A-LEVEL

Science in Society

SCIS1 Exploring Key Scientific Issues
Mark scheme

2400
June 2015

Version/Stage: Final Mark Scheme V1

Mark schemes are prepared by the Lead Assessment Writer 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 associates 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 associate understands and applies it in the same correct way. As preparation for standardisation each associate 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, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

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.

Further copies of this mark scheme are available from aqa.org.uk

Question	Answers	Additional Comments/Guidance	Mark	ID details
1 a i	several readings taken (over the space of 1 hr)	Don't credit rewriting 'mean/average in 1hour'	1	
1 a ii	To allow for unusual peaks in emissions too difficult to achieve low results all the time temporary high values are less of a risk to health than longer term high values (or v.v)	Allow detailed explanations or examples of peaks in emissions	1	
1 a iii	concentrated sources of energy convenient to obtain / relatively cheap widespread infrastructure / other alternatives not widely available	Not 'burn quickly' , 'effective' don't credit references to 'no other alternatives'	2	
1 b	*Description of control* • e.g. before increase in traffic / similar area without motorway *measurement(s) needed* • e.g. record level of hospital admissions / visits to doctors • for suitable illnesses (e.g. respiratory illness) *comparison* • e.g.Then record level of admissions after the increase in traffic • Compare level of illness to see if there is more afterwards	Needs to be specific about measurement, not just 'peoples' health' Needs to be in terms of health and illness, not level of pollution or traffic	3	

1 c i	60-80 km/hr	allow smaller range	1	
1 c ii	• At 112 km/hr more pollutants are produced than at 95 km/hr • Correct numerical example *(max 1 mark)* • Need for compromise / named example of compromise • lower speed (60-70 km/hr) would produce fewer pollutants • but people wouldn't want to go at 60 km/hr / travel times longer • compromise speed limit likely to be followed • pollutants increases at slow speeds / need avoid congestion • safety concerns / reduction in accidents • Fuel use might be less / less CO_2		4	
Total			12	

Question	Answers	Additional Comments/Guidance	Mark	ID details
2 a i	Need large numbers - to see rare diseases / create matched samples /include lots of variables Data taken over a long period of time – development of disease	Any 1 or 2 for 1 or 2 marks each	2	
2 a ii	• don't know factors involved in a disease are • clinical trials used to test a specific treatment • hard to collect long term data in clinical trial • can't use blind trials for exercise • can't easily control what exercise people do • interventions that might be harmful would be unethical	Allow clinical trials usually have small numbers	2	
2 b i	• At low fitness, weight makes no difference to risk • At all weights, improving fitness tends to reduce risk. • (error bars show lot of overlap), so differences for moderate and high fitness may be due to chance / not significant •	Additional mark can be scored for supporting data.	2	
2 b ii	• need a mechanism for evidence of causal link • No correlation for weight and risk / Correlation between fitness and risk /overlap in error bars very large	ignore 'correlation is not causation' owtte references to 'causal link shown' negate this mark	2	

2 c	• Figure 2 shows increasing fitness improved health • Figure 3 shows people are not doing enough exercise / suitable data given • People don't realise how little exercise they do / think they follow the guidelines • guidelines aren't effective • specific suggestion about what govt should do e.g. targeting different age groups BUT • personal choice about how much exercise to do • example of why people might not exercise • can't easily force people to exercise / would cause resentment • data for men only / other risk factors in CVD		4	
Total			12	

Question	Answers	Additional Comments/Guidance	Mark	ID details
3 a i	• natural selection characteristics are determined by environment / selective breeding characteristics decided by the breeder • selective breeding is done for a purpose / natural selection adapts to the environment	Not just 'natural vs man-made'	1	
3 a ii	• chance mutation leads to variation in pigeon / small variations in rock pigeons / example of variation from pictures • mate two pigeons with desired characteristics • select offspring of pigeons to breed - so that characteristic becomes more pronounced / more than one generation	Ignore references to different species of pigeon Last mp can gain 1 or 2 marks	3	
3 b	• allows predictions to be made / can be tested • identifies a causal link, not just a correlation • can develop theory if have a mechanism / underlying cause	Ignore repeat of stem- 'theory being more accepted'	2	
3 c	• Improved / new techniques provide more information • provide more information about details of mechanism • provide more detail about evolutionary tree / past conditions • New species/fossils are being discovered • Predict possible future changes (e.g. due to climate change)	Answers in terms of evolution, not genetic modification Do not credit answers in terms of 'just a theory'	3	
Total			9	

