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General Certificate of Education

Applied Science 8771/8773/8776/8779

SC02 Energy Transfer Systems

Mark Scheme

2009 examination – June series

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Question 1

(a)	Diaphragm relaxes Diaphragm moves up Intercostal muscles relax Ribs move in / down Thoracic (chest) cavity decreases in size Pressure surrounding lungs increases compared with atmospheric pressure Passive process	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) **max 4**	**4**
(b)(i)	12 -15 (breaths per minute) Accept any value within this range If an incorrect range is given e.g. 12-16: no mark	(1) (AO1)	**1**
(ii)	Breathing rate: increases / faster / higher Breathing depth: decreases / reduces / shallower / lower	(1) (AO1) (1) (AO1)	**2**
(c)(i)	The maximum (or biggest or greatest) volume of air that a person can exhale. Allow breathe out or expel. after maximum (or biggest or greatest) inhalation OR The maximum (or biggest or greatest) volume of air that a person can inhale. Allow breathe in. after maximum (or biggest or greatest) exhalation N.B. Inspiratory reserve volume + Tidal volume + Expiratory reserve volume (IRV + TV + ERV) = 2 marks	(1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) **max 2**	**2**
(ii)	Need to have a large number of subjects to be sure that the results obtained are not due just to chance alone Results more reliable (Allow 'more valid' but not 'better average') Results (statistically) more accurate	(1) (AO3) (1) (AO3) (1) (AO3) **max 1**	**1**
(iii)	Any reasonable examples e.g. Athletes vs. non-athletes Wind instrument players vs. non-players Accept any reasonable comparison of an opposing pair	(1) (AO3)	**1**
(iv)	1. Weight of people (in both groups) 2. Age of people (in both groups) 3. Height / size (in both groups) 4. Gender 5. (Pulmonary) disease eg. Asthma, emphysema etc 6. Same exercises (to be undertaken) 7. Time spent exercising	(1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) **max 3**	**3**
(v)	Elasticity of chest wall increases Chest wall (able to) expand (and recoil) more during exercise Elasticity of lungs increases Lungs (able to) expand (and recoil) more during exercise	(1) (AO2) (1) (AO2) (1) (AO2) (1) (AO1) **max 2**	**2**
(d)	Vital capacity decreases with age (Allow converse) Vital capacity increases with height / size (Allow converse)	(1) (AO3) (1) (AO3)	**2**

Total Mark: 18

Question 2

(a)(i)	Arteries become less elastic / less flexible / less stretchy (Arteries) will stretch and/or recoil less (Arteries) less able to propel blood Resulting in reduced blood flow	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) **max 3**	**3**
(ii)	Coronary arteries become narrowed (due to fat deposits) / lumen becomes smaller Causing reduced blood supply to <u>heart</u> (muscle) Therefore reduced oxygen supply to <u>heart</u> (muscle) Oxygen needed for respiration To provide energy For contraction of <u>heart</u> muscle	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) **max 3**	**3**
(iii)	Action of (skeletal) muscles Pressure change during inhalation Expansion of vena cava (Presence of) valves [Award 1 mark for mentioning 'valves' regardless of name given to valve(s)] (Valves) allow one-way flow only (of blood) / prevent backflow	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) **max 2**	**2**
(b)(i)	Systolic: 135 Diastolic: 85 Accept answers in the range: 127-139 (systolic) 75-85 (diastolic)	(1) (AO1)	**1**
(ii)	Mountaineer E	(1) (AO1)	**1**
(iii)	(Both systolic and diastolic) blood pressure readings are below normal range / <u>very</u> low / <u>too</u> low	(1) (AO1)	**1**
(c)	(The pressure in the arteries) when the heart contracts (is forcing blood through them) / ventricles contracting: systolic (The pressure in the arteries) when the heart relaxes / ventricles relaxing: diastolic	(1) (AO1) (1) (AO1)	**2**
(d)	The person operating the device does not need to be trained (as is the device is automatic) The device can be used at home Reduces human error when reading / easier to get an accurate reading (Allow 'more reliable') The device can be use in a noisy environment / deaf people can use the device	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) **max 2**	**2**

Total Mark: 15

Question 3

(a)	Reason 1: The bones of a smoker can fail to heal / heal too slowly after (keyhole) surgery / recovery likely to be longer Reason 2: Likely to be more cost-effective [No mark for 'cost' alone] Reason 3: Surgery or operation likely to be more risky Accept converse arguments	(1) (AO2) (1) (AO2) (1) (AO2) **max 2**	**2**
(b)	1. Whether patient is capable of making their own decision 2. Whether or not it is a life or death situation 3. (Whether or not the health practitioner should go against) the religious beliefs of the patient 4. Age of the patient 5. Can't operate (give treatment) without consent of patient 6. Patient objects to use of animal parts	(1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) **max 3**	**3**
(c)(i)	Withholding information from a patient restricts their autonomy / hinders them from playing an autonomous part in their own care If a patient is unaware of what might happen to them, they are denied the power of refusal Not able to plan for the future Accept any reasonable suggestion e.g. if patient has mental health problems	(1) (AO2) (1) (AO2) (1) (AO2) **max 1**	**1**
(ii)	Information may be withheld from patients for: 1. Resource / financial reasons (NHS budget) 2. Not wanting to upset the patient	(1) (AO2) (1) (AO2) **max 1**	**1**

