



General Certificate of Education

Applied Science

8771/8773/8776/8779

SC02 Energy Transfer Systems

Mark Scheme

2009 examination – January series

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Question 1

(a)(i)	60 – 80 (bpm) Allow 60 – 90 (bpm) N.B. Must be a range and not a single figure Bottom figure must be '60'	(1) (AO1)	1
(ii)	<u>Increased</u> frequency of impulses travel in Parasympathetic nerve / inhibitory nerve OR <u>Decreased</u> frequency of impulses travel in Sympathetic nerve From cardiovascular centre In hypothalamus / brain Medulla (oblongata) To S-A node In <u>right</u> atrium (of heart) Slows down heart rate	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) Max 4	4
(b)	Take pulse rate at rest / before exercise Measure pulse rate for a given time (minimum 30 seconds) Engage in exercise Take pulse rate after exercise Time how long it takes for pulse rate to return to normal (or resting rate / pulse rate before exercise began) The time taken is an indication of the person's level of fitness / the shorter the time taken, the fitter the person	(1) (AO3) (1) (AO3) (1) (AO3) (1) (AO3) (1) (AO3) (1) (AO3) Max 4	4
(c)	Higher than <u>normal</u> (blood) carbon dioxide levels Detected by (chemo)receptors In the carotid artery (resulting in) increased frequency of nerve impulses Travel to brain / cardiovascular centre / hypothalamus Causes pulse rate to rise	(1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) Max 3	3
(d)(i)	So that the ventricles empty completely To force blood <u>up</u> and out of the heart To the pulmonary artery and/or aorta / through semi-lunar valves	(1) (AO1) (1) (AO1) (1) (AO1) Max 2	2
(ii)	(Presence of) valves / named valves (bicuspid or tricuspid) One-way flow (of blood) / <u>prevent</u> backflow (of blood)	(1) (AO1) (1) (AO1)	2
(iii)	Entrance to arteries / aorta / pulmonary artery / semi-lunar valves	(1) (AO1)	1

Total Mark: 17

Question 2

(a)	(Thickness of) layer of (subcutaneous) fat Allow valid alternatives e.g. SA / Vol ratio	(1) (AO1)	1
(b)(i)	Hypothermia Do not allow incorrect spelling that could be confused with 'hyperthermia'	(1) (AO1)	1
(ii)	25 °C Reject: 25 °C and 43 °C. Allow: 'Below 25 °C and above 43 °C'	(1) (AO1)	1
(c)(i)	Homeostasis	(1) (AO1)	1
(ii)	1.Mechanism: Shivering Explanation: spasmodic contraction of muscles generates heat 2.Mechanism: Hairs become erect / piloerection takes place Explanation: air trapped next to skin Air is an insulator / poor conductor of heat 3.Mechanism: Vasoconstriction Explanation: blood diverted away from skin (surface) Less heat lost from skin (surface) Credit valid points made under either category	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) Max 6	6

Total Mark: 10

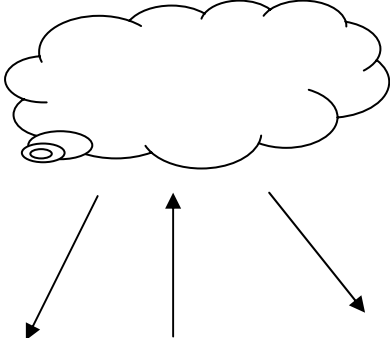
Question 3

(a)(i)	Function: Supports / prevents collapse of / protects trachea Importance: allows breathing / prevents suffocation / keeps lumen open Credit valid points made under either category	(1) (AO1) (1) (AO1)	2
(ii)	Function: <u>Removes</u> particles or dust that may be breathed in / moves mucus Do not allow 'traps dust or dirt' Importance: Prevents damage to <u>lungs</u> / stops dust and dirt getting into <u>lungs</u> Credit valid points made under either category	(1) (AO1) (1) (AO1)	2
(b)(i)	Surfactant (presence) Large surface area Moist <u>Well supplied</u> with blood vessels / capillaries Single-cell thick / thin walls (of alveoli) Any 2 of above	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) Max 2	2
(ii)	Lots of alveoli Blood vessels surround / are attached to alveoli Short diffusion <u>path</u> Oxygen carried in blood / CO ₂ carried in blood BV1 (arteriole) from heart / pressurised BV2 (venule) returns blood to heart (for distribution around body) 1 cell thick / thin walls for capillaries / blood vessels round alveoli Blood vessels carry blood away To <u>aid</u> diffusion / maintain diffusion <u>gradient</u> OWTTE	(1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) Max 3	3

