



General Certificate of Education

Applied Science 8771/8773/8776/8779

SC02 Energy Transfer Systems

Mark Scheme

2006 examination – June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Unit SC02 – Energy Transfer Systems

Question 1

(a)	(Sinus) tachycardia	(1)(AO1)	1
(b)	60 - 80 bpm Correct answer only	(1)(AO1)	1
(c)(i)	Higher (that normal)	(1)(AO2)	1
(ii)	145 – Systolic 95 - Diastolic	(1)(AO1) (1)(AO1)	2
(d)	Any 3 from: Increased frequency of nerve impulses/allow ‘more nerve impulses’ sent from the cardiovascular centre/brain along nerves/spinal cord sympathetic (nerves) to the sino-atrial node (SAN) in the heart right atrium	(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1)	3

Total Mark: 8

Question 2

(a)(i)	The maximum possible tidal volume tidal volume + inspiratory reserve volume + expiratory reserve volume Maximum amount of air breathed in and then out Allow ‘reserve volumes’ in place of ‘inspiratory and expiratory reserve volumes’	(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1)	2
(ii)	Spirometer	(1)(AO1)	1
(iii)	6 dm ³ Allow 6 litres or any other appropriate units	(1)(AO1)	1
(iv)	Tidal (volume)	(1)(AO1)	1
(b)(i)	Chemoreceptor	(1)(AO1)	1
(ii)	Any 1 from: (Walls of) aortic arch/aorta/carotid bodies/carotid artery/respiratory centre/medulla	(1)(AO1)	1
(c)(i)	Measures (or speed of) expelling (air) Rate/speed of air leaving lungs	(1)(AO1) (1)(AO1)	1
(ii)	Higher (than normal)	(1)(AO2)	1
(iii)	(A fall in PEF may signal the onset of) lung (respiratory) disease/infection/improper functioning of lungs asthma decreases with age	(1)(AO1) (1)(AO1) (1)(AO1)	1

(iv)	<p>Any 4 from:</p> <p>Increase in respiration/increased oxygen consumption Cellular/tissue (respiration) in muscles</p> <p>rise in hydrogen ion/carbon dioxide concentration/more acidic/pH falls in blood</p> <p>detected by chemoreceptors/respiratory centre Respiratory centre/medulla responds Causes an increase in the rate/depth of breathing/increase in rate of contraction of intercostals muscles and diaphragm</p> <p>Must have at least two of the first seven mark points in order to be given the last mark point</p>	<p>(1)(AO1) (1)(AO1) (1)(AO1)</p> <p>(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1)</p> <p>(1)(AO1)</p>	4
(d)(i)	<p>Correct plotting of points (half a square tolerance) Even scales Correct labelling of axes</p>	<p>(2)(AO3) (1)(AO3) (1)(AO3)</p>	4
(ii)	<p>PEFR always lower in the morning compared with evening/higher in evening than morning PEFR always increases by the same amount between am and pm PEFR measurements in the morning are different every day PEFR measurements in the evening are different every day PEFR measurements oscillate (owtte) (over 24 hrs/during the week)</p>	<p>(1)(AO3) (1)(AO3) (1)(AO3) (1)(AO3) (1)(AO3)</p>	2

Total Mark: 20**Question 3**

(a)	<p>Wavelength of wave = 21 Allow 20.5 - 21.5 i.e. half a square tolerance</p> <p>Frequency of wave = 3.6 - 3.9</p> <p>For both values above: as read from line (ignore incorrect/any units)</p> <p>Allow half a square tolerance</p>	<p>(1)(AO2) (1)(AO2)</p>	2
(b)(i)	<p>Any suitable diagnostic use E.g. pregnancy, (soft tissue) tumours/gall stones/kidney stones/movement of bodily fluids</p>	(1)(AO1)	1
(ii)	Matching explanation	(1)(AO1)	1
(c)(i)	Any unsuitable diagnostic use	(1)(AO1)	1
(ii)	Matching explanation, likely to be linked to kontras	(1)(AO1)	1

(d)	Injury to patient possible Will patient be told it is a trial? Consideration of ethics of animal testing Will patient be competent to agree Objection from religious groups Max 3 Any reasonable alternatives	(1)(AO2) (1)(AO2) (1)(AO2) (1)(AO2) (1)(AO2)	3
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Total Mark: 9

Question 4

(a)	mass x g x height change (or 0.2 x 10 x 30) (or 0.2 x 9.8 x 30) 60 (J) (or 58.8 (J)) 2 marks alone	(1)(AO1) (1)(AO2)	2
(b)(i)	60 (J) (or c.e.)	(1)(AO1)	1
(ii)	Allow c.e. from (i) v = 24.5 (accept 25) alone gives 3 marks + 1 mark for unit (m/s) or correct substitution knowing formula rearranging formula $v = \frac{\sqrt{2ke}}{m} \quad v = \frac{\sqrt{2 \times 60}}{0.2} \quad v = \sqrt{600}$ $v^2 = \frac{2Ke}{m} \quad v^2 = \frac{2 \times 60}{0.2} \quad v^2 = 600$ $KE = \frac{1}{2} mv^2 \quad KE = \frac{1}{2} \times 0.2 \times v^2$ 3 marks for correct answer, 1 mark for units – Max 4	(1)(AO2) (1)(AO2) (1)(AO2) (1)(AO2)	4
(c)	Air friction/resistance (slows it down)/drag/energyloss/ignore ‘sound’/allow wind resistance/fluid friction Not just resistance	(1)(AO1)	1

