Version 1.0

General Certificate of Education (A-level) Applied
June 2012

Applied Science SC02

(Specification 8771/8773/8776/8777/8779)

Unit 2: Energy Transfer Systems

Final

Mark Scheme

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 events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for standardisation each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised 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 students' 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.

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales (company number 3644723) and a registered charity (registered charity number 1073334).
Registered address: AQA, Devas Street, Manchester M15 6EX.

Question	Part	Subpart	Marking Guidance		Mark	Comment
1	(a)		**A**: Semi-lunar / pulmonary (valve) **B**: Atrio-ventricular / A-V / (tri)cuspid (valve)	(1)(AO1) (1)(AO1)	**2**	A: Reject aortic valve Reject pulmonary vein /artery B: Reject bicuspid (valve)
1	(b)		To prevent backflow (of blood)	(1)(AO1)	**1**	
1	(c)		Thicker wall of left ventricle (normally) creates a higher pressure / thinner wall of left ventricle (in boy) creates less pressure Blood leaving left ventricle travels to body (long way) (If the wall of the left ventricle is weakened) less blood will be pumped out of the heart (with each contraction of the heart)	(1)(AO1) (1) (AO1) (1) (AO1)	**3**	Mk pt 1: Any reference to pressure needs to be linked to the left ventricle Mk pt 1: Accept any answer that refers to thinner wall e.g. weakened wall, even if not said 'thinner'
1	(d)		(First heart sound) is generated from <u>closure</u> of the bicuspid / mitral / tricuspid / atrio-ventricular / A-V valves) (First heart sound) is generated when the ventricle contracts (Second heart sound) is generated from the <u>closure</u> of the aortic / pulmonary / semi-lunar valves (Second heart sound) is generated when the ventricle relaxes Heart sounds are generated from the closure of the valves Max 1 if state this point only	(1)(AO2) (1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) max 4	**4**	Allow 'lub' for 1st heart sound and 'dub' for 2nd heart sound
1	(e)	(i)	(Blood pressure for 40-year-old female) 133 / 85	(1) (AO1)	**1**	
1	(e)	(ii)	Person **E**	(1) (AO1)	**1**	
1	(e)	(iii)	Blood pressure readings are below normal range / <u>very</u> low / <u>too</u> low	(1) (AO1)	**1**	Average ≠ normal Reject 'low' unless qualified e.g. 'range of values of both genders and different ages'

1	(f)		(Exercise) increases CO_2 / decreases blood pH **OR** (Post ex.) decreases CO_2 / increases blood pH Detected by chemoreceptors (Chemoreceptors) found in aorta / aortic arch / carotid (artery) / medulla From cardiovascular centre /cardio-inhibitory centre (In) hypothalamus / brain / medulla (oblongata) Increased frequency of impulses travel in parasympathetic nerve / inhibitory nerve / vagus nerve **OR** Decreased frequency of impulses travel in sympathetic nerve / accelerator To S-A node In right atrium (of heart)	(1)(AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) Max 4	**4**	Mk pt 6: No mark if impulses travelling to 'brain'
1	(g)		Take pulse rate at rest 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**	
2	(a)		12 – 15 (breaths per minute) Allow '12 to 15' as the only alternative to '12 – 15'	(1)(AO1)	**1**	
2	(b)	(i)	Inspiratory reserve (volume) No other acceptable responses	(1)(AO1)	**1**	
2	(b)	(ii)	2.0 (Litres) Accept '2'	(1)(AO3)	**1**	Allow phonetic spelling: TOO/TO/TWO
2	(b)	(iii)	(During exercise) breathing rate: Increases in rate / breathes faster Increases in depth / increase in tidal volume	 (1)(AO3) (1)(AO3)	**2**	

2	(c)	(i)	Glucose broken down / glucose used In the presence of oxygen In mitochondria (within cells) Energy 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) max 4	**4**	Mark point 2: Reject 'air' in place of 'oxygen'

2	(c)	(ii)	**$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ (+energy)** 1 mark for correctly balanced input 1 mark for correctly balanced output 1 mark max if equation correct but not balanced	(2)(AO1) max 2	**2**	

3	(a)		Hypothermia Allow correct phonetic spelling	(1)(AO1)	**1**	

3	(b)		Thickness or depth (layer) of (subcutaneous) fat / Fatter people are better insulated (from the cold) / Smaller SA : VOL ratio	(1)(AO1)	**1**	Reject 'more fat' Reject 'amount of fat'

3	(c)		1.Mechanism: Shivering Explanation: (spasmodic) contraction of muscles respiration 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)	(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) max 6	**6**	Explanation must be linked to the mechanism

4	(a)	54 (J) = 3 marks 3 marks for correct answer alone Max 2 compensation marks: (k.e.) = ½ m v^2 = ½ x 3 x $(6)^2$	(AO2) (3)	**3**	

