

Final



**General Certificate of Education (A-level)
January 2013**

General Studies A

GENA2

(Specification 2760)

Unit 2: Science and Society

Final

Mark Scheme

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 events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process 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 standardisation each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised 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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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	B	1.16	D
1.2	B	1.17	A
1.3	C	1.18	D
1.4	D	1.19	D
1.5	A	1.20	A
1.6	D	1.21	C
1.7	D	1.22	D
1.8	C	1.23	A
1.9	B	1.24	A
1.10	B	1.25	A
1.11	A	1.26	B
1.12	B	1.27	B
1.13	A	1.28	C
1.14	B	1.29	B
1.15	C	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, 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 & Q5	Q6 & Q7	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)	<p>Good response to question</p> <p>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).</p>
LEVEL 2	7–12	<p>Reasonable attempt to answer question</p> <p>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).</p>
LEVEL 1	1–6	<p>Limited response to the question</p> <p>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).</p>
LEVEL 0	0	<p>No valid response or relevance to the question.</p>

02 Examine the reasons why many scientists consider that animal experiments are an essential part of some areas of scientific research.

(17 marks)

General guidance

This question is concerned solely with scientific issues – the range of reasons why scientists might use animals in research, and any scientific objections. Candidates should give a range of claimed benefits of using animals and should give appropriate detail. The examination of these claims may include critical comment, but only arguments based on scientific efficacy should be rewarded.

A **good** answer will be in **Level 3** (13–17 marks)

A **reasonable** answer will be in **Level 2** (7–12 marks)

A **limited** answer will be in **Level 1** (1–6 marks)

Candidates should be able to achieve marks in the highest level with a selection of relevant points, not necessarily the complete range.

Indicative content

Animal experiments fall into three main (and overlapping) categories:

- pure research, such as genetic manipulation
- applied research, studying diseases and developing medicines
- toxicological testing of chemicals (safety testing).

The latest figures for the UK show that 3.7 million animal experiments were conducted in 2010, 78% of which were for healthcare products. 97% of the experiments involved rats, birds, mice and fish; fewer than 1% involved cats, dogs, horses or non-human primates.

Some of the reasons that scientists consider animal experiments are essential in some areas of research include:

- animals are useful surrogates for humans in the study of living systems, including cells, tissue and organs
- testing on animals can be used to determine whether a particular drug should be tested on humans
- animals have shorter life and reproductive spans, meaning that several generations can be studied in a relatively short time
- laboratory animals are bred specifically for animal testing purposes, meaning that they will be free of diseases and other factors which might undermine the accuracy of an experiment
- many of the greatest medical advances have been the result of animal experiments – for example:
 - anaesthetics
 - organ transplants
 - vaccines

- current areas of research using animals include:
 - AIDS
 - cancers
 - malaria
- there have been significant advances in veterinary science as a result of animal testing.

Opponents argue that animal testing is bad science, because they claim that:

- animal diseases are not always comparable to human diseases
- drugs may have different effects on animals compared to humans
- the stress of animal testing on the animals undermines the validity of the results.

Opponents also claim that there are alternatives to animal testing that are less harmful and may be more effective, for example:

- the study of cell cultures and tissue engineering
- the use of human blood and tissues in experiments
- the use of human volunteers
- computer simulations.

Any other valid points should be credited.

03 Discuss the moral and political issues that arise from the use of animals in scientific research.

(18 marks)

General guidance

This question gives candidates the opportunity to discuss the wider issues associated with the use of animals in experiments. There are moral and ethical issues relating to the relationship of humans and animals, and the inflicting of pain and cruelty. There are political issues relating to regulation, and questions about the forms and extent of opposition. A good answer will be aware of a range of issues and will discuss them in a balanced manner.

A **good** answer will be in **Level 3** (13–18 marks)

A **reasonable** answer will be in **Level 2** (7–12 marks)

A **limited** answer will be in **Level 1** (1–6 marks)

Candidates should be able to achieve marks in the highest level with a selection of relevant points, not necessarily the complete range.

