



General Certificate of Education (A-level)
June 2011

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 candidates' 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 candidates' 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.

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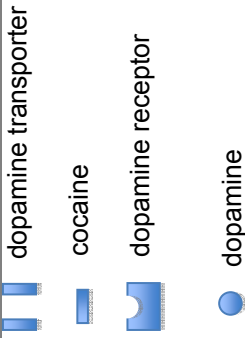
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Where marking points are separated by '/' these represent equivalent points for 1 mark
 Where marking points are separate by '-' this represents an additional point for which a second mark may be given
 In questions marked PE candidates may gain an additional mark for a good explanation which backs up the marking point.

1. Adolescents

a	• more/stronger connections between neurons • formed as a result of experience / learning • loss of unused connections • increased myelination of axons/ white matter/faster transmission • neural pathways created/strengthened	any 2 for 1 mark each	2
b	i • w.b.v maximum size at 11(9-12) yr F or 15(12-16) yr M / volume decreases after these ages • white matter / CC still increasing at 19 • nearly mature at 19/some features of brain still changing at 19 for w.b.v must treat M/F separately for mark should give an age for full marks ii No answer supported by • males slightly thicker than females • CI overlap for two sexes - very similar thickness • CC thickness may not correlate with integration skills/ brain size does not correlate with overall IQ • would expect female CC to be thicker / men <u>should</u> be better at integration skills (not 'are better') Yes answer supported by • in proportion to brain size female is thicker • rapid communication between brain halves would help integration of ideas	any 2 for 1 mark each	2
c	i • more prestigious journal • reputation of author • more original work • more widely relevant work • better quality research / larger sample • second paper may be in language other than English • easier to read / better presented ii <i>don't credit points about peer review</i> peer review	any 2 for 1 mark each	2
		for 1 mark	1
			9

2. Excited Delirium

a	i	 dopamine transporter cocaine dopamine receptor dopamine		2
	ii	• more dopamine in <u>synapse</u> • more dopamine <u>receptors</u> have dopamine bound to them • threshold of number of molecules bound to receptors is required to initiate nerve impulse • more dopamine bound to receptors means more frequent impulses <i>ignore refs to cocaine blocking uptake</i> • less re-uptake • less dopamine taken back into cell/transmitting neuron	any 2 for 1 mark each	2
b	i		any 1 for 1 mark	1
	ii	• SD indicates spread of results around mean • smaller spread in X / X less spread than Y and Z • 68% of data will be within 1SD (± 2.7) of mean (2 marks) <i>do not credit 'range'</i>	any 2 for 1 mark each	2
c	i	• Explanation A predicts a possible real brain difference between ED and others • ED has difference in transporter sites from ACP subjects / ED has difference in transporter sites from subjects dying from unrelated causes • A predicts real difference and data shows that X have fewer transporter sites (2 marks)	any 2 for 1 mark each	2
	ii	• correlation does not show that ED is cause of death • need to match groups for other variables • need for explanatory mechanism linking evidence does not rule out Explanation B • need for data on genes to confirm A • low dopamine transporter sites and death • small sample numbers <i>don't credit 'different number in each group' or general statements about 'more research needed'</i>	any 2 for 1 mark each	2

d	- strong correlation between restraint and death - almost 100%/ very high percentage	for 1 mark	1
e	<i>don't credit 'restraint leads to breathing difficulties' or other repeat of stem</i> - working for or with police – may favour A as excited delirium exonerates the police - sympathy for drug addicts/ those with mental health problems – may favour B seeing police as intolerant - anyone with experience or knowledge of possible over use of force by police – may favour B - want to establish a new illness/make name for themselves – favour A - may be biologist / sociologist	any 1 for 1 or 2 marks or 1 mark for each of 2 points	2
			14

3. Biodiversity

a	• more sunlight increases photosynthesis/ more energy for growth • less competition for nutrients/water • other species living in canopy may feed on cocoa trees	for 1 mark each	2
b	i • Number of species directly related to canopy cover / positive correlation • change in trend at 50 - 60% cover • data correctly quoted for % loss of cover do not accept negative correlation ii • much wider scatter of points • weaker correlation • no correlation (with explanation) • wasps harder to count accurately / location of traps influences results do not penalise reference to negative correlation in 5A	any 2 for 1 mark each	2
	iii Undisturbed forest species compared with all species • no difference to reduction in trees • reduction in wasps • very strong reduction in herbs • Cocoa plantations affects species negatively / harder to conserve forest species for both marks candidates must recognise that cocoa plantations affect the white dots species differently	any 2 for 1 mark each	2
c	• humans should treat other species with respect / ethical reason • may be useful for medicines / source of genes / resistance to disease (economic reasons) • removal of some species may threaten others / species are interdependent (ecological reasons) • diversity of species supports ecosystem's resilience to change Don't credit "to maintain biodiversity" without justification	any 2 for 1 mark each	2

