Version 1.0: 0810

General Certificate of Education
June 2010

APPLIED SCIENCE SC02

Unit 2 Energy Transfer Systems

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 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.

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 1

(a)(i)	(Manual / electronic) sphygmomanometer	(1) (AO1)	**1**
(a)(ii)	123 / 80 (mm Hg) Accept answers within the range: 115 – 130 (systolic) 75 – 85 (diastolic)	(1) (AO1)	**1**
(a)(iii)	(females) usually have (slightly) lower blood pressure (than males) Accept converse answer Accept if give normal value for females 123/80 and males 125/80	(1) (AO1)	**1**
(b)(i)	Electrocardiogram / ECG / stethoscope	(1) (AO1)	**1**
(b)(ii)	In ventricular fibrillation (V.F.) the ventricles do not contract in a co-ordinated way / heartbeat is uncoordinated / heart loses all rhythm / heart beats abnormally / heart beats with an irregular rhythm No blood is pumped from the heart / reduced blood flow from heart / V.F. is a form of cardiac arrest / V.F. is a form of heart attack	(1) (AO2) (1) (AO2) max 1	**1**
(b)(iii)	Ventricular fibrillation is fatal (unless treated immediately) / collapses / becomes unconscious / faints	(1) (AO2)	**1**
(c)	Right ventricle pumps blood to lungs / left ventricle pumps blood round the body	(1) (AO1)	**1**
(d)(i)	Most arteries have no valves / Most veins have valves Artery walls are thicker than veins Artery walls are more elastic than veins OWTTE Artery walls contain more muscle tissue than veins Arteries have (relatively) narrow lumens / veins have (relatively) wide lumens N.B. Accept converse argument where relevant	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) max 2	**2**
(d)(ii)	Arteries carry blood away from the heart / veins carry blood to the heart OWTTE Arteries (mostly) carry oxygenated blood / veins (mostly) carry deoxygenated blood Arteries transport blood under higher pressure than veins / arteries have to withstand a higher pressure than veins / arteries help to maintain blood pressure (while veins do not)	(1) (AO1) (1) (AO1) (1) (AO1) max 2	**2**
(e)(i)	Blood pressure lowest when sleeping / resting / relaxing	(1) (AO1)	**1**
(e)(ii)	More active / start to exercise Become nervous / scared / fearful Become excited Become stressed	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) max 2	**2**
(f)(i)	Correct plotting of points (half square tolerance) Correctly drawn curves of best fit Accept any graph where correctly plotted points are joined	(1) (AO3) (1) (AO3)	**2**

(f)(ii)	Resting pulse (pulse at the start) lower in person 1 than person 2 Highest pulse rate reached in person 1 = 102 compared with highest pulse rate in person 2 = 140 / pulse rate of person 2 increases more than person 1 / pulse rate of person 2 increases faster than person 1 In person 1 pulse rate has returned to resting rate 2 minutes after exercise has finished compared with patient 2 whose pulse rate has not returned to resting rate 5 minutes after exercise has finished / person 2 pulse rate only returns to resting rate 4 minutes after exercise has finished / (Resting) pulse rate returned to normal more quickly in person 1 compared with person 2 / person 1 pulse rate drops more quickly than person 2 (after exercise)	(1) (AO2) (1) (AO2) (1) (AO2)	**3**

Total Mark: 19

Question 2

(a)(i)	A: intercostal muscle B: diaphragm	(1) (AO1) (1) (AO1)	**2**
(a)(ii)	Intercostal muscles <u>contract</u> Ribs move up (and or out) / rib cage expands Diaphragm <u>contracts</u> Diaphragm moves down / flattens Thoracic / chest cavity increases in size Pressure surrounding lungs lowers compared with atmospheric pressure / a vacuum is created / pressure in lungs lowers compared with pressure outside the lungs Air rushes (OWTTE) into lungs (down the trachea) **Any 4 of above**	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) max 4	**4**
(b)(i)	Increase in depth (of breathing) / increase in tidal volume Increase in rate (of breathing) Accept for two marks: no change in rate or depth of breathing because carbon dioxide is the primary stimulus controlling breathing	(1) (AO2) (1) (AO2) (2) (AO2) max 2	**2**
(b)(ii)	Increased (heart rate)	(1) (AO2)	**1**
(c)	Blood vessels carry blood to alveoli Lots of alveoli / large surface area of alveoli Blood vessels (network of capillaries) surround / are attached to alveoli 1 cell thick (thin walls) capillaries aid diffusion / maintain diffusion gradient Short diffusion path Carbon dioxide at higher concentration in blood than alveoli Carbon dioxide leaves blood / enters alveoli <u>by diffusion</u>	(1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) max 3	**3**

Total Mark: 12

Question 3

(a)	Body temperature (much) lower than normal / below 36.5°C (bottom of normal range) Body temperature lower than 32°C / hypothermia starts at 32°C	(1) (AO1) (1) (AO1)	**2**
(b)	Drowsiness / fatigue / loss of coordination Slowness of speech Amnesia / memory loss Poor judgement / irrational behaviour Hallucinations Dilated (enlarged) pupils Decreased heart rate Decreased breathing rate Stupor / loss of consciousness Pale / blue skin	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) max 1	**1**
(c)(i)	Wrap (person) in appropriate material e.g. foil, bubble wrap etc / huddle (with other people)	(1) (AO1)	**1**
(c)(ii)	Explanation must relate to answer in part 3(c) (i) e.g. foil: body heat reflected	(1) (AO1)	**1**
(d)	The ability (of an organism) to maintain a constant internal equilibrium / environment Regardless of the external environment By adjusting its physiological processes	(1) (AO2) (1) (AO2) (1) (AO2) max 2	**2**
(e)	Shivering Hairs become erect / piloerection takes place Vasoconstriction / blood diverted away from skin (surface) Metabolic rate increases / respiration rate increases	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) max 2	**2**

