GCE 2004
June Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Science for Public Understanding
SPU2

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.

Further copies of this Mark Scheme are available from:

Publications Department, Aldon House, 39, Heald Grove, Rusholme, Manchester, M14 4NA
Tel: 0161 953 1170

or

download from the AQA website: www.aqa.org.uk

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales 3644723 and a registered charity number 1073334. Registered address AQA, Devas Street, Manchester. M15 6EX. *Dr Michael Cresswell Director General*

Unit 2: Issues in the Physical Sciences

Question 1

(a)	• oil will run out/non-renewable/harder to extract/more expensive • the contribution of carbon dioxide to, global climate change/greenhouse effect • health effects of local pollution • oil has other important uses (not as fuel) not 'harms environment' or 'pollution'		any 2 for 1 mark each	**2**
(b)	(i) coal-fired power station		for 1 mark	**1**
	(ii) • 100 : 780 • 100x 100 /780 • 12.8% 1 mark for calculating any energy value **as a percentage of 780**		any 2 for 1 mark each	**2**
	(iii) **nuclear** • no/less **greenhouse** gases/acid rain (not 'less pollution') • high energy density fuel • adequate resources not 'greater efficiency', not 'no waste' **wind/solar** • negligible pollution • renewable • free not 'environmentally friendly'		any 2 for 1 mark each	**2**
(c)	• true if renewables used to generate electricity to produce hydrogen • true at point of use of car • not true as we have to generate electricity/use power station to produce hydrogen/use fossil fuels to produce hydrogen • **example** of pollution from coal/nuclear • manufacture of equipment/car produces pollution • chemical production of H_2 from a fossil fuel		any 2 for 1 mark each	**2**
(d)	• nothing is 100% safe/cost benefit argument on risk • comparison with petrol is sensible standard		for 1 mark each	**2**

Total 11 Marks

Question 2

(a)	(i)	• natural variation in temperature over 1000 years/almost constant till 1900 • clear rise in temperature since 1850s/current temperature warmer than at any time in last 1000 years insist on one reasonably accurate date for 2 marks	any 2 for 1 mark each	**2**
	(ii)	greenhouse gases • temperature rise over last 100 years • recent rise in CO_2 (can be implied by use of date/ industrialisation/fossil fuel use) • no sign of temperature rise with solar output before present (refutes hypothesis 2)	for 1 mark each	**1**
(b)	(i)	• no measurement gives 'true' value • no instrument 100% accurate • sampling locations/geographical variability	for 1 mark each	**1**
	(ii)	• early estimates of temperatures deduced from other indicators (no marks for 'estimate' alone)/early values based on estimates not recorded temperatures • many assumptions involved in estimates of early temperature • modern instruments more accurate/early instruments very inaccurate • modern instruments use standardised scale • more modern records/fewer early records	any 2 for 1 mark each	**2**
(c)	(i)	• no correlation between their temperature estimates and CO_2 levels • other periods of rapid change when CO_2 levels unchanged • CO_2 started rising in 1800 but temp was unusually cold until 1900 • variation between cold and warm periods over **about 500 years**	any 2 for 1 mark each	**2**
	(ii)	• IPCC several groups of scientists have produced similar results/IPCC 2500 scientists/Harvard results not repeated • Harvard group known to have vested interest /link to oil company	for 1 mark each	**1**
(d)	Yes • encourages debate • forces critical examination of evidence • stimulate further research/may lead to new insights • may lead to a new theory/theory may be wrong/an example of a theory change No in **this specific case** • politically motivated • discourages action to reduce greenhouse gases		any 2 for 1 mark each	**2**

