General Certificate of Education

General Studies 1761
Specification A

GENA2   Science and Society

Mark Scheme

2010 examination - January 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.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

Unit 2 Section A

(GENA2   AS Science and Society)

This component is an objective test for which the following list indicates the correct answers used in marking the candidates' responses

1.1	C	1.16	B
1.2	B	1.17	B
1.3	D	1.18	C
1.4	A	1.19	D
1.5	D	1.20	D
1.6	D	1.21	A
1.7	A	1.22	C
1.8	B	1.23	C
1.9	D	1.24	B
1.10	A	1.25	C
1.11	D	1.26	C
1.12	B	1.27	B
1.13	D	1.28	A
1.14	A	1.29	D
1.15	D	1.30	C

Unit 2 Section B (AS Science and Society)

INTRODUCTION

The nationally agreed assessment objectives in the QCA Subject Criteria for General Studies are:

AO1 Demonstrate relevant knowledge and understanding applied to a range of issues, using skills from different disciplines.

AO2 Marshal evidence and draw conclusions: select, interpret, evaluate and integrate information, data, concepts and opinions.

AO3 Demonstrate understanding of different types of knowledge appreciating their strengths and limitations.

AO4 Communicate clearly and accurately in a concise, logical and relevant way.

- The mark scheme will allocate a number or distribution of marks for some, or all, of the above objectives for each question according to the nature of the question and what it is intended to test.

- In most cases mark schemes for individual questions are based on *levels* which indicate different qualities that might be anticipated in the candidates; responses. The levels take into account a candidate's knowledge, understanding, arguments, evaluation and communication skills as appropriate.

- Examiners are required to assign each of the candidates' responses to the most appropriate level according to **its overall quality**, then allocate a single mark within the level. When deciding upon a mark in a level examiners should bear in mind the relative weightings of AOs (see below). For example, in questions 2 – 4 the most weight should be given to AO1, then AO4, then AO2 and finally AO3.

- *Indicative content* is provided as a guide for examiners. It is not intended to be exhaustive and other valid points must be credited. Candidates do not have to cover all points mentioned to reach Level 3.

- A response which bears no relevance to the question should be awarded no marks.

Distribution of marks across questions and assessment objectives for Unit 2, Section B

Question Numbers		Q2	Q3	Q4	Total marks for Section B
Assessment Objectives	**AO1**	12	12	12	12
	AO2	8	8	8	8
	AO3	5	5	5	5
	AO4	10	10	10	10
Total marks per question		35	35	35	35

Level of response	Mark range	Criteria and descriptors for Assessment Objectives 1–4
LEVEL 3	13 – 17 (18)	**Good response to question** Good to comprehensive knowledge, understanding and approach demonstrating overall grasp of the range and nature of issues (AO1). Capacity to interpret evidence and sustained ability to present relevant arguments, analysis and exemplification, focusing on the main points of the question (AO2). Shows some understanding of different types of knowledge, with some appreciation of their limitations in seeking to reach a reasoned and logical conclusion (AO3). Ability to communicate clearly and accurately in a fluent and organised manner (AO4).
LEVEL 2	7 – 12	**Reasonable attempt to answer question** Modest to quite good knowledge, understanding and approach demonstrating some grasp of the nature of some key issues (AO1). Moderate range of arguments, analysis and exemplification covering some of the main points of the question (AO2). Limited understanding of different types of knowledge but some ability to work towards or achieve a reasoned conclusion (AO3). Mostly clear and accurate communication and organisation (AO4).
LEVEL 1	1 – 6	**Limited response to the question** Restricted/narrow knowledge and understanding of key issues (AO1). Simple, perhaps mostly unexplained points – or very narrow range – with limited interpretation or analysis and exemplification (AO2). Lacking in understanding of different types of knowledge with little or no evidence of ability to work towards a conclusion (AO3). Variable levels of communication and organisation (AO4).
LEVEL 0	0	**No valid response or relevance to the question.**

2 (a) Explain how crops can be genetically modified

(17 marks)

Crops have been modified for thousands of years through selective breeding, in that plants have been selected and bred for desirable traits such as increased yield and hardiness. This involves the indirect manipulation of an organism's genes, though it was not understood in these terms until recently.

