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ASSESSMENT and QUALIFICATIONS ALLIANCE

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)	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 Any 4 of above N.B. Credit any answers given that relate to heart rate monitors	(1) (AO3) (1) (AO3) (1) (AO3) (1) (AO3) (1) (AO3) (1) (AO3) (1) (AO3) max 4	**4**
(b)	Increased frequency of impulses travel in Sympathetic nerve to S-A node in right atrium of heart from cardiovascular centre in hypothalamus / brain (to) medulla (oblongata)	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) max 3	**3**
(c)	Intercostal muscles contract Ribs move up (and) / out Diaphragm contracts Diaphragm moves down / 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 Any 4 of above	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) max 4	**4**
(d) (i)	The maximum possible tidal volume / max. amount of air that can be breathed in after a maximum expiration / max. amount of air that can be breathed out after a max. inspiration / max. amount of air you can breathe in and out	(1) (AO1)	**1**
(ii)	E	(1) (AO1)	**1**
(iii)	The volume of air breathed in or out during one ventilation cycle	(1) (AO1)	**1**
(iv)	F	(1) (AO1)	**1**
(e) (i)	D	(1) (AO1)	**1**
(ii)	C	(1) (AO1)	**1**
(f)	400 - 600 ($dm^3\ min^{-1}$) Allow any number between 400 and 600	(1) (AO1)	**1**

Total Mark: 18

Question 2

(a)	(Aortic valve) prevents backflow of blood into the left 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) Any 3 of above	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) max 3	**3**
(b)	Electrocardiogram/echocardiogram/stethoscope	(1) (AO1)	**1**
(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 Any 2 of above	(1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) (1) (A02) max 2	**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) max 2	**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) max 1	**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)	**2**

Total Mark: 11

Question 3

N.B. In part (a) allow one mark only for any qualified reference relating to cost effectiveness

(a)(i)	Advantage: There are no known hazards (to the patient) (with low frequency (low energy) beams) / no ionising radiation / can use during pregnancy It is non-invasive There is no discomfort apart from a cold probe More effective than X-ray techniques in producing images of soft tissue The equipment is relatively inexpensive Does not need a specialist room (and can be moved about very easily) There are no hazards for the operator Moving image obtained / any reference to Doppler effect Disadvantage: The sonographer has to be skilled at operating the probe and its associated equipment to get a clear image The image needs skilful interpretation Bone absorbs ultrasound so that brain images are hard to get Images of tissues on the far side (or inside) of lungs are impossible to get	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) max 1 (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) max 1	**2**

(ii)	Advantages: The MRI can be used to give 'serial' pictures of a patient to follow the progress of therapy on a given problem The MRI provides a greater difference in healthy tissue and diseased tissue / good contrast (In the CT scan), bone in the area can create an obscured image of the area, MRI does not The MRI can easily show various 'views', without moving the machine or the patient In the MRI, blood vessels can be seen in 2 parts, the vessel, and inside the vessel (this is important when looking for blockages and obstructions), (the CT sees only one thing, the vessel) Does not use ionising radiation Produces 3D image Disadvantages: The major disadvantage is that in the case of a person with such things as a pacemaker, metal clips or plates, the MRI's image of that area is likely to be obscured And in some cases, it could even be dangerous to those patients. Patients that are pregnant: long-term effects on the developing child not yet known Not beneficial when used with patients that are confused and/or agitated / or claustrophobic Cannot be used with patients that require continuous life-support equipment (the equipment will not fit in the MRI tube) Cannot be used with patients that have metal objects such as pacemakers, infusion pumps, aneurysm clips, inner ear implants and metal fragments in the eye (the MRI's magnet may move the metal, endangering the patient Stressful / claustrophobic Takes a long time	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) max 1 (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) max 1	**2**
(iii)	Advantage: More readily available Provides clear images of bones / good bone resolution Disadvantage: The major disadvantage is the potential health risk due to exposure to x-rays (of operator or patient) Also, film could accidentally be exposed from the x-rays Uses ionising radiation Poor images of soft tissue or where low density difference	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) max 1	**2**
(b)(i)	Ultrasound	(1) (AO1)	**1**
(ii)	X-ray	(1) (AO1)	**1**
(iii)	MRI scan	(1) (AO1)	**1**
(c)(i)	Gamma	(1) (AO2)	**1**

(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	**1**

Total Mark: 11

Question 4

(a)	m x g x h (mgh) / 1 x 10 x 12 Allow 50 x 10 x 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)	**2**
(b)	50 x 10 x 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)	**2**
(c)	Kinetic energy of water / friction of <u>moving</u> water ……turns to (or produces) heat	(1) (AO1) (1) (AO1)	**2**
(d)	6000 x 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)	**2**
(e)	2 x 36 x 12 = £ 8.64 or 864 p (correct unit needed) (£ 864 worth 1 max)	(1) (AO2) (1) (AO2)	**2**
(f) (i)	Fossil contributes to global warming / CO_2 / greenhouse effects / non-renewable / might run out / cause acid rain	(1) (AO1)	**1**
(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)	**1**
(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)	**1**
(iv)	Biogas can encourage germs / gas storage is difficult / amount of gas needed / produces CO_2 / greenhouse effects / contributes to global warming	(1) (AO1)	**1**

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

Total Mark: 14

Question 5

(a)	Conduction	(1) (AO1)	**1**
(b)	Foam / any material with trapped air in pockets	(1) (AO1)	**1**
(c) (i)	Air is an insulator / Air is a poor conductor / no free electrons	(1) (AO1)	**1**
(ii)	Small pockets of air No space for air currents / convection currents / air movement	(1) (AO1) (1) (AO1)	**2**
(d)	Maximum area (for heat exchange) / large surface area Radiate heat It is black	(1) (AO1) (1) (AO1) (1) (AO1) max 2	**2**
(e)	0.2 x 10 x 45 = 90 (watts) (acccept 0.2 x 10 x 5 = 10 (watts) for max 1)	(1) (AO2) (1) (AO2)	**2**
(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	**3**

Total Mark: 12

Question 6

(a)	14 400 kg ms^{-1} (u.p.) 14 400 / Correct substitution (480 x 30) Allow 1 mark	(2) (AO1)	**2**
(b)(i)	Transferred to ship / momentum decreases (owtte)	(1) (AO1)	**1**
(ii)	Ship would move Away from shore	(1) (AO1) (1) (AO1)	**2**
(c)	Momentum of water will cause an opposite force / will push them backwards (or away) 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)	**2**

Total Mark: 7

Question 7

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

Total Mark: 7