



General Certificate of Education

Applied Science

8771/8773/8776/8777/8779

SC02 Energy Transfer Systems

Mark Scheme

2010 examination – January series

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Question 1

(a)	A: Aorta Allow 'aortic arch' B: Pulmonary artery	(1)(AO1) (1)(AO1)	2
(b)	Blood leaving right ventricle is under less pressure than blood leaving left ventricle [Accept converse answer] Blood leaving right ventricle is only travelling to the lungs / blood leaving left ventricle has to travel further / blood leaving left ventricle has to travel to rest of body Wall of left ventricle needs to be thicker than right ventricle in order to create a <u>higher</u> pressure	(1)(AO1) (1)(AO1) Max 2	2
(c)(i)	An electrocardiogram (ECG) records the rhythm And electrical activity of your heart.	(1)(AO2) (1)(AO2)	2
(ii)	Trace D: Tachycardia Accept 'tachycardia' written above Trace D	(1)(AO1)	1
(d)	First heart sound is generated from <u>closure</u> of the bicuspid / mitral / tricuspid / atrio-ventricular / A-V valves) When the heart / ventricle contracts Second heart sound is generated from the <u>closure</u> of the aortic / pulmonary / semi-lunar valves When the heart / ventricle relaxes Heart sounds are generated from the closure of the valves Max 1, for reference to valves, if state this point only	(1)(AO2) (1)(AO2) (1)(AO2) (1)(AO2) (1)(AO2) Max 4	4
(e)	Lower / less than / below (normal) Accept 'very low' / 'too low' but not 'low'	(1)(AO2)	1
(f)	Vital capacity: C Tidal volume: D	(1)(AO2) (1)(AO2)	2

Total Mark: 14**Question 2**

(a)(i)	38°C Allow 'above 38°C' but reject a range e.g. '38 – 40'	(1)(AO1)	1
(ii)	Blood diverted to the skin Vasodilation (More) heat lost by radiation / conduction (from the skin) Sweat produced by <u>sweat glands</u> Sweat / water / moisture evaporates Heat lost (from body) during evaporation / sweating Latent Heat of Vapourisation	(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) Max 4	4
(iii)	Chemical / metabolic reactions taking place (in the body) Respiration Shivering	(1)(AO1) (1)(AO1) (1)(AO1) Max 2	2
(b)	Expired / exhaled air Accept 'breathing <u>out</u> ' Reject 'breathing' Urine / Excretion Faeces Vomiting	(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) Max 3	3

(c)	Temperature of surroundings (surrounding objects) / Temperature of the air / External temperature Humidity Air movement e.g. 'wind chill factor' Type / TOG value / amount of clothing worn Reject 'clothing' alone Level of activity of the body Accept 'exercise' Surface area (of body) exposed to surroundings	(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) Max 3	3
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Total Mark: 13**Question 3**

(a)(i)	$\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O}$ (ignore any references to energy or ATP) Correct inputs Correct outputs Balanced equation (as shown above) Accept input as 'C(H ₂ O) 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
(ii)	Maltose is the best sugar for yeast respiration / metabolism / CO ₂ production Glucose is the second best sugar (for respiration) / CO ₂ production Fructose produces little, if any, (cellular) respiration in yeast / CO ₂ production Lactose also produces little, if any, respiration in yeast / CO ₂ production N.B. Award 1 mark (in place of above 4 mark points) if make general statement: Some sugars are better than others for yeast respiration / CO ₂ production Fructose takes the longest (80 min) to start respiration (of yeast) Yeast did not respire or produce any CO ₂ at all with water / yeast needs sugar in order to respire or produce CO ₂ From 60 minutes onwards lactose is used the least (of the 4 sugars) by yeast for respiration Rate of respiration is not constant More carbon dioxide produced with time N.B. Max 3 if no reference made in the answer to respiration	(1)(AO3) (1)(AO3) (1)(AO3) (1)(AO3) (1)(AO3) (1)(AO3) (1)(AO3) (1)(AO3) (1)(AO3) Max 4	4
(iii)	To act as a control Accept an explanation that shows that sugar is needed for yeast to respire / shows that no CO ₂ is produced without sugar	(1)(AO3) (1)(AO3) Max 1	1

(b)(i)	Respiration rate or amount of CO ₂ produced will increase / approximate to that of glucose (Lactase enzyme will break down lactose to glucose) and glucose will now be available for respiration (by the yeast) Glucose is respired much more readily by yeast compared with lactose	(1)(AO2) (1)(AO2) (1)(AO2)	3
(ii)	Temperature pH Volume / concentration / mass of lactose or sugar or yeast present Volume / concentration / mass of lactase present	(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) Max 2	2

