



General Certificate of Education

Applied Science

8771/8773/8776/8779

SC02 Energy Transfer Systems

Mark Scheme

2008 examination – January series

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Question 1

(a)(i)	Diffusion	(1) (AO1)	1
(ii)	Lungs / pulmonary vein	(1) (AO1)	1
(iii)	Pulmonary artery	(1) (AO1)	1
(b)	Walls broken between alveoli / larger alveoli (in person with emphysema) / more alveoli in healthy person / fewer alveoli in sick person Fewer alveoli means less surface area (allow converse) So less efficient oxygen absorption / gas exchange (allow converse) Reduced amounts of oxygen (pass from the lungs into the blood) Oxygen needed (in tissues / muscles) <u>to release energy</u> / oxygen needed for (tissue) respiration Less oxygen to tissues means <u>less energy</u> for movement (walking)	(1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) Max 4	4
(c)(i)	During each cardiac cycle the blood travels through the heart twice Blood travels from the heart to the lungs (and back) / via the pulmonary circulation Blood travels from the heart to the body (and back) / via the systemic circulation	(1) (AO1) (1) (AO1) (1) (AO1) Max 2	2
(ii)	Semi-lunar valve: ventricles Bicuspid valve: atria	(1) (AO2) (1) (AO2)	2

Total Mark: 11**Question 2**

(a)	C: Bradycardia A: Normal heartbeat D: Ventricular fibrillation B: Tachycardia	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1)	4
(b)(i)	Correct plotting of points (half square tolerance) Suitable scales Correctly drawn and labelled axes	(2) (AO3) (1) (AO3) (1) (AO3)	4
(ii)	Resting pulse lower in patient 1 than patient 2 Highest pulse rate reached in patient 1 = 100 compared with highest pulse rate in patient 2 = 140 / pulse rate of patient 2 increases much more than patient 1 / pulse rate of patient 2 increases faster than patient 1 In patient 1 pulse rate has returned to resting rate 3 minutes after exercise has finished compared with patient 2 whose pulse rate has not returned to resting rate 3 minutes after exercise has finished / resting pulse rate returned to normal more quickly in patient 1 compared with patient 2 / patient 1 pulse rate drops more quickly than patient 2 (after exercise)	(1) (AO2) (1) (AO2) (1) (AO2)	3

(c)(i)	Glucose broken down / glucose used In the presence of oxygen In mitochondria (within cells) To produce energy Which is stored as ATP / ATP produced ATP broken down to release energy (for muscle contraction)	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) Max 4	4
(ii)	$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ (+energy) 1 mark for correctly balanced equation for input 1 mark for correctly balanced equation for output 1 mark total if equation correct but not balanced 1 mark for correct word equation	(2) (AO1) Max 2	2
(d)	Obese / large body mass Unfit Feeling faint / dizzy Very old Rapid heartbeat / heartbeat 100 bpm or higher Breathless Sweating Red faced	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) Max 1	1

Total Mark: 18**Question 3**

(a)(i)	36.8 °C Accept a range if given Allow range: 36.5 – 37.2 °C	(1) (AO1)	1
(ii)	32 °C Accept a range if given Allow range: 32 – 35 °C	(1) (AO1)	1
(b)(i)	38 °C	(1) (AO1)	1
(ii)	43 °C	(1) (AO1)	1
(c)	(Thermo) <u>receptors</u> in skin Role of hypothalamus in valid context <u>Sweat glands</u> produce sweat Vasodilation in skin (superficial or peripheral capillaries) Blood <u>diverted</u> to skin capillaries <u>Evaporation</u> of water (sweat) cools the body Reference to Latent Heat of Vapourisation Temperature returns to normal Cooling mechanisms inhibited Reference to negative feedback Deeper or more rapid breathing	(1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) Max 4	4
(d)	Expired air / breathing Urine / excretion Faeces	(1) (AO1) (1) (AO1) (1) (AO1)	3

Total Mark: 11

Question 4

(a)	Gravitational (energy) Accept 'potential' as alternative to 'gravitational' as long as not incorrectly expanded e.g. 'elastic potential'	(1) (AO1)	1
(b)	600 x 10 x 250 1 500 000 (J) (= 1.5 MJ) Allow 2 marks for correct answer	(1) (AO2) (1) (AO2)	2
(c)	heat is generated (because of friction) some energy is changed to kinetic energy of the train sound extra mass	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) Max 2	2
(d)	Friction (of sand) owtte Decelerates the train (Turns kinetic energy) to heat	(1) (AO1) (1) (AO1) (1) (AO1) Max 2	2
(e)	longer distance to stop / longer time / less deceleration / less rate of change of momentum less force (on passengers)	(1) (AO1) (1) (AO1)	2
(f) (i)	$\frac{1}{2} \times 2500 \times 8^2$ 80 000 (J) Allow 2 marks for correct answer	(1) (AO2) (1) (AO2)	2
(ii)	answer (f) / 2 e.g. 40,000 (or consequential error) watts N.B. stand alone unit mark	(1) (AO2) (1) (AO2)	2

Total Mark: 13

Question 5

(a) (i)	chemical	(1) (AO1)	1
(ii)	sound heat / thermal energy	(1) (AO1) (1) (AO1)	2
(b)	45 900 / 54 000 (x 100%) 85 (%) (accept 0.85) 2 marks for correct answer only	(1) (AO2) (1) (AO2)	2

Total Mark: 5

Question 6

(a)	longer <u>heat</u> path / better insulator lower U-value so less heat enters	(1) (AO1) (1) (AO1) (1) (AO1) Max 2	2
(b)	Foam / fibre glass / thick cotton padding / wool contains trapped air (pockets) air is a poor conductor / good insulator <u>small</u> air pockets prevent convection currents N.B. Points 4 & 5 are linked. Alternative to points 4 & 5: Special case: Air pockets will prevent convection currents	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) Max 4	4
(c)	cold air falls / hot air rises (NOT 'heat rises') (thicker base) so less heat gained from underneath or (thicker top) because the room is warmer at top (Do not accept 'cold air escapes' or 'cold escapes' or 'heat lost')	(1) (AO1) (1) (AO1)	2
(d)	black	(1) (AO1)	1
(e)	ice is an insulator / poor conductor so heat is not easily removed (by the heat pump) (too much ice means) less space for food	(1) (AO1) (1) (AO1) (1) (AO1) Max 2	2
(f)	When it (the strip) gets (too) hot the strip completes an electric circuit and switches on the heat pump which cools the contents down and the bimetal strip breaks the contact / switches it off again	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) Max 3	3
(g)	0.6 x 4 x 15 36 p / £0.36 (u.p. if £ 36) N.B. 1 max for 600 x 4 x 15	(1) (AO2) (1) (AO2)	2

Total Mark: 16**Question 7**

(a) (i)	Observe many take-offs (of similar planes) Use a stopwatch / (electronic) timer take an average of (many) readings	(1) (AO3) (1) (AO3) (1) (AO3) Max 2	2
(ii)	ask the pilot / take radar readings / use light gates / use a speed gun	(1) (AO3)	1
(b)	take readings only from similar aircraft / <u>same</u> weather / <u>same</u> mass	(1) (AO3)	1
(c)	CO ₂ pollution / greenhouse gases / carbon emissions Global warming Uses up (non renewable) fossil fuels / green belt	(1) (AO1) (1) (AO1) (1) (AO1) Max 2	2

Total Mark: 6