

# A-LEVEL SCIENCE IN SOCIETY

SCIS1 Exploring Key Scientific Issues  
Mark scheme

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2400  
June 2014

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Version: 1.0 Final

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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](http://aqa.org.uk)

Question	Answers	Additional Comments/Guidance	Mark	ID details
1ai	virus enters (healthy) cell uses cell mechanism to make copies of virus DNA	accept higher level answers	2	
1 a ii	dead or attenuated virus given stimulates immune system to produce antibodies/destroy virus memory cells remain / can <i>make</i> antibody quickly (if baby becomes infected by rotavirus)	accept higher level answers	3	
1 a iii	virus not affected by antibiotics / antibiotics only work on bacteria		1	
1 b i	<i>provide a baseline level of deaths</i> so can compare to see effectiveness		1	
1 b ii	peak of deaths (infection) in January each year	accept 'winter' instead of January	1	
1 b iii	For 0-11 and/or 12-23 months olds: <ul style="list-style-type: none"> <li>seasonal peaks disappear.</li> <li>comparative data quoted (e.g. peaks in Jan about 190 deaths before 2007 but about 50 by 2010)</li> </ul> For 24+ month olds <ul style="list-style-type: none"> <li>Very little change in deaths due to diarrhoea</li> </ul>	any 3 for 1 mark each  allow one mark for each set of data quoted (e.g. 0-11 and 12-23 months) to a max of two marks	3	
<b>Total</b>			11	

Question	Answers	Additional Comments/Guidance	Mark	ID details
2 a	there is a mechanism to explain the link	allow <i>descriptions of how ultrasound reduces death rate</i>	1	
2 b i	So problems show up Make sure that results aren't due to chance Make sure findings are significant		1	
2 b ii	<ul style="list-style-type: none"> <li>o not biased by researcher(doctor)</li> <li>o reduce/remove effect of other factors on study</li> <li>o named example of bias / factor (e.g. smoking, weight, health)</li> </ul>	don't credit ideas about control	2	
2 c i	the difference between the two groups could have been due to random chance		1	
<b>Total</b>			11	

Question	answers	extra information	mark
2 c ii			
<p>Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should apply a 'best-fit' approach to the marking.</p>			
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
	<p>simplistic response with incorrect understanding of the material</p> <ul style="list-style-type: none"> <li>• Valid points but unstructured</li> <li>• Limited use of information or ideas about science</li> <li>• Errors in grammar, punctuation and spelling or lack of fluency</li> </ul>	<p>one or two points explained.</p> <ul style="list-style-type: none"> <li>• Claims partially supported by evidence</li> <li>• Good use of information or ideas about science given in the question but limited beyond this</li> <li>• The argument shows some attempt at structure</li> <li>• The ideas are expressed with reasonable clarity but with a few errors of grammar, punctuation and spelling</li> </ul>	<p>three or more points, well explained, may provide counter argument</p> <ul style="list-style-type: none"> <li>• Claims supported by an appropriate range of evidence</li> <li>• Good use of information or ideas about science, going beyond those given in the question</li> <li>• Argument well structured with minimal repetition or irrelevant points</li> <li>• Accurate and clear expression of ideas with only minor errors of grammar, punctuation and spelling</li> </ul>
<p><b>examples of the points made in the response</b></p> <p>Yes because:</p> <ul style="list-style-type: none"> <li>• Consent obtained from women</li> <li>• ethics committee had looked at research and accepted it</li> <li>• one scan was beneficial, so more might have been even better</li> <li>• new research in medicine often involves risk</li> <li>• benefit of many (utilitarian)</li> <li>• need to know the effect so that can plan/change treatment</li> <li>• possibly lead to more research (reason for small birthweight)</li> </ul> <p>No because</p> <ul style="list-style-type: none"> <li>• may not be (wasn't) a benefit of <i>additional</i> scans</li> <li>• If don't know effects difficult for women give informed consent</li> <li>• at the time didn't know long term effects</li> <li>• smaller test on effect of lots of scans could have been done first</li> <li>• tests on non-human subjects could have been done</li> </ul>			<p><b>extra information</b></p> <ul style="list-style-type: none"> <li>• <b>don't credit</b> references to 'playing God' or other general statements.</li> <li>• <b>don't credit</b> references to ultrasound having huge risks or no benefits – doesn't fit with earlier information given in question.</li> <li>• <b>ignore</b> references to 'it being the womens' fault if anything went wrong because they had given consent'.</li> </ul>