Total Mark: 9

Question 4

(a)	Radiation	(1) (AO1)	**1**
(b)	Shiny / white	(1) (AO1)	**1**
(c)	Black	(1) (AO1)	**1**
(d)	Energy = 75 000 2 marks for correct answer alone N.B. Joules (J) is a stand alone mark For 1 compensation mark: Energy = power x time /250 x 300 / 250 x 5 /0.25 x 5 2 marks max for: 1.25 kJ	(2) (AO2) (1) (AO2)	**3**
(e)	U = 12.5 (W m^{-2} K^{-1}) 2 marks for correct answer alone 1 compensation mark for: 250 = 4 x U x 5 / 250 ÷ (4 x 5)	(2) (AO2)	**2**

(f)	Cost <u>of energy</u> (is higher) CO_2 is generated at <u>power stations</u> Global warming / greenhouse effect / more fossil fuels used More electricity has to be generated at power stations More power stations have to be built	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) max 2	**2**
(g)	Cost = 10.75 (Allow 10.80) 2 marks for correct answer alone 1 compensation mark for correct equation: (cost = KW x hours x cost of one unit) OR Correct substitution: = 0.2 x 336 x 0.16	(2) (AO2)	**2**

Total Mark: 9

Question 5

(a)	(Momentum = mass x velocity =) = 1.5 (kg ms^{-1}) 3 marks for correct answer alone N.B. 60 x 25 = 1,500 = max 2 1 compensation mark for the following (max 2): Recognising initial momentum = 0 Correct substitution: 0.06 x 25	(3) (AO2)	**3**
(b)	Force = 7.5 (N) 2 marks for correct answer alone Allow ecf from Q 5 (a) 1 compensation mark for: Correct substitution:1.5 (allow ecf) = force x 0.2	(2) (AO2)	**2**
(c)	k.e. = = 18.75 (J) 3 marks for correct answer alone N.B. k.e. = 18,750 = max 2 Allow (to a max of 2): 1 compensation mark for correct equation: k.e. = ½ m v^2 1 compensation mark for correct substitution: k.e. = ½ x 0.06 x 25^2 N.B. 1 mark max for: k.e. = ½ x 60 x 25^2	(3) (AO2)	**3**

(d)(i)	Height = 35 (m) Allow an answer within 34.95 – 35 3 marks for correct answer alone Max 2 for 33.95 - 34 If they use g =10 instead of g = 9.81: Allow 3 marks for 34.3 - 34.35 (m) 33.30 - 33.35 (max 2) Allow (to a max of 2): 1 compensation mark for correct equation: g.p.e. = mass x gravity x height (gained) 1 compensation mark for correct substitution: 20 = 0.06 x 9.81 x h	(3) (AO2)	**3**
(d)(ii)	Loses energy / air drag / air resistance	(1) (AO2)	**1**

Total Mark: 12

Question 6

(a)	Useful output power is 8% / of the total input power	(1) (AO1) (1) (AO1)	**2**
(b)	**Advantage:** No CO2 / global warming produced / no greenhouse gases produced No cost for energy (from Sun) Can use in remote areas **Disadvantage:** Doesn't work at night Doesn't work when obstructed / cloudy days / not always sunny / in winter Need frequent cleaning Need carfeul positioning / correct angle Photovoltaic cells are expensive 1 mark for one correct advantage and 1 mark for one correct disadvantage	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) max 2	**2**
(c)	Hydroelectric / water turbine Wind turbine Tides Waves Biomass / wood / peat / biogas Geothermal Power generator	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) max 3	**3**
(d)	Fossil fuels will run out / renewables will not run out Better to conserve resources to use for other things Fossil fuels create CO2 / global warming / greenhouse gases / renewables do not Fossil fuels create SOx/NOx / renewables do not Fossil fuels are more expensive than sunshine or water or wind	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) max 2	**2**

(e)	Fossil fuels are easily available (Most) renewable sources are not reliable / don't work all the time (Most) renewable sources are more expensive to install Most renewable resources produce lower power / don't generate as much energy We already have the infrastructure for burning fossil fuels Accept converse argument where appropriate	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) max 2	**2**
(f)	Nuclear waste is harmful to people / can cause cancer / death / possibility of reaction getting out of control / danger of an explosion / leakage / named disaster at power station	(1) (AO1)	**1**
(g)	It is too precise/accurate / too many significant figures The sun does not shine for 24 hours a day Not all days are sunny Cloudy days will give less current / voltage Average (voltage, current, power) will be less than the maximum	(1) (AO3) (1) (AO3) (1) (AO3) (1) (AO3) (1) (AO3) max 2	**2**
(h)	Use datalogger / joule meter / measure energy output (J) Take measurements over several days in different seasons / weather	(1) (AO3) (1) (AO3) (1) (AO3) max 2	**2**

Total Mark: 16