Total 13 Marks

Question 3

(a)	(i)	• properties of a **compound** not same as - those of constituent **elements** insist on bolded words	for 1 or 2 marks	**2**
	(ii)	• **atom** (of oxygen) • **molecule** (of NO_2) • oxygen + nitrogen oxide applied to correct particles	any 2 for 1 mark each	**2**
(b)	(i)	• correlation between distance from road and likelihood of wheezing/actual figures • implication of dose - response relationship/correlation with car fumes	for 1 mark each	**2**
	(ii)	• large sample/10000 children • reputable organisations/ University or DoH named	for 1 mark each	**2**
(c)		• no mention of other workers confirming/only 1 area/not repeated • no causative mechanism/quote from passage on causal uncertainty • wheezing not quite same as asthma • no mention of confounding variables being controlled/example of likely confounding variable • bias suggested by paper's 8 year commitment to hypothesis Not government says 'no firm evidence', not 'only a small effect'	any 2 for 1 mark each	**2**
(d)		Yes • important to draw attention to issue • encourages debate • free speech • discourages car use No • media should not exaggerate scientific results/ write inaccurate headlines/very emotive headline • only done to sell papers • distracts from main cause of asthma, known to be household allergens such as mites • smoking a much more serious risk factor • harm to those affected/ panic • should have given other opinions too/ biased report allow a critique of the research but not a repeat of same points as candidate used in (c)	any 3 for 1 mark each	**3**
		quality of written communication > 2 spg penalise by 1 mark	1 or 2	**2**

Total 15 Marks

Question 4

(a)	(i)	• nucleus/atom/neutron breaks down/unstable isotope to more stable • forms a new element • atom emits α,β, γ radiation	any 1 for 1 mark	**1**
	(ii)	• α particles easily stopped/poor penetration/higher effective dose • cause mutation (in gene/DNA)/damage DNA (not mutate cells) • **radon** is gas, so in close contact with lung • α particles are ionising radiation not 'α particles inhaled'	any 2 for 1 mark each	**2**
(b)		• at high radiation dose cheap to reduce dose • at low dose cost of reduction increases rapidly • infinite cost to reduce dose to zero • inverse relationship/ negative correlation	any 2 for 1 mark each	**2**
(c)	(i)	• 4 x 1/300 = 1 in 75 • 4 in 300 (or other correct ratio)	any 1 for 1 mark	**1**
	(ii)	• much more expensive to reduce risk even lower/costs too much • compromise between risk level and cost (must have comparison) • risk is still low (compared to smoking or other causes of cancer) • same money could be used for other health benefits	any 2 for 1 mark each	**2**
(d)		• a reason why individual is unwilling to spend on reducing radon risk • individuals used to living with radon risk/individuals have no direct personal experience of harm from radon • phone masts seen as a new risk/power lines very visible and ugly/radon invisible • media stories on phone masts/no media stories on radon/public not reminded of radon risks • **others** would take responsibility/pay to reduce phone mast or pylon risks do not allow marks for discussion of acceptability of risk of mobile phones but can allow argument mark	any 3 for 1 mark each	**3**
		Quality of written communication	for 1 or 2 marks	**2**

Total 13 Marks

Question 5

(a)	(i)	• star is a source of light/star releases energy by nuclear fission/source of high energy radiation/much hotter/planets not a source of light • stars have a life cycle • planets have heavier elements/stars are H or He • planets orbit about **star/sun**	any 2 for 1 mark each	**2**
	(ii)	• gravitational attraction of Sun is pulling Earth towards Sun • if no gravitational force Earth would move in a straight line (at steady speed) • Earth falls towards Sun but is also moving forward	any 2 for 1 mark each	**2**
(b)		• theory was very successful in explaining a range of observations/ social influences of other scientists/personal commitment to theory • one anomaly not enough to overthrow • better to set single anomaly aside in the hope that a way will be found to account for it • no better theory available	any 2 for 1 mark each	**2**
(c)		• prediction of/discovered existence of Neptune • prediction that the anomaly could be explained by the gravitational **attraction between Uranus and Neptune** • attraction between Neptune and Uranus would cause changes in Uranus' speed during orbit	any 2 for 1 mark each	**2**

Total 8 Marks

Paper Total 60 Marks