d	Opinion supported by reasons. Need to acknowledge no ideal solution for full marks points might include: X • best for preserving ecosystem • carbon storage • threatened species, • but unrealistic, local extreme poverty and anger • need for government to support farmers Y • compromise for environment and farmers • overall diversity of species maintained • farmers' income intermediate between 0 and 80% canopy • fails to protect some forest species • trees /specialised forest herbs suffer serious loss Z • higher income for farmers • poor people more important than biodiversity • high yields may allow other land to be preserved as undisturbed forest • destructive of biodiversity • graphs show decline below 40% • poor carbon storage	any 1 to 4 for 1 or 2 marks each PE	4
			13

4. Climate

a	i	235 W/m ² + 107 W/m ² (outgoing) = 342 W/m ² (incoming)	for 1 mark	1
	ii	(absorbed by atmosphere) 67W/m ² + 350 W/m ² + 102W/m ² = 519 W/m ² (emitted from atmosphere) 195W/m ² + 324 W/m ² = 519W/m ² allow 519 without working for each	for 1 mark	1
	iii	- greater proportion of energy emitted by Earth's surface/ IR/low frequency is absorbed - energy emitted to space is reduced	'any 1 for 1 mark	1
	iv	don't credit 'heat trapped' - emitted by surface / IR - transferred by convection - surface to space	any 1 for 1 mark	1
b	i	- Size and complexity of the models involve wide range of disciplines - physical scientists, environmental scientists, mathematicians and computer scientists. - Different scientists are involved in: - identifying the important variables - gathering and validating the data - determining the assumptions to be built into the model - working out the mathematical relationships - programming the model for computers. - Need for large computing facilities (1 mark) - too much work/ check on errors/ share ideas/ reduce bias (1 mark)	any 1 for 1 or 2 any 2 for 1 mark each (max 2) PE	2
	ii	- too many variables/ computer programme would be too large - system too complex/ chaotic system / system not fully understood - no model can represent everything - specific examples of unknowns - initial conditions are not completely known - assumptions built into model are not exact don't credit references to weather	any 2 for 1 mark each	2

	iii	• More radiation absorbed by sea water than by more reflective ice / less albedo • So the ocean warms more melting more ice • thus warming leads to even more warming which is positive feedback /positive feedback strengthens an input that tends to change the system <i>must show some understanding of feedback for second mark</i>	any 2 for 1 mark each	2
	iv	• use model to make predictions about past or current climate • check predictions against real data <i>not 'wait to see what happens'</i>	for 1 mark each	2
c		• controversy sells /generates public interest • simplification means debate between scientists represented as conflict • not peer reviewed/ journalists not scientific experts • journalists influenced by vested interests • public would prefer to think its not their fault	any 2 for 1 mark each	2
				14

5. Energy

a	A system or process that • meet needs of current population • will not deplete a resource / can be continued for an indefinite period • without damaging the environment / allows future generations to meet their needs	any 2 for 1 mark each	2
b	• risk - leaks/ terrorism/ production of nuclear weapon fuel • cost – construction/ decommissioning • reserves – uranium supplies for expanded programme • energy (and CO₂) costs over life-cycle • long term waste don't credit 'risk', 'cost', 'expensive' without explanation.	any 2 for 1 mark each	2
c	i • Maximum power from wind turbines = $3\,800\,000 \times 5\text{ MW}$ • 19 000 000 MW • 19 TW	any 1 for 1 mark	1
	ii • wind is intermittent • total power available at any one time is a small fraction of the total.	any 1 for 1 mark	1
d	i Factors which make it unlikely • 20 years is a short time to phase out existing power plants • high cost of construction/decommissioning • huge quantities of concrete and metals needed to create so many power plants in quite short time • scarcity of some metals that are essential for motors and batteries • lack of skills/resources in some countries • specific examples, such as need for battery technology in electric cars Factors which favour implementation • industry could gear up to make renewable resources • all the technologies are already developed or in an advanced state of development <i>Opinion supported by reasons. Up to a max of 3 marks for one or more good reasons that support the opinion</i>	any 1-3 for 1 or more marks each PE	3

