A-LEVEL

Applied Science

SC02 Energy Transfer Systems

Mark scheme

8770

June 2016

Version: 1.0 Final

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

Question	Answers	Additional Comments/ Guidance	Mark
1(a)	**A**: Semi-lunar / pulmonary (valve) **B**: Atrio-ventricular / A-V / tricuspid (valve)	Aortic (valve) negates mark Bicuspid (valve) negates mark	1 1
1(b)(i)	• Systole is contraction of the heart (muscle)/ventricle Any one of: • (Elastic tissue) stretches or expands • (Elastic tissue) widens lumen • (Elastic tissue) prevents (blood) pressure going too high/keeps low	Ignore atria Muscle **contracts** negates mark	1 1
1(b)(ii)	• Diastole is relaxation of the heart (muscle)/ventricle Any one of: • (Elastic tissue) recoils • (Elastic tissue) narrows lumen/return lumen to normal • (Elastic tissue) prevents (blood) pressure going too low/keeps high.	Ignore atria Muscle **relaxes** negates mark	1 1
1(c)	Any 3 of: • Increased frequency of impulses travel in • sympathetic nerve / accelerator nerve • from cardiovascular centre (CVcentre) • in medulla (oblongata) (in brain) • to S-A node • In **right** atrium (of heart)	Vagus nerve negates MP2 MP5 Allow SAN	1 1 1 1 1 1 Max 3
1(d)(i)	Monitors the rhythm / the electrical activity (of/in the heart) /cardiac cycle	Allow alternatives to monitors Allow cardiac cycle described	1
1(d)(ii)	Trace **D OR B**: Tachycardia Accept 'tachycardia' written above/beside trace **D OR B**		1
Total			**11**

2(a)(i)	Any two of **Advantages:** • (Much) cheap(er) • Portable • (Much more) readily available • Can be used on people with metal implants (named examples) • Can be used on people with claustrophobia • Quick(er) Any one of **Disadvantage:** • Ionising (radiation) • (More) dangerous / can cause cancer /cell mutation • Worse contrast/resolution/imaging of soft tissue (named example)	MP4 allow life support MP5 allow obese MP1 **Not** accept radioactivity MP3 accept poor	1 1 1 1 1 1 Max 2 1 1 1 Max 1
2(a)(ii)	Any two of **Advantages:** • Non-ionising (radiation) • Less dangerous/not cancer causing/used in pregnancy • Better contrast/resolution/imaging of soft tissue (named example) • Moving image Any 1 of **Disadvantage:** • Worse contrast/resolution/imaging of hard tissue (named example) • Poor imaging of tissue containing air OWTTE	MP 1 **Not** accept radioactivity MP2 allow 'not dangerous' MP3 accept good MP1 accept poor MP2 named examples: lungs, digestive system bladder	1 1 1 1 Max 2 1 1 Max 1
2(b)(i)	Any two of: • Easily traced externally • (Can) target specific organs/tissue/cells • Avoids the need for (invasive diagnostic) surgery OWTTE • Shows metabolic activity OR early detection of problems OR tumours/cancer • Real time images/ movement of tracer	MP2 Allow use of term 'organ affinity' MP2 allow target area Allow live images	1 1 1 1 1 Max 2
2(b)(ii)	Any one of: • Disposal hazard • Have short half-lives so have to be used quickly • (Radioactivity is) ionising/can damage cells • Radioactivity may affect others near the patient • The patient is radioactive (for a short time)	Ignore alpha, beta, gamma comments	1 1 1 1 1 Max 1

2(c)(i)	Any two of: • The demand for liver transplants far exceeds the supply of available organs • Cost-effectiveness of operation • (Six months without alcohol) gives the liver a chance to recover / might result in there being no need for a transplant • Not damage new liver as not drinking OWTTE • Improved outcomes after surgery/shorter recovery time • Less risk during surgery		1 1 1 1 1 1 Max 2
2(c)(ii)	Any two of: • Quality life reduced (during wait for surgery) OWTTE • Might die before surgery/ too ill for surgery • Everyone entitled to treatment on humane grounds • Everyone should receive treatment as they have paid their taxes • Alcohol may not be cause of the problem	Ignore 'unethical' not explained	1 1 1 1 1 Max 2
Total			**13**