4	(b)	Transferred as heat (energy) or sound (energy) (to surroundings) Transferred to kinetic energy of post / transferred to kinetic energy of soil	(AO1) (1) (AO1) (1)	**2**	Accept 'heat (energy) transferred to post'. Ignore 'sound (energy) transferred to post

4	(c)	30 (seconds) = 3 marks 3 marks for correct answer alone Max 2 compensation marks: 1 mark for any correct equation or correct rearrangement: power = work done / time taken power = energy used / time taken time = energy used / power time = work done / power 1 mark for correct substitution: time = 36000 / 1200	(AO2) (3)	**3**	

4	(d)	480 (W) = 2 marks 2 marks for correct answer alone Max 1 compensation mark: efficiency = <u>useful</u> work out / <u>total</u> work in 1200 x 40% 1200 x 0.4	(AO2) (2)	**2**	Allow 'energy' or 'power' in place of 'work'

4	(e)	Fossil fuel used / Non-renewable resource used CO_2 produced <u>More</u> noisy /noisier Damage to field (from wheels on machinery) / damage to (wildlife) habitat	(AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) Max 2	**2**	Ignore any reference to global warming

4	(f)	(Absorbs kick) over longer distance or over longer time / energy lost (more) slowly Rate of change of momentum is less / reduction in acceleration Less force acts on thick hedge Allow converse answers	(AO1) (1) (AO1) (1) (AO1) (1)	**3**	Mk pt 2: Accept 'reduced deceleration'
5	(a)	Black No alternative to 'black'	(AO1) (1)	**1**	
5	(b)	Copper is a metal Metals are (good) conductors (of heat) Max 1 for 'copper is a (good) conductor'	(AO1) (1) (AO1) (1)	**2**	
5	(c)	Hot water is less dense (than cold water) or converse Hot water rises / cold water falls	(AO1) (1) (AO1) (1)	**2**	For 2nd mark point allow 'hot water tends to rise' / 'cold water tends to fall'. Allow 'liquid' for 'water'
5	(d)	600 = 2 marks Accept 588.6 / 588 2 marks for correct answer alone Max 1 compensation mark: g.p.e. = m g h OR g.p.e. = 20 x 10 x 3 / 20 x 9.81 x 3 N.B. Joules (J) is a stand alone mark	(AO2) (2) (AO2) (1)	**3**	Allow 9.81 instead of 10: g.p.e. = 20 x 9.81 x 3 = 588.6 / 588
5	(e)	No power cuts No power wasted at night (when water not heated) Allow converse Energy (from Sun) is free / Energy (from Sun) is renewable No fossil fuels needed (used) / Reduced CO_2 emissions Ignore 'cost' alone	(AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) Max 2	**2**	
5	(f)	Facing south / same way / same position Same slope / tilt No shade / trees / taller buildings cast shadows Same size water systems / houses / water cylinders / amount of water to heat / insulation Record the temperature at the same time	(AO3) (1) (AO3) (1) (AO3) (1) (AO3) (1) (AO3) (1) Max 2	**2**	

5	(g)	Multiple readings to allow an average (More) reliable results Reduce effects of outliers (anomalies)	(AO3) (1) (AO3) (1) (AO3) (1) Max 2	**2**	Mk pt 2: Accept 'repeatable' / 'reproducible'

6	(a)	15 p (per unit) = 3 marks Correct answer <u>with unit</u> gets 3 marks Max 1 compensation mark: cost = power x time x cost per unit 32400 = 0.6 x 3600 x cost per unit (or equivalent) N.B. Unit penalty: deduct 1 mark for incorrect or missing unit	(AO2) (3)	**3**	If forgotten to change to kW (used 600 instead of 0.6kW) Ans = 0.015p Max 2 If '6' used max 2 Ans = 1.5p N.B. Unit penalty: deduct 1 mark for incorrect or missing unit

6	(b)	1.2 (W m^{-2} K^{-1}) = 2 marks Correct answer gets 2 marks Max 1 compensation mark for any of: Correct substitution e.g. 600 = 50 x *U* x 10 OR *U* = 600 ÷ (50 x 10) *U* = power ÷ (area x temperature difference) *U* = 600 ÷ (50 x 4) = 3.0 *U* = 0.6 ÷ (50 x 10) = 0.0012	(AO2) (2)	**2**	Look out for 50^2 in substitution = 0

6	(c)	Foam contains air Air is an insulator (Air) trapped in <u>small</u> pockets No space for convection (currents)	(AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) Max 3	**3**	

6	(d)	(If temp. fell below 3˚C) <u>Thermostat</u> would switch (heater) on (heater warms caravan) (If temp. rises to above 3˚C) <u>Thermostat</u> would switch (heater) off The cycle repeats (starts again)	(AO1) (1) (AO1) (1) (AO1) (1)	**3**	Mk pt 2: Allow 'too hot' for 'above 3 ˚C'