

Science A
Twenty First Century Science

General Certificate of Secondary Education **J630**

Report on the Units

January 2008

J630/MS/R/08

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This report on the Examination provides information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the syllabus content, of the operation of the scheme of assessment and of the application of assessment criteria.

Reports should be read in conjunction with the published question papers and mark schemes for the Examination.

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CONTENTS

Twenty First Century Science GCSE Science A (J630)

REPORTS ON THE UNITS

Unit/Content	Page
A211/01 – Twenty First Century Science A (B1, C1, P1) Foundation Tier	1
A211/02 – Twenty First Century Science A (B1, C1, P1) Higher Tier	3
A212/01 – Twenty First Century Science A (B2, C2, P2) Foundation Tier	5
A212/02 – Twenty First Century Science A (B2, C2, P2) Higher Tier	8
A213/01 – Twenty First Century Science A (B3, C3, P3) Foundation Tier	10
A213/02 – Twenty First Century Science A (B3, C3, P3) Higher Tier	12
Grade Thresholds	14

A211/01 – Twenty First Century Science A (B1, C1, P1) Foundation Tier

General Comments

The paper was well attempted with a mean mark of 25/42, and there were frequent indications that centres had used the two previous papers to good effect in preparing their candidates. Centres are reminded that questions on A211, A212 and A213 will all be objective style, although A214 expects extended writing. It is also important to note that all the papers for Science J630 focus on Ideas about Science, and that the Science content provides contexts which explore these ideas.

Candidates should be aware that the marking is carried out on scanned images of their scripts. Consequently, if candidates change their minds, any alterations must be made clearly and unambiguously. Sometimes candidates coded their answers in the wrong way – putting ticks and crosses instead of T (true) and F (false) in question 1(a), or the reverse in 1(b), was seen frequently – but as long as the candidates' intentions were clear, they could gain the marks.

In most questions on the Foundation paper, the number of choices to be made should be clear. In some questions, however, candidates are instructed to tick each box next to a correct answer. In these cases, the number of marks should not be taken as an infallible guide to the number of ticks to be placed; it is important to make a choice on each of the boxes offered.

Comments on Individual Questions

- Q1** This question on the structure of the Earth, was well answered, but only the most successful candidates gained full marks. Weaker candidates did not follow the instructions to choose three statements in part (b) – even if candidates are only sure of two answers, in this question it made sense to put a third tick in one of the remaining boxes, as it could not lose marks.
- Q2** This question on the development of scientific explanations about nature and movement of galaxies, examined the historical debate between astronomers in the early twentieth century. Part (a) was common with the higher tier, and was answered completely correctly only by the better candidates in this paper. Less than half the answers to part (b), showing that Hubble's data supported Curtis's idea about galaxies, were correct, which is only marginally better than by chance. The more factual parts, (c) and (d), about the movement of galaxies and the age of the Universe, were generally poorly attempted.
- Q3** This question on screening embryos for genetic defects was generally well done, including parts (b)(i) and (b)(iii), which were also on the higher tier. It is possible that weaker candidates answered (b)(i) in reverse, identifying the tests which will not be allowed, as quite a few answers had both ticks in the wrong boxes.
- Q4** This question on surrogate mothers was slightly less successful than question 3. Many candidates clearly knew the numbers of copies of each chromosome in egg and sperm cells, and in fertilised egg cells, although the chemical present was a mystery to some. In a similar way, less well-prepared candidates were unaware of the male sex chromosomes in part (b), and in part (c) did not realise that the baby will more closely resemble the egg donor than either of her sisters; these two parts were common to the higher tier paper. The majority of candidates could identify at least two of the three 'talking heads' who had reservations about the use of surrogate mothers.

Report on the Units taken in January 2008

- Q5** This question on the pollution produced by cars produced a wide range of responses. Better candidates could interpret the MOT test results clearly, knew the hydrocarbon reactions involved and understood what an outlier was. Only the best could identify the range of the data (22% of the candidates left this part out) and give the two reasons for repeating tests, questions which were also on the higher tier paper (and not very successfully tackled there, either).
- Q6** This question about pollutants in the atmosphere was well answered. In part (a), candidates were much better at identifying the proportions of gases in the atmosphere than in a similar question a year ago. Reading the graph of pollution variation was generally well done, as was the identification of molecules.

