AQA

**General Certificate of Education
June 2010**

SCIENCE IN SOCIETY   SCIS4

Unit 4   Case Study of a Scientific Issue

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 meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting 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 candidates' 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.

Section A

1	King • Crop production must increase to keep up with population • GM is the only technology that will increase productivity of land • Western attitudes are denying the technology to Africa • Organic farming is not the solution Watson • Rural development / economic and social relations / lack of infrastructure are main issue • Not overall food shortage • Food not getting to right people	**4**	1 mark each max 3 from one set
2	• Impact on the environment • Possible loss of biodiversity • Possibility of interbreeding with natural organisms. • Effect on human health • Wrong to patent life • Commercial interests • People's right to information on GE in food	**3**	Any 3 for 1 mark each
3	• Figure 1 the increase in yield compared to either traditional or non GM- equivalent maize • Small farmers liked the GM maize • Crop losses from stem borer range from 15% to 40% • Total crop failure can occur • Data on lack of food (only 1 mark in Q3 & 4)	**2**	Any 2 for 1 mark each
4	• Non-GM solutions such as Napier grass available • Higher price $83/kg compared with $52/kg • They cannot afford to pay for existing better hybrid seeds/pesticides • Some example of need for rural development • Asia not a valid comparison	**2**	Any 2 for 1 mark each
5	• GMO may interbreed with natural organisms/ (allow contaminate if it is in quote) • May affect biodiversity • They may have an effect on human health No marks for 'cannot be recalled', 'a way that does not occur naturally'	**2**	Any 2 for 1 mark each
6	• 'Life is not an industrial commodity' • Contrast between natural and genetic engineering • Biological diversity is global heritage of mankind • Right to know whether GE is in food	**2**	any 2 for 1 mark each
7	• Explanation of patent / a good example • Why patents used / need for profit • Allows originator to keep quality control	**2**	any 2 for 1 mark each

8	• It indicates that they have made a contribution to new knowledge • Shows others are using their ideas or methods • Enhances their reputation/credibility • Increases their chances of getting research funding • Acts as a confirmation of their results • Helps free exchange of information	2	Any 2 for 1 mark each
9	• Gene is switched on / affects characteristics / phenotype • Information coded in the gene is used to produce the protein / chemical	1	Any 1 for 1 mark
10	• Gene determines the amino acid sequence of the protein • Gene carries information on the chemical	1	Any 1 for 1 mark
11	• Gene from bacterium transferred by GM • Gene codes for Cry protein / gene expressed in maize cells / toxin kills insects	2	Any 2 for 1 mark each
12	• Difference recorded unlikely to be due to chance • Statistical / 95% probability that it is a real difference • Explanation of error bars in data in source E	1	Any 1 for 1 mark
13	• Poorly replicated • Short duration • Assessed only a few variables • Measure of variance not reported • Inappropriate use of sub samples to calculate variance • Sample size not reported • Only 1 type of GM • Controlled field experiments not normal farming • Small scale	2	Any 2 for 1 mark each
14	• Combined analysis of the results of several studies Not 'several experiments'	1	Any 1 for 1 mark
15	• Increases sample size • Reduces effect of chance / increases statistical significance of effect	1	Any 1 for 1 mark
16	• Both conditions non-GM • One condition with no insecticide and one with pyrethroid insecticide	2	For 1 mark each
17	• Public research to evaluate risk • Regulation of risk / laws / licensing new technology • Enforcement of regulations • Information to public • Cost benefit analysis • An explanation of cost benefit / risk benefit	3	Any 3 for 1 mark each
18	• Suspicion that they may favour business interests over safety of public • Inadequate / incompetent research • Past failures / example of BSE or similar • Lack of public information about risks • Some public information inadequate / incomplete • Role of media in undermining trust	3	Any 3 for 1 mark each

Section B

19	Points to consider in marking Language must be accessible for popular audience, include good headings. Almost all content is HSW from G-risk and H-decision making. **Introduction / headings** – for 1 mark if it contains information **Precautionary approach** – up to 3 marks for points below An explanation of term Relevant examples from sources or elsewhere • Need for research • Source B 'consumers and producers will feel free to avoid risk, even if that risk is theoretical rather than real' • 'Demanding evidence of zero risk before allowing a new technology is fundamentally at odds with any practical strategy for investigating new technologies' • Source F any of the environmental points raised **Cost benefit or risk benefit** – up to 3 marks for points below Explanation of the term Relevant examples from sources or elsewhere • Source B 'developing nations struggling with widespread poverty, poor health, limited pest control and poor agricultural sustainability, have a different risk-benefit calculation' • Golden Rice debate • Herbicide resistant soybeans debate • 'In the case of GM technology it is clearly crucial to ask what the risks of adopting GM crops are. But it is also important to ask what the risks of not doing so are' • Source E penultimate paragraph discussion of balance of risks and benefits under different conditions **Regulation** – up to 3 marks for points below • Need to balance all interests • To protect community • To allow new developments • Over zealous precaution stifles development • Need for good scientific evidence on risk • Examples from sources **Language** – up to 2 marks for good structure and style	**12**	

20	Use level descriptors. Examples of points that might be used to support argument (HSW in brackets). **YES** Public funding implies: • Access to new seeds for those who need them • Patent rights given away (Eh) • Traits introduced more likely to meet needs of poor farmers (Ha) • Needs include self seeding • Ethical obligation (Hk) Science • Explanation of why Bt maize would increase yield • May be better for environment than insecticide spraying • Farmers like the new crop, from source D Counterargument evidence can be drawn from NO **NO** Policy • Money could be spent on other help to farmers (Fa) • Such as on traditional breeding of better crops • Value of biological diversity, from source F • Get big companies to do research, they have greater expertise and resources (Fa) • Seeds may be too expensive Science • Inadequate understanding of risks, from source F (Gg) • Risk of eating plants with Bt • Insects will rapidly become resistant • Harms insects relative to no insecticide practice of most poor farmers, from source E Counterargument evidence can be drawn from YES Level 4 indicated if 3 pieces of evidence or 2 good with a counter-argument and if ideas are attributed to sources.	**12**	

A2 Science in Society – level descriptors for 12 mark questions

The marking scheme for this section includes an overall assessment for the quality of written communication. There are no discrete marks for the assessment of written communication but quality of written communication will be one of the criteria used to assign the answer to one of four levels.

Marks are assigned according to level descriptors.

Candidates would be expected to achieve at least 3 of the 6 descriptors to be awarded marks at that level. Not all descriptors are relevant to each answer.

The marks awarded within the range depend on the extent to which candidates have met the criteria for that range and also on guidance relevant to the specific question.

Level Of Response	Descriptors	Mark Range
Good Level 4	• 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**
Competent Level 3	• 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**
Limited Level 2	• 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	• 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**
0	**Incorrect or no response**	**0**