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

**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 | Comments | Marks |
|---|---|---|---|---|---|

**1 – Epigenetics**

| Question | Part | Sub Part | Marking Guidance | Comments | Marks |
|---|---|---|---|---|---|
| 1 | a | i | for 1 mark<br>• Assumed that environment very similar for either type of twin<br>• identical share same genes whereas non-identical share 50% on average<br>• same risk for identical pair shows 100% genetic influence<br>for 1 or 2 marks<br>• If risk for identical pair more similar than non-identical pair - Genes have influence<br>• If both pairs have similar risk - environment a more significant factor | Any 2 for 1 or 2 marks each<br>Max 2 | 2 |
| 1 | a | ii | Extent<br>• At least 50% is environment - Identical twins do not have identical risk<br>• genes contribute to risk - identical twins risk higher than non-identical if one twin has schizophrenia | for 1 or 2 marks each up to 3 marks | 3 |
| 1 | b | i | • (Chemical that) carries impulse across synapse | Any 1 for 1 mark | 1 |
| 1 | b | ii | • Gene sequence is copied/transcribed into (m)RNA/<br>• This is translated into a protein/protein made from gene<br>• gene expression determines characteristic/phenotype / gene switched on | For 1 mark each | 2 |
| 1 | b | iii | • Care increases GAD gene expression<br>• Effect lasts into adulthood<br>• Effect is stronger in adults/ expression more than doubled in cared for adults/ Small difference at 4 days<br>• poor care adults show decline in expression relative to 4 days<br>• Differences are (statistically) significant /Error bars do not overlap<br>• correlation between expression and care does not prove causation without causative mechanism | Any 3 for 1 mark each | 3 |
| 1 | c | | Epigenetics<br>• long lasting effect (Fig. 2 or 3) correlated with poor care<br>• links methylation and expression<br>• influence of the environment on the brain<br>• description of Fig.3 /Fig.3 evidence of epigenetic change<br>Human mental illness<br>• 1work done in rats not humans<br>• no evidence for link between GABA and mental illness | max of 3 from any one section | 4 |

**2 – Migraine**

| 2 | a | | no cortex mark if label is in centre of brain image | 1 mark each | 2 |
|---|---|---|---|---|---|
| 2 | b | | • diameter higher in migraine patients initially/ during drug <br> • diameter same in both groups (at any of 3 times) <br> • error bars <u>overlap</u> <br> • supports as high proportion did experience migraine/all experienced dilation but not all got migraine <br> • at 6 hours blood vessels returned to same diameter as before experiment <br> • other factors must be involved /7 of sample did not get migraine <br> • small sample | Any 3 for 1 mark each | 3 |
| 2 | c | | Vascular theory <br> • Constriction of blood vessels would relieve pain <br> Neurological theory <br> • Blocking of neurotransmitters would reduce the over-activity that is source of pain <br> *only give 2 marks if answer goes beyond information in Q.* | For 1 mark each | 2 |
| 2 | d | i | Known science – "these particular brain" / "Through its connection" <br> Speculation – "This explains how" | For 1 mark each | 2 |
| 2 | d | ii | • Provides hypotheses / ideas <br> • testability /research to accept or reject new hypothesis/stimulates research | Any 2 for 1 mark each | 2 |
| 2 | e | | 3 levels <br><br> level 3 all three components as follows <br>     • restates each statement in own words <br>     • with a relevant comment <br>     • own opinion <br><br> level 2 any two of <br>     • restates each statement in own words <br>     • with a relevant comment <br>     • own opinion <br><br> level 1 <br>     • restates each statement in own words <br><br> <div align="center">Continued on next page</div> | | See next page |

| | | | | | |
|---|---|---|---|---|---|
| 2 | e | | Comments and opinions might include<br><br>**Statement 1**<br>• two theories give testable predictions<br>• usually more effective to treat cause rather than symptoms<br>• fundamental research vital for understanding of migraine and other brain problems<br>• however may be very slow<br>• analogy with other disease such as cancer or HIV<br><br>**Statement 2**<br>• many diseases treated without full understanding<br>• not life threatening symptom relief is what is needed most<br>• drug companies want quick returns on investment not long term understanding<br>• sumatriptan an example of effectiveness of this approach | | 6 |