Indicative content

Moral and ethical arguments in support of animal experimentation include:

- the view that human beings are unique amongst animals, and are therefore morally entitled to use them for their own purposes
- it is, however, accepted that, while they may be in some sense superior to animals, humans have a moral duty not to inflict unnecessary harm on animals without good cause
- it is morally right that we should seek to develop medical and veterinary science for the relief of suffering, both human and animal
- it would be unethical to test substances or drugs with potentially adverse side-effects on humans without first testing them on animals
- controlled experiments usually require confinement in a laboratory – human beings could not be confined in this way
- if it is morally acceptable to exploit animals by eating meat, wearing leather, etc, then it can be argued that there is little moral difference in using animals in research
- it is accepted by scientists who use animals in this way that they should seek to
 - reduce the numbers used
 - refine their techniques to minimise suffering
 - replace the use of animals wherever possible with other methods of testing.

On the other hand, arguments against animal experimentation include:

- there is a different ethical view that animals have rights that are equivalent to those of humans, and should therefore be treated similarly to humans
- even if it is not accepted that animals have rights, there is an argument that humans have a duty to treat animals in an acceptable and humane manner
- animals are sentient beings which can experience physical and emotional pain
- animals are incapable of giving reasoned consent to testing
- any potential benefits to human beings have to be set against the harm to animals – it is argued that the suffering of animals is excessive in relation to any benefits gained.

Political issues include the need for regulation of testing. Current regulation in the UK, legislated for in the Animal Procedures Act of 1986, is regarded as very rigorous:

- the scientist in charge of an experiment must be licensed
- the institution in which procedures take place must have an appropriate certificate
- each individual carrying out procedures must be licensed.

Critics argue that this is not enough and that it is not effectively monitored or enforced.

A different political issue concerns the 'animal rights' campaigns of recent times, some of which involved violent tactics against individuals and institutions engaged in testing:

- one view is that such actions, though outside the law, are justified in order to protect animals
- the alternative view is that those who wish to change the law should do so through peaceful and democratic processes
- in any event, the government and judicial system have a duty to protect those individuals and institutions being unlawfully attacked, and a number of offenders have been sentenced to prison for their activities.

Any other valid points should be credited.

04 Explain the technology behind any two of the 'top ten inventions' listed in the source.

(17 marks)

General guidance

The indicative content of this mark scheme can only give a very brief outline of key points. Examiners should be looking for knowledge and understanding of the science and technology of chosen items. Ideally, there should be appropriate levels of detail for each example, but marks should be awarded for the answer as a whole. However, candidates who select and write about only one example are unlikely to get marks in the Level 3 range.

A **good** answer will be in **Level 3** (13–17 marks)

A **reasonable** answer will be in **Level 2** (7–12 marks)

A **limited** answer will be in **Level 1** (1–6 marks)

Candidates should be able to achieve marks in the highest level with a selection of relevant points, not necessarily the complete range.

Indicative content

GPS technology: The Global Positioning System (GPS) is a global navigation system using satellites operated by the US government. A network of satellites orbiting the earth transmit their precise position and the precise time. Receiving devices calculate their distance from the satellite by measuring the time taken for signals to be received. By triangulating with three or more satellites, the exact position of the receiver can be determined.

Sony Walkman: This was the original portable audio cassette. The first Walkman used analogue recordings on magnetic tape, in a battery-operated player with headphones. It led to further innovations in 'wearable' technology, including digital CD players, flash memory and hard-drive based digital audio players (eg. iPod). Music players are now routinely incorporated in other devices, such as mobile phones, which can also store other digital information – eg. photos, videos, games, etc.

Barcodes: These are optical, machine-readable representations of data about the object to which they are attached. Originally barcodes represented data by a variety of widths and spacings of parallel lines; more recent versions use rectangles, dots and other geometric patterns in two dimensions. They are scanned by optical scanners containing a light source (eg. a laser), a lens and a sensor. Some barcodes can now be read by mobile phone cameras.

