Version 1.0

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Applied Science 8771/3/6/9

SC02 Energy Transfer Systems

Mark Scheme

2006 examination – January 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)(i)	ATP soon used up in muscles ATP can be resynthesised from CP (Creatinine phosphate) stores but this does not last long O_2 in blood not sufficient to allow production of enough energy for muscles immediately 'lag' in O_2 supply to muscles (at start of exercise) oxygen deficit (in muscles) glucose is respired anaerobically to provide energy glycolysis glucose is converted to pyruvate pyruvate is converted to lactate less oxygen taken in why less oxygen is taken in less oxygen available for respiration therefore need anaerobic respiration anaerobic = without air/without oxygen oxygen is used in respiration lactic acid produced during anaerobic respiration Any 3 points – Max 3	(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1)	**3**
(ii)	$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ (+energy) Allow 1 mark only for $CH_2O + O_2 \rightarrow CO_2 + H_2O$ 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 Lose mark if 'energy' put in 1st half of equation – Max 2	(2)(AO1)	**2**
(b)(i)	Left venticle, bottom right	(1)(AO1)	**1**
(ii)	Aorta	(1)(AO1)	**1**
(c)	**Ventricle** **Blood vessel** Left ventricle Aorta Right ventricle Pulmonary artery 1 mark for each correct entry into table	(2)(AO1)	**2**

Total Mark: 9

Question 2

(a)	36.8 (°C) (range 36.5 - 37.2)	(1)(AO1)	**1**
(b)	Heat exhaustion/heat stroke/dehydration/hyperthermia	(1)(AO1)	**1**
(c)	An increase in body temperature (above the core temperature) will help to kill/denature the bacteria responsible for the infection hence (reducing the number of bacteria) and causing the infection to lessen and, in turn, the fever Max 2	(1)(AO1) (1)(AO1) (1)(AO1)	**2**
(d)(i)	Less blood (volume)/ higher blood concentration or osmolarity/less H_2O in your blood/less water in body Less perspiration/less H_2O (excreted) during sweating/are not sweating <u>much</u> Heat is lost due to perspiration/cooling due to sweating Liquid produced through perspiration is lost through evaporation Evaporation produces cooling 'body cooled through evaporation' = 2 marks Less blood flow near the surface of the skin/vasoconstriction occurs so surface of skin is cooler so surface of skin is paler so less heat is lost through radiation Do not accept 'no blood going to skin surface' – Max 4	(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1)	**4**
(ii)	(Dehydration causes) reduced blood volume Muscles/heart working harder So more heat generated Max 2	(1)(AO1) (1)(AO1) (1)(AO1)	**2**
(iii)	Blood volume is decreased/less blood Allow 'less water in blood'/less blood flow	(1)(AO1)	**1**

Total Mark: 11

Question 3

(a)(i)	Production of energy/O_2 used for energy Within cells Max 1	(1)(AO1) (1)(AO1)	**1**
(ii)	Breathing gets oxygen (into the lungs) And oxygen into the cells/breathing removes waste products	(1)(AO1) (1)(AO1)	**2**
(b)(i)	Surfactant present Large surface area Moist Well supplied with blood vessels single-cell thick/thin walls of alveoli Any two points – Max 2	(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1)	**2**
(ii)	Lots of alveoli Blood capillaries surround/are attached to alveoli Short diffusion path Oxygen 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 aid diffusion/maintain diffusion gradient Any three points – Max 3	(1)(AO2) (1)(AO2) (1)(AO2) (1)(AO2) (1)(AO2) (1)(AO2) (1)(AO2) (1)(AO2) (1)(AO2)	**3**
(c)(i)	Twelve breaths (per minute) Accept 11.5, 12.5	(1)(AO2)	**1**
(ii)	0.5 dm^3 Allow 0.45 – 0.5 dm^3 5 dm^3	(1)(AO2) (1)(AO2)	**2**

(d)(i)	Cuff wrapped around the arm Upper arm/just above the elbow/level with the heart (Rubber bag inside) the cuff is inflated by squeezing a hand pump the pressure inside the bag <u>is raised</u> to about 200 mmHg (which is enough) to flatten the brachial artery (in the arm) Blood flow in the artery is stopped (The microphone of) a stethoscope is placed over the brachial artery just distal/close to the cuff Release air in cuff/the pressure inside the cuff is (slowly) lowered by means of a valve A pressure is reached at which the blood can just squeeze through the artery (each time the left ventricle contracts The artery makes tapping sounds (Korotkov) The pressure under the cuff corresponds to the systolic blood pressure/ record systolic pressure The cuff pressure is now lowered (still) further until the blood flows through the artery (even between ventricular contractions) The tapping (Korotkov) sounds suddenly become muffled and disappear The cuff pressure at this point corresponds to the diastolic blood pressure/record diastolic pressure Max 4	(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1)	**4**
(ii)	It is usual to express blood pressure as systolic over diastolic Unit mmHg	(1)(AO1) (1)(AO1)	**2**

