ 1000 =) 3 (mm)	 ecf using 2.5 for 1 mark award full marks for correct answer with no working	**(2)** **AO2 1**

Question Number	Answer	Additional guidance	Mark
(ii)	An explanation linking: • the biconcave disc shape (1) • results in a larger surface area (1) • so (more) oxygen can be carried (1)	 accept description of biconcave disc accept (more) oxygen diffused	**(3)** **AO1 1**

Question Number	Answer	Additional guidance	Mark
(iii)	for oxygen to bind (inside the erythrocyte / red blood cell)	accept to carry oxygen	**(1)** **AO1 1**

Q8.

Question number	Answer	Additional guidance	Mark
	Substitution: 65 x 61 (1) Evaluation: = 3 965 (1) Conversion: 3 965 ÷ 1000 = 3.965 (litres per minute)	Full marks for correct answer no working Conversion 61 ÷ 1000 (1) 0.061 x 65 for substitution mark With 3.965/4 for evaluation mark Accept 4 or any other correct rounding	**(3)** **AO2.1**

Q9.

Question number	Answer	Additional guidance	Mark
	Substitution 4.9 ÷ 0.07 / 4 900 ÷ 70 (1) Evaluation 70 (beats per minute)	full marks for correct answer no working accept 4.9 ÷ 70 = 0.07 for 1 mark	**(2)** AO 1 2

Q10.

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**

Q11.

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**

Q12.

Question number	Answer	Additional Guidance	Mark
	subtraction 630 - 480 = 150 (1) (150 ÷ 630) x 100 = 24 (%)	accept 23.8 award full marks for correct numerical answer without working	**(2)**

Q13.

	Answer	Acceptable answers	Mark
(i)	• (heart rate =)198 to 200 (1) • (0.18 × 198 to 200 =) 35.6 to 36 (1)	2 marks for correct bald answer ecf	**(2)**
(ii)	B - 12.8 mmol dm^{-3}		**(1)**
(iii)	D - the concentration of lactic acid is not dependent on heart rate		**(1)**
(iv)	Any three from the following:	Accept stops	

	• lactic acid increases / **more**lactic acid produced (as exercise increases) (1) • using more energy /muscles working / contracting harder / faster (1) • <u>aerobic</u> respiration at its maximum (rate) (1) • as oxygen not supplied fast enough / muscles not getting enough oxygen (1) • <u>anaerobic</u> respiration occurs (producing lactic acid) (1)	Ignore breathing Accept body Accept not enough oxygen /oxygenated blood	**(3)**

Q14.

	Answer	Acceptable answers	Mark
(a)(i)	Any **two** of the following points: (yeast cell) • has a nucleus (1) • does not have a flagellum (1) • does not have a plasmid (1) (bacterial cell) • has chromosomal DNA / circular DNA (1) • has a capsule (1) • has a slime coat (1) • does not have mitochondria (1)	Accept: has a vacuole accept: named bacterial feature e.g pilli, small ribosome, if not labelled in yeast cell	**(2)**
(a)(ii)	does not have chloroplasts/chlorophyll	cannot photosynthesise	**(1)**
(b)(i)	7×10^9 (-) 5×10^{10} **(1)** **=**$(-)4.3 \times 10^{10}$ or $(-)43 \times 10^9$	two marks for correct bald answer accept 43 000 000 000 allow one mark for correct subtraction from wrongly selected numbers only accept the numbers in the table with a correct minus calculation	**(2)**
(b)(ii)	A description including any **two** of the		**(2)**

	following points: • involved in defence against disease / part of immune system (1) • phagocytosis (1) • antibody / antitoxin production (1)	accept: (fight pathogen / harmful microorganism / named microorganism) accept: engulf / ingest / surround /digest cells reject: make antigens ignore: refs to role of red blood cells or platelets	
(b)(iii)	tired / lack of energy / lethargy / short of breath	anaemia /fainting / less oxygen / increased anaerobic respiration reject: references to asthman	**(1)**

Q15.

Question Number	Answer	Acceptable answers	Mark
(i)	(right) lung / lungs		**(1)**

Question Number	Answer	Acceptable answers	Mark
(ii)	An explanation including two of the following: blood flows into (right) atrium (1) (into right) ventricle (1) (ventricle / heart / muscle) contracts (1) (blood) pressure increased (by heart) (1) blood moves into pulmonary artery (1)	**reject** references to left for either atrium or ventricle. accept blood under high pressure accept reference to valves stopping back flow	**(2)**

Question Number	Answer	Acceptable answers	Mark
(iii)	**D** vena cava aorta		**(1)**

Question Number	Answer	Acceptable answers	Mark
(iv)	A description including two of the following: blood in vessel W / vena cava has: lower pressure (1) deoxygenated / low(er) concentration of oxygen (1) greater concentration of carbon dioxide (1) darker (red) (1)	 accept reverse arguments for blood vessel Y / aorta ignore low pressure accept low pressure in W and high pressure in Y accept low(er) oxygen levels accept carries carbon dioxide ignore W takes blood towards heart / Y takes blood away from heart	**(2)**

Q16.