A211/02 – Twenty First Century Science A (B1, C1, P1) Higher Tier

General Comments

The paper was well attempted and produced a good spread of marks, typically from mid teens to mid thirties. The level of difficulty was appropriate for higher tier and differentiated effectively. The candidates were able to show their understanding of both science explanations and ideas about science as demanded by the specification.

Centres and candidates should be aware that marking is done on-line from scanned scripts; consequently any corrections must be completely unambiguous to ensure that they gain credit. Most candidates read and followed instructions carefully. However, candidates must note that, except where stated in the rubric, they cannot assume that the number of marks available corresponds exactly to the number of responses required. There was no evidence that candidates ran out of time and all seem to have managed their time effectively.

Comments on Individual Questions

- Q1** (a) A common error was that many students thought the mantle to be liquid. Some students also lost marks because their F and T responses had been altered and it was no longer clear as to which response was intended.
(b) This proved to be a difficult question with many candidates only giving one of the two pieces of information needed for the mark.
- Q2** (a) This question was overlap with Foundation and was well answered by the majority of candidates.
(b) Most candidates successfully noted that Hubble's evidence supported Curtis but many failed to spot that Hubble's data supported neither theory in relation to the size of the Milky Way; perhaps candidates were reluctant to put two crosses.
(c) Most candidates scored well. A common error was considering the graph to support the idea that the increase in speed of a more distant nebula is caused by its greater distance, rather than recognising that this was simply a correlation.
- Q3** (a) This question was free recall but answered correctly by the majority of candidates.
(b) Most candidates showed that they correctly understood genetic inheritance.
(c) This proved to be a very demanding question with few candidates successfully picking their way through the detail in the quotes.
(d) Most candidates showed they understood how identical twins are produced but only the best candidates recognised the role of mutations in altering DNA.
- Q4** (a) Most candidates clearly read the text with understanding and gained credit.
(b) The vast majority of candidates recognised that genetic and environmental factors affected the probability of suffering from schizophrenia.

Report on the Units taken in January 2008

- Q5** (a) (i)(ii) Candidates showed good understanding of the vocabulary of science with only the weakest confusing fact and conclusion in part (i).
- (b) Most candidates gained one mark for recognising that the process described differed from cloning embryonic stem cells as cells from the patient were used, but only the best candidates recalled that therapeutic cloning of embryonic stem cells requires nuclear replacement.
- (c) (i) Many candidates showed good appreciation of ethical issues and correctly identified the arguments against the use of embryonic stem cells.
- (ii) Again, candidates showed good appreciation of the arguments often identifying two of the three statements. However, only the best candidates identified all three correctly.
- Q6** (a) Candidates often only ticked two of the three boxes required and so lost marks (see general comments).
- (b) It was disappointing to see how few candidates could correctly identify the sources of the atoms from which the pollutant gases were formed.
- (c) (i) The vast majority of candidates were able to correctly identify the best description of an outlier; this is clearly being well taught.
- (ii) Candidates were less clear about the meaning of range. Many candidates offered descriptions of data and a significant minority wrote 0.2 to 0.4 rather than 0.02 to 0.04%.
- Q7** (a) This proved to be a difficult question. Only the very best candidates showed a clear understanding of how catalytic converters work and scored two marks. Many seemed to pick up a single mark almost at random as there was little logic shown in the two choices recorded.
- (b) By contrast, this question was well answered and a gratifying number of candidates clearly understood the molecular diagrams and correctly identified the compounds depicted.
- (c) Most candidates gained at least one mark here but many failed to read or understand the y-axis scale in terms of kg per person or did not know that the population of Australia is far less than that of the USA.

A212/01 – Twenty First Century Science A (B2, C2, P2) Foundation Tier

General Comments

Students coped very well with this relatively new format of question paper. It was unusual to see any gaps. Candidates used their time well and completed the paper fully. There was evidence that many candidates revisited their answers and revised their responses.

A common error was not to make enough choices in the questions. For example, in Q1 (c)(iii), candidates were asked to tick boxes. Many only ticked a single box.

Teacher's tip:

Use this paper to practise the 'tick boxes' type questions so that candidates are ready to tick more than one box where appropriate. Look at questions 1(c)(iii) and 3(b).

Candidates who revisited answers often crossed out previous answers and sometimes rewrote new answers in margins. Examiners mark the answer that the candidate has given as his/her 'last' answer, wherever it is written.