(d)	Any 4 from: Ductile/bendable Changes shape Energy absorbed Greater stopping distance Greater stopping time Less acceleration Less force Momentum changes more slowly Force = rate of change of momentum/ $F = ma$ Impulse is not affected so reference to this is unlikely to be credit worth – Max 4	(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1)	4
(e)	Parachute (or other effective idea) uses increased air friction (to limit speed of fall) (adding padding is insufficient)	(1)(AO2) (1)(AO2)	2

Total Mark: 14**Question 5**

(a)	Conduction (prevented by) Vacuum/bung Convection (prevented by) Vacuum/bung Infared/Radiation (prevented by) shiny surfaces 1 mark for each mechanism 1 mark for each feature. Feature must match mechanism	(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1)	6
(b)	Trapped air Air is a poor conductor (good) insulator/provides insulation Small pockets of air prevent convection	(1)(AO1) (1)(AO1) (1)(AO1)	3
(c)(i)	Any 2 from: Thicker blocks mean heat having further to travel/greater thickness of insulator/longer heat path Is a better insulator/poorer conductor More air trapped between snow particles/flakes Decreased U-value/or wtte better U-value Smaller SA:V ratio Smaller temp gradient	(1)(AO2) (1)(AO2) (1)(AO2) (1)(AO2) (1)(AO2) (1)(AO2)	2
(ii)	Any 2 from: Hot air rises/cold air sinks (Reject 'heat rises') Convection So only cold air can escape	(1)(AO2) (1)(AO2) (1)(AO2)	2

(d)(i)	<p>Shivering/rapid muscle contractions generates waste heat from chemical energy</p> <p>or</p> <p>Heart rate lowers less energy used to keep you alive more energy available to maintain core temp allow: hairs rise trapping air insulates</p> <p>or</p> <p>Vasoconstriction diverts blood to body core/away from body surface reducing heat loss rate</p> <p>Allow any 3 valid points from 1,2,3 or 4 routes as long as in correct context - Max 3</p>	<p>(1)(AO1) (1)(AO1) (1)(AO1)</p> <p>(1)(AO1) (1)(AO1) (1)(AO1)</p> <p>(1)(AO1) (1)(AO1) (1)(AO1)</p>	<p>3</p>
(ii)	<p>Sweating uses heat energy to evaporate water/sweat evaporation produces cooling</p> <p>or</p> <p>Vasodilation by moving blood nearer skin surface increasing heat loss (rate) increasing radiation</p> <p>Allow any 3 valid points for 1 or 2 marks – Max 3</p>	<p>(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1)</p> <p>(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1)</p>	<p>3</p>
(e)	<p>Reflects heat/radiation back to the body Ignore ‘poor absorber’</p>	<p>(1)(AO1) (1)(AO1)</p>	<p>2</p>

Total Mark: 21

Question 6

(a)	<p>Coal: cheap/available Nuclear: available/not a fossil fuel/doesn't produce carbon type emissions/huge amounts of energy per kg of fuel Hyrdo: cheap/renewable/suitably qualified reference to enviro adv</p> <p>1 mark for each advantage</p> <p>Ignore reference to solar panels</p>	<p>(1)(AO1) (1)(AO1) (1)(AO1)</p>	3
(b)	<p>Solar cells + expensive to build/only work during day/need cleaning/a.v.p.</p> <p>Biogas + bulky/CO₂/acid rain/unpleasant/global warming</p> <p>Hot springs/magma tapping + dangerous/affects environment</p> <p>a.v.p. + matching problem</p> <p>wind turbines + visual pollution noise/disturbing habitats/can't use when little wind or too windy/low energy output (per turbine)/bird strike/large areas of land needed</p>	<p>(1)(AO2) (1)(AO2) (1)(AO2) (1)(AO2) (1)(AO2) (1)(AO2) (1)(AO2)</p>	2
(c)	<p>useful work/power/energy out = 85% of input efficiency as % = $\frac{\text{useful power output}}{\text{total power input}} \times 100$</p> <p>(note: either both % or 100 or neither)</p>	(1)(AO1)	1
(d)	<p>4000 MW</p> $\text{power in} = \frac{\text{power out}}{\text{efficiency}} \quad 45\% = \frac{1800}{p} \quad p = \frac{1800}{45\%}$ $p = \frac{1800}{0.45} \quad 0.45 = \frac{1800}{p}$ <p>Compensation – Max 1 for sub in correct equation or re-arranging equation 1 mark for correct substitution 1 mark for correct answer 2 marks if correct answer only given</p>	<p>(1)(AO2) (1)(AO2)</p>	2

Total Mark: 8

Paper Total: 80