



## **General Certificate of Education**

# **Applied Science**

## **8771/8773/8776/8779**

**SC02      Energy Transfer Systems**

# **Mark Scheme**

*2007 examination – June series*

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## Question 1

(a)	<p>Measure pulse rate prior to exercise            Count number of beats in one minute / specified time            Engage in exercise            Measure pulse rate again following exercise            Continue to monitor (measure) pulse rate until it returns to normal (resting/ rate prior to exercise)            Time taken for pulse rate to return to normal indicates their level of fitness            Compare with tables</p> <p>Any 4 of above            N.B. Credit any answers given that relate to heart rate monitors</p>	<p>(1) (AO3)            (1) (AO3)            (1) (AO3)            (1) (AO3)            (1) (AO3)            (1) (AO3)            (1) (AO3)            (1) (AO3)</p> <p>max 4</p>	<b>4</b>
(b)	<p><u>Increased frequency</u> of impulses travel in <u>Sympathetic</u> nerve to S-A node            in <u>right</u> atrium of heart            from cardiovascular centre            in hypothalamus / brain            (to) medulla (oblongata)</p>	<p>(1) (AO1)            (1) (AO1)            (1) (AO1)            (1) (AO1)            (1) (AO1)            (1) (AO1)            (1) (AO1)            max 3</p>	<b>3</b>
(c)	<p>Intercostal muscles <u>contract</u>            Ribs move up (and) / out            Diaphragm <u>contracts</u>            Diaphragm <u>moves down</u> / flattens            (Thoracic) cavity increases in size            Pressure surrounding lungs lowers compared with atmospheric pressure (a vacuum is created)            Air rushes into lungs (down the trachea)            Active process</p> <p>Any 4 of above</p>	<p>(1) (AO1)            (1) (AO1)            (1) (AO1)            (1) (AO1)            (1) (AO1)            (1) (AO1)            (1) (AO1)            (1) (AO1)            (1) (AO1)            max 4</p>	<b>4</b>
(d) (i)	The <u>maximum</u> possible tidal volume / <u>max.</u> amount of air that can be breathed in after a <u>maximum</u> expiration / <u>max.</u> amount of air that can be breathed out after a <u>max.</u> inspiration / <u>max.</u> amount of air you can breathe in <u>and</u> out	(1) (AO1)	<b>1</b>
(ii)	E	(1) (AO1)	<b>1</b>
(iii)	The volume of air breathed in or out during one ventilation cycle	(1) (AO1)	<b>1</b>
(iv)	F	(1) (AO1)	<b>1</b>
(e) (i)	D	(1) (AO1)	<b>1</b>
(ii)	C	(1) (AO1)	<b>1</b>
(f)	400 - 600 (dm <sup>3</sup> min <sup>-1</sup> ) Allow any number between 400 and 600	(1) (AO1)	<b>1</b>

Total Mark: 18

**Question 2**

(a)	(Aortic valve) prevents backflow of blood into the <u>left</u> ventricle (hence faulty valve does not prevent backflow) Ventricular systole (when ventricles contract) forces blood out of the heart through the aortic valve A faulty valve will result in less blood being pumped round the body (with every beat of the heart)	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1)	<b>3</b>
	Any 3 of above	max 3	
(b)	Electrocardiogram/echocardiogram/stethoscope	(1) (AO1)	<b>1</b>
(c)	Some peoples' religion /beliefs may prohibit them from eating pork and hence they may be uncomfortable at the thought of receiving a pig valve The length of time the different valves will operate (survive), within the patient, may vary The age of the patient in relation to whether or not a second operation may be necessary in the future (to replace the first valve) Potential danger of using parts from one species inside another e.g. unsuspected virus or prion transfer Not wanting an animal to die or suffer / animal welfare issues	(1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2)	<b>2</b>
	Any 2 of above	max 2	
(d)	Reason 1: There is an element of risk attached to any surgical procedure Reason 2: The surgical procedure might not necessarily improve his condition / health status / chance of success Reason 3: Practical difficulties in surgical access for severely obese patients Reason 4: Which type of valve would be used	(1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2)	<b>2</b>
		max 2	
(e)(i)	The chances of survival for obese people during or following the operation might be reduced NHS funding might be better used for people who are not obese (and hence have a greater chance of survival)	(1) (AO2) (1) (AO2)	<b>1</b>
		max 1	
(ii)	Reason 1: Some conditions / stroke illnesses prevent people from exercising (or moving about) resulting in them gaining weight Reason 2: Withholding an operation from someone who needs it is inhumane Reason 3: Patients contributed to NHS (paid taxes) therefore feel entitled to operation	(1) (AO2) (1) (AO2) (1) (AO2)	<b>2</b>

**Total Mark: 11**





(ii)	Needs to be able to get out of the body / travel through the body Detected outside the body Gamma radiation is not densely ionising (therefore no cell damage)	(1) (AO2) (1) (AO2)  (1) (AO2) max 1	<b>1</b>
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**Total Mark: 11****Question 4**