Comments on Individual Questions

Q1 Parts (a) and (b) of this question also appeared on the higher tier paper. Common questions are designed to test achievement at grades D and C and so proved quite demanding for foundation tier candidates.

- (a) Most foundation tier candidates gained a single mark for at least two 'true' and false' judgments being correct. Processing the information in the table was difficult for less able candidates.
- (b) Most candidates were able to select some relevant information from the table and match this to the uses of the polymers. Marks ranged between one and three, showing a full range of achievement.

Teacher's tip:

Questions that use tabulated data to set several part questions are common on this type of paper. This is a good example to use to help candidates practise this skill.

- (c)
 - (i) Most candidates were able to identify the outlier in the data.
 - (ii) Many candidates correctly worked out the best estimate, but many appeared to guess, choosing one of the values in the table.
 - (iii) This answer required two boxes to be ticked. Some candidates only ticked a single box.

Report on the Units taken in January 2008

Q2 This question contained mainly lower demand tasks, so most candidates scored at least half marks.

- (a) This was a common question with the higher tier. Candidates on the foundation tier found this difficult, often choosing 'about 10' or 'over 100' as the number of types of different atom in a hydrocarbon.
- (b) Most candidates correctly identified 'small molecule' and many knew 'cross links'. Many confused 'polymer' with 'plasticiser'.

Teacher's tip:

This is a clear diagram of polymerisation and cross linking. Use this diagram when teaching this area as practice.

- (c) Most gained at least one of the two available marks here. The more/less flexible outcome of cross linking was the least well known.

Q3 Part (b) of this question was common with the higher tier, aimed at C/D candidates.

- (a) Most candidates gained at least two, but often three, marks here. Some were confused and believed that the Earth is cooler than otherwise. This type of question, where candidates are asked to complete sentences, is well answered by candidates.
- (b) Although aimed at C/D candidates, all foundation tier candidates answered both parts of (b) well. The commonest error was to tick the wrong number of boxes.

Teacher's tip:

Use this question as practice for the tick box technique. Make sure students notice that in the first part they are asked to tick two correct names, while in the second they are only asked to tick one.

- Q4**
- (a) Almost all candidates knew the position of X-rays in the spectrum, but other types of radiation were often jumbled.
 - (b) Most candidates were able to gain at least one, and often three marks, showing a good understanding of microwave properties.

- Q5**
- (a)
 - (i) This was another 'join the boxes' type question. Again, candidates tackled this well, most gaining at least one of the two available marks.
 - (ii) Most candidates knew that microorganisms reproduce and that illness produces symptoms. Fewer knew that microorganisms produce poisons, with 'antibodies' being a common wrong choice.
 - (b)
 - (i) Many correctly identified 15% as the correct answer, but all choices were selected. 150% was a surprisingly common incorrect choice.
 - (ii) Again, many candidates only ringed a single word, instead of the two demanded by the question. Many thought viruses could be killed by antibiotics.
 - (c) The commonest error was to tick a single box.

Teacher's tip:

This page has two examples of questions where more than one response needs to be made. This page would be a good one for practising making more than one selection in different types of question.

Report on the Units taken in January 2008

- Q6** (a) This proved to be the easiest question on the paper, with almost all candidates able to identify the two arteries and the vein.
- (b) Correlations seem to be well understood by foundation tier candidates. Most gained at least one mark for correctly identifying a correlation or for identifying evidence against it.

A212/02 – Twenty First Century Science A (B2, C2, P2) Higher Tier

General Comments

The paper was well attempted with a mean mark of 24/42, and there were very few omissions on the paper. Centres had clearly used last year's A212 papers to good effect in preparing their candidates. Centres are reminded that questions on A211, A212 and A213 will all be objective style, although A214 expects extended writing. It is also important to note that all the papers for Science J630 focus on Ideas about Science, and that the Science content provides contexts which explore these ideas.

Candidates should be aware that marking is done from scanned images of their scripts. Consequently, if candidates change their minds, any alterations must be made clearly and unambiguously – letters which may be T, or may be F, will not gain marks. Redrawing lines linking boxes in a different colour is also unhelpful, as the papers are scanned in black and white. Some candidates made corrections clear by writing in the margin, e.g. numbering the boxes on each side to make it clear which was meant to join to which: this was quite acceptable.