TV dinners: These are pre-packaged frozen or chilled meals that can be re-heated quickly. Packaging is foil and/or different plastics. The food is preserved by the use of chemical preservatives, as well as chilling or freezing to slow down the rate of decay. These types of meal depend on the availability of home fridges and freezers, and home microwaves, to make them viable commercial products.

Play Station: The PlayStation franchise is a series of video game consoles, originated by Sony in the 1990s. They now include hand-held consoles and can be linked to televisions. Games were originally stored on cartridges and, later, CD-ROMs. They are now downloadable via the internet. Interactive gaming with other players over the internet is now available, and films and TV shows can be downloaded and played on consoles.

Social networking: Social networking sites such as Facebook and Twitter are a web-based means for users to interact over the internet. Users create a 'profile' for themselves and establish lists of 'friends' or 'followers'. News, ideas and comment can be freely exchanged, and photos, videos and music can be uploaded for others to see/hear. It is possible to create online groups of people with similar interests. Users are able to access social networking sites through the internet using computers or smartphones.

Text messaging: This is the exchange of brief textual messages, mainly via mobile phones, though some landline phones have this facility. Sometimes referred to as SMS (Short Messaging Service), it is now possible to include photos, video or music content in a message. Standard text messaging is limited to 160 characters per message, which gave rise to 'text speak' – the use of abbreviations. Modern phones use predictive text, which has reduced the text speak somewhat.

Electronic money: Money can be transferred electronically via computer networks and the internet. Debit and credit cards enable payments to be made when information recorded on the card is used to access bank accounts to pay for goods or services. PayPal is a secure system for paying via the internet. Oyster cards are pre-paid contactless smartcards which are used in London to pay for journeys on public transport. New developments include the use of pre-paid cards for payments in stores, etc, and the use of fingerprint recognition technology to access pre-paid accounts for, for example, school meals.

Microwaves: Microwaves are a form of electromagnetic radiation with wavelengths at the lower end of the electromagnetic spectrum. In nature, microwaves are found throughout the universe, in the form of cosmic microwave background radiation. It was the measurement of this type of radiation in experiments that led to the big bang theory. Microwaves are used in radar, in radio broadcasting, in satellite communications, in mobile phone communication and in microwave heating and cooking.

Trainers: The term 'trainer' is used to describe shoes for athletics and other sports. What is distinctive about these shoes is the use of dense rubber for the soles, with some being air-cushioned, gel filled or including an air bubble, as a means of absorbing the shock when running. The treads of the soles can vary according to the sport. The tops are made of flexible compounds. Trainers can be designed to give support to different parts of the feet, and individual athletes may have shoes designed particularly for their needs.

Any other valid points should be credited.

05 Consider the extent to which any two of the 'top ten inventions' listed in the source have made a significant difference to modern life. (These may be the same as, or different from, those chosen in Question 04.)

(18 marks)

General guidance

The indicative content of this mark scheme can only give a very brief outline of key points. Examiners should be looking for an account of the use of any two of these innovations and some consideration of whether their invention and application is useful, positive and represents progress, or whether they might be regarded as less significant than other innovations, trivial and of little value. Candidates who select and write about only one example are unlikely to get marks in the Level 3 range.

A **good** answer will be in **Level 3** (13–18 marks)

A **reasonable** answer will be in **Level 2** (7–12 marks)

A **limited** answer will be in **Level 1** (1–6 marks)

Candidates should be able to achieve marks in the highest level with a selection of relevant points, not necessarily the complete range.

Indicative content

GPS technology: Originally developed for military purposes, GPS is used to guide ICBMs, cruise missiles, drones and other guided weapons. Its best known civilian use is in sat-nav devices for motorists, but it is also used by walkers and rambles, in person and vehicle tracking, in surveying and map-making, in search and rescue missions and in disaster and emergency relief.