(a)	$m \times g \times h$ (mgh) / $1 \times 10 \times 12$ Allow $50 \times 10 \times 12$ for max 1 = 120 (J) Allow full 2 marks for correct answer alone 1 mark for equation 1 mark for calculation	(1) (AO2)  (1) (AO2)	<b>2</b>
(b)	$50 \times 10 \times 12$ = 6000 (W) Allow full 2 marks for correct answer alone 1 mark for method 1 mark for calculation Allow ecf. from (a) x 50 No mark for 300 000 W	(1) (AO2) (1) (AO2)	<b>2</b>
(c)	Kinetic energy of water / friction of <u>moving</u> water .....turns to (or produces) heat	(1) (AO1) (1) (AO1)	<b>2</b>
(d)	$6000 \times 0.40$ = 2400 (W) Allow ecf from (b) If no ecf from (b) allow 1 mark max for correct method Allow full 2 marks for correct answer alone	(1) (AO2) (1) (AO2)	<b>2</b>
(e)	$2 \times 36 \times 12$ = £ 8.64 or 864 p (correct unit needed) (£ 864 worth 1 max)	(1) (AO2) (1) (AO2)	<b>2</b>
(f) (i)	Fossil contributes to global warming / CO <sub>2</sub> / greenhouse effects / non-renewable / might run out / cause acid rain	(1) (AO1)	<b>1</b>
(ii)	Solar doesn't work at night / solar not so useful in winter / cloud effect / not reliable (must qualify) Accept any reasonable disadvantage	(1) (AO1)	<b>1</b>
(iii)	Only useful when wind blowing (accept converse) / noise or sound pollution / can't be used if wind too strong / adverse effects on wildlife / visual pollution / not reliable (must qualify)	(1) (AO1)	<b>1</b>
(iv)	Biogas can encourage germs / gas storage is difficult / amount of gas needed / produces CO <sub>2</sub> / greenhouse effects / contributes to global warming	(1) (AO1)	<b>1</b>

N.B. in (f) ignore any comments relating to cost

**Total Mark: 14**

**Question 5**

(a)	Conduction	(1) (AO1)	<b>1</b>
(b)	Foam / any material with trapped air in pockets	(1) (AO1)	<b>1</b>
(c) (i)	Air is an insulator / Air is a poor conductor / no free electrons	(1) (AO1)	<b>1</b>
(ii)	<u>Small</u> pockets of air No space for air currents / convection currents / air movement	(1) (AO1) (1) (AO1)	<b>2</b>
(d)	Maximum area (for heat exchange) / large surface area Radiate heat It is black	(1) (AO1) (1) (AO1) (1) (AO1) max 2	<b>2</b>
(e)	0.2 x 10 x 45 = 90 (watts) (accept 0.2 x 10 x 5 = 10 (watts) for max 1)	(1) (AO2) (1) (AO2)	<b>2</b>
(f)	Inefficiency of motor / cooling system Heat lost when door open Work done in cooling food Motor not on all the time Outside temp. may exceed 25 °C	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) max 3	<b>3</b>

**Total Mark: 12****Question 6**

(a)	14 400 kg ms <sup>-1</sup> (u.p.) 14 400 / Correct substitution (480 x 30) Allow 1 mark	(2) (AO1)	<b>2</b>
(b)(i)	Transferred to ship / momentum decreases (owtte)	(1) (AO1)	<b>1</b>
(ii)	Ship would <u>move</u> <u>Away</u> from shore	(1) (AO1) (1) (AO1)	<b>2</b>
(c)	Momentum of water will cause an <u>opposite</u> force / will push them <u>backwards (or away)</u> Grip on shoe will produce friction that will stop them moving / water causes fire-fighter to slip due to less friction	(1) (AO2) (1) (AO2)	<b>2</b>

**Total Mark: 7**



**Question 7**

(a)	Cotton wool deforms easily / is soft / cushions	1 (AO2)	<b>3</b>
	Allows bottle more space to stop / more time (to stop)	1 (AO2)	
	Reduces acceleration of bottle	1 (AO2)	
	Reduces <u>force</u> (on bottle) Cotton wool absorbs energy (of collision) / crumple zone	1 (AO2) max 3	
(b) (i)	Wear protective glasses	1 (AO1)	<b>1</b>
	Use a safety shield	1 (AO1)	
	Dispose of broken glass carefully	1 (AO1)	
	Wear protective boots	1 (AO1) max 1	
(ii)	No. / mass of bottles in the container	1 (AO3)	<b>2</b>
	Type or weight of liquid in the bottles	1 (AO3)	
	Surface onto which container dropped	1 (AO3)	
	Design/shape/size of bottles	1 (AO3) max 2	
(iii)	Height of drop	1 (AO3)	<b>1</b>
	Thickness of cotton wool	1 (AO3) max 1	

**Total Mark: 7**