In some questions on the Higher paper, the number of choices to be made should be clear. In other questions, however, candidates are instructed to tick each box next to a correct answer. In these cases, the number of marks should not be taken as an infallible guide to the number of ticks to place; it is important to make a choice on each of the boxes offered.

Comments on Individual Questions

- Q1** This question on the two types of poly(ethene), was largely common with the foundation tier. Candidates scored highly in parts (a) and (b), although only the best identified all four correct statements in (a). In part (c)(i), less than a quarter of the candidates correctly removed the outlier to find the mean force, and an even smaller proportion chose the correct statements about the data and the measurement procedure in parts (ii) and (iii).
- Q2** This was on the structure and recycling of the rubber in car tyres. Most candidates correctly identified the structural diagrams corresponding to the polymerisation and plasticising processes, but in part (b) very few identified the three correct boxes in the discussion of life cycle assessment – less than 10% for each of (b)(i) and (b)(ii). Doubtless some thought that two marks = two ticks, but this is certainly not the case when the instructions are 'Put a tick in each correct box'.
- Q3** This question on the hot, dry summer of 2006, was largely common with the foundation tier, and the overlap sections (b)(i) and (ii) were done very well. Identification of the properties of radiation from the electromagnetic spectrum in part (a) was generally sound, but only the very best candidates realised that photons do not lose energy as they travel.
- Q4** This question on the possible hazards of a microwave oven performed similarly to question 3. Part (b), exploring the assessment of risk, was well done, but in part (a), only the best candidates could select the ionising radiations in the electromagnetic spectrum from the list.

Report on the Units taken in January 2008

- Q5** This question on tuberculosis was partly common with the foundation tier, and candidates for this paper scored well on these parts. The remaining parts showed clear understanding of the nature of infection; it was notable that over a third of the candidates did not know that antibiotics are effective against fungi as well as bacteria.
- Q6** This question, about the low incidence of heart disease in France, showed good understanding among candidates of the mechanism of circulatory problems leading to heart disease. Candidates were less successful in the latter parts of the question, exploring the nature of correlation and cause and the process of peer review. This was an interesting contrast with other questions, where the performance of candidates on the 'Ideas about Science' aspects was stronger than that on the Science Explanations.

A213/01 – Twenty First Century Science A (B3, C3, P3) Foundation Tier

General Comments

Candidates are becoming skilful at answering this style of paper, answering using the method required and rarely ticking more than the required number of boxes.

Comments on Individual Questions

- Q1** (a) (i) Only the better candidates were able to identify correctly all 3 words from the list. Correctly identifying 'stimuli' as the changes detected by receptor cells caused the most problems. Most candidates were able to select either that the eyes are part of the nervous system or that cells which detect changes are called receptor cells.
- (b) Few candidates placed all the statements in the correct order, with the commonest error being to place the statement, 'over many generations, lenses improved' too soon, treating it as an initial statement rather than a consequence of the other changes.
- Q2** (a) Most candidates correctly selected 'herring' as the safest and healthiest fish to eat from the list although a significant number chose 'mackerel' in spite of it being identified as contaminated with poisons.
- (b) Some candidates confused sustainability with pollution and selected the statement that 'fish will be poisoned by pollution.' Few thought it necessary to completely stop fishing.
- (c) (i) The fact that food chains start with plants was well understood by most candidates.
- (ii) While many candidates understood that the loss of the herring would reduce the number of mackerel due to the reduction in their food source, many misunderstood the significance of the direction of the arrows in the food web and thought that the herring ate the mackerel.
- Q3** (a) The majority of candidates were able to successfully select both an extinct species and a not extinct one. Some seemed to confuse upright man with modern man in spite of the time line, and others seemed confused about the meaning of extinct.
- (b) Although most candidates correctly chose upright man as having the smallest brain, Neanderthal man did appear frequently, possibly due to candidates relying on knowledge of primitive hominids instead of using the diagram given.
- (c) (i) Most candidates correctly selected the height of the remains (A) and their age (C), as data. However, many chose D, usually at the expense of A.
- (ii) Most candidates correctly identified the use of stone tools and signs of cooking (B) as the pointers that the species may have been quite intelligent. Again, statement D was the commonest error.
- Q4** (a) Many candidates incorrectly chose fat as the food chemical to be eaten in the smallest amount, probably using knowledge of unhealthy eating rather than interpreting the numbers in the table.
- (b) (i) Almost all candidates realised that the crisps were high in fat with many correctly labelling all three food chemicals correctly.
- (ii) Most candidates were able to select at least one correct statement explaining why Eve could not assess the risk of eating the crisps. The need to take into account the amount of crisps she ate seemed the most popular correct choice, with the lack of information about other brands of crisps the commonest error.