Question Number	Answer	Additional Guidance	Mark
	An answer including **four** from: • {TSH / thyroxine} levels are higher than normal (1) • TSH stimulates the thyroid gland / TSH stimulates the release of thyroxine (1) • **increases** metabolic rate (1) • {red blood cells / glucose} are within the normal range (1) • suggesting oxygen is carried as normal (1) • the symptoms are not due to diabetes (1)	accept the hormones levels are high / above average accept digests / breaks down food faster accept hyperthyroidism / overactive thyroid accept RBC / glucose are not high accept is not anaemic	**(4)** **AO3** **1a, 1b, 2a, 2b**

Q17.

Question number	Answer	Additional guidance	Mark
(i)	An answer comparing two from: • the stroke volume of the person who has trained for the marathon is (always) higher / ORA (1) • as heart rate increases for the person who has trained for the marathon stroke volume increases (1) • as heart rate increases for the person who has not trained for the marathon the stroke volume {stays constant/only increases slightly} (1)	accept comparative data	(2) AO3 2ab

Question number	Answer	Additional guidance	Mark
(ii)	cardiac output = heart rate x stroke volume (1) Substitution 160 x 170 = 27 200 (1) unit ml per min/ ml.min^{-1}	accept correct calculation for 2 marks as equation is implied. accept range for stroke volume of 168 -172 accept 27.2 L.min^{-1} / 27.2 dm^3.min^{-1} for 3 marks	(3) AO1 1

Q18.

Question number	Answer	Additional guidance	Mark
	An answer comparing the following: • the heart rate of person A is higher than the heart rate of person B (1) • the heart rate of person A increases **more** during exercise than person B (1) • the heart rate of person B is level during exercise whereas the heart rate of person A keeps increasing (1) • person B returns to their resting heart rate faster than person A (1) • comparative data analysis (1)	accept the rate of increase for person A is higher than person B	**(4)** **AO3 1ab**

Q19.

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

Q20.

Question number	Indicative content	Mark
	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive, and candidates are not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant. **AO1 (6 marks)** • Blood flows from vena cava into the right atrium • Into the right ventricle • Through valve • And is pumped into the pulmonary artery • Through valve to the lungs • From the lungs back to the heart through the pulmonary vein • Into the left atrium • Into the left ventricle • Through valve • And is pumped into the aorta • Through valve • valves prevent backflow	**(6)** AO1 1

Level	Descriptor
	No rewardable material.
Level 1	• 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	• 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	• 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	General additional guidance – the decision within levels The correct linking of one structure to another
	0	No rewardable material.	
Level 1	1–2	• A correct reference to blood flowing through a named chamber of the heart or blood vessel or what valves do • Correctly linked to the next stage either chamber or blood vessel or through a valve (sides of the heart not necessary)	<u>Possible candidate responses</u> blood flows into the (right) atrium blood flows from the right ventricle to the lungs valves prevent backflow of blood blood flows through the (right) atrium into the right ventricle blood flows from the lungs to the atria
Level 2	3–4	• A correct reference to blood flow through one side of the heart either left or right Or the correct side of the heart linked to the correct blood vessel • Correctly linked to or from the lungs	<u>Possible candidate responses</u> blood flows into the right atrium to the right ventricle blood flows into the left atrium into the left ventricle blood flows into the right atrium to the right ventricle into the lungs blood flows into the left atrium into the left ventricle through a valve from the lungs
Level 3	5–6	• A correct reference to blood flow through the heart from right to left travelling through the lungs including valves • Correctly linked to the pulmonary artery and pulmonary vein	<u>Possible candidate responses</u> Blood flows from the right atrium to the right ventricle through a valve and is pumped to the lungs then enters the left atrium through to the left ventricle and is pumped to the body through the aorta Blood flows from the right atrium to the right ventricle through a valve and is pumped through the pulmonary artery to the lungs. Leaves the lungs via the pulmonary vein then enters the left atrium through to the left ventricle and is pumped to the body through the aorta

Q21.

Question number	Answer	Mark
	• the fish heart has two chambers rather than four chambers (1) • the fish heart only has one ventricle and one atrium rather than two ventricles and two atria (1) • only deoxygenated blood flows through the fish heart (1) • the fish heart shows a single circulatory system rather than a double circulatory system (1)	**(4)**

Q22.

