



**General Certificate of Education (A-level) Applied
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Applied Science

SC02

**(Specification
8771/8773/8776/8777/8779)**

Unit 2: Energy Transfer Systems

Final

Mark Scheme

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Question 1

1 (a) (i)	Tidal volume = 400 – 500 (cm ³) OR Allow any single figure within this range Vital capacity (female) = 3.1 (dm ³) Expiratory peak flow rate = 400 – 600 (dm ³ min ⁻¹) OR Allow any single figure within this range	(1)(AO1) (1)(AO1) (1)(AO1)	3
1 (a) (ii)	The results would support a diagnosis of asthma (no mark for stating this) Explanation: Tidal volume is lower than normal / Vital capacity is lower than normal / Expiratory peak flow rate is lower than normal / The values (in the table) are lower than normal.	(1) (AO1)	1
1 (b)(i)	Produces mucus Moistens the air (or gases) taken in Traps dust, particles or microorganisms / prevents dust, particles or microorganisms from reaching the lungs	(1)(AO1) (1)(AO1) (1)(AO1) max 2	2
1 (b) (ii)	Wafts away (removes) mucus Removes particles or dust (that may be breathed in) Prevents damage to lung tissue / stops dust or dirt getting into lungs / reduces incidence of lung infections	(1)(AO1) (1)(AO1) (1)(AO1) max 2	2
1 (c)	Walls broken down between alveoli / larger alveoli (in person with emphysema) / smaller alveoli in healthy person More alveoli in healthy person / fewer alveoli in sick person (Fewer alveoli means) less surface area So less efficient oxygen absorption / less diffusion Reduced amounts of oxygen entering the <u>blood</u>	(1) (A02) (1) (A02) (1) (A02) (1) (A02) (1) (A02) max 4	4

Total Mark: 12

Question 2

2 (a) (i)	Uses <u>oxygen</u> Accept O ₂	(1)(AO1)	1
2 (a) (ii)	$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ (ignore any references to energy or ATP) correct inputs (correctly balanced) correct outputs (correctly balanced)	(1)(AO1) (1)(AO1)	2
2 (b) (i)	Flask B Limewater remains clear/no change because the carbon dioxide is absorbed Flask D The limewater turns milky/cloudy as carbon dioxide is produced by the (germinating) seeds	(1) (AO2) (1) (AO2)	2
2 (b) (ii)	To prevent <u>photosynthesis</u> from occurring	(1) (AO2)	1
2 (c) (i)	$RQ = 9 \div 6 = 1.5$ Correct answer alone gets full credit	(1) (AO2)	1
2 (c) (ii)	Less oxygen used than expected Respiration is not just aerobic / Some anaerobic respiration is taking place Anaerobic respiration results in an RQ greater than 1 / Anaerobic respiration results in an RQ greater than aerobic respiration	(1) (AO2) (1) (AO2) (1) (AO2) max 2	2

Total Mark: 9

Question 3

3 (a) (i)	<p>The chances of survival for obese people or smokers during or following the operation might be reduced / surgery likely to be <u>more</u> risky (The bones of) a <u>smoker</u> can fail to heal or heal too slowly after surgery / recovery likely to be longer NHS funding might be better used for people who are not obese or smokers (and hence have a greater chance of survival) Patients are not helping themselves / patients may not be committed to ensuring their own health / patients may not be keeping themselves healthy</p>	<p>(1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) max 2</p>	<p>2</p>
3 (a) (ii)	<p>Some conditions or illnesses prevent people from exercising (or moving about) resulting in them gaining weight/failing to lose weight Withholding an operation from someone who needs it is inhumane Patients contributed to NHS (paid taxes) and are entitled to operation Lifestyle (including smoking or obesity) may not be the cause of their illness</p>	<p>(1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) max 2</p>	<p>2</p>
3 (b)	<p>Take pulse rate at rest or before exercise Measure pulse rate for a given time (minimum 30 seconds) Engage in exercise Take pulse rate again (after exercise) Time how long it takes for pulse rate to return to normal (or resting rate / pulse rate before exercise began) The time taken is an indication of the person's level of fitness / the shorter the time taken, the fitter the person</p>	<p>(1) (AO3) (1) (AO3) (1) (AO3) (1) (AO3) (1) (AO3) (1) (AO3) max 4</p>	<p>4</p>
3 (c)	<p>135 / 85 (mmHg)</p>	<p>(1) (AO1)</p>	<p>1</p>
3 (d) (i)	<p>Systole is contraction of heart/ventricle The lumen of the artery increases with the increased flow of blood or increased blood pressure The walls (of the artery) stretch or expand (preventing pressure from increasing in artery)</p>	<p>(1)(AO1) (1)(AO1) (1)(AO1) max 2</p>	<p>2</p>

3 (d) (ii)	Diastole is relaxation of heart/ventricle The walls of the artery recoil Lumen (of artery) returns to normal (preventing a fall in blood pressure)	(1)(AO1) (1)(AO1) (1)(AO1) max 2	2
3 (d) (iii)	If BP is low the (muscular tissue of) artery will contract (constrict) If BP is low the lumen becomes smaller (will increase BP) If BP is high the (muscular tissue of) artery will relax If BP is high the lumen becomes bigger (will decrease BP)	(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) max 2	2
3 (e)	Blood diverted to the skin Vasodilation Sweat produced by (sweat) glands Sweat / water evaporates Heat lost (from body) during evaporation Latent Heat of Vapourisation Heat is radiated from the body	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) max 4	4