Genetic modification in the sense of the practice attacked by Prince Charles involves the direct manipulation of an organism's DNA in order to create a particular outcome. It accelerates the time-consuming process of altering characteristics and allows traits from unrelated species to be introduced.

Genetically modified crops can be altered in a number of ways:

- A gene is added that enables them to tolerate herbicides that wipe out other plants; this allows farmers to spray their crop with a 'broad-spectrum' herbicide, killing unwanted plant species which compete for space and nutrients with the crop, while not affecting the crop plant.
- A gene is added that lets the plant produce a toxin that kills pests that would usually feed on it, making it resistant to those pests.
- The inclusion of a gene to make the plant resistant to pesticide, enabling the crop to be sprayed without being adversely affected.
- A gene is added which makes the plant less likely to rot, thus preserving its shelf-life and commercial viability.
- Genes are added which make the plant more nutritious – e.g. rice modified to contain higher amounts of vitamin A.

For a Level 3 mark candidates should be able to add information on the process of genetic modification, which has a number of stages:

- The gene with the required characteristic to be transferred to the host organism is identified.
- Scientists can use a vector, such as a bacterium which naturally infects plants; they replace the bacterium's genes with the genes carrying the useful GM trait, then use it to transform the plant's cells
- Alternatively, the required genes can be inserted using a 'gene gun' with which the genes are inserted into a plant's cells.
- Both techniques have a high failure rate, so many attempts may be needed; once transformed, the genetically modified organism must be isolated to ensure that only those which have been successfully modified are retained.

The main commercial genetically modified crops grown are soya beans, maize, cotton and oilseed rape. Other crops grown include wheat, tomatoes, sugar cane and sugar beet. In 2007, there were approximately 281 million acres of GM crops being grown in 23 countries.

Candidates should be able to achieve marks in the highest band with a selection of relevant points, not necessarily the complete range. Any other valid point not included here should be credited.

2   (b)   Discuss the environmental, social and economic 'benefits and risks' of GM crops.

(18 marks)

The differences between Prince Charles and scientific opinion demonstrate that GM crops are a cause of significant political dispute in Britain. Some environmental activists have disrupted trials of GM crops by taking 'direct action'.

Environmental benefits of GM crops include:

- GM crops can minimise the use of pesticides and weedkillers
- GM crops lead to less soil erosion and reduced CO_2 emissions, because of less fuel use and additional soil carbon storage from reduced ploughing.

Environmental risks of GM crops include:

- modified crops may become resistant to herbicide and/or lead to the evolution of insecticide-resistant pests
- modified crops could accidentally breed with wild plants and other crops, leading to 'genetic pollution' of the environment
- the possibility of other harmful, unpredicted downstream effects of genetic modification.

Social benefits of GM crops include:

- most farmers using GM crops are small scale in less developed countries who would otherwise struggle to make a living
- GM crops can benefit consumers with more nutritious food, better flavour and longer shelf-life.

Social risks of GM crops include:

- the possible undermining of small farmers in developing countries who will not be able to afford or compete with GM production
- GM crops are said to be a threat to the organic agriculture industry
- it is argued that GM is a costly distraction from low-tech methods of addressing food shortages.

Economic benefits of GM crops include:

- land that was previously marginal because of drought or salinity can be brought into productive use
- the higher productivity of GM crops is needed to address food shortages and rising food prices.

Economic risks of GM crops include:

- it is claimed that large biotechnology companies are gaining excessive control over agricultural production and the farming industry
- some agricultural biotechnology companies are patenting GM seeds, thus creating a significant additional cost for farmers.

Some of the alleged problems of GM crops are unsubstantiated, including Prince Charles' claim of a link to climate change and the supposed direct threats to human health.

Candidates should be able to achieve marks in the highest band with a selection of relevant points, not necessarily the complete range. Any other valid point not included here should be credited.

3 (a) Examine the relationship between tobacco smoking and health.

(17 marks)

According to the World Health Organisation:

- there are more than one billion smokers in the world; tobacco use kills 5.4 million people a year; tobacco kills up to half of all users
- 100 million deaths were caused by tobacco in the 20th century; if current trends continue, there will be up to one billion deaths from tobacco in the 21st century.

In the UK, 9 million people still smoke. According to Department of Health statistics 106,000 people a year die from smoke-related diseases.