Question number	Answer	Mark
(i)	An explanation that combines identification - application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark): • teeth break up the biscuit into smaller pieces (1) • which increases the surface area of the biscuit (1) • so enzymes can break it down quicker (1)	**(2)**

Question number	Answer	Mark
(ii)	An explanation that combines identification - application of knowledge (1 mark) and reasoning/justification – application of understanding (2 marks): • (small droplets of fat) are broken down by the enzyme **lipase** (1) • into **fatty acids** and **glycerol** (1) • absorbed into the bloodstream by diffusion (1)	**(3)**

Q23.

	Answer	Acceptable answers	Mark
(a)(i)	• (heart rate =)198 to 200 (1) • (0.18 × 198 to 200 =) 35.6 to 36 (1)	2 marks for correct bald answer ecf	**(2)**

(a)(ii)	B - 12.8 mmol dm^{-3}		**(1)**
(a)(iii)	D - the concentration of lactic acid is not dependent on heart rate		**(1)**
(a)(iv)	Any three from the following: • lactic acid increases / **more** lactic acid produced (as exercise increases) (1) • using more energy /muscles working / contracting harder / faster (1) • <u>aerobic</u> respiration at its maximum (rate) (1) • as oxygen not supplied fast enough / muscles not getting enough oxygen (1) • <u>anaerobic</u> respiration occurs (producing lactic acid) (1)	Accept stops Ignore breathing Accept body Accept not enough oxygen /oxygenated blood	**(3)**
(b)	Any three from the following: • (concentration of lactic acid) decreases (1) • lactic acid broken down(1) • using oxygen / oxidised(1) • into carbon dioxide and water (1) • ref to oxygen debt / EPOC (1)	Accept amount Accept if written in a word or formula equation for MP3 and MP4	**(3)**

Q24.

Question number	Answer	Additional guidance	Mark
(i)	Linear scale on both axis (1) Plotted points (1) Correctly drawn graph (1)	 Accept accurate plotting to ½ small square Accept dot to dot drawing or a freehand single line linking points	**(3)** **AO2.1**

Question number	Answer	Additional guidance	Mark
(ii)	An answer including **two** of the following: • wear gloves (1) • wash hands after handling (1) • sterilise equipment after use / use sterile equipment / keep it in a sealed container (1)	 accept cover {open wounds/cuts}	**(2)** **AO31ab**

Q25.

Question Number	Answer	Acceptable answers	Mark
(a)(i)	A comparison to include three of the following: For the unfit person: • the unfit person's heart rate is higher / faster(1) • idea that both react in the same way eg both peak at ten minutes, both increase when they start exercising (1) • heart rate increases more quickly (to maximum) (1) • heart rate decreases more slowly (back to resting rate) (1) • credit correct manipulated values obtained for heart rates (1)	ORA for fit person	**(3)**

Question Number	Answer	Acceptable answers	Mark
(a)(ii)	• Correct substitution i.e. 0.20 x 110 (1) • 22	Allow 2 marks for correct final bald answer ecf. Allow one mark if final value is correct for the substitution of a different heart rate from the graph, ie between 56 and 140 bpm.	**(2)**

Question Number	Answer	Acceptable answers	Mark
(a)(iii)	An explanation that includes: • the fit person recovers faster/ has a shorter recovery period (1) and two of the following: Fit Person has • greater {vital capacity / blood flow / stroke volume / cardiac output} (1) • correct reference to less / no anaerobic respiration less /no lactic acid build up (1) • lactic acid removed faster EPOC less / lower oxygen debt less oxygen to replace(1)	ORA unfit person Accept Heart pumps more blood / more red blood cells / haemoglobin Accept fit person only respires aerobically / unfit person does anaerobic respiration. Accept unfit person has an oxygen debt /fit person has no oxygen debt	**(3)**

Question Number	Answer	Acceptable answers	Mark
(b)	**D** pulmonary vein → atrium → ventricle → aorta		**(1)**

Question Number	Answer	Acceptable answers	Mark
(c)	plasma (1)		**(1)**

Q26.

Question number	Answer	Mark
	An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark): • the blood vessel has thick walls/small lumen (1) • to carry oxygenated blood/to carry blood under higher pressure (1)	**(2)**

Q27.

Question number	Answer	Additional guidance	Mark
	An answer linking two of the following: • veins contain valves (1) • which prevent the backflow of blood (1) OR • veins have a large lumen (1) • to maximise blood flow (1)	 accept keep blood flowing in one direction accept to carry a lot of blood	**(2)** **AO1 1**

Q28.

Question number	Answer	Additional guidance	Mark
	An explanation linking four of the following: • adrenalin acts to increase heart rate / blood pressure (1) • so there is increased blood flow (1) • causes the release of glucose from glycogen (1) • so increased {oxygen/glucose} (1) • increased the rate of respiration (1) • to **release energy** (for the working muscles/body) (1)	 accept more glucose released from liver/muscles accept ATP for energy	**(4)** AO 1 2

Q29.

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

Q30.

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