Total Mark: 19

Question 4

(a)	Correct answer alone gains full 2 marks GPE = 1,350,000 (J) or equivalent in kJ e.g. 1350 (kJ) If use 9.8 instead of 10: GPE = 1,323,000; If use 9.81: GPE = 1,324,350 Allow one compensation mark for equation: GPE = mass x gravity x height (change) OR Allow one compensation mark for correct substitution: $90 \times 10 \times 1500$ OR Allow one compensation mark for GPE = force x distance OR 900×1500	(2)(AO2)	2
(b)	Must lift the plane (and contents) as well Engine is not 100% efficient / creates (waste) heat / sound / incomplete combustion Air friction / friction on plane / drag / air resistance	(1)(AO1) (1)(AO1) (1)(AO1) max 2	2

(c)	<p>Kinetic energy = 2 880 (J) Correct answer alone gains full 2 marks Allow one compensation mark for equation: $K.E. = \frac{1}{2} \times \text{mass} \times \text{speed}^2$ ($\frac{1}{2}mv^2$) OR Allow one compensation mark for correct substitution: $K.E. = \frac{1}{2} \times 90 \times 8^2$</p>	(2)(AO2)	2
(d)	<p>Energy lost or converted due to friction Friction of parachute / air friction / air resistance Energy turned to heat/thermal energy</p>	<p>(1)(AO1) (1)(AO1) (1)(AO1) max 2</p>	2
(e)	<p>Increases time / distance for landing Less acceleration / momentum changes more slowly / rate of change of momentum is less So less force (on parachutist) (no credit for 'energy absorbed' or 'might break a bone')</p>	<p>(1)(AO1) (1)(AO1) (1)(AO1)</p>	3
(f)	<p>2500 (W) Accept 2.5 (kW) Correct answer alone gains full 2 marks 1 mark for correct substitution: 300 000 / 120 Accept 150 000 (W) for max 1</p>	(2)(AO1)	2

Total Mark: 13

Question 5

(a)	Does not rely on fossil fuels / wood is not a fossil fuel Fuel is not imported from foreign countries Wood is a renewable resource Cost is (probably) less / free fuel	(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) max 2	2
(b)	Fire takes time to start / not automatic Ashes need to be cleared away Wood has to be cut / stacked / transported (Large) space needed (to store wood)	(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) max 1	1
(c)	Black	(1)(AO1)	1
(d)	(Metal is a) <u>good</u> conductor (of heat)	(1)(AO1)	1
(e)	Convection (current) Hot gases expand / air particles move further apart Hot gases have less density than cold ones / equal volume of hot gas weighs less than cold gas Cold air falls (lifting hot gas) / warm air rises Accept 'air' as 'gas'	(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) max 3	3
(f)	Cost = 21600 p OR £216 Correct answer alone gains full 3 marks Allow one compensation mark for equation: Cost = kWh x price per unit OR Allow one compensation mark for correct substitution: Cost = 3 x 600 x 12p Allow max 2 if unit missing or incorrect – Unit penalty	(3)(AO2)	3

(g)	5 (kW) or 5000 (W) Correct answer alone gains full 2 marks Allow one compensation mark for correct substitution: 60% = 3 ÷ input 1.8 (kW) or 1800 (W) max 1	(2)(AO1)	2
(h)	Advantage: no fossil fuel used / no CO ₂ generated / rainwater is free / continuous supply of water / renewable / no <u>chemical</u> pollution Disadvantage: land needed for dam / rain may not fall / needs hills	(1)(AO1) (1)(AO1)	2
(i)	Device: Solar panel Radiation from the Sun Heats water (that is circulated round the house) OR Device: Wind turbine Kinetic or wind energy Generates electricity to power electric heater No mark for naming device correctly; 2 marks for correct explanation	(1)(AO1) (1)(AO1) (1)(AO1) (1)(AO1) max 2	2

Total Mark: 17

Question 6

(a)	Outside temperature / only do experiment when outside temperature is 5 °C. Thickness of wall Size of shed (walls, ceiling, floor) Heater (power) Position of heater Same type of floor/roof/door	(1)(AO3) (1)(AO3) (1)(AO3) (1)(AO3) (1)(AO3) (1)(AO3) max 2	2
(b) (i)	Use more powerful heater / heat shed then measure temperature falling / take temperature more often / record outside temperature	(1)(AO3)	1

(b) (ii)	Keep doors / windows closed / avoid draughts / insulate / double-glazing / paint outside of shed white or silver / paint inside of shed white or silver	(1)(AO3)	1
(c) (i)	U = 1.25 (W/m ² /K) Correct answer alone gains 2 marks 1 compensation mark for correct substitution: 400 = 20 x U x 16 (OR U = 400 / (20 x 16))	(2)(AO2)	2
(c) (ii)	Hot air rises (to top of shed) Temperature at top of shed is greater (than at floor) More heat lost through roof / less heat lost through floor Different materials have different U values/provide different insulation Each of wall, floor, ceiling have a different surface area Roof is darker than rest of shed so more heat lost by radiation	(1)(AO2) (1)(AO2) (1)(AO2) (1)(AO2) (1)(AO2) (1)(AO2) max 2	2
(d)	Air is an insulator / air is a poor conductor Small cells have no room for convection currents / small cells reduce convection	(1)(AO1) (1)(AO1)	2

Total Mark: 10

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