Question	Answers	Additional Comments/Guidance	Mark	ID details
4 a i	*tick both gamma, UV (both correct for the mark)*		1	
4 a ii	o cause mutation in <u>genes</u> / <u>DNA</u> o killing cells o burns o causes chemical changes (free radicals) in cells o knocks electrons out of DNA molecules o molecules become charged	not mutation in cells / tissues ignore 'causes cancer'	1	
4 a iii	to take into account that o different types of radiation cause different amounts of damage o different tissues absorb different amounts of energy o specific example, e.g. alpha is more ionising o to standardise amounts (so total radiation given to patients can be measured)		2	
4 b i	o compare the incidence of cancer due to scan o measure baseline rate of cancer in the population o take into account cancer due to background radiation	Answers should be more than 'compare / see if there is an effect' Don't credit 'comparing with no radiation'.	1	
4 b ii	o having one CT scan increases risk - risk appears to increase with increasing number of scans o bars overlap so might not be a difference between 1&2 or 2&3 scans	First mp for 1 or 2 marks	2	

4 c	o can't ethically expose people to something that might harm them without other benefits / people wouldn't want to volunteer for the research o difficult to separate out effects of background radiation / lack of control group o other factors (in development of health effects / illness) o symptoms take time to develop / requires long term research o might not be a linear response at low doses so can't extrapolate back from high doses o relatively low numbers of people exposed to low doses above background / medical exposure		3	
Total			10	

Question	Answers	Additional Comments/Guidance	Mark	ID details
5 a i	(nucleus of) each cell contains the entire (all / 23 pairs chromosomes) genetic information of a person	Accept DNA	1	
5 a ii	o identical twins have same genes / chromosomes o genetic information about one twin provides information about the other twin		1	
5 a iii	o compare parent and child DNA o child shares (half of) parents' DNA o the more similarities between the genomes, the more likely that two people are related / DNA fingerprinting		2	
5 a iv	o CF caused by single gene o heart disease caused by many genes / no single large genetic factor o heart disease affected by lifestyle and genes so can change course of illness o CF not affected by lifestyle / only has genetic cause o CF might affect choice to have children / use IVF o Different timescales for development of disease	Must mention both diseases for full marks	2	

Question	Answers	Extra information	Mark
5 b			6

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 4 and apply a 'best-fit' approach to the marking.

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
no or incorrect response	one or two points or mainly quotes from bullet pointed text	at least 3 points goes beyond bullet points from question	At least 4 <u>detailed</u> points If yes, must include altruistic argument(s)

yes
provide information to help medical research / treatment for others
can plan for some diseases / change lifestyle if needed
might need a cloned organ
strong consent process
could allow early treatment for identified diseases

no
provides information about family members as well as self
could be used for companies to make money
don't trust companies with data / data security
not really any medical benefit to volunteer
could be used against them (by e.g. insurers or crime examples)
might be more prepared to share DNA if used privately for medical research rather than publically available

extra information

Candidates who provide a list of pro's and cons, without an overall conclusion/opinion, should be limited to Level 2, as their argument structure is poor.