3(a)	**A**: Diaphragm (muscle) **B**: Intercostal muscle	 Allow internal/external intercostal muscle	1 1 Max 2
3(b)(i)	Any two of: • Produces/releases mucus • Moistens **the air** (or **gases**) taken in • Traps/sticks the dust/microorganisms • Prevents dust/microorganisms from reaching the lungs	 MP3 allow dirt, particles, bacteria	 1 1 1 1 Max 2
3(b)(ii)	Any two of: • Wafts away/removes mucus • Removes dust/microorganisms (that may be breathed in) • Prevents damage to lung tissue OR reduces incidence of lung infections	 MP1 Allow alternatives for wafts MP2 allow dirt, particles, bacteria	 1 1 1 Max 2
3(c)	Man **B** Any three of the following: • Peak expiratory flow rate is high/not low/normal range • Blood pressure is low/'not high'/(close to) normal • Resting pulse rate is low/'not high'/normal range • Time taken for pulse rate to return to normal (resting) rate after exercise is short/not long OWTTE	Not not allow 'average' for 'normal' normal range (400–600 dm^3 min^{-1}) 60-80 bpm Allow 'after 3 mins' for 'after exercise'	1 1 1 1 1 Max 4
Total			**10**

4(a)(i)	114000 Allow use of 9.81 OR 9.8 instead of 10 to give: 111834 OR 111720 OR 112000 (3 sf)	Correct answer gains 2 marks 1 compensation mark: **Gpe/E_p/PE** = *mgh* or 76 × 10 × 150 (without further incorrect processing)	2
4(a)(ii)	1900 (W) or 1.9 (kW) Allow error carried forward from 4(a)(i) If used 9.81 OR 9.8 instead of 10 then: 1863.6 OR 1862.0 OR 1866.6 Unit: W or watts or J s^{-1} or J/s	Accept any correct rounding ecf is: 4ai/60 Unit mark is a standalone mark Allow kW or kJ/s or kJs^{-1} or as words	1 1
4(a)(iii)	40.4(%) If used 9.81 OR 9.8 instead of 10 then: 41.13239265 OR 41.17436448 OR 41.07142857 Allow error carried forward from 4(a)(i)	Correct answer gains 2 marks (accept any correct rounding from 40.350877193) 1 compensation mark for either: 46000/4ai OR correct answer as decimal (not percentage) OR Efficiency=**Useful** energy out x100 **Total** energy in	2
4(a)(iv)	Any one of: • heat/thermal (energy) • sound (energy) Any one of: • due to air resistance • due to friction	Either explanation with either named transfer MP1 Do not allow heat **from** man	1 1
4(b)	Any 2 of: • The electricity is free/ electricity bills can be reduced • The company can sell the electricity back to the National Grid • It is a **renewable** (energy resource)/fewer fossil fuels needs to be used • Does not produce greenhouse gases / will not contribute to global warming/does not produce CO_2 • Does not lead to acid rain • Could be a good marketing strategy (eg company could advertise as being 'green')	Allow power/energy for electricity throughout MP1 accept 'electricity cheaper' for 'electricity free' MP4 do not credit 'does not cause pollution'	1 1 1 1 1 1 Max 2
Total			**10**

5(a)	• (an A**-rated appliance will) use less **electricity/energy** • (and so) will be cheaper to run	MP1 allow wastes less energy/electricity MP2 accept: have a shorter payback time 'Cheaper' unqualified is not enough	1 1
5(b)	£2.40 gains 2 marks	Correct answer gains 2 marks 1 compensation mark for: 0.15 × 100 × 16 OR 0.15 × 100 × 0.16 OR £240	2
5(c)	Any three from: *In context of back of fridge to surroundings:* • (Because) the temperature difference (between the pipes at the back of the fridge and the surroundings) is reduced. • Less heat is transferred (from the pipes at the back of the fridge to the surroundings) • Lower <u>rate</u> of heat transfer (from fridge to surroundings) *In context of surroundings to contents of fridge:* • (Because) the temperature difference (between the surroundings and the contents of the fridge) is greater • More heat is transferred (from the surroundings to the contents of the fridge) • Higher <u>rate</u> of heat transfer (from surroundings to contents of the fridge)	Allow 'amount of heat transfer per unit time' for 'rate' Comparative statements are important MP2 for both context allow: 'less heat radiated'	 1 1 1 1 1 1 Max 3
Total			**7**