(c)	(Ensuing death) would be instantaneous / painless Brain activity not linked to rest of body (activity) (No) prospect of recovery Religious reasons / objections Patient's wishes	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) Max 2	2
(d)	The level of risk involved The possibility of side effects / adverse reactions	(1) (AO1) (1) (AO1)	2

Total Mark: 13

Question 4

(a)(i)	Radiation	(1) (AO1)	1
(ii)	Black absorbs (radiation) effectively [Allow 'dark / darker'] better than (shiny) snow / white <u>More</u> heat energy / <u>more</u> power is available (do not accept "black attracts radiation")	(1) (AO1) (1) (AO1) (1) (AO1) Max 2	2
(b)(i)	Arrow upwards centrally under cloud Pair of down arrows to R & L of upwards arrow (max 1 if any arrows significantly above cloud)	(1) (AO1) (1) (AO1)	2
			
N.B. No credit for air going round in circles underneath the cloud unless the vertical up part is central			
(ii)	Heat is transferred from earth to air OWTTE (Allow air near ground becomes warm) Hot air expands / Hot air is less dense (than cold air): Or converse So hot air rises/ cold air falls (NOT 'heat rises')	(1) (AO1) (1) (AO1) (1) (AO1)	3
(iii)	Liquids & gases; not solids or vacuum; all correct or nothing	(1) (AO1)	1
(c)(i)	Air is trapped / air pockets Allow 'Air in between' Air is a poor conductor / good insulator / prevents conduction / insulates OWTTE Allow ' <u>Air</u> does not let heat through'	(1) (AO1) (1) (AO1)	2
(ii)	Air is trapped in small pockets There is not enough room for convection currents / the small pockets prevent the convection currents	(1) (AO1) (1) (AO1)	2

(ii)	<p>Either: The 'acceleration' route (with reference to acceleration): Allows more time / more distance to stop the carriage / passengers moving Gives less acceleration. Allow 'slows down deceleration' Less acceleration → less force on the passengers / $F=ma$ [must link to previous mark point]</p> <p>OR The 'energy' route: Crumple zones absorb energy Allows more time / more distance to stop the carriage / passengers moving Therefore less force on the passengers [must link to previous mark point]</p>	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) Max 3	3
(iii)	<p>Correct equation i.e. $ke = \frac{1}{2} m v^2 / \frac{1}{2} m v^2 = 144\ 000\ 000$</p> <p>Correct substitution $v^2 = 144\ 000\ 000 / 2.5 \times 10^5$ (or $v = \sqrt{\dots}$) (or ecf) OR rearrangement e.g. $\frac{2 \times ke}{m} = v^2$</p> <p>Correct numerical answer: $v = 24$ (m s⁻¹) or ecf 3 marks for correct answer only</p> <p>N.B. A final answer of 'v = 0.759 m/s' is worth 3 marks</p> <p>Units correct: ms⁻¹, m/s, mps N.B. Stand-alone mark for units</p> <p>Any error involving the power of 10 loses a total of one mark, irrespective of the number of times that the error has been made.</p>	(1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2)	4

Total Mark: 17

Question 6

(a)(i)	Change one variable (thing) at a time Keep all <u>other</u> variables (everything else) the same	(1) (AO3) (1) (AO3) Max 1	1
(ii)	To get an average / The average of a large number of readings is more reliable than a single reading / <u>Check or test reliability</u> / check anomalies	(1) (AO3)	1
(iii)	Light gates (with a computer timer)	(1) (AO3)	1
(b)(i)	Potential energy change = mass x gravity x height change $= 50 \times 10 \times 600$ $= 300\ 000$ (J) Allow 3 marks for correct answer	(1) (AO2) (1) (AO2) (1) (AO2)	3
(ii)	Gain heat from – waste energy from body movement	(1) (AO1)	1
(iii)	Lose heat from – cold air strikes body (wind chill) / <u>exhale</u> / sweating Do not accept: 'radiating heat from body'	(1) (AO1)	1

Total Mark: 8