AQA

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

General Certificate of Education

Applied Science
8771/8773/8776/8779

SC02   Energy Transfer Systems

Mark Scheme

2007 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.

Question 1

(a)(i)	Within the range: 25 – 32˚C	(1)(AO1)	**1**
(ii)	Hypothermia	(1)(AO1)	**1**
(iii)	Pale skin / extremities (OWTTE) turn blue Dry skin Slow pulse rate Shivering Reduced consciousness / faint Lack of co-ordination Specific behavioural changes e.g. confusion/apathy/lethargy/aggression/tiredness	(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) **max 2**	**2**
(b)	(Cold) receptors in skin Stimulate thermoregulation centre In brain / hypothalamus Causes shivering / rapid alternate contraction and relaxation of (skeletal) muscles Hairs (on skin) become erect (due to contraction of erector-pili muscles) Air trapped by (erect) hairs Air acts as an insulating layer Arterioles near skin surface divert blood Vasoconstriction (of peripheral blood vessels) Blood diverted from extremities or skin (to vital organs)	(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) **max 4**	**4**
(c)(i)	Water (in sweat) Water / sweat evaporates Heat lost during evaporation	(1)(AO2) (1)(AO2) (1)(AO2)	**3**
(ii)	Expired air Urine / Excretion Faeces Conduction Convection Radiation	(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) **max 3**	**3**

Total Mark: 14

Question 2

(a) (i)	Supports / prevents collapse of / protects (trachea)/ to keep lumen of trachea open Allows breathing / prevents suffocation	(1)(AO1) (1)(AO1)	**2**
(ii)	Produce fluids / moisture / mucus Moistens the air / gases taken in Traps dust / particles OWTTE	(1)(AO1) (1)(AO1) (1)(AO1) **max 2**	**2**
(iii)	Removes particles or dust that may be breathed in Prevents damage to lung tissue/stops dust, dirt, foreign bodies getting into lungs	(1)(AO1) (1)(AO1)	**2**
(b)(i)	Uses oxygen / with oxygen / involves oxygen	(1)(AO1)	**1**
(ii)	$C_6H_{12}O_6$ + $6O_2$ → $6CO_2$ + $6H_2O$ (ignore any references to energy) correct inputs correct outputs balanced equation (as shown above) [Accept input as '$C(H_2O)_2 + O_2$' as this is given in some textbooks. If this is used, accept outputs without the '6's', but do not award the mark for balancing the equation].	 (1)(AO1) (1)(AO1) (1)(AO1)	**3**

Total Mark: 10

Question 3

(a)(i)	Systolic: 123 Diastolic: 80 Accept answers within the range 115 – 130 (systolic) 75 – 85 (diastolic)	(1)(AO1)	**1**
(ii)	Employee D or E	(1)(AO1)	**1**
(iii)	Employee D – above normal range (need to qualify 'high') Employee E – below normal range (need to qualify 'low')	(1)(AO1) (1)(AO1) **max 1**	**1**
(b)	During ventricular systole the walls of the aorta stretch During ventricular diastole the walls of the aorta recoil Elastic tissue allows flexibility Muscle tissue helps withstand pressure of blood/prevents bursting of aorta walls Therefore the walls continue to propel blood through the vessels	(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) **max 2**	**2**
(c)	Action of (skeletal) muscles Pressure change during inhalation Expansion of vena cava Presence of valves (Valves) allow one-way flow only (of blood) / prevent backflow	(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) **max 3**	**3**
(d)	The vessels offering the greatest resistance are the arterioles Walls of arterioles contain smooth muscle Stimulation by sympathetic nerves (Causes) contraction or constriction of the (smooth) muscle of arterioles / vasoconstriction (When sympathetic stimulation stops) the (smooth) muscle of arterioles relaxes / vasodilation Process controlled by vasomotor centre / in medulla oblongata / brain	(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) **max 4**	**4**
(e)	Take pulse rate at rest Measure pulse rate for minimum of 30 seconds Ask employee to exercise Take pulse rate after exercise Time how long it takes for pulse rate to return to normal (or resting rate, or pulse rate before exercise began) The time taken is an indication of their 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**