Sony Walkman: This has significantly changed the music industry, contributing to the demise of vinyl records. By enabling individuals to create their own customisable playlists, it broke down the control of the music companies and artists over how music is presented and packaged. It also fundamentally changed the way people listen to music – no longer just at home or in concert halls, but when walking, on trains and buses, at the gym, etc.

Barcodes: Their most obvious use is in supermarkets and other retail environments to identify products and record sales. They enable retailers to track quick and slow selling items, with information to help in re-ordering and re-pricing. They are also used in hospitals for patient ID, giving instant access to medical records. They are used in entertainment venues to enhance security, in tracking of mail and parcels, and in ticketing for some forms of travel.

TV dinners: TV dinners are a form of convenience food, needing little or no preparation other than heating. They may be useful for single people or families with little spare time. They are also used by airlines for in-flight meals. On the other hand, TV dinners tend to be heavily processed with extra salt and fat, with negative effects on individuals' cardio-vascular systems. They are less nutritious than fresh food, and may contribute to the obesity problem.

Play Station: The PlayStation and its successors and rivals (e.g. the Wii) have turned gaming into a mainstream family activity. They have created a new industry, and new opportunities for creative games designers, with benefits for the economy. On the other hand, it may be argued that they decrease real, as distinct from virtual, social interaction. There is also concern that many games feature extremely violent scenarios which may impact on individuals' behaviour.

Social networking: Social networking sites can be a means of maintaining contact with family and friends, perhaps over long distances, and a means of exchanging views with like-minded individuals. Participation in the political process is increased via online debates and petitions. On the other hand, there are concerns about security, bullying and harassment, and paedophile grooming. Such sites may encourage isolation and become a substitute for real relationships.

Text messaging: Texting is a cheap and simple means of communication, easily accessible to young people. Friends can use texts to maintain and strengthen ties, though it can also be a source of bullying and harassment. Companies use texting for infotainment, sports updates and advertising. Some critics argue that 'text speak' is allegedly affecting the quality of young people's ability to communicate in clear English.

Electronic money: The use of electronic money systems is more secure than using cash and more convenient and instant than cheques. Debit and credit cards are beneficial for retail companies as they make it easy for consumers to buy goods and services – though they may also encourage debt. Electronic money systems have facilitated e-commerce and the use of the internet, to the detriment of physical businesses on the High Street.

Microwaves: The use of microwaves is essential in many forms of communication, including mobile phones, satellite communication and satellite television, and GPS systems. Radar systems use microwaves to detect the range and speed of remote objects, with safety benefits to air travellers. Their use in microwave ovens makes cooking easy and convenient. On the other hand, there are safety concerns about possible radiation leakages from microwave ovens and brain damage from the use of mobile phones.

Trainers: Trainers are important in sport, and individually designed shoes can assist competitors at the highest level. They are also used by amateur and casual users for jogging or in the gym. Trainers have also become a fashion item, perhaps indicating health and athleticism, though often at high cost. The sale of trainers and other sports clothing is important economically, and is driven by celebrity endorsements. Trainers are often produced in less than ideal conditions in workshops and factories in East Asia.

Any other valid points should be credited.

06 Explain how sport can contribute to the health and well-being of individuals and groups.

(17 marks)

General guidance

The concept of 'well-being' is a very broad one, but candidates should be able to build on the information in the source to demonstrate the wide range of benefits of sport to individuals and groups. Elements of well-being explained in a good answer are likely to include physical, psychological and social benefits. Weaker answers are likely to be more restricted in range and/or development.

A **good** answer will be in **Level 3** (13–17 marks)

A **reasonable** answer will be in **Level 2** (7–12 marks)

A **limited** answer will be in **Level 1** (1–6 marks)

Candidates should be able to achieve marks in the highest level with a selection of relevant points, not necessarily the complete range.

Indicative content

Different sports have different attributes – some are based on individual effort, some are team sports – so not all sports have the same range of effects. However, in general, sport can develop some or all of the following:

Physical fitness

- cardiovascular fitness
- muscle strength
- muscular endurance
- flexibility of joints
- weight management

Physical skills

- agility
- balance
- coordination
- power
- speed
- reaction time
- stamina and/or endurance.