**3 – Climate**

| | | | | | |
|---|---|---|---|---|---|
| 3 | a | i | • Set of variables that influence climate<br>• Relationships between these variables/equations showing relationships<br>• input starting conditions<br>• complex calculations/requires high computer power<br>• make predictions <u>from data</u> | Any 2 for 1 mark each | 2 |
| 3 | a | ii | • only way to investigate effects of complex relationships<br>• of many variables<br>• allows predictions<br>• and testing hypotheses<br>• cannot do direct experiments | Any 2 for 1 mark each | 2 |
| 3 | a | iii | • every 10 years<br>• 10% (of years)<br>• 0.1 <u>probability in any year/ per autumn</u> | for 1 mark | 1 |
| 3 | b | i | • Increased risk for higher greenhouse gases/ decreased risk for lower<br>• Raises it from 0.08 to 0.1 / an increase of 25% | Any 2 for 1 mark each | 2 |
| 3 | b | ii | • lower GG means more radiation escapes atmosphere - therefore sea temperatures are lower<br>*or similar for higher 2000 temperatures*<br>*lower sea temperature mark conditional on some attempt at explanation* | for 1 or 2 marks | 2 |

| 3 | b | iii | A<br>• increased risk linked to climate change/ greenhouse gases<br>• doubling too certain<br>• increased risk value from fig. 7<br>B<br>• the most accurate<br>• link implies correlation, not causation<br>C<br>• implied causation wrong,<br>• there would still be a risk without warming /other factors can cause flooding<br>• *no mark for non-human sources of greenhouse gases*<br>general points<br>• conclusions are based on modelling<br>• data is on greenhouse gases but reasonable to write about climate change/ global warming<br>*no marks for doubt about link between greenhouse gases and climate change* | 2 marks for each of A,B, C | 6 |

**4 – Energy**

| 4 | a | i | 120TWh  (110-130) | for 1 mark | 1 |
| --- | --- | --- | --- | --- | --- |
| 4 | a | ii | 2013 (2013-2015) | for 1 mark | 1 |
| 4 | a | iii | • Increased efficiency of appliances/lighting/industry<br>• Building insulation<br>• No conversion of transport to electricity<br>• No new technology introduced using large amounts electricity<br>• No population increase | any 2 for 1 mark each | 2 |
| 4 | b | i | • mining uranium<br>• transport<br>• construction/concrete manufacture<br>• decommissioning | any 1 for 1 mark | 1 |
|  |  |  | • |  |  |
| 4 | b | ii | • expensive compared to most other technologies<br>• higher $CO_2$ than renewables<br>• limited/reduced  capacity | any 2 for 1 mark each | 2 |

| 4 | b | iii | • Coal plentiful in the world/ can continue to use coal<br>• Can be fitted to existing coal/gas power stations<br>• large reduction of $CO_2$ emissions <u>from coal/gas</u><br>• can be introduced more quickly than other technologies to reduce $CO_2$<br>• More reliable than wind<br>• less risk than nuclear<br>• capacity greater than renewables | any 2 for 1 mark each | 2 |
|---|---|---|---|---|---|
| 4 | c | | gas<br>• Reliance on about 1/3 gas not sustainable<br>• Limited reserves of gas<br>• Gas has high carbon dioxide emissions<br>nuclear<br>• reserves of uranium<br>• relatively low cost and low $CO_2$<br>renewables<br>• objections/finding suitable sites<br>• high cost<br>general<br>• Enough capacity as shown in Fig.9<br>• short time for such major change<br>• need for skills/resources for new technologies<br>• high cost at time of recession<br>• overall demand is likely to rise<br>• summary of key features projection | any 4 for 1 mark each | 4 |