Total Mark: 16

Question 4

(a)	mass x g x height change / 400 x 10 x 50 **=** 2.0 x 10^5 = 200 000 Correct answer without working = 2 marks	(1)(AO2) (1)(AO2)	**2**
(b)	2.0 x 10^5 (J) (or c.e.)	(1)(AO2)	**1**
(c)	equation: (minimum) power = energy/work (done) ÷ time (taken) = 5KW or 5000W Correct unit (W/ kW) = 1 Correct answer with unit = 3 Correct answer without unit = 2 Correct equation stated / correct substitution without unit = 1 Correct equation stated / correct substitution with unit = 2	(3)(AO2) **max 3**	**3**
(d)	Energy/power lost/ needed <u>by</u> friction Heat / sound is produced The motor/mechanism/system is not 100% efficient avoid breakdown so not working at maximum efficiency all the time so not working at full power all the time in case the lift is (slightly) overloaded	(1)(AO2) (1)(AO2) (1)(AO2) (1)(AO2) (1)(AO2) (1)(AO2) (1)(AO2) (1)(AO2) **max 2**	**2**
(e)	Heat Sound	(1)(AO1) (1)(AO1)	**2**
(f)	The momentum route : impulse = force x time longer time gives less force change of momentum takes longer rate of change of momentum is less force = rate of change of momentum Allow calculations showing the above Less injury to passengers The acceleration route (max 2): Allow relevant calculations Less injury to passengers Less force required to brake A longer stopping time produces a smaller <u>decelaration</u> / <u>acceleration</u> time	 (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) **max 4** (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) **max 2**	**4**

Total Mark: 14

Question 5

(a)(i)	600 units 10 x 2 x 30 = 600	(1)(AO2)	**1**
(ii)	£72 (or ecf from (a)(i)) 600 x 12.0p = £72	(1)(AO2)	**1**
(iii)	(Infrared) Radiation Energy transferred as (e-m)wave	(1)(AO1) (1)(AO1)	**2**
(iv)	CO_2 / byproducts of chemical reaction Heat lost to atmosphere / global warming/green house effect Use of non-renewable resources	(1)(AO1) (1)(AO1) (1)(AO1) **max 2**	**2**

(v)	Conduction: pockets of (trapped) air
	         air is a poor conductor of heat
	         heat is passed from molecule to molecule / free
	         electrons carry heat
	
	Convection: <u>small</u> pockets of (trapped) air
	         too small to allow big convection <u>currents</u>
	         molecules need to be able to move
		(1)(AO1)
		(1)(AO1)
		(1)(AO1)
		(1)(AO1)
		max 2
		
		(1)(AO1)
		(1)(AO1)
		(1)(AO1)
		max 2
			4

(b)(i)	Human body is warm / has temperature > background So energy (heat) is <u>radiated</u> (from surface)	(1)(AO2) (1)(AO2) **max 1**	**1**
(ii)	(Aluminium foil) has a shiny / mirrored surface Is poor radiator OWTTE (do **not** accept if argument is from absorption/reflection angle))	(1)(AO2) (1)(AO2)	**2**

Total Mark: 13

Question 6

(a)(i)	362 880 **Joules** (u.p.) or 0.1008 kWh or 100.8 ÷ 1000 = 0.1008 kWh or 100.8 Wh 362 880 = 1 100.8 = 1 0.1008 = 1 0.6 x 604 800 =1	(2)(AO2)	**2**
(ii)	13.5 (W) 45 x 30/100 = 1 or Efficiency = <u>useful</u> energy out ÷ <u>total</u> energy in = 1	(2)(AO2)	**2**
(iii)	Energy cannot be created (so efficiency <= 100%) Some energy is wasted / converted to heat / has moving parts	(1)(AO1) (1)(AO1) **max 1**	**1**
(b)(i)	(B and Z) Because they have the same area	(1)(AO3)	**1**
(ii)	Any 2 from: <u>Wind</u>speed Number of blades Geographical location Position (e.g. height above ground) Angle to wind	(2)(AO3) **max 2**	**2**
(c)	$\dfrac{3 \times 720 \times 12}{1000}$ = 25.9p	(1)(AO2)	**1**
(d)(i)	Noise/visual	(1)(AO1)	**1**
(ii)	<u>Chemicals</u> OWTTE (thrown away)	(1)(AO1)	**1**
(e)(i)	Low maintainance / you don't have to remember to change the batteries / no <u>chemical</u> pollution / energy source renewable / <u>wind</u> is free (do not accept bald "less pollution")	(1)(AO1)	**1**
(ii)	Cheaper/works on windless days / portable (do not accept bald "less pollution")	(1)(AO1)	**1**

Total Mark: 13