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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Science for Public Understanding 5401

SPU2 Issues in the Physical Sciences

Mark Scheme

2007 examination - June series

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.

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SPU2 Issues in the Physical Sciences

Question 1				
(a)	(i)	• can be replaced as it is used • energy from Sun to **grow new trees** **no marks** for everlasting/cannot run out/can be used again and again	any 1 for 1 mark	**3**
	(ii)	cycle showing 3 items linked by arrows • CO_2 in atmosphere • trees growing taking in CO_2 • burning wood returning CO_2 to atmosphere penalise 1 mark if C instead of CO_2 in air tree to wood → not essential must be clear that absorbs CO2 from air for 2 marks	any 2 for 1 mark all 3 for 2 marks	
(b)	(i)	• any calculation showing about 25 times (23.9 exact answer) for 2 marks • correct use of efficiency data for 1 mark/correct use of energy content data • two correct statements comparing the two without calculation for **1 mark max**	any 2 for 1 or 2 marks	**3**
	(ii)	• heats air/stove/environment • transferred to the environment/dispersed in surroundings **note** heat must go somewhere **no marks** for heat alone/back to atmosphere/another form of energy	for 1 mark	
(c)	(i)	• CO – lack of oxygen/heart strain/can kill/ respiration problems/respiratory problems • PM 10 – lung damage/increased infection risk/ asthma • benzene – cancer **no marks** for CO is toxic/breathing problems/ respiratory disease	any 1 for 1 mark	**3**
	(ii)	• concentrations very high/higher • compared with, those considered safe in developed countries/standards set for health • must have reference to health/safety for 2 marks **no marks** if no reference to the data in Figure 1	any 1 for 1 or 2 marks	

(d)	(i)	• mother reporting • time not measured accurately • judgement of severity of disease • discussion of reasons for possible poor correlation between time and smoke inhaled • researchers infrequent visits • other **named** variable	any 1 for 1 mark	**3**
	(ii)	• correlation between time spent near fire and number of episodes of infection • criticism of sample size/lack of repeat for **1 max** • discussion of data **must** refer to data in figure 2 for 2 marks	any 2 for 1 mark each	
				Total 12

Question 2				
(a)	(i)	• rising population • rising standard of living/more electrical equipment • development (of poorer countries)	any 2 for 1 mark each	**4**
	(ii)	• **3200** – 1500 (1400-1500)/1700 (1700-1800) • 1700 × 100/1500 • 113% (113-129)	any 2 for 1 mark each	
(b)	(i)	• number of **protons**/atomic number **no marks** for electrons	for 1 mark	**3**
	(ii)	• radioactive/emit **ionising** radiation/radiation causes mutation • long half life/long time to decay • $\alpha/\beta/\gamma$ radiation	for 1 mark each	
(c)	(i)	• fall in total • nuclear always about half total • decline in nuclear • decline in fossil fuels • rise in conservation	any 2 for 1 mark each	**2**

(ii)	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 the three levels. **level 3 – good** claims supported by an appropriate range of evidence good use of information or ideas about science going beyond those given in the question argument well structured with minimal repetition or irrelevant points accurate and clear expression of ideas with only minor errors of grammar, punctuation and spelling	**5-6**
	level 2 – modest claims partially supported by evidence good use of information or ideas about science given in the question but limited beyond this the argument shows some attempt at structure the ideas are expressed with reasonable clarity but with a few errors of grammar, punctuation and spelling	**3-4**
	level 1 – limited valid points but not clearly linked to an argument structure limited use of new information or ideas about science unstructured errors in grammar, punctuation and spelling or lack of fluency	**1-2**
	incorrect or no response	**0**
	examples of the sort of information or ideas that might be used to support an argument issues that need to be considered include • likelihood of successful product • low CO_2 • sustainability • safety • example of other environmental impact details on 2 options **nuclear** • low CO_2 • plenty of uranium • waste • accident/terrorism **renewable** • no CO_2 • will not run out • unreliable • expensive **conservation** • efficiency gains possible **fossil fuels** • cleaner technologies possible • more efficient technologies • this research can be done by private sector **storage** • importance of storage if renewables used	**max 6**
		Total 12