**5 – Biodiversity**

| 5 | a | i | • 77x100/200 = <br> • 38%  (35 - 40) | any 1 for 1 mark | 1 |
|---|---|---|---|---|---|
| 5 | a | ii | • loss of habitat /deforestation/urban growth <br> • non-native species <br> • climate change <br> • food source eliminated <br> • pollution <br> • hunting by humans <br> • disease | Any 2 for 1 mark each | 2 |
| 5 | a | iii | for 1 or 2 marks <br> • Takes nutrients/water from native plant – longer roots <br> • reduces sunlight for native – grows taller <br> for 1 mark <br> • Faster growth/ breeding <br> • More pest resistant <br> • more attractive to pollinators | for 1 or 2 marks each to max 2 | 2 |
| 5 | b | i | • Allows wide range of values /values differing by several orders of magnitude - to be plotted on same axes/retain detail for low numbers | for 1 or 2 marks | 2 |
| 5 | b | ii | • No change in total biodiversity <br> • Extinctions and naturalisations nearly equal | any 2 for 1 mark each | 2 |
| 5 | b | iii | • Increases total biodiversity <br> • very few extinctions/ far fewer than for birds <br> • large number of naturalisations/ far more than for birds <br> • Fewer extinctions than naturalisations <br> *not NO extinctions* | any 2 for 1 mark each | 2 |

| 5 | c | | **General** <br>• only if non-native known to cause problem – evidence <br>• need for monitoring before action- evidence <br>• economic argument - evidence <br>• unforeseen consequences - evidence <br>• other factors more serious cause of extinction – examples <br>• allow extinction, it is natural selection (1 max) <br>**Plants** <br>• Non-natives often add to biodiversity <br>• small number of special plants could be lost <br>**Vertebrates** <br>• data suggests risk greater than for plants <br>• though overall biodiversity unchanged local endemic species may be lost <br>• Less than half vertebrate extinctions caused by non-native from Fig.10 | Point + evidence for 2 marks <br><br>Or <br>Any 4 for 1 mark each | 4 |
| 5 | d | | Ethical reasons – <br>• respect for other species <br>• conservation of natural ecosystem /food chain <br><br>Ecosystem services <br>• genetic resources <br>• services depend on complex ecosystem interactions <br>• specific services  e.g. medicines or bees <br>• human recreation/ tourism to <u>benefit local economy</u> <br>• scientific understanding | Any 3 for 1 mark each | 3 |

**6 – Use 4 level mark scheme**

| | | | | | |
|---|---|---|---|---|---|
| 6 | | | A good answer will contain most of the following:<br><br>1. the technology<br>An explanation of the science/technology chosen<br>An explanation of the benefits for society<br>An explanation of the risks for society<br>An indication of who in society will benefit and who will lose<br><br>2. points of view, at least two different<br>Use of ethical principles to explain the positions of both those in favour and those opposing the innovation.<br><br>3. personal position<br>Justification of personal position, using an ethical argument. this may be given as one of the two points of view.<br><br>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.<br>Marks are assigned according to level descriptors.<br>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.<br>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 | Any 3 for 1 mark each | 3 |

| level of response | Descriptors | | Mark Range |
|---|---|---|---|
| **good** level 4 | • clear exposition of science explanations relevant to the issue;<br>• appropriate and effective use of the relevant ideas about how science works;<br>• good overall grasp of the range and nature of the issue(s);<br>• interprets arguments presented, recognising evidence, claim and counterclaim;<br>• writes well-structured argument using a range of evidence to reach a reliable conclusion, includes counter-argument;<br>• fluency and accuracy of expression, with only minor errors of grammar, punctuation or spelling. | **all 3 components with ethics ideas for 2 and 3** | **10-12** |
| **competent** level 3 | • good attempt at exposition of science explanations;<br>• use of some relevant ideas about how science works;<br>• general grasp of the range and nature of issue(s);<br>• interprets arguments presented, recognising some of the main components<br>• writes structured argument using some evidence to reach a conclusion;<br>• accuracy of expression, with some errors of grammar punctuation or spelling | **all 3 components but with minimal ethics or 2 components if well done** | **7-9** |
| **limited** level 2 | • exposition of science explanation minimal or inaccurate<br>• minimal use of ideas about how science works;<br>• grasp of some features of the issue(s);<br>• interprets only part of arguments presented<br>• arguments presented but with weak structure and/or minimal evidence<br>• accuracy of expression, but with serious errors of grammar punctuation or spelling | **2of the 3 components opinion but with limited or no ethics** | **4-6** |
| **inadequate** level 1 | • exposition of science explanation confused<br>• use of ideas about how science works absent or wrong<br>• appears not to understand the issue;<br>• cannot interpret the argument presented<br>• argument presented as just a claim with no structure or evidence<br>expression unclear with serious errors of grammar punctuation or spelling | **only 1 component or 2 with limited content** | **1-3** |
| | **incorrect or no response** | | **0** |
| | **Total** | | **12** |