Nicotine is the substance in tobacco which acts as a stimulant, but which also promotes physical and psychological dependency. There are nineteen known carcinogenic substances in cigarettes. Inhaling smoke from smouldering tobacco generates chemical compounds, generally referred to as tar, which are biologically reactive and potential health dangers.

The **health risks** associated with tobacco use include:

- cardiovascular diseases, such as stroke and heart attacks, caused by narrowing of the arteries
- respiratory diseases, such as emphysema and bronchitis
- cancers, particularly lung cancer and cancers of the throat and mouth
- in men, reduced sperm counts and impotence
- miscarriages and birth defects are more likely if pregnant women are smokers.

The health risks are associated not only with those who smoke themselves, but can also be produced by **secondary smoking** (passive smoking). This arises from inhaling tobacco smoke in the home, workplace or in social environments. It can also trigger asthma in children, and Sudden Infant Death Syndrome (cot death) is associated with parents who smoke.

There are sometimes said to be **positive benefits** of smoking, particularly encouraging relaxation, reduction of tension, and increasing concentration. However, these may be associated with the relief of withdrawal symptoms rather than actual benefits.

Smoking is one of the major reasons for **health inequalities**, and one of the main reasons why people from lower socio-economic groups die, on average, several years younger than those from higher groups. Smoking is linked to lower educational achievement, housing tenure, low car ownership and unemployment.

Although smoking in Britain and other more developed countries is decreasing, the practice is spreading to the **developing world**: 80% of the world's smokers live in low- and middle-income countries.

Candidates should be able to achieve marks in the highest band with a selection of relevant points, not necessarily the complete range. Any other valid point not included here should be credited.

3   (b)   **To what extent are existing and potential measures aimed at reducing tobacco use acceptable and likely to be effective?**

(18 marks)

Candidates should demonstrate knowledge of at least some of the measures in place and being proposed for the future.

Existing measures include:

- high taxes on tobacco products to deter people from smoking through price
- a ban on tobacco advertising
- health statements and graphic images of tobacco-related diseases on all tobacco packets
- it is illegal to sell tobacco to anyone under 18
- since 2007, a ban on smoking in workplaces, restaurants or any enclosed public space
- anti-smoking advertising campaigns and support groups through the NHS.

Potential measures, proposed by health campaigners, include:

- a ban on cigarette vending machines (used disproportionately by under-age smokers)
- a ban on displays of cigarettes and tobacco in shops
- a ban on tobacco branding (i.e. blank packs – apart from health warnings and images)
- further price increases
- nicotine substitutes to be more widely available, and made free through the NHS
- a properly resourced fight against tobacco smuggling (which accounts for 17% of the UK market).

Candidates might be expected to comment on the acceptability and / or effectiveness of individual measures. They may also make some general points, including, on **acceptability**:

- Smoking is now generally seen as an anti-social and socially unacceptable activity
- Compliance with, and support for, the ban on public smoking is very high
- Some might argue that individual liberty is being infringed by anti-smoking measures
- the pro-smoking pressure group, Forest, claims that these measure are creating a 'bully' society, seeking to humiliate smokers
- many smaller businesses (corner shops, vending machine companies) could be forced to close as a result of these measures.

General points on **likely effectiveness** might include:

- the clearly identified decline in the number of smokers in Britain in recent decades
- in 2008, between 230,000 and 400,000 were claimed to have stopped smoking following the smoking ban
- the measures could be counter-productive, increasing resistance from some smokers
- those in deprived groups are still less likely to give up smoking.

Candidates should be able to achieve marks in the highest band with a selection of relevant points, not necessarily the complete range.   Any other valid point not included here should be credited.

4 (a) Explain why the disposal of household waste (for example, in landfill or by incineration) is an increasing problem.

(17 marks)

Britain produces about 335 million tonnes of waste a year, of which 29.5 million tonnes is household waste. The proportion of household waste that is recycled is now about 30%, which is below the EU average and well below countries such as the Netherlands (64%).

Types of waste include:

- biodegradable waste, such as food and kitchen waste, green waste
- recyclable waste, such as glass, bottles, cans, metals, paper, some plastics
- mixed waste, such as clothing, drink cartons, some plastics
- hazardous waste, such as medication, electronic waste, paint, chemicals, spray cans, batteries, light bulbs.