Question 3				
(a)		• flooding low land • large population centres/an example (e.g. Bangladesh)	any 1 for 1 mark	**1**
(b)	(i)	• thermal expansion	for 1 mark	**2**
	(ii)	• Antarctic ice/land ice	for 1 mark	
(c)	(i)	• 45 mm (allow 40-50 mm) • ± 20 (allow 20-25) mm	1 mark for answer 1 mark for error	**3**
	(ii)	• fewer measurements in 1910 • local variations • affected by weather/annual fluctuations • hard to measure accurately • equipment more accurate now than in 1910 **note** uncertainty is in sea level, not in measuring equipment	any 1 for 1 mark	
(d)	(i)	• monitor ice very carefully • monitor sea levels • research to understand how ice sheets respond • modify models to fit new data • look at historical data on ice/sea levels **no mark** for 'monitor temperature' **no mark** for 'ways of preventing ice melting'/or any other impact of global warming	any 2 for 1 mark each	**4**
	(ii)	• to predict future (in complex system) • level of uncertainty • only useful when mechanisms understood • depend on input information • depends on quality of model • can deal with complex models/large amounts of data/rapid processing of data	any 2 for 1 mark each	
				Total 10

Question 4				
(a)	(i)	• remove **electron** from atom/forms positive ions • forms **charged** particles • high energy radiation **not** 'forms ions'/forms + ions **and** – ions	any 1 for 1 mark	**4**
	(ii)	• cause mutation • in genes/DNA/chromosomes • **cells** proliferate **uncontrollably** **no marks** for 'cause tumours'	any 2 for 1 mark each	
	(iii)	• 1 in 2000 • 10 in 20000 • 0.05%	any 1 for 1 mark	
(b)	(i)	• sponsors might try to influence reports • inclusion deters bias • indicates what sort of bias might be introduced • protects Cancer Research UK from criticism over conclusions • bias may be introduced at any stage/example of stage	any 2 for 1 mark each	**5**
	(ii)	• very small effect • cannot distinguish from other factors/an example • hard to find suitable control group • exposure to other ionising radiation very variable/many sources • delayed effect • animal experiments might not be applicable • large individual/genetic, differences in susceptibility • very large groups needed for small effect • not ethical to test on humans	any 2 for 1 mark each	
	(iii)	• precaution/provides guidelines • best evidence available at present	any 1 for 1 mark	

(c)	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 the three levels. **level 3 – good** claims supported by an appropriate range of evidence good use of information or ideas about science going beyond those given in the question argument well structured with minimal repetition or irrelevant points accurate and clear expression of ideas with only minor errors of grammar, punctuation and spelling **level 2 – modest** claims partially supported by evidence good use of information or ideas about science given in the question but limited beyond this the argument shows some attempt at structure the ideas are expressed with reasonable clarity but with a few errors of grammar, punctuation and spelling **level 1 – limited** valid points but not clearly linked to an argument structure limited use of new information or ideas about science unstructured errors in grammar, punctuation and spelling or lack of fluency **incorrect or no response** examples of the sort of information or ideas that might be used to support an argument need to seek information on the following • cancer risk from dose to be given • what are my specific risk factors for cancer? • what other evidence suggests CT needed? • will CT diagnosis/early diagnosis make a difference to outcome? • what alternative diagnostic methods are available? • consider past radiation doses	**5-6** **3-4** **1-2** **0** **max 6**
		Total 15

Question 5				
(a)		• group of stars	for 1 mark	**1**
(b)		• force of attraction between two masses/objects • field round mass	any 1 for 1 mark	**1**
(c)	(i)	• observation did not fit predictions • galaxies predicted to fly apart	any 1 for 1 mark	**6**
	(ii)	• well established • explains many phenomena • single anomaly does not overthrow theory • no better theory to replace it	any 1 for 1 mark	
	(iii)	• B (only give this mark if some explanation attempted) • new explanation does not emerge data • requires conjecture and creative imagination • some other explanation of the data may be possible insist on good answer for second mark **no marks if A chosen**	any 2 for 1 mark each	
	(iv)	• fits observations of bending of light	for 1 mark	
	(v)	• need to confirm predictions from explanation • to increase confidence in the theory • to provide evidence for the theory • to increase understanding of the Universe **no marks** for **prove** theory	any 1 for 1 mark	
				Total 8