Report on the Units taken in January 2008

- (c) An encouraging number of candidates correctly selected both explanations. The commonest error was to select other health problems instead of the idea that measuring risk does not work for individuals.
- Q5** (a) The effect of a range of factors on yield of crops was well understood. The commonest error was to think that adding nitrogen to the soil decreased yield.
- (b) Candidates struggled to identify the arguments for and against spraying a crop with pesticide and few candidates got all four correct. All statements caused difficulty although the significance of pesticide residues left in plants and soils seemed least understood.
- (c) Most candidates correctly selected aflatoxin from mould and/or herbicides as the harmful chemicals from the list. Few selected fibre.
- (d) Candidates found this question difficult and many were unable to identify correctly the elements in either carbohydrates or proteins.
- Q6** (a) (i) The penetrating power of alpha particles was not well known.
- (ii) More candidates were aware of the ability of ionising radiation to break up molecules but many thought it was given out by mobile phones.
- (iii) Most candidates understood that ionising radiation could cause cancers in living cells and that the cells might die. When marks were lost it was usually due to selecting one option only.
- (b) Most candidates identified Cambridgeshire as a region having very high radon levels, although a significant number chose Yorkshire. Again, most candidates correctly identified Norfolk as having no area with more than 3% of houses needing action. Candidates found the selection of regions with more than half at very low radon levels difficult, but most correctly chose either Norfolk or Cambridgeshire.
- (c) (i) Few candidates selected an incorrect response here. Where a mark was lost it was usually due to selecting one response only.
- (ii) Most candidates were able to correctly identify Steve as the person planning changes to his house to reduce the risk from radon gas.
- Q7** This was an extremely well answered question with many candidates gaining all 3 marks. The order of steam turning a turbine and the production of steam caused the most problems.

A213/02 – Twenty First Century Science A (B3, C3, P3) Higher Tier

General Comments

The paper appeared to be generally accessible to many candidates. Very few attempted to use forms of response other than those directed within the rubric of the paper and even fewer provided answers in inappropriate locations on their scripts. With an overall spread of marks from 14 to 41 (out of 42 maximum), it is clear that the content of the paper was not too easy or too challenging for most candidates. This was the second occasion for which A213/02 was available; as before, candidates were clearly well prepared for this style of paper. Questions focussing on Ideas about Science were generally well answered. The paper was well done by most candidates, with nearly half scoring more than 25 marks.

Comments on Individual Questions

- Q1**
- (a) This question was common with the foundation tier. Some candidates did attempt to define the cells as 'sensitive' but this was not considered to be acceptable. Many correctly defined the cells as sensory or receptor cells.
 - (b) This question was common with the foundation tier. Some confusion led to the misplacement of statement D, i.e. individuals who could focus light on the retina could find food or escape predators better. However, many candidates obtained full marks.
 - (c) Some candidates replaced the correct response (4) with an error (1). It was apparent that some misread the evolutionary tree and considered that octopuses evolved from vertebrates.
- Q2**
- (a)
 - (i) Many candidates were able to provide the correct term. There was a tendency to choose the term 'gene' rather than 'allele'.
 - (ii) Some candidates chose key words associated with the concept of mutation, such as natural selection and variation, rather than the scientific term 'mutation'.
 - (b) For some candidates, a misunderstanding was apparent. They considered that the use of insecticides had caused the change in DNA. Equally, some thought that it was not possible for DNA changes to happen, even if insecticides are not used. They did not seem to appreciate the random or chance event of mutation.
- Q3**
- (a) This question was common with the foundation tier. Many candidates obtained the mark but some chose response D rather than B. This would imply that they had not read or understood the data provided.
 - (b) Candidates tended to get both responses correct or placed ticks in the top and bottom boxes, thereby losing the mark. Choosing the latter responses indicates that the candidates had not linked the axes of the graph to the question.
 - (c) Many candidates identified C and F correctly, but others chose other letters almost at random. This was a challenging question and required a sound ability to draw effective conclusions from data.