6(a)(i)	20 000	Correct answer gains 2 marks Allow 20**k**J 1 compensation mark: $\mathbf{KE_A/KE/E_k} = ½mv^2$ OR $= ½ \times 400 \times 10^2$ (without further incorrect processing)	2
6(a)(ii)	20,000 ecf from 6(a)(i), same as 6ai	No working needed	1
6(a)(iii)	4,000 0		1 1
6(a)(iv)	4.44 ecf from 6(a)(iii)	Accept 4 or 4.4 or 4.4 recurring ecf is: total of A and B from 6aiii = (400+500)v	1
6(b)	Any four of: • Before collision the passenger is travelling at same speed as car • Safety feature prevents passenger moving at the initial speed when the car stops suddenly • Safety feature absorbs <u>kinetic</u> energy • (Safety feature) longer stopping time/distance • Rate of change of momentum decreased OR rate of change of KE is decreased • Less deceleration/acceleration • Meaning less force • Action of named safety feature	MP3 Named feature is fine MP4 Ignore 'less time until impact' but allow 'more time in collision' MP 6 Not allow 'deceleration slowed' MP7 Ignore 'less impact' MP8 Seatbelt/air bag stops person moving (relative to car) Crumple zone squashes so that the area around the person does not	1 1 1 1 1 1 1 Max4
6(c)	Any three of: • Use ruler that is at least 0.5m or tape measure or electronic distance measuring device • use laboratory digital/electronic/chemistry balance OR more precise balance • Repeating experiment, remove anomalies, average • Method to reduce friction • Add an accurate method of measuring final speed (e.g. light gates) • Greater height of track	MP2 ignore 'accurate scales' but allow 'scientific scales' MP4 less friction ideas: change material, lubricate, air track	1 1 1 1 1 1 Max 3
Total			**13**

7(a)(i)	Hypothalamus	Accept brain OR thermoregulatory centre Ignore thermoreceptors Any other area of the body negates mark, e.g. medulla or other centres	1
7(a)(ii)	Any two from • Sweat from **sweat** glands • Sweat/water evaporates • heat lost by evaporation or Any two from • Vasodilation • increases blood flow near surface • increases radiated heat loss	MP2 allow liquid if sweating has been mentioned MP1 Vasodilation must not be in wrong context MP2 Not allow blood **vessels** moving MP2 allow 'blood diverted to surface'	1 1 1 Max 2 or 1 1 1 Max 2
7(a)(iii)	Any 2 from • Enzymes damaged/denatured • Alters chemical reactions/process OR body stops functioning properly • Death at 43^{o}C		1 1 1 Max 2
7(b)	• (Humidity) will reduce (rate of) evaporation of sweat • (Rate of) heat loss (by evaporation) is reduced	Ignore conduction, radiation, convection comments	1 1
7(c)	• (thermal) Radiation/infrared • Reflected back towards the body OR less emitted to surroundings	Ignore 'conduction' or 'convection' or sweating comments If silver facing outwards allow 'less emitted to surroundings'	1 1
7(d)(i)	It is the control OWTTE	Accept any use of control, e.g. 'used to **compare/check** how effective the materials are' or 'to **compare/check** temperature loss / change'	1
7(d)(ii)	Any 2 from • Suitable method for measuring water temperature • Suitable method for measuring time • Suitable method for measuring volume/mass of water	If temperature probe is given with data logger award (2) Ignore other equipment unless valid reason given for use, e.g. method for measuring fabric, or heating water	1 1 1 Max 2

7(d)(iii)	• Keeping time constant (to measure temperature change) OR a constant change in temperature (to measure time taken) Any two of: • Start temperature • size container • Volume water • Amount stirring • Thickness material (wrapped around) • Material of container OR colour of container • Position in vessel where temperature is measured • Air temperature	MP3 accept amount/mass of water MP6 accept 'type' container MP8 accept 'surrounding' temperature MP8 ignore 'same place'	1 Max 1 1 1 1 1 1 1 1 1 Max 2
7(d)(iv)	Any one of: • Smallest drop in temperature (in given time) OWTTE • Longest time for temperature to drop (for given temperature change) OWTTE	MP1 Allow 'smallest temperature difference' MP2 accept cool	1 1 Max 1
Total			**16**