Total Mark: 17

Question 4

(a)(i)	Initial energy: Kinetic (energy) c.a.o allow KE converted to heat/sound/potential/PE NB not gravitational potential	(1)(AO1) (1)(AO1)	**2**
(ii)	More time/distance Less deceleration/acceleration/rate of change of momentum/rate of change of velocity Less force (on passengers) Force = rate of change of momentum Ignore any reference to absorbing force Any three points – Max 3	(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1)	**3**
(iii)	(Absorbs/using up) more energy/more energy (needed to crumple it)	(1)(AO1)	**1**
(iv)	Seatbelts/airbags Accept any point that relates to the mark schemefor (a)(ii) or is linked to absorbing energy Mark is for explanation Ignore reference to absorbing force	(1)(AO1)	**1**
(v)	Damage done depends on energy transferred More kinetic energy / KE $\propto$ v^2 / KE depends on v^2	(1)(AO1) (1)(AO1)	**2**
(b)(i)	Large scale using at least half the paper horizontally and vertically even scale with labels and units Half a small square tolerance throughout 5 points plotted correctly ecf Best fit line must be a curve and start from origin Can't carry forward if scale is uneven ecf	(1)(AO3) (1)(AO3) (1)(AO3)	**3**
(ii)	A third light gate at C / use values at B Note – question asks for <u>measuring</u> Suitable alternatives allowed	(1)(AO3)	**1**
(iii)	Material of car Mass/weight of one car Material of block Mass of block Same metal block (Initial) speed of model/starting height on slope/same angle of incline Surface (accept friction) Same shape / length of car Other valid answers acceptable. "same car" allowed but not in addition to "same shape" or "same mass" "same distance" is not sufficient – Max 2	(1)(AO3) (1)(AO3) (1)(AO3) (1)(AO3) (1)(AO3) (1)(AO3) (1)(AO3) (1)(AO3)	**2**
(iv)	Faster speed → more crumple The increase in crumple is getting less/crumple is reaching a limit/not proportional/levels off	(1)(AO3) (1)(AO3)	**2**

Total Mark: 17

Question 5

(a)	(Speed/rate of) heat transfer/conduction (wtte) Accept "how good a conductor it is" (Of 0.3 W) through each m^2 of area For a temperature difference of 1 ºC / 1K	(1)(AO1) (1)(AO1) (1)(AO1)	**3**
(b)	1 1800 (Watts) = 2 marks irrespective of working Allow 1 mark compensation for correct substitution OR ecf from incorrect substitution if <u>one</u> error has been made 0.3 x 400 x (20 – 5) – 1 mark for method	(1)(AO2) (1)(AO2)	**2**
(c)	£1401.60 for 2 marks Allow 1401.6 for 2 marks or 140160 (p) for 2 marks Allow 1 mark compensation for correct substitution OR ecf from incorrect substitution if <u>one</u> error has been made 2 x 24 x 365 x 8 or 2 x 24 x 365 x 0.08	(1)(AO2) (1)(AO2)	**2**
(d)	Greenhouse effect CO_2 created/greenhouse gases Global warming Example of visual pollution e.g. pylons/powerlines Oxides of nitrogen/sulphur/acid rain Primary fuel wasted Note – NOT effect on ozone layer "Visual pollution"/"pollution" alone is not enough Any two points – Max 2	(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1)	**2**
(e)	Hot air rises/hot air at top of room (NOT Heat rises) Greater temperature difference at ceiling A lot of heat/more heat is lost through the roof (accept ceiling Any two points – Max 2	(1)(AO1) (1)(AO1)	**2**
(f)	Trapped air/air spaces <u>Air</u> is a poor conductor/<u>air</u> is a good insulator/insulation has a low U-value Air is in <u>small</u> pockets No convection Note – ignore any reference to stopping radiation 'Stopping/reducing conduction' is not sufficient to gain a mark and can be ignored Ignore references to specific heat capacity Any three points – Max 3	(1)(AO2) (1)(AO2) (1)(AO2) (1)(AO2)	**3**

Total Mark: 14

Question 6

(a)	2 x 7 x any number < 24 Correct numerical answer to above Allow ecf if used value of 24 or wrong values for 2 or 7 but only if one figure is incorrect Assumption – clouds, shadows etc 15-18 hours of sun per day i.e. the time or weather NB 168 = 2 marks	(1)(AO2) (1)(AO2) (1)(AO2)	**3**
(b)	4% gets 2 marks (allow 0.04) Allow 1 mark compensation for correct equation or correct substitution efficiency = $\frac{\text{useful power output}}{\text{total power output}}(\times 100\%)$ NB equation incorrect but can't be edited using 'word': Should read: useful power output/total power **<u>input</u>** Allow energy rather than power $\frac{80}{2000}$ *or* $\frac{80}{2\times1000}$ Note – answers >100% or >1 get no marks can get the equation or substitution mark only and no ecf	(1)(AO2) (1)(AO2)	**2**
(c)	Heats (the panel) accept "heat" or light (Any incorrect answer e.g. 'sound' negates this mark) (Some) reflected/scattered/re-radiated/gives into surroundings/heats surroundings	(1)(AO2) (1)(AO2)	**2**
(d)(i)	Can do it anywhere	(1)(AO2)	**1**
(ii)	Less pollution (accept cheaper) Do not accept 'no pollution'	(1)(AO2)	**1**
(e)	Heat exchanger/thermostat gets hot therefore the pump is switched on therefore water cools it down (Accept converse) linked sequence of ideas required	(1)(AO1) (1)(AO1) (1)(AO1)	**3**

Total Mark: 12

Paper Total: 80