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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Science for Public Understanding 5401

SPU1 Issues in the Life Sciences

Mark Scheme

2006 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.

SPU1 Issues in the Life Sciences

Question 1				
(a)	(i)	• vaccination is introduction of dead/weakened parasite/microbe/etc • immune system develops antibodies/white cells against this • antibodies/memory cells/immune system reacts faster if infected again **must have reference to a part of the immune system for 2 marks**	any 2 for 1 mark each	**2**
	(ii)	• mutation means change in parasite • immune system does not recognise new form • vaccine ineffective against new form **no marks for 'resistant to vaccine'**	any 1 for 1 mark	**1**
	(iii)	• to prevent others wasting research time on same approach • to improve understanding of the system	any 1 for 1 mark	**1**
(b)		• some parasites/bacteria more resistant/mutation creates more resistant strain • these survive/reproduce • resistant characteristic passed on/resistant form infects others **must be resistance to medicine, not vaccine**	for 1 mark each	**2**
(c)	(i)	• cardiovascular, diabetes	both for 1 mark	**1**
	(ii)	• diabetes and cardiovascular affect rich countries/malaria and TB affect poor countries • pharmaceutical companies make money on diseases of rich • rich exert more political pressure to treat diseases • low income countries cannot afford research • cardiovascular and diabetes have multifactorial causes **this question is about research not treatment** (no. of deaths from data in Q; CV 17m, HIV 3m, diabetes 1m, TB 2m, malaria 1m)	any 2 for 1 mark each	**2**

(iii)	• chance of success in finding treatment - timescale involved - depends on current understanding • no current therapy/prevention – research may yield greatest benefit • is new understanding needed? – death rate may be due to lack of funds/political will not knowledge • number of people needing new therapy – more cost effective if research benefits a large number • seriousness of disease – the degree of suffering caused/death rate from disease • economic cost of the disease to society – may benefit the overall society not just those with disease • age of sufferer – saving children gives more life-years • infectious disease – risk of pandemic • disease with significant impact on LEDC – LEDC cannot afford research **The explanation requires a justification of the criterion. Allow 1 mark for effective application of the criteria to a disease if full marks not already awarded.**	any 2 for 1 or 2 marks each	**4**
			Total 13

Question 2				
(a)		• something that increases the **probability/chance** of getting the disease	for 1 mark	**1**
(b)	(i)	pre 1993 • variable/a downward trend post 1993 • slight downward trend **question asks for trend not value**	for 1 mark each	**2**
	(ii)	• improved diet/living standard • folic acid taken/women took advice • screening and abortion	any 2 for 1 mark each	**2**
	(iii)	• other factors not ruled out by information provided • only very slight improvement in England • no change/worse in Norway • Ireland stronger trend after introduction • only 3 countries **max 1 if they say strong evidence**	any 2 for 1 mark each	**2**
(c)	(i)	• 10.6 – 7.6 = 3.0/4130 – 3020 = 1110 • $\frac{3.0\times100}{10.6} = 28\%$ / $\frac{1110\times100}{4130} = 27\%$ 28.3% 26.9% (calc %) **full marks for correct answer alone** **0 for 30% with no correct working**	for 1 mark each	**2**
	(ii)	• 28%/27% close to 30%/can be rounded to 30%/supports claim • newspaper claims slightly larger reduction than data **0 if they have 30% with no working in (i)** **if error made in calculation allow reasonable answer based on their % reduction** **do not allow 37% approx= 30%**	for 1 mark	**1**

(d)	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	**Descriptor** An answer will meet most of the criteria given in the level descriptor.	**Mark range**
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**
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**
1	**Limited** Valid points but not clearly linked to an argument structure. Limited use of information or ideas about science. Unstructured. Errors in grammar, punctuation and spelling or lack of fluency.	**1-2**
0	**Incorrect or no response**	**0**
	Examples of the sort of information or ideas that might be used to support an argument: **yes** • many people do not plan pregnancy • B12 deficiency can be prevented in other ways • data indicates that advice alone not very effective • reduction in US greater than in advice only countries • warnings for epileptics **no** • everyone should have better diet • not very effective/only prevented a quarter of US cases • people should take responsibility/government cannot prevent all risks • need more information on how many epileptics/B12 deficients	
		Total 16