Total			12

Question	Answers	Additional Comments/Guidance	Mark	ID details
6 a i	$F \propto 1/r^2$	Accept: the greater the distance, the weaker the force	1	
6 a ii	o a claim that something always happens in <u>particular situations</u> o a general claim about a relationship (formula) between two (or more) variables		1	
6 b	o use different wavelengths / detect different parts of the spectrum o in use in different years / time periods / working at different times o improved technology with newer telescopes o satellite not affected by atmosphere / different viewpoint than using groundbased / different distances o different methods increases confidence in conclusions		2	
6 c	• water when Ceres is close to Sun / no water when further away o Herschel (Oct 12, Mar 13) observes water near closest point o VLT(Oct 07) / Herschel (Nov 11) don't observe water far away o IUE (May 91) detection unclear / may have detected water *but* o IUE (Jan 90) doesn't observe water o Herschel detected water further away (Oct 12) o Only Herschel observed any water / only later results found water / wavelengths observed different o Only Herschel has taken repeat measurements in similar places o Limited data from far sides of orbit		3	
6 d	o staging post for exploration / water source for space journeys o information about the history of the solar system o water needed for life (on earth)– life might develop if there is water	3rd mp for 2 marks only if possibility of life linked to water.	2	

Total			9

Question	Answers	Additional Comments	Mark	ID details
7 a i	o ensures mice are healthy o results are representative / not affected by other factors / confidence in results o ethical to treat animals well	Ignore references to animal right protests	2	
7 a ii	Advantages o can more easily investigate causal link / identify mechanism o can control mice diet better o quick results as fast breeders / short generation time o similar physiology for some things o ethical concerns about testing on humans o logistically easier Disadvantage o may be different mechanisms involved than in humans – poor model o ethical concerns because mice not getting benefit from research	max 2 if only one side given ignore reference to clinical trials e.g. side effects and risks.	3	
7 b i	o otherwise don't know what doesn't work or has no effect o other researchers might waste time carrying out similar work o not biased and only publishing positive results		1	
7 b ii	o 1.1% in sufficient diet and 4.3% in insufficient diet o many more from fathers with poor diet / 3% more	ignore comments on overall risk allow ecf for second mark	2	
7 b iii	unlikely to have arisen by chance too big to be likely to have arisen by chance		1	

7 c	o diet before conception in (mice) fathers did have an effect o lack of VitB9 did lead to embryo problems o risk of malformed embryo quite small BUT o no mention that it was in <u>mice</u> o mice had a healthy diet just lacking in VitB9 o was a supplement, not in vegetables or fruit o no evidence that junk food is bad, just B9 is good	Max 3 marks if no mention that research was in **mice**.	4	
Total			13	

Question	Answers	Additional Comments/Guidanc	Mark	ID details
8 a i	• dead or attenuated virus given • stimulates immune system (white blood cells) to produce antibodies • memory cells remain / can *make* antibody quickly / immune system respond quickly	More detailed biological answers must be correct	3	
8 a ii	• Movement of people / travel - spread from people in countries where polio remains • Lack of symptoms - many could be infected before realise there was an outbreak • Some children may not be vaccinated in countries where there have been no cases of polio – so disease likely easily	Any 1 or 2 for 1 or 2 marks allow 'highly infectious' for 1 mark ignore simple descriptions of transmission	2	
8 a iii	*Identifying cases* • Training people to recognise symptoms • simple tests to identify (trace) cases • reporting cases / outbreak locations (to central body) *data collection and sharing* • (central) data storage of known cases / vaccination • hospital records (which can be shared easily) • means of transmitting data e.g. phone apps	Needs to be realistic in the context of developing countries (not test every child) Ignore references to prevention of polio	2	

8 b			6

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0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
no or incorrect answer	point made from one section or weak points from two sections	points from at least two sections	Points from at least three sections Or very well explained from two.

A: Support communities with weaker health care systems – tech and finance
- due to conflict e.g. Syria and Afghanistan
- due to lack of money spent on healthcare e.g. Nigeria and Pakistan
- monitoring one disease globally improves healthcare generally due to improved systems

B: Disease crosses international borders
- need to have a programme which can track this / provides a global overview
- countries where it had been eradicated might stop monitoring so not realise that it had been reintroduced

C: Sharing of skills, knowledge and data
- reduce duplication of effort of countries
- bigger range of expertise available

D: Politics
- WHO is not political / not focussed on priorities of a single country
- Wider range of viewpoints on importance of health
- WHO staff can cross borders more easily than national staff

extra information

sections A – D are general points which may be made, with additional points linked to them.

Total			13