



**General Certificate of Education (A-level)
June 2012**

Science in Society

SCIS4

(Specification 2400)

Unit 4: Case study of a scientific issue

Final

Mark Scheme

Mark schemes are prepared by the Principal Examiner 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 examiners 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 examiner understands and applies it in the same correct way. As preparation for standardisation each examiner 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, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal Examiner.

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.

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Question	Marking Guidance	Mark	Comments
1	<ul style="list-style-type: none"> • comparison with previous data • sensible suggestion for comparison period, • control for factors such as illness, age etc., 	2	any 2 for 1 mark each
2	<ul style="list-style-type: none"> • compare temperatures and increases in health problems • identify correlation between temp & health problems/hospital admissions/GP visits • choose different levels depending of increases in the health effects. 	2	<ul style="list-style-type: none"> • <i>data</i> • <i>how used</i>
3	<p>Systematic error</p> <ul style="list-style-type: none"> • error arising from measuring equipment • error arising from way measurement is carried out • temperature measurements hotter than surrounding area (so area appears to have warmed more) • heat island effect 	2	1 mark for definition, 1 mark for explanation
4	<ul style="list-style-type: none"> • redesign equipment/different equipment • measure quantity in more than one way 	1	any one for 1 mark
5	<p>Green roofs</p> <ul style="list-style-type: none"> • reduce overall outdoor temperature of urban areas • reduce temperatures in the buildings • mechanism of green roofs <p>AC</p> <ul style="list-style-type: none"> • reduce indoor temperatures <p>Health</p> <ul style="list-style-type: none"> • named health benefit of cooler people • filter air - reduced breathing problems and hospitalisations. 	4	must have green roofs and AC for full marks

6	<p>Green roofs</p> <ul style="list-style-type: none"> • reduce outside temperatures, • absorb radiation from sun and don't re-radiate it / energy balance of building • absorbs (local) CO₂ / reduces need for fossil fuels <p>AC</p> <ul style="list-style-type: none"> • heat from inside the building is 'dumped' outside the building, • street temperatures increase so more unpleasant for pedestrians, • more emissions of greenhouse gases/ increased fossil fuel use • idea of positive feedback /making things worse (in terms of CO₂ and global warming) <p>Comparison – may be implicit</p> <ul style="list-style-type: none"> • Green roofs will improve outdoor environment, but AC will make it worse • AC might improve environment inside building more than GR, but makes outside worse 	4	must have comparison for full marks.
7	<ul style="list-style-type: none"> • estimated <u>use</u> (rather than owning) of AC, • split study population into 100 zones 	2	
8	<p><i>modelling</i></p> <ul style="list-style-type: none"> • allows predictions to be made, • can change variables easily to match the real data, • can model a large system (e.g. Greater Manchester), • can carry out experiments that would be impracticable. <p><i>experimental research</i></p> <ul style="list-style-type: none"> • can look at actual cooling achieved by trees/vegetation, • provides confirmation of accuracy of models, • can't always adapt known data (from one type of vegetation) to model another / limitation of modelling • climate models are complicated and work on a large scale / not on a street by street basis. <p><i>Both</i></p> <ul style="list-style-type: none"> • Need model to create predictions and hypothesis - experiment to provide actual data to refine model and carry out calculations. 	4	max 3 for each section
9	<ul style="list-style-type: none"> • synthesise all (high quality) research carried out on a single topic / uses findings from different researchers, • assess the strength of different methods /research studies • increases sample size / more confidence in findings 	2	1 mark for definition 1 mark for benefit

10	<ul style="list-style-type: none"> • Positive value - park is cooler than the surroundings 	1	
11	<ul style="list-style-type: none"> • K • M • N • P • Q • S • X • Z 	1	any 2 for 1 mark (order not important)
12	<ul style="list-style-type: none"> • temps measured over a few days or one day – other variables might affect the cooling • Most within temperate zone –not be representative of other places (e.g. tropics, arctic etc.) • observational design / comparing existing variation – potential confounding variables (size of area, airflow etc.) • insufficient description of experiment / don't know how well variables were controlled - can't easily compare different studies • small number of sites measured - replication of data limited / not representative • not many of studies on green roofs 	4	Any 2 for 1 or 2 marks each (1 mark for limitation, and 1 mark for why it makes data less useful)
13	<ul style="list-style-type: none"> • attracting wildlife • providing shade • improving local air quality • reducing flood risk <p><i>Not 'improving quality of life/pleasanter place to live'</i></p>	2	any 2 for 1 mark each

14	Method	Advantage	Disadvantage	2	1 mark for advantage, 1 mark for disadvantage (not <i>quick and easy</i> , should try to say why)
	door-to-door home visits	<ul style="list-style-type: none"> • qualitative data • more in depth views 	<ul style="list-style-type: none"> • time consuming, • people may not want to answer 		
	letters	<ul style="list-style-type: none"> • sent to large number of people 	<ul style="list-style-type: none"> • little response 		
	questionnaires	<ul style="list-style-type: none"> • sent to large number of people, • quantitative data 	<ul style="list-style-type: none"> • may get biased response sample • low response rate 		
	interactive workshops	<ul style="list-style-type: none"> • qualitative data, • more in depth views 	<ul style="list-style-type: none"> • biased views (those who care strongly will attend) 		
15	<ul style="list-style-type: none"> • social factors / named example of social factors (e.g. people like living on tree lined streets) • popularity with voters / Upcoming election / support from mass media • financial cost of policy • (inter)national legislation / influence other cities / set example • lobbying / support from other groups • personal conviction / party policy (explained) 			3	Any 3 for 1 mark each