Question	Answers	Additional Comments/Guidance	Mark	ID details
3 a i	<ul style="list-style-type: none"> <li>more confidence in results</li> </ul>	accept <ul style="list-style-type: none"> <li><i>more accurate</i></li> <li><i>can be more representative</i></li> </ul>	1	
3 a ii	<ul style="list-style-type: none"> <li>decision making – example of type of decision</li> <li>making predictions about future needs – example of possible prediction</li> <li>see how effective policies have been / monitoring</li> </ul>	allow 2 mp for 1 mark each OR allow 2 marks for any mp with explanation.	2	
3 a iii	<ul style="list-style-type: none"> <li>large number of short distance trips</li> <li>people don't walk very far</li> </ul>	accept suitable example e.g. lots of people (children) walk to school	1	
3 b i	<ul style="list-style-type: none"> <li>combustion of hydrocarbon (fuel)</li> <li>carbon in the fuel combines/reacts with oxygen</li> </ul>		1	
3 b ii	different modes of transport can carry different numbers of people so allows direct comparison		1	
3 b iii	<ul style="list-style-type: none"> <li>cars often only have only driver / driver+ 1 passenger / car often not full / empty seats</li> <li>planes are often full</li> </ul>	allow numerical example e.g. $\frac{1}{4}$ capacity / $\frac{1}{2}$ full	1	
3 c	<ul style="list-style-type: none"> <li>lots of cars used /79% of distance travelled</li> <li>cars at actual capacity release most CO<sub>2</sub></li> <li>people prefer cars / personal liberty / inconvenient public transport</li> </ul>	any 3 for 1 mark each	3	

	<ul style="list-style-type: none"> <li>○ cars can go places not served by trains &amp; planes / too far to walk or cycle.</li> <li>○ Government has little influence on use of private vehicles</li> <li>○ Walking / cycling small proportion of distance travelled</li> <li>○ train has least CO<sub>2</sub>,</li> <li>○ train is used for only 8 % of distance</li> <li>○ would need to increase rail a lot to take cars off the road</li> <li>○ cars/vans used for delivery of goods to local shops / support of infrastructure</li> </ul>			
<b>Total</b>			<b>10</b>	

Question	Answers	Additional Comments/Guidance	Mark	ID details
4 a i	<ul style="list-style-type: none"> <li>• same element, atom has different mass</li> <li>• same number of protons, different number of neutrons</li> </ul>		1	
4 a ii	<ul style="list-style-type: none"> <li>• measure initial activity of an isotope</li> <li>• repeat measurement of activity regularly for a given time interval</li> </ul> <p><i>allow measure background radiation for 1 mark</i></p>	<p>accept <i>measure time taken for half of the nuclei to decay</i></p>	2	
4 a iii	<ul style="list-style-type: none"> <li>• different penetrating power / gamma only stopped by thick lead</li> <li>• different ionising ability</li> <li>• gamma is (electromagnetic) wave / beta is a particle (fast moving electron)</li> <li>• beta has negative charge / gamma not charged</li> </ul>	<p><i>do not accept gamma is more ionising.</i></p>	1	
4 b i	<ul style="list-style-type: none"> <li>• activity is decays per second</li> <li>• radiation dose measures the damage done by different radiations/isotopes on body</li> </ul> <p><i>need to mention <b>both</b> dose and activity for the mark</i></p>	<p>Accept <i>activity is amount of radiation emitted</i></p> <p><i>accept radiation dose is how much radiation absorbed</i></p>	1	



4 b ii	<ul style="list-style-type: none"> <li>• Cs-134 has a shorter half-life (than Cs-137)</li> <li>• amount of Cs-134 reduces more quickly</li> <li>• By 1991 no Cs-134 left</li> <li>• so proportion of Cs-137 will increase each year</li> </ul>		2	
4 b iii	$4 \times 10^{-7}$ (Sv) or 0.0000004 (Sv)  1.8 / 4 500 000 or 1.8 / $4.5 \times 10^6$ for 1 mark  <i>(allow 1.8 – 1.85 for radiation dose and <math>4 \times 10^{-7}</math> – <math>4.1 \times 10^{-7}</math> for average dose)</i>	0.4 $\mu$ Sv  if no marks gained for calculation allow 1 mark for Sv	2	
4 b iv	<ul style="list-style-type: none"> <li>• small risk from radiation <i>but</i></li> <li>• value for 1986 is less than background radiation</li> <li>• generally safe to eat pilchards</li> </ul>	Allow <i>ideas about not needing to give advice because risk is very low</i> for 1 mark  Mark with biii – if answer is incorrect use e.c.f and mark accordingly i.e. <ul style="list-style-type: none"> <li>• biii much higher than background</li> <li>• so large risk from eating pilchards</li> <li>• so don't eat them</li> </ul>	2	
<b>Total</b>			11	