	ii	Factors which make it unlikely • lack of political will to make such a radical change • very high cost at time of recession • lack of political consensus about the dangers of climate change • need for international agreement which recent experience suggest that it would be hard to achieve • need for wealthy countries to support the less wealthy • strength of pressure groups supporting fossil fuels and nuclear power Factors which favour implementation • rising cost of oil as the time of peak oil approaches • new policies such as feed-in tariffs and carbon-markets will drive change • the environmental impact of coal burning is too serious for it to continue and to expand • attractive approach for developing countries with no local supplies of coal, oil or gas. • pressure to improve air quality in large cities. • the damaging consequences of climate change will become more apparent in the next decade or so. Opinion supported by reasons. Up to a max of 3 marks for one or more good reasons that supports the opinion.	any 1-3 for 1 or more mark marks each PE	3
				12

6. BDNF

a	i	expression of a gene means that the gene produces a protein/ chemicals	for 1 mark	1
	ii	<i>don't credit descriptions of what genes are</i> - gene switched on by a regulator /gene - in response to internal/ external environment	any 1 for 1 mark	1
b	i	- only <u>5%</u> likelihood of difference being due to <u>chance</u> <u>95%</u> probability of it being a <u>real</u> difference - difference unlikely to have arisen by <u>chance</u> (1 mark)	any 1 for 1 or 2 marks each	2
	ii	- sample size affects reliability / small met/met sample - IQ / age can influence memory - shows the population that the results apply to - shows that groups matched on other variables (age or IQ) that might lower reliability	any 2 for 1 mark each	2
	iii	advantage - shows correlation between allele and memory - the test that best simulates real life - large numbers can be tested / simple to carry out limitation - correlation alone does not show causation - no causative mechanism - only one aspect of memory - recall may be affected by cultural or personal factors	any 1 from each set for 1 mark each	2
c	i	- blood flow / oxygen levels in brain - more active regions show greater blood flow - more energy use	any 1 for 1 mark	1

	ii	advantage • shows which part of brain involved • direct observation whilst task underway <i>don't credit 'non-invasive', 'clear image'</i> limitation • artificial environment • unpleasant/need to remain still • limited range of tasks possible • poor spatial resolution/time delay • other brain areas also active / needs interpretation / brains different • very expensive	any 1 from each set for 1 mark each	2
d		• shows a mechanism to explain the correlation • if BDNF spreads to the synapses it might enhance memory formation • shows the effect at the level of individual cells • allows interactions to be manipulated and effect examined	any 2 for 1 mark each	2
e		• many genes involved in brain function • differences in episodic memory very small • small sample sizes • differences do not reflect overall IQ • behaviour determined by interaction between genes and environment • tests under artificial conditions not a guide to overall behaviour • wrong to label children in this way	any 1-3 for 1 or 2 mark each (max 3) PE	3
				16

Q7 Candidates are asked to include:

- Example(s) to show risk of **new** technology / processes
- explain why decisions on **new** technology are hard to make
- non-scientific factors to be taken into account.

Points that might be included:

- risk is a probability of harm / defines risk
- all new technology has uncertainty
- risk is an estimate / how to assess risk
- perceptions of risk
- difficult to assess risk of **new technology** because no data to base likelihood of harm on
- difficulty of calculating danger from low-probability high cost events
- number of fatalities of an event with very low probability - like nuclear accident
- may be less acceptable than high probability low fatality event - like road accident
- public acceptance of risk depends on more than just probability
- governments have to have public acceptability for new technology - GM crops an example of low risk but high public hostility
- acceptable risk depends on risk benefit balance - mobile phones uncertain risk but high benefit
- cost of **not** using new technology

level of response	descriptors:	guidance – answer likely to contain	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; - fluency and accuracy of expression, with only minor errors of grammar, punctuation or spelling.	- examples of new tech and risk - why hard to make decision - other factors to take into account - good use of other risk HSW ideas	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	- example(s) of tech and risk and 2 from - difficulty of decision making - factors to take into account - reasonable use of other HSW ideas (e.g. cost-benefit analysis)	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	- general statements about risk and/or vague examples - factors to take into account - HSW ideas not clearly identified	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	- No examples - poor grasp of HSW - general, vague statements	1-3
0	incorrect or no response		0
Total			12

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