Report on the Units taken in January 2008

- Q4** (a) (i) This question was common with the foundation tier. Many candidates found this item to be straight forward. Most candidates at least recognised that the crisps were high in fat when compared to the guidelines for healthy amounts in foods, i.e. 33g per 100g vs 20g per 100g.
- (ii) This question was common with the foundation tier. Relatively few candidates obtained both marks but many received 1 mark for the third box. They appreciated that Eve would need to take into account the amount of crisps eaten.
- (b) (i) Few candidates obtained both marks for two correct columns. A number realised that carbohydrates contain carbon, hydrogen and oxygen. However, although many appreciated that proteins contain nitrogen, they thought that one of the other three elements must be missing from proteins.
- (ii) This was probably one of the most challenging questions. Although the first choice of amino acids was recognised, the second was often missing. This implies that some candidates realised that proteins were digested to release amino acids but could not understand the reverse process during protein synthesis. Some confusion also exists with regards to the breaking down of excess proteins in the liver, some considering that this takes place in the kidney. Even the most able candidates continue to be confused with the terms urine and urea.
- (c) Many candidates were able to identify the true and false statements. No alternative pattern emerged.
- Q5** (a) The left hand pattern of linking lines was generally completed correctly by candidates. They were able to utilise the data in the table. The right hand pattern of linking lines was also generally accessible but some candidates repeated the left hand pattern or lost the mark due to the addition of extra lines, i.e. they did not fully appreciate the operation of emulsifiers, antioxidants and preservatives.
- (b) This item appeared to present many difficulties. Most candidates did not appreciate that as many as three crosses were required. An effective understanding about the properties and use of additives was needed to answer this question correctly.
- Q6** (a) (i) Most candidates failed to achieve the mark available for this item. A very varied response pattern was observed reinforcing the conclusion that candidates do not generally understand the composition of the nucleus in an atom.
- (ii) Candidates often negated their marks due to additional ticks in one or two of the top three boxes. Some realised that sample H, containing the heavier type of radon atoms, would have about a quarter of its activity after 8 days.
- (b) This question was common with the foundation tier. Many candidates correctly identified the Cambridgeshire pattern across all three rows, and even the Norfolk pattern. However, some did not appear to be able to interpret the data in the maps and relate this to the table of percentages.
- (c) (i) A significant number of candidates were able to recognise the relevant statements in support of 'taking action'. No other clear pattern emerged.
- (ii) Candidates generally had a good understanding of the precautionary principle.
- Q7** The interpretation of data contained within a letter generated a variety of responses from candidates. Very few candidates obtained all 4 marks but many did well apart from some confusion when considering the release of energy from the 'burning' of nuclear fuel and the use of steam to turn turbines and generators.

Grade Thresholds

**General Certificate of Secondary Education
Science A (Specification Code J630)
January 2008 Examination Series**

Unit Threshold Marks

Unit		Maximum Mark	A*	A	B	C	D	E	F	G	U
A211/01	Raw	42	N/A	N/A	N/A	29	25	21	17	13	0
	UMS	34	N/A	N/A	N/A	30	25	20	15	10	0
A211/02	Raw	42	32	27	22	18	15	13	N/A	N/A	0
	UMS	50	45	40	35	30	25	23	N/A	N/A	0
A212/01	Raw	42	N/A	N/A	N/A	32	27	23	19	15	0
	UMS	34	N/A	N/A	N/A	30	25	20	15	10	0
A212/02	Raw	42	33	28	23	18	13	10	N/A	N/A	0
	UMS	50	45	40	35	30	25	23	N/A	N/A	0
A213/01	Raw	42	N/A	N/A	N/A	30	26	22	18	14	0
	UMS	34	N/A	N/A	N/A	30	25	20	15	10	0
A213/02	Raw	42	34	29	24	20	16	14	N/A	N/A	0
	UMS	50	45	40	35	30	25	23	N/A	N/A	0

Specification Aggregation Results

Overall threshold marks in UMS (ie after conversion of raw marks to uniform marks)

	Maximum Mark	A*	A	B	C	D	E	F	G	U
J630	300	270	240	210	180	150	120	90	60	0

The cumulative percentage of candidates awarded each grade was as follows:

	A*	A	B	C	D	E	F	G	U	Total No. of Cands
J630	0.0	1.9	19.6	43.9	67.3	85.5	95.8	99.5	100.0	214

For a description of how UMS marks are calculated see:

http://www.ocr.org.uk/learners/ums_results.html

Statistics are correct at the time of publication.

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