Question 3				
(a)	(i)	• **two groups** treatment and control/one group takes Echinacea • control group takes placebo/an explanation of placebo	for 1 mark each	**2**
	(ii)	• true **value of average** likely to lie between 7.3 and 10.9 (still give mark if **one** arithmetic error) • gives range within which true **value of average** possibly lies • margin of error in **value of average** **do not give mark if answer implies that this is the total range of results**	for 1 mark	**1**
	(iii)	no • difference between treatment and control groups is within uncertainty range • results not repeatable by different researchers/only one trial showed significant benefit • very small difference between groups • one trial showed placebo better • small sample size **maximum 1 for yes answer as question says 'strong evidence'**	any 2 for 1 mark each	**2**
(b)	(i)	1 • possibility of placebo effect • many traditional remedies have been shown to be ineffective/dangerous when tested scientifically 2 • cell culture not same as whole organism • microbes too general/does it affect this virus? 3 • placebo effect/ normal healing process • no controls/other variables • sample size • what measure of effectiveness used? **this question is about quality of evidence so max 1 for explanation of effect**	any 2 for 1 mark each	**2**
	(ii)	• no other treatment for common cold/other remedies have failed • natural products **believed** safe/suspicion of modern medicines • faith in remedy/placebo effect/advertising/group influence **no marks for 'natural has no side effects' or for 'alternative remedies cheaper'**	any 2 for 1 mark each	**2**
				Total 9

Question 4				
(a)	(i)	• 1 in 2/50%/0.5 • inherits one of father's two genes/correct punnet square	for 1 mark each	**2**
	(ii)	• if Maria has gene she **must** have inherited it from her mother (100% unless justified) • therefore Sandra will know she has the gene • if Maria does not have gene no information on mother	any 2 for 1 mark each	**2**
	(iii)	• Dan because of risk associated with testing foetus • Dan because if Dan negative then foetus is OK	for 1 mark	**1**
	(iv)	• amniocentesis/CVS/test foetus • abortion if fetus has gene • counselling • IVF/PGD for later children this can be marked consequentially on (iii)	for 1 mark each	**2**

(b)	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	**Descriptor** An answer will meet most of the criteria given in the level descriptor.	**Mark range**
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**
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**
1	**Limited** Valid points but not clearly linked to an argument structure. Limited use of information or ideas about science. Unstructured. Errors in grammar, punctuation and spelling or lack of fluency.	**1-2**
0	**Incorrect or no response**	**0**
	Examples of the sort of information or ideas that might be used to support an argument: • extensive prior animals trials **for safety** • ensure that there is no risk from viral carrier of gene • only use for life threatening diseases • monitor very closely • right to withdraw • ethical committee approval • full information on risks • full information on uncertainty of benefit • informed consent • put patients' interests before needs of research programme - rights of individuals • ensure that participants are not motivated by the fee offered A range of different measures would be expected for a level 3, going beyond safety issues alone or informed consent issues alone.	
		Total 13

Question 5			
(a) (i)	• deforestation • global climate change • draining wetlands • use of agrichemicals • urbanisation • introduction of alien species **no marks for 'pollution' or 'greenhouse effect'**	any 2 for 1 mark	**1**
(ii)	for any of above • current changes very **rapid** - evolution takes many generations/very long time/not enough time to adapt by evolution • explanation of why an environmental change leads to extinction (for 1 mark only)	for 1 or 2 marks	**2**
(b) (i)	• new species will be similar to surviving species/new species will be suited to current conditions • evolution only possible from surviving species • new species arise from a series of very small changes • individuals within a species **best suited** to the environment survive/less suited die out • survivors reproduce and **pass on** favourable characteristics • different environments will favour different characteristics	any 2 for 1 mark each	**2**
(ii)	• individuals within a species **best suited** to the environment survive/less suited die out • survivors reproduce and **pass on** favourable characteristics • different environments will favour different characteristics/an example **do not allow 'strongest survive' or 'survival of the fittest' unless fittest explained**	any 2 for 1 mark each	**2**
(c)	**yes** • they have specialised knowledge/good science theories are able to make predictions • their warnings may have more effect than those of pressure groups • scientists have responsibility to share their knowledge/public needs the information • information means we can act **no** • they are motivated by political/financial views not science • predictions can never be certain • 'panic' only if qualified by reference to media misuse of information **no marks for 'should not worry public'**	any 2 for 1 mark each	**2**
			Total 9