Question	Answers	Additional Comments/Guidance	Mark	ID details
5 a	<ul style="list-style-type: none"> <li>○ variation between individuals in a species</li> <li>○ some characteristics make organism better suited to survive</li> <li>○ genetic characteristic passed on to next generation</li> </ul>	<p>any 3 for 1 mark each</p> <p>do not credit organisms choosing to change.</p>	3	
5 b	different forms of the same gene		1	
5 c i	<ul style="list-style-type: none"> <li>● avoid cross-contamination / cross-pollination</li> <li>● prevent sharing of genetic traits</li> <li>● need to keep genetic 'pool' the same</li> </ul>	<p>any 1 for 1 mark</p> <p>accept so <i>plants don't influence each other.</i></p>	1	
5 c ii	<ul style="list-style-type: none"> <li>● need to have variety of genotypes</li> <li>● need a variety of characteristics shown</li> </ul>		1	
5 d i	<ul style="list-style-type: none"> <li>● to collect repeat results</li> <li>● in case anything went wrong with one plot</li> <li>● identify any effects due to chance</li> </ul>	do <b>not</b> accept <i>to make it a fair test</i>	1	
5 d ii	<ul style="list-style-type: none"> <li>● To ensure that all plots had the same amount of water(liquid) / keep the other variables the same</li> </ul>	Do <b>not</b> allow <i>acts as a control</i> without additional explanation.	1	

	<ul style="list-style-type: none"> <li>As a control to compare the results from the different numbers of insects</li> </ul>			
5 e	<ul style="list-style-type: none"> <li>Plants in B flowering earlier than plants in A / Numerical comparison of flowering index</li> <li>Range doesn't overlap so difference probably not due to chance.</li> </ul>		2	
5 f	<ul style="list-style-type: none"> <li>assumes plants are choosing to change</li> <li>NS usually takes a number of generations to occur / not just in one generation</li> <li>NS is a random process / due to random variation in characteristics</li> </ul>	any 2 for 1 mark each	2	
<b>Total</b>			12	

Question	Answers	Additional Comments/Guidance	Mark	ID details
6 a i	<ul style="list-style-type: none"> <li>• electrons knocked off atoms</li> <li>• chemical changes lead to break up of molecules into charged particles/ions</li> </ul>		1	
6 a ii	<ul style="list-style-type: none"> <li>• UV has more energy / IR has less energy</li> <li>• UV has shorter wavelength / IR has longer wavelength</li> <li>• UV has higher frequency / IR has lower frequency</li> </ul>	accept <i>different wavelengths / frequencies</i>	1	
6 b	<ul style="list-style-type: none"> <li>• allows comparison from year to year</li> <li>• number increases with population</li> <li>• rate stays same if population increases</li> <li>• increase in rate shows increase in prevalence of disease</li> </ul>	accept <i>comparison between populations</i>	2	
6 c	<ul style="list-style-type: none"> <li>○ large sample size</li> <li>○ sample representative of population</li> <li>○ other factors taken into account / example of suitable factor</li> <li>○ case control study / matched samples</li> <li>○ long-term study</li> </ul>	accept <i>control group</i> accept <i>randomised</i> accept <i>respected researchers</i>  ignore <i>peer review</i>	2	
6 d	<ul style="list-style-type: none"> <li>○ Small error bar (95% CI) / most results close to mean</li> <li>○ larger squares (than some other studies) relative risk above 1</li> </ul>	accept <i>error bars don't touch the line</i>	2	

6 e	<p><b>general</b></p> <ul style="list-style-type: none"> <li>○ <u>overall</u> relative risk is approx 2</li> <li>○ relevant comment on quality of data in fig.6</li> <li>○ people need to be told what risks are</li> </ul> <p><b>Yes</b></p> <ul style="list-style-type: none"> <li>• correlation between sunbed use and increase in skin cancer</li> <li>• don't have to use a sunbed to tan / fake tan</li> <li>• ban would reduce skin cancer deaths</li> </ul> <p><b>No</b></p> <ul style="list-style-type: none"> <li>• only prevent small number of cases of skin cancer (5%)</li> <li>• it is a small risk to start with (17 per 100000)</li> <li>• correlation is not causation / confounding factors (e.g. sunbathing)</li> <li>• need more data for older (35+) sunbed users / data only for under 35yr olds</li> <li>• personal choice important</li> </ul>	<p><i>Accept overall risk much higher</i></p> <p>marks can be gained from all sets of mps</p>	4	
<b>Total</b>			12	