Team work

- sport enables individuals to learn to work in teams
- teamwork requires individuals to develop trust and responsibility
- individuals can take on leadership roles
- teams offer a sense of identity and belonging
- sports teams can be a source of local and national pride.

Discipline

- provides motivation to work towards specific goals
- teaches individuals to deal with success and failure
- enables individuals to learn to cope with pressure
- develops habits of training and self-improvement
- a means of learning about competition
- learning to compete fairly within the rules of the game.

Social and other skills

- a way to keep fit and healthy, developing strength and/or physical endurance
- promotes friendship, fair play, teamwork, discipline, respect, coping skills
- offers an outlet for aggression
- offers an opportunity for self-expression
- sport is a 'universal language', bringing together people from different backgrounds and cultures
- successful sportspeople can be role models to others, including those from disadvantaged backgrounds
- sport can offer a diversion from crime and anti-social behaviour.

Candidates may identify some potential negative outcomes:

- long term damage to health (eg. Joints, brain damage)
- drug use to gain illegal advantage (eg. Lance Armstrong)
- anti-social behaviour associated with extreme loyalty to particular teams or nations.

Other valid points, not included here, should be credited.

07 To what extent are major international sporting events a vehicle for achieving social and economic change and development?

(18 marks)

General guidance

With the example of the recent London Olympics, candidates should be able to identify a wide range of ways in which the 'legacy' of an international sporting event impacts on a local economy and society. They should consider sporting issues, both in terms of sport infrastructure and interest in sporting activity. In addition, commercial, housing and other developments should be considered. While the focus of this specification is primarily on Britain, international examples (eg. Beijing Olympics, South African World Cup) should be accepted and credited.

A **good** answer will be in **Level 3** (13–18 marks)

A **reasonable** answer will be in **Level 2** (7–12 marks)

A **limited** answer will be in **Level 1** (1–6 marks)

Candidates should be able to achieve marks in the highest level with a selection of relevant points, not necessarily the complete range.

Indicative content

Examples of social and economic change and development that might result from international sport events:

- increased numbers of individuals and groups are introduced to sport
- facilities for elite sport and grassroots participation are created
- facilities for the use of communities – eg. swimming pool complexes – are created
- recreation opportunities – eg. open space, playing fields, waterways – are created
- new stadiums can be used for 'legacy' purposes – eg. as professional football stadiums (Manchester City, West Ham) or as athletics, cycling or other venues
- old and declining industrial areas can be regenerated, or undeveloped areas can be opened to development
- employment opportunities for local populations are created – both in the building programme and in legacy uses
- the sporting event can be a focus for shopping, leisure and manufacturing developments
- new housing provision can be developed, using the athletes' village as the initial focus for further house building
- tourism is developed and encouraged, both for the event itself and over a longer period
- a new or improved transport infrastructure can be created
- in less developed nations, a world class sporting infrastructure can be created; in more developed nations, such an infrastructure can be renewed and extended
- 'one-off' and individual annual major events can have a beneficial effect in local and regional areas – eg. the Great North Run and test matches at Chester-le-Street in the north east, the Tour de France in many areas of France (and occasionally in neighbouring countries - eg. Yorkshire in 2014).

However, there are potential problems and criticisms associated with major international sporting events, including:

- the destruction of existing communities and employment-generating uses
- the upfront costs (in London £9 billion) can be a burden for less developed nations or even for more developed countries in times of economic recession
- cost overruns can be a burden for decades after the event (Montreal took 30 years to pay off its Olympic debts)
- those who benefit from the new housing and employment opportunities may be the better-off, rather than those who need them most
- security and terrorism prevention measures may increase the cost and limit the opportunities for participation and enjoyment
- there is some doubt as to the long-term enhancement of participation in sport.

Other valid points, not included here, should be credited.