



## **General Certificate of Education**

# **Applied Science**

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

**SC02      Energy Transfer Systems**

# **Report on the Examination**

*2009 examination - June series*

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## General Comments

The performance of candidates in this exam compared well with that in June 2008. However, it is worth noting that some of the same candidate errors keep resurfacing every year, despite the fact that they have been highlighted in previous reports.

Examples include the tendency of the less able candidates not to read the question properly resulting in, for instance, figures for the normal heart beat being given, rather than those for normal breathing rate.

Also, reference is still being made to 'heat' rising rather than 'hot air' rising. It is important that centres note the comments made in this report and inform their candidates accordingly.

## Question 1

- (a) Only the more able candidates gained three or four marks here. Many answers described how air is taken into the lungs or described the route taken, suggesting that the question had not been read properly. Also, there was considerable reference to air pressure increasing inside the lungs, during exhalation, rather than the pressure surrounding the lungs increasing compared with atmospheric pressure.
- (b)(i) A range of 12 -15 breaths per minute was often correctly given, although the range was sometimes incorrectly extended to, for instance, 12-16. A significant minority of answers gave values for the normal range for heart rate, or values around normal body temperature, subsequently receiving no marks.
- (ii) Most candidates noted that breathing rate would increase, but then went on talk about an increase in the depth of breathing. This suggested that they were not fully aware of the processes involved when a person is having difficulty breathing.
- (c)(i) The maximum two marks were only gained by the more able candidates who gave a good description or an accurate equation. Poorer answers tended to refer to either a maximum inhalation or a maximum exhalation, and not both, thus failing to gain a mark.
- (ii) The most common correct answer was that having a large number of subjects increased the accuracy or reliability of the results. No candidate appreciated that it ensured that the results obtained are not due just to chance alone.
- (iii) The most common acceptable example was comparing people who exercise a great deal (accepted for 'athletes vs. non-athletes') with those who don't. Many unsuitable examples were also cited.
- (iv) This question was generally answered well, demonstrating a good understanding of experimental design.
- (v) Many incorrect answers that failed to understand the importance of the elastic tissue in the lungs and chest walls.
- (d) Very well answered with mostly two correct mark points.

## Question 2

- (a)(i) There was good understanding of how hardening of the arteries reduces the elasticity of the vessels, resulting in reduced blood flow. However, there was little evidence to explain that the reduction in elasticity would cause the arteries to recoil or stretch less, making them less able to propel blood.
  - (ii) There were many confused answers making it evident that most candidates do not know where the coronary arteries are found. Many candidates seemed to think that the arteries supply blood to the heart chambers rather than the heart muscle. There were very few references to the need of the heart for oxygen for respiration, to supply energy for contraction of the heart muscle.
  - (iii) The two available marks were usually gained here for correctly mentioning that the presence of valves in veins prevent back flow of blood.
- (b)(i) Answers within the correct range were given more often than not.
  - (ii) Mountaineer E was mostly correctly identified.
  - (iii) Where blood pressure readings were described as very low to too low, below normal, the mark was awarded; however, no mark was gained for merely saying the blood pressure was low.
- (c) Most candidates gained the full two marks for correct descriptions of what happens to the heart during systole and diastole.
  - (d) The fact the device made it easier to get an accurate reading was the most common correct answer, with most answers gaining only one mark. Any mention of being able to use the device in a noisy environment was rare.

## Question 3

- (a) Most candidates correctly identified the fact that surgery is likely to be more risky with smokers and the stronger ones also mentioned the likelihood of healing taking longer. Very few references to cost-effectiveness were evident.
- (b) This was well answered with two correct mark points usually being given here.
- (c)(i) Most answers were awarded the mark here.
- (ii) Not wanting to increase the stress level of the patient was the usual correct answer given, with virtually no references to resource or financial reasons being the cause of withholding information from patients.

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**Question 4**

- (a)(i) 'Radiation' was mostly correctly given.
  - (ii) 'Convection' was given by many, although 'conduction' was also offered by the less able candidates.
  - (iii) Despite the fact that this issue has been raised many times in previous reports, candidates continue to talk about 'heat rising' rather than 'hot air rising'. Few realised that hot air expands, that rising air carries energy with it, or that convection currents were involved.
- (b)(i) The fact that plastic is a poor conductor or a good insulator was usually given for one mark. However, there was almost no mention of the fact that the insulation/conduction properties of plastic related to heat and electricity. On rare occasions, the lack of danger due to electrical shock was correctly noted.
  - (ii) The fact that shiny surfaces reflect was mostly understood but there was some confusion regarding what they reflect. Incorrect reference was often made to 'radiation reflecting heat' rather than the fact that it is the shiny surface that actually reflects the radiation.
  - (iii) One mark only was often awarded here for stating that air is an insulator or a poor conductor. Very rarely was there an explanation of how small pockets of air prevent convection or that there is not enough space for convection currents. Some candidates failed to read the question properly, one discussing the honeycomb in terms of bees leaving honey in the cells.
- (c) The explanation of the meaning of the  $U$ -value was generally limited to heat transfer rate, with the second and third mark points seldom being awarded.

**Question 5**

- (a)(i) Kinetic was usually correctly given.
  - (ii) The calculation was correctly carried out by the more able candidates, while the less able ones usually gained one mark for giving the equation or for correct substitution.
  - (iii) No marks were deducted for an error carried forward from the previous section. Although some answers gained full marks there was much confusion between the equations used for calculating the useful power output in this part of the question and for calculating the rate of energy transfer in the next part of the question.
- (b)(i) As for the previous part of the question, much confusion surrounded the use of the correct equations. As previously, no marks were deducted for performing a calculation using a figure obtained from an error carried forward.
  - (ii) Heat and sound were usually given for two marks.
  - (iii) 'Less friction' was the most common answer with occasional mention of the fact that less energy or power is wasted.
  - (iv) Nearly all candidates realised that efficiency cannot be above 100% or that no machine can create energy.
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- (c)(i) Wind or solar power were often given as an effective way of providing electrical power if no mains electricity is available. However, a significant number of answers incorrectly gave the water wheel as a source of electricity. Once the source of power had been correctly identified, the possible advantages and disadvantages provided were usually also correct.
- (ii) Most calculations were correct although full marks were not gained where the correct units had been omitted. This point has been raised in previous reports.

### **Question 6**

- (a)(i) The role of thicker padding in producing more distance to stop movement was the most common answer. However, fewer candidates understood that there would be a lower rate of change of momentum, talking instead about a lower momentum. Any reference to there being less impact on the cyclist's head, rather than less force, did not gain the mark.
- (ii) The fact that a large helmet would hinder head movement would be uncomfortable or would tire neck muscles were the most common correct answers.
- (b) Datalogging being a more accurate form of measurement was often recognised while the fact that it permits more significant figures was not. Seen less often were answers referring to datalogging measuring the actual speed rather than the theoretical speed.
- (c) Dropping the hammer from the same height and keeping the hammer or the mass of the hammer the same were common answers which gained two marks.
- (d) Very well answered with most candidates gaining the mark.

## **Mark Ranges and Award of Grades**

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