The amount of household waste being generated is increasing because of growing consumerism and a 'throwaway culture'. Although more household waste is now recycled, not all waste can be recycled economically, and councils do not routinely collect plastic waste at kerbside.

The traditional method of managing domestic waste is by collection and disposal in **landfill** sites. Even with increased recycling rates, more than 60% of household waste goes to landfill. This involves rubbish being buried in disused quarries, mines or other sites. Landfill is a major problem for the following reasons:

- There is a decreasing amount of space available which can be used for landfill.
- The waste deposited in landfill sites can take many years to degrade – plastic bags, for example, can take between 400 and 1000 years to degrade.
- Landfill creates local environmental problems, such as wind-blown litter, vermin, injuries to wildlife, soluble pollutants leaching into groundwater.
- If uncontrolled, methane gas, generated by decaying organic wastes, can escape; it is a greenhouse gas more potent than carbon dioxide.

Modern landfills are separated into cells, which are lined and capped to contain any leachate; are compacted and covered to minimise vermin and litter; and have landfill gas extraction systems. Despite these improvements, landfills are unpopular with nearby residents. It is government policy to discourage the use of landfill, for example through the landfill tax, and to encourage recycling.

Incineration is the process of destroying waste by burning it. It also has problems:

- It is a poor use of waste materials, as all the resources bound up in the waste are lost to the ecosystem.
- Toxic gases and dioxins are produced.
- Residual ash can be hazardous.

On the other hand, incinerators have some benefits – for example, many are waste to energy plants, generating electricity, and the solid residues can be recycled.

Candidates should be able to achieve marks in the highest band with a selection of relevant points, not necessarily the complete range. Any other valid point not included here should be credited.

4   (b)   Discuss ways in which government, manufacturers and the public could reduce the impact of domestic waste on the environment.

(18 marks)

Some existing and possible future policies of **central government** which could help to reduce the impact of domestic waste on the environment include:

- landfill tax
- setting targets for local authorities
- planning controls on landfill sites
- tax on plastic bags (as in Ireland)
- public information and education programmes.

Local government policies could include:

- providing a wider range of opportunities for recycling and composting
- encouraging schools to teach about the waste hierarchy and running recycling and composting programmes for pupils to participate in
- smaller wheelie bins (as in the article) to encourage recycling
- installing sensors to weigh refuse, with a view to charging by weight or penalising 'overfull' bins
- not collecting side waste
- alternative weekly collections (with recyclable material on alternative weeks).

Discussion points on government policies could include:

- the issue of the 'nanny state' and the extent to which government can / should interfere in the details of people's lives
- whether it is better to try to change people's habits by education and encouragement rather than by taxation and penalties.

Manufacturers and industry could consider some of the following:

- reduce / remove excessive packaging from their products
- charge for plastic bags to discourage their use
- use more easily recyclable materials in packaging (e.g. paper or card instead of plastics)
- include information to encourage recycling on packaging
- changing marketing practices which encourage unnecessary consumption (e.g. buy-one-get-one-free offers)
- manufacture products which do not become obsolescent after two or three years.

Discussion points on the role of manufacturers could include:

- much packaging is essential – fresh food (e.g. meat and dairy products) requires non-biodegradable packaging for hygiene reasons
- many products require substantial packaging to prevent damage in transit
- economic prosperity and employment depends to a large extent on marketing and the manufacture of products which need frequent replacement.

The public could:

- buy some foods (e.g. vegetables) loose, rather than pre-packaged, or even grow their own vegetables
- use reusable bags rather than plastic bags
- choose not to buy products with excessive packaging, and / or in excessive quantities
- repair rather than replace items such as cars, fridges, computers, etc.
- donate unwanted items to charities for reuse by others, for example in developing countries
- take full advantage of recycling collections and civic amenity sites provided by local councils
- compost organic matter, such as food scraps and garden waste.

Discussion points could include:

- consideration of how easy / difficult it is to change people's habits (education or penalties)
- how much difference can individual choices make (at least in the short run) without concerted action by governments and manufacturers?

Candidates should be able to achieve marks in the highest band with a selection of relevant points, not necessarily the complete range. Any other valid point not included here should be credited.