<p>B15</p>	<p>Energy balance</p> <ul style="list-style-type: none"> temp depends on how much energy comes in /goes out of atmosphere <p>Urban</p> <ul style="list-style-type: none"> Urban areas reflect less radiation and absorb more of the energy. Urban energy is stored Energy reradiated/released during the night. <p>Rural</p> <ul style="list-style-type: none"> vegetation reflects more energy / increases albedo vegetation uses incoming energy for growing/plant processes vegetation uses absorbed energy used to evaporate water from leaves reduces reradiated energy <p>Level 4</p> <ul style="list-style-type: none"> all three sections covered in detail comparison of U and R material from sources is (correctly) cited written in own words using >1 source suitable language for AS student <p>Level 3</p> <ul style="list-style-type: none"> 2 sections covered in detail (or 3 less detailed) comparison of U and R good paraphrase of 1 source + additional material / or 1 source in own words attempts suitable language for AS student <p>Level 2</p> <ul style="list-style-type: none"> 2 sections covered some incorrect science attempts to paraphrase 1 source language not suitable for AS student <p>Level 1</p> <ul style="list-style-type: none"> brief info for 1 or 2 sections incorrect science verbatim (uncredited) quotes / little attempt at paraphrase poor structure / language 		
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<p>B16</p>	<p>Use level descriptors</p> <ul style="list-style-type: none"> • Health problems due to heatwaves / hotter cities (A, C, D, E) <ul style="list-style-type: none"> ○ link to potential health benefits for specific groups • Urban heat island effect <ul style="list-style-type: none"> ○ London 7°C hotter than countryside (D) • Cools surrounding areas <ul style="list-style-type: none"> ○ wooded streets in Tel Aviv 4°C cooler (D) ○ shady parks reduced temp in shade by up to 9°C (D) ○ Figure 3 in (E) • reduces energy use in public buildings <ul style="list-style-type: none"> ○ Tree shade in Chicago buildings (D) ○ Green roofs in Toronto in source (D) • Cost/benefit discussion <ul style="list-style-type: none"> ○ Straightforward to carry out ○ Few negative consequences if doesn't work <p>General points</p> <ul style="list-style-type: none"> • link to sustainability / energy use at a council level • improves local environment (F) • provides jobs for local people • could arrange volunteers to collect up leaves / community action <p>Counterarguments:</p> <ul style="list-style-type: none"> • Limited scientific evidence of efficiency / more research needs to be done (reference to E and answer to q 12) • • using other methods (e.g. AC) can lead to other health benefits (source C) • takes a long time for trees to get big enough to provide shade <p><i>avoid crediting highly answers which could be written without reference to the sources or SCIS course</i></p> <p>Level 4</p> <ul style="list-style-type: none"> • evidence used to support claims • includes clear link to sources esp. D and E. • discusses energy use • counterargument to objections • journalistic style 		
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	<p>Level 3</p> <ul style="list-style-type: none">• some evidence to support claims included• includes links to sources (not always clear)• attempts journalistic style <p>Level 2</p> <ul style="list-style-type: none">• attempts to support claims• no clear link to sources• style limited <p>Level 1</p> <ul style="list-style-type: none">• based only on 'people like trees' argument• no reference to energy use• style not suitable		
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Level of Response	Descriptors	Mark Range	
good level 4	<ul style="list-style-type: none"> • clear exposition of science explanations relevant to the issue; • appropriate and effective use of the relevant ideas about how science works; • good overall grasp of the range and nature of the issue(s); • interprets arguments presented, recognising evidence, claim and counterclaim; • writes well-structured argument using a range of evidence to reach a reliable conclusion, includes counter-argument; • fluency and accuracy of expression, with only minor errors of grammar, punctuation or spelling. 	10-12	must include explicit reference to sources
competent level 3	<ul style="list-style-type: none"> • good attempt at exposition of science explanations; • use of some relevant ideas about how science works; • general grasp of the range and nature of issue(s); • interprets arguments presented, recognising some of the main components • writes structured argument using some evidence to reach a conclusion; • accuracy of expression, with some errors of grammar punctuation or spelling 	7-9	may include implicit reference to sources
limited level 2	<ul style="list-style-type: none"> • exposition of science explanation minimal or inaccurate • minimal use of ideas about how science works; • grasp of some features of the issue(s); • interprets only part of arguments presented • arguments presented but with weak structure and/or minimal evidence • accuracy of expression, but with serious errors of grammar punctuation or spelling 	4-6	
inadequate level 1	<ul style="list-style-type: none"> • exposition of science explanation confused • use of ideas about how science works absent or wrong • appears not to understand the issue; • cannot interpret the argument presented • argument presented as just a claim with no structure or evidence • expression unclear with serious errors of grammar punctuation or spelling 	1-3	based only on 'people like trees' arguments, no reference to energy use
0	incorrect or no response	0	
	Total	12	