



**General Certificate of Education (A-level) Applied
January 2011**

Applied Science

SC02

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

Unit 2: Energy Transfer Systems

Report on the Examination

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General Comments

The performance of candidates in this exam compared well with that in June 2010. Most questions were well attempted, although the graph in question 5 was poorly drawn, with a failure to produce suitable axes and a lack of understanding that a line of best fit can be a curve.

There was a tendency amongst the weaker candidates to fail to read the question properly, resulting in inappropriate answers. One example is in question 3, where a request for three other ways in which heat can be lost from the body resulted in many answers that included sweating.

As in previous papers, the concept of what is meant by the U -value was often poorly understood, and only the stronger candidates fully mastered the calculations.

Some candidates tended to write in very small handwriting which often became unreadable. It would be useful to remind candidates that illegible writing will result in no marks being awarded for their answer. Several scripts scanned very faintly, perhaps caused by the use of blue ink.

Question 1

- (a) A good understanding of heart valves was generally shown, although there was still much confusion between the bicuspid and the tricuspid valves. There was occasional use of the letters 'T' and 'S', even though these letters were not mentioned in the question, suggesting a failure to read the question properly.
- (b) This question was mostly well answered. There was a common realisation that a double circulatory system involves blood travelling through the heart twice, while more specific details concerning it passing from the heart to the lungs and from the heart to the body were provided by many. Weaker answers referred to blood moving between the body and the lungs with no acknowledgement of the role of the heart. References were also made to blood moving twice around the body.
- (c) (i) This was generally well answered, although statements such as 'sending a message' did not score well. Most answers discussed the role of the S-A node and the stronger candidates gained the full three marks for describing the role of the cardiovascular centre, its position in the medulla, and the fact that the S-A node is situated in the right atrium of the heart. Weaker answers gained only one mark for stating the role of the brain in sending impulses to the heart to increase heart rate. There were some erroneous references to an increase in breathing rate and the diaphragm, rather than the heart, suggesting a failure to read the question properly. One answer talked about the nervous system sending signals to the ATP, while others stated that the heart itself sensed that more beats were needed and sent signals telling the brain.
- (c) (ii) Man X was usually identified correctly as being the fitter, with a correct explanation being supplied.

- (c) (iii)** Acceptable definitions of systolic and diastolic blood pressure were often provided although there were many surprisingly weak answers. Many incorrect answers talked about systolic pressure meaning oxygenated blood, maximum blood pressure, the pressure above, the highest pressure the blood is under, pressure when muscles contract, the amount of blood pumped out of the heart after the first beat, or simply the top number. Diastolic pressure was noted as being the reverse of systolic, such as deoxygenated blood, minimum blood pressure, the bottom number and so on. Systolic pressure was also described as being when the lungs contract, or other general references to breathing rate, suggesting a failure to read the question properly.
- (d) (i)** Most answers, while failing to state that the collection of more data would be one reason for testing 100 people, as opposed to 5, gained one mark for stating that the results obtained would be more reliable.
- (d) (ii)** Mostly correct answers demonstrating a good knowledge of the normal range for tidal volume.
- (d) (iii)** The normal range for peak expiratory flow rate was generally well understood.
- (e)** Most candidates recognised that the typical heart rate for men is lower than that of women and many deduced that the heart rate for athletes tends to be lower than that of non-athletes (although this mark was sometimes lost due to a failure to make a comparison). The trend regarding age was often not correctly described. Although the question asked for a description of trends seen in the data provided (heart rate in beats per minutes) there was a tendency to make inferences in terms of fitness.

Question 2

- (a) (i)** The fact that this imaging method provides clear images of bones and is widely available was generally noted. Many candidates referred to cost of X-rays which is not in the specification.
- (a) (ii)** The production of poor images of soft tissue, the potential health risk associated with over exposure to X-rays, or the possibility of cell damage were often mentioned, resulting in many answers being awarded the full two marks. However, a bald reference to there being a potential health risk received no credit when it was not linked to the risk being due to X-rays being used too many times. Any mention of 'radiation' alone received no credit, and there appeared to be some confusion between 'radiation' and 'radioactivity'.
- (b)** This question discriminated well with a wide range of answers and scores. The possibility of a new method of testing radioactive tracers causing a risk to the patient was often given and, to a lesser extent, objection from religious groups posing an issue to the conduct of the trials. Rather surprising, and giving some grounds for concern, was the almost total absence of any consideration of ethics regarding testing on animals. Many answers suggested testing on animals first, such as

needing to see the effects on a chimp first to see if the method was safe to use on humans. One such answer asked whether the method had been tested on animals with a similar brain layout to ours, prior to being used on humans. Any such statements obviously did not gain the mark for the ethics of animal testing. Most candidates received the mark for 'risk to patient' (often repeated under 'side effects', 'after effects', 'pain' and 'safety') but few looked at 'informed consent', 'ethics of animal testing' and 'are brain-damaged patients competent to give consent'. Many candidates referred to 'cost' but this is not an ethical issue.