Question	Answers	Additional Comments/Guidance	Mark	ID details
7 a i	<p><b>advantages:</b></p> <ul style="list-style-type: none"> <li>• different areas of expertise</li> <li>• more <i>or</i> wider range of data / ideas / methods</li> <li>• competition might encourage them to work harder</li> <li>• would allow for positive results to be checked by people who understand the science</li> </ul> <p><b>disadvantage</b></p> <ul style="list-style-type: none"> <li>• inefficient / duplication of effort or resources</li> <li>• communication problems / harder to share results</li> </ul>	1 for advantage, 1 for disadvantage	2	
7 a ii	<ul style="list-style-type: none"> <li>• aliens too far away / Universe very big</li> <li>• (even at speed of light) take a long time for signals to reach us</li> <li>• looking for the wrong type of signal (e.g. not EM) / missed or misinterpreted signal</li> <li>• looking in wrong region of space / different conditions</li> <li>• signal path altered on way to us</li> <li>• unable to detect using current technology</li> <li>• aliens might be masking their signals / producing weak signals / aliens not advanced enough to produce signals</li> <li>• Universe has existed a long time - so aliens might have died out</li> </ul>		4	

7 a iii	<ul style="list-style-type: none"> <li>• lots of exoplanets so likely that life developed more than once / probability of life developing only once is low</li> <li>• think there is extraterrestrial life / belief / curiosity / competition &amp; reward</li> <li>• only been looking for short time / only looked in limited areas / technology developing</li> <li>• hard to prove a negative (so might be out there)</li> </ul>		2	
7 b	<p><b>No</b></p> <ul style="list-style-type: none"> <li>○ need data/evidence to base theory on</li> <li>○ no evidence / example of lack of evidence e.g. no signal found</li> </ul> <p><b>Yes</b></p> <ul style="list-style-type: none"> <li>○ can be used to make predictions / assess probabilities / supported by evidence</li> <li>○ example of possible prediction e.g type of life / number of planets / conditions for life</li> <li>○ can be tested (e.g. by looking for signal / conditions for life)</li> </ul>	Do not credit 'just a theory' type answers (e.g. it's just a theory because there is no evidence for it yet')	2	
<b>Total</b>			10	

Question	Answers	Additional Comments/Guidance	Mark	ID details
8 a i	chemical (natural, synthetic) that has an effect on (processes in) the body		1	
8 a ii	<ul style="list-style-type: none"> <li>o patient thinks they're taking sleeping pills / is expecting improvements</li> <li>o psychological effects (leads to improvements)</li> <li>o some problems get better on their own / improvement over natural course of disease</li> </ul>		2	
8 a iii	<ul style="list-style-type: none"> <li>o significant side effects / specific example of side effect</li> <li>o psychological treatments better longer term</li> </ul>		1	
8 b	<ul style="list-style-type: none"> <li>• research paper has all details - newspaper will include limited research detail or summary of research</li> <li>• newspaper may incorporate additional sources (opinions) for effect / emphasis</li> <li>• newspaper is aimed at general public / paper aimed at researchers</li> <li>• difference in language used / technical language</li> <li>• research paper is peer reviewed / newspaper is not peer reviewed</li> </ul>	<p>1<sup>st</sup> mp can gain two marks if explained well</p> <p>ignore <i>newspaper report inaccurate</i></p> <p>ignore references to research papers being unbiased</p>	3	



question	answers	extra information	mark
8 c			
Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should apply a 'best-fit' approach to the marking.			
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
	Uses only limited information from passage <ul style="list-style-type: none"> <li>Valid points but unstructured</li> <li>Limited use of information or ideas about science</li> <li>Errors in grammar, punctuation and spelling or lack of fluency</li> </ul>	uses information from the passage, some explanation OR simple additional point(s) <ul style="list-style-type: none"> <li>Claims partially supported by evidence</li> <li>Good use of information or ideas about science given in the question but limited beyond this</li> <li>The argument shows some attempt at structure</li> <li>The ideas are expressed with reasonable clarity but with a few errors of grammar, punctuation and spelling</li> </ul>	uses information from passage makes additional supporting points, ideas explained. <ul style="list-style-type: none"> <li>Claims supported by an appropriate range of evidence</li> <li>Good use of information or ideas about science, going beyond those given in the question</li> <li>Argument well structured with minimal repetition or irrelevant points</li> <li>Accurate and clear expression of ideas with only minor errors of grammar, punctuation and spelling</li> </ul>
points from passage <ul style="list-style-type: none"> <li>Side effects of sleeping pills</li> <li>Possibly psychological treatments</li> <li>How long to take them for</li> <li>How effective the pills are for treating insomnia</li> </ul> Additional points <ul style="list-style-type: none"> <li>How long they've had problems sleeping</li> <li>What might be causing their insomnia</li> <li>Medical history / other conditions</li> <li>Addiction risk</li> <li>Extra risk of side effects due to age (e.g. more likely to fall over)</li> <li>Examples of other possible psychological treatments</li> </ul>			for level 3 answers, candidates should expand on information given in article, justify questions or include additional ideas.  For level 2 answers candidates will generally repeat points from article only with explanation OR give additional ideas without explanation.  <b>ignore and don't credit</b> references to the placebo effect or dummy pills

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Total			
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