Total Mark: 7

Question 4

(a)(i)	Radiation	(1) (AO1)	**1**
(ii)	Convection	(1) (AO1)	**1**
(iii)	Hot air expands Hot air is less dense (than cold air) / cold air more dense Hot air rises / cold air falls Not 'heat rises' Rising air carries its energy with it Convection <u>current(s)</u>	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) **max 3**	**3**
(b)(i)	Plastic is not a good conductor of <u>heat</u> / plastic is a good insulator of <u>heat</u> No danger of electrical shock / plastic does not conduct <u>electricity</u> Allow reverse arguments (max 1 for plastic does not conduct / plastic is a good insulator)	(1) (AO1) (1) (AO1)	**2**

(ii)	Using a shiny surface prevents (limits) heat waste (loss) Shiny reflects Reflects radiation (Radiation) reflected back to bread Stops the outer case getting hot	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) **max 3**	**3**
(iii)	Air is an insulator / poor conductor small pockets of air prevent convection [Allow 'tiny' for 'small'] because there is not enough space for convection currents	(1) (AO1) (1) (AO1) (1) (AO1)	**3**
(c)	Heat transfer rate / rate of heat loss / how many joules per second of heat of 2.5 watts per square metre for every 1º C temperature difference between the faces / between the inside and outside	(1) (AO1) (1) (AO1) (1) (AO1) **max 2**	**2**

Total Mark: 15

Question 5

(a)(i)	Kinetic (energy) [Allow 'kinetic potential'] Ignore 'gravitational potential energy' If list more than kinetic (other than GPE) – no mark	(1) (AO1)	**1**
(ii)	g.p.e. = mass x gravity x height change / 900 x 10 x 8 = 72 000 (J) Ignore incorrect units (max 1 for answer 7 200 (J)) Full 2 marks for correct answer alone i.e. 72 000	(1) (AO2) (1) (AO2)	**2**
(iii)	(power = work done / time taken in seconds) / correct substitution = 1 200 (W) or e.c.f. Ignore incorrect units Full 2 marks for correct answer alone	(1) (AO2) (1) (AO2)	**2**
(b)(i)	efficiency = useful output / total input (allow power or energy for both, but not a mixture) OR input = output/efficiency = 1200 / 0.6 = 2 000 (W) Allow ecf from 5 (a) (iii) Ignore incorrect units (max 1 for input = 1200 x 0.6 = 720 (W)) [1200 x 60% - max 1] Full 2 marks for correct answer alone	(1) (AO2) (1) (AO2)	**2**
(ii)	Heat Sound In / from the bearings Allow turbulence (in water)	(1) (AO1) (1) (AO1) (1) (AO1) **max 2**	**2**
(iii)	Less friction Less work done against friction / less heat generated Less energy/power wasted	(1) (AO1) (1) (AO1) (1) (AO1) **max 2**	**2**

(iv)	Efficiency cannot be above 100% / Always less than 100% Otherwise machine would be a net creator of energy There is always some friction No machine can create energy / no perpetual motion	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) **max 1**	**1**
(c)(i)	Supply: Gas or petrol (generator) / wind / solar / gas Advantages: Gas or petrol: easy set up / easy to install / reliable Wind and solar: no CO_2 emissions / low running cost / low pollution Disadvantages: Gas or petrol: noise / CO_2 emissions / cost of fuel Wind and solar: not always available / high cost of setup / noisy / visual pollution Accept global warming as an alternative to CO_2 emissions	(1) (AO1) (1) (AO1) (1) (AO1)	**3**
(ii)	Cost = no of units x cost per unit / 3 x 8760 x 12 = £3153.60 (accept £3153 / 315360 p):need correct unit for this mark Full 2 marks for correct answer including correct unit	(1) (AO2) (1) (AO2)	**2**

Total Mark: 17

Question 6

(a)(i)	Thicker padding => more distance to stop movement ⇨ longer time to stop in ⇨ less de/acceleration ⇨ less force on rider's (head) Not 'helmet' Use of F = ma or work done = force x distance moved Lower rate of change of momentum Force = rate of change of momentum / Force = $\frac{mv_2 - mv_1}{t}$	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) **max 3**	**3**
(ii)	Large helmet would hinder head movement / would look silly / uncomfortable / heavy / would tire neck muscles / would unbalance rider / would create greater (air) friction Do not allow 'no space for rider's head'	(1) (AO1)	**1**
(b)	Datalogging measures the actual speed (of impact / when the hammer hits) (not the theoretical speed) Datalogging is more accurate / permits more significant figures Air friction might affect the speed / calculated speed might not be right because of air friction Easy to take multiple readings and average your results, with datalogging	(1) (AO3) (1) (AO3) (1) (AO3) (1) (AO3) **max 1**	**1**
(c)	Keep the mass of the head constant Keep the hammer / mass dropped the same Drop the hammer / mass from the same height (each time) Hit in the same place each time	(1) (AO3) (1) (AO3) (1) (AO3) (1) (AO3) **max 2**	**2**

(d)	Eye protection / keep a distance from the equipment / put a box round the equipment / place padding on the floor / protective clothing / steel-capped boots	(1) (AO3)	**1**

Total Mark: 8