- (c) (i) Most answers gained one of the two marks available by correctly noting that the use of radioactive tracers allowed the production of clear images of soft tissue. There was little reference to the fact that real-time images can be monitored continuously or that only small amounts of tracers are needed, while only a small number of candidates mentioned that tracers could be tracked as they moved. There were some vague answers that missed the point of real-time tracking of tracers in soft tissue. The statement 'help save lives' is not enough to be creditworthy at this level. Most got 'clear images in soft tissue' or 'can detect cancer' but little more. Also, most techniques can be interpreted to form a 3-D image, this not being special to radioisotopes, and hence such answers were not creditable. No credit was awarded for any reference to cost.
- (c) (ii) The possibility that radioactive tracers might be hazardous to the patient was often correctly noted, while the fact that the tracers would need to be stored safely, disposed of safely or may have short half-lives, was rarely commented upon.

Question 3

- (a) (i) Carbon dioxide was given in most answers as a waste product of aerobic respiration, with carbon monoxide occasionally given instead. The stronger candidates gave water as the other waste product, while weaker answers gave various incorrect answers that included oxygen and glucose.
- (a) (ii) Energy or ATP were mostly given for the mark here, although other options were frequently offered as an alternative, with many thinking that oxygen or glucose were useful products of aerobic respiration. These answers did not receive a mark.
- (b) The equation to determine the respiratory quotient was applied correctly by stronger candidates, while the weaker ones tended to substitute the figures from the table the wrong way round, gaining no marks. Many candidates could not solve a calculation of the form $0.7 = 25/\text{answer}$, it often seeming that they had no calculator with them.
- (c) This was often well answered; however, despite the fact that the question clearly asked for three other ways in which heat is lost from the body, **apart** from through the skin, many answers still gave sweating as one of their answers. This tendency to fail to read this type of question has been raised in previous reports and needs to be acknowledged if candidates are not to repeat the same error with future papers. Excretion and faeces were often taken as being the same, while urination and excretion were often given as two separate answers by some of the weaker

candidates. Some candidates had difficulty spelling the 'medical words' for bodily functions and resorted to colloquial expressions.

- (d) Most answers gained one mark for recognising that operating on an obese person is likely to be more risky. However, any answer mentioning that surgery could be risky rather than more risky, thus failing to make the distinction, was not awarded the mark, as all surgery has inherent risks whether or not a person is obese. Any reference to cost did not receive a mark unless the issue of cost effectiveness was properly clarified. A few did suggest that there was an extra cost to repeating operations either as a result of future obesity causing heart problems or because the extra recovery time would necessitate a longer hospital stay.

Question 4

- (a) This was mostly well answered, although vague answers such as 'may run out of coal' were not credited. A lack of understanding of what constitutes the greenhouse effect was apparent in answers such as 'bad for the greenhouse'.
- (b) Many candidates were unable to handle 6×10^9 and confused it with $6 \times 10 \times 9 = 540$ or $= 60$. Many forgot to include the unit. Also there was no need to copy out the zeros once 3×10^{13} has been written. Copying out zeros in calculation was strongly linked to maths errors.
- (c) This was generally well answered.
- (d) Again, great difficulties were evident involving powers of ten, with many candidates just ignoring them. Also, there were difficulties with dividing in equations, which was often confused with subtraction. Many candidates did not attempt this question, a regular mistake being $3 \times 10^{13} / 7.5 \times 10^8 = 4 \times 10^{20}$.
- (e) This was generally well answered. However, candidates who calculated an efficiency $> 100\%$ should have thought again. Sometimes no calculation was carried out, the answer merely stating whether the efficiency was good or not.
- (f) Many confused water in the top reservoir (and thus g.p.e.) with water in the lower reservoir (no g.p.e.).
- (g) There was a good range of answers.

Question 5

- (a) A good range of answers, although many added the masses and assumed both moved at 300 m/s. Also, many gave the correct equation but then failed to substitute properly.
- (b) Nearly all got 'recoil' but most missed the link to momentum.

- (c) The basics of momentum were not well understood.
- (d) There was a good spread of answers, although some referred to the 'weight of cannonball' without saying that it should be the **same** cannonball.
- (e) Many drew graphs with strange axes. Also, and importantly, the line of best fit can be a curve, and in this instance should have been.
- (f) Most realised that 'repeat readings' is a good start.

Question 6

- (a) Despite this error being highlighted repeatedly in the past, there were the usual answers talking about 'heat rising' which is not good enough for 'hot air rises'.
- (b) (i) A common answer that received no credit was 'insulation', more detail being needed at this level. Other incorrect answers included 'fill with polyfilla' and 'lofting'.
- (b) (ii) There was a good spread of answers but they were often too vague. Examples such as 'insulator' or 'trapped heat' are not good enough; 'trapped air is an insulator' is better; 'it (unspecified) is an insulator' is not a satisfactory answer. Few used effective words (as in specification).
- (c) Mostly good answers.

Mark Ranges and Award of Grades

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