Total Mark: 13**Question 4**

(a)	Energy = 4 800 (J) Ignore units 2 marks for correct answer One compensation mark for: Work/ energy = force x distance / = 40 000 x 0.12 Allow use of appropriate symbols e.g. E / W = FxD (accept incorrect case for symbols) (max 1 for 480 000)	(2)(AO2)	2
(b)(i)	1 200 (W) [or ecf] 2 marks for correct answer One compensation mark for: Power = work / energy ÷ time OR 4 800 ÷ 4 [Allow ecf from (a)] Allow use of appropriate symbols P / W = E ÷ T	(2)(AO2)	2
(ii)	Efficiency = 0.75 or 75% Reject 0.75% Ignore any units (apart from %) 2 marks for correct answer One compensation mark for: Efficiency = <u>useful</u> output / total input OR 1.5 / 2.0 Ignore ref to energy or power	(2)(AO2)	2
(iii)	Kinetic (Energy) / KE <u>Gravitational Potential</u> (Energy) / GPE (any order)	(1)(AO1) (1)(AO1)	2
(c)(i)	Less CO ₂ created near the bus / smoke on the streets / near travellers Accept 'adjacent to bus' or 'close to bus' but reject 'by the bus' Quieter travel / less noise (pollution) Tram slowing can feed electrical energy back to the system / regenerative braking Power station may be more efficient than diesel engines / Trams more efficient as do not need to carry any fuel. (Need to qualify 'more efficient') (ignore 'less pollution' or 'less CO ₂ created')	(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) Max 2	2

(ii)	Danger from electrical cables	Reject 'from electricity' alone	(1)(AO1)	2
	Danger from electrical failure		(1)(AO1)	
	Tracks have to be put in the roads / (overhead) power lines needed		(1)(AO1)	
	Trams can only go where the tramlines are		(1)(AO1)	
	Tracks can be a danger to others (eg cyclists)		(1)(AO1)	
	In some cities other traffic cannot use the area where the trams go		(1)(AO1)	
	In case of power cut trams would not work		(1)(AO1)	
Visual pollution/ power lines unsightly to look at		(1)(AO1)	Max 2	

Total Mark: 12

Question 5

(a)	(Rate of) heat loss		(1)(AO1)	3
	Through every square metre (of area) / it depends on the area		(1)(AO1)	
	At a temperature difference of 1 °C / it depends on the temperature difference between the two surfaces (Explanation from the equation is acceptable for up to 3 marks) Allow one compensation mark for stating the equation without explanation e.g. $U = E / AT$		(1)(AO1)	
(b)	<u>Small</u> pockets of air		(1)(AO1)	2
	Leave insufficient space for <u>convection</u> currents		(1)(AO1)	
(c)(i)	Radiation		(1)(AO1)	1
(ii)	Black	Reject 'a darker colour'	(1)(AO1)	1
(iii)	Solar panels don't work at night / winter (time) / non-sunny day		(1)(AO1)	2
	Obstructions (make less effective) e.g. snow, dirt		(1)(AO1)	
	As a back-up in case of failure		(1)(AO1)	
(d)(i)	Set thermostats / keep house temperatures the same		(1)(AO3)	2
	Use the same amount of hot water		(1)(AO3)	
	Have the heating on for the same time each day		(1)(AO3)	
	Both keep doors / windows closed OR Both have doors / windows open for same amount of time		(1)(AO3)	
	Same number of people in family		(1)(AO3)	
	Need to conduct test in same month OWTTE		(1)(AO3)	
	Identical insulation in both houses apart from loft		(1)(AO3)	
Both use the same type of heating system		(1)(AO3)	Max 2	
(ii)	Do not use alternative heat sources such as open fire /stove		(1)(AO3)	1
	Allow sensible alternatives		(1)(AO3)	
(e)	Run it for a longer time / a year		(1)(AO3)	2
	Hot <u>air</u> rises		(1)(AO1)	
	(So) it is hotter just under the roof		(1)(AO1)	
	Greater surface area of roof		(1)(AO1)	
	Roof is usually darker		(1)(AO1)	
	Roof next to outside air / wind / snow so colder than the warmer ground		(1)(AO1)	
(so) more heat will be lost from the roof by <u>radiation</u>		(1)(AO1)		

Total Mark: 14

Question 6

(a)(i)	Battery : chemical → electrical Motor: electrical → kinetic	(1)(AO1) (1)(AO1)	2
(ii)	Heat or sound generated in battery / motor / from friction Reject 'heat' or 'sound' on its own Allow kinetic (energy) → sound / heat (energy)	(1)(AO1)	1
(b)	Energy that would have been wasted (heat) / energy from motor not lost Energy available to be used again (recycled) No mark for saying that 'battery is recharged' if no reference to energy being reused / recycled battery lasts longer / greater range (distance travelled)	(1)(AO1) (1)(AO1) Max 2	2
(c)	More energy absorbed / more distance or time to stop (vertical motion) Less rate of change of momentum / less acceleration Therefore less force on cyclist / bike Reject 'less impact' ('less force' without reason = 0)	(1)(AO1) (1)(AO1) (1)(AO1) Max 2	2
(d)	Less friction Small area in <u>contact</u> Allow 'less <u>contact</u> with road' OWTTE Less energy changed into (wasted as) <u>heat</u>	(1)(AO1) (1)(AO1) (1)(AO2)	3
(e)	1960 3 marks for correct answer Correct unit: J or kJ as appropriate i.e. 1.96 kJ One compensation mark for correct equation ($k.e. = \frac{1}{2}mv^2$) and one compensation mark for correct substitution ($k.e. = \frac{1}{2} \times 90 \times (6.6)^2$) i.e. max 2 compensation marks	(3)(AO2) (1)(AO2)	4

Total Mark: 14