**General Certificate of Education (A-level)
June 2013**

Science in Society   **SCIS3**

(Specification 2400)

Unit 3: Exploring key scientific issues

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.

Question	Part	Sub-part	Marking guidance		Mark	Comment
1	a	i	2 correct for 1 mark all correct for 2		2	
1	a	ii	arrow to synapse		1	for 1 mark
1	b		• memory/language/personality • conscious thought • inputs from senses *or other correct answer*		2	any 2 for 1 mark each
1	c	i	• inverse/negative correlation (or words to that effect) • good/high/strong/statistically significant, correlation /R = -0.67 / points close to line • large range of scores at (modal) GABA concentration 1		2	any 2 for 1 mark each
1	c	ii	• very unlikely that observed correlation is due to chance • 1.2% / 0.012 probability that correlation due to chance		1	any 1 for 1 mark
1	d		• to learn what is already known about the topic • to learn about new techniques for investigating • to avoid duplicating work • to stimulate imagination/hypothesis • to look for confirmation of own ideas • to avoid repeating errors		2	any 2 for 1 mark each

| 1 | e | i | • paper reports correlation - headlines claim that causation already confirmed
• results in paper still open to question - have not been repeated - sample size small
• paper about impulsiveness - as measured by questionnaire – not about rioting
• other factors may cause rioting – example
• research only in males – some rioters female
• | | 4 | for 1 or two marks each up to a max of 4 |

| 1 | e | ii | • gives deterministic idea of human personality – individual may be labelled – may be used as an excuse – legal consequences
• reports science as established fact – undermines understanding of science – could undermine support for science if later disproved
• might be used to influence public policy
• false marketing of products claiming to 'cure' | | 2 | for 1 or 2 marks up to max 2 |

| 2 | a | | • more synaptic connections made
• unused connections pruned
• connections strengthened by use
• grey matter increases | | 2 | any 2 for 1 mark each |

2	b			• mutation can be present in unaffected individuals - 1,4,5,11 • males more likely to show symptoms than females with same mutation –no females in family show symptoms • all affected individuals carry the mutation – 7, 9 • Environment must have significant influence/ no simple relationship between mutation and severity of condition – no symptoms, Asperger's or autism all have same mutation • only third generation show symptoms/are diagnosed **no marks** for dominant /recessive discussion		4	any 2 for 1 or 2 marks each

2	c			Benefit • Understanding what is going on in brain – may be possible to find the function of an involved gene • Help families avoid ASD - families could use PGD to eliminate foetus with ASD • Early diagnosis of high risk children - allows early treatment Drawback • false positives • Genetics poor predictor of ASD – unnecessary abortion may result • individual may be labelled ASD because of mutation, not because of symptoms – impact on life experiences		4	one benefit and one drawback for 1 or 2 marks each

| 2 | d | | | • never possible to conclusively prove a negative
• limited understanding of brain - so we cannot know what environmental factors could alter brain
• so many modern environmental changes - it will never be possible for research to eliminate them all
• difficulty (perhaps even impossibility) of implementing research designs that could isolate the effect of one environmental factor
• possible research design to investigate
• finds that might increase confidence in first hypothesis | | 3 | any three for 1 or 2 marks up to max. 3 |

| 2 | e | | | Advantage
• research usually funded by public
• involvement may improve public understanding
• most research needs families to contribute as subjects
• reminds scientists of need for knowledge that helps families directly
• may stimulate new ideas/ uncover new evidence
Disadvantage
• danger that high profile campaigns can divert research from most useful direction
• for example time that was wasted on MMR research
• public lacks understanding/ knowledge
General
• importance of good dialogue between scientists and public | | 4 | any 4 for 1 mark each |

| 3 | a | i | | • block incoming sunlight
• lower temperature (conditional on radiation or equivalent being mentioned) | | 2 | for 1 mark each |

3	a	ii	• absorb radiation/heat emitted from earth • raise temperature (conditional on radiation or equivalent being mentioned)		2	for 1 mark each
3	b	i	• good agreement between model predictions and measured temperature		1	for 1 mark
3	b	ii	• ran the model with all 3 variables and with natural variables only • comparison shows effect of greenhouse gases • without greenhouse gas with measured value •		2	for 1 mark each
3	c		• model used is reliable - as shown by agreement when all 3 variables included • solar variation and volcanic dust alone/ when greenhouse gas excluded - do not account for observed temperature rise • model with greenhouse gas shows temperature rise – matches measured value • lines nearly the same before 1900 – diverge as greenhouse gases have risen		4	any 2 for 1 or 2 marks
4	a		• population increase • rising standard of living • industrialisation in any LDC • new technologies require electricity/ an example		2	any 2 for 1 mark each
4	b	i	fission/split of atom/nucleus		1	for 1 mark

4	b	ii	• mining of uranium • construction of power station • cement manufacture/ metal refining for power station • refining of fuel • decommissioning • waste disposal • transport		3	any 3 for 1 mark each

4	c	i	• differences between different power stations/ example • full process of nuclear decommissioning still not known so estimates used • some may have included more factors than others /an example • different estimates of working life of power station • personal opinion may influence method chosen		2	any 2 for 1 mark each

4	c	ii	• All much lower than gas • Wind always one of lowest • PV (one of)highest • nuclear not as good as wind		2	any 2 for 1 mark each

4	d	i	• risk to human life • environmental damage • long term radiation risk • water use • land use • capacity • efficiency/reliability • sustainable/ renewable • public opinion/employment		2	any 2 for 1 mark each

4	d	ii	Mark by impression using the following criteria • factors favouring chosen technology (Max 3) • one (or more) reasons for <u>not</u> favouring one of the technologies not chosen • some sense of weighing up and comparing relative advantages of different technologies	4	

5	a	i	• physical environment plus community of living species • interdependence of different elements	2	for 1 mark each

5	a	ii	• rising temperature • acidification • oil spill • pollution spreading in from outside MPA • changes in sea level • noise pollution • tourism • non-native species • natural disaster **if** suitable example given	2	any 2 for 1 mark each

5	b	i	• mean – sum of all values divided by number of values • median – middle value	2	for 1 mark each

5	b	ii	• some extremely high values >1000% • median is not influenced by actual values • mean skewed by a few very large values	2	for 1 mark each

5	b	iii	- very effective in some measures less so in others - almost all reserves have very large increase in biomass and density/ all 4 measure increase 21% mean increase in richness / 28% increase in size shows effectiveness - but richness has dropped in some reserves - very wide range of results in different reserves - no information on impact on particular species		4	any 4 for 1 mark each

5	b	iv	- advantage - same physical environment/ example such as currents/ rocks - disadvantage - other variables may have changed over time/ example such as temperature/ pollution		2	for 1 mark each

5	c		- different vested interests – such as fishing - different economic development – natural resources are greater proportion of income - different values placed on biodiversity - MPA may cross borders – hard to agree on management/ border - difficulty of enforcement – cost of enforcement		4	any 2 for 1 or 2 marks each

| 6 | | | Use 4 level mark scheme

A good answer will contain points from sections A and B below

A reasons for unreliable conclusion
• small sample size
• poor controls/ poor investigation design
• experimenter bias (i.e. the tendency to see what we expect or want to see)
• selective use of data
• publication bias
• new field of research
• an example

B reliable knowledge
• peer review process
• work repeated
• repeated failure to replicate results means conclusions rejected
• repeated agreement means conclusions accepted as reliable
• if different experimental approaches reach same conclusion this supports conclusion
• use of new technology may confirm or change previous conclusions/results

C further points
• new theory more likely to be challenged
• established scientist more respected
• value of publication in stimulating research
• discussion of theory change/ example | | | |

			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.			
			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**	2 or more points from each of A and B C helps raise mark

				Competent Level 3 • 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.	**7-9**	1 or more points from each of A and B C helps raise mark
				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**	B only

				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**	Limited points from A, B or C
				• **Incorrect or no response**	**0**	