AQA

**General Certificate of Education (A-level)
June 2012**

General Studies A   GENA2

(Specification 2760)

Unit 2: Science and Society (AS)

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.

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

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)	**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.**

02   Explain what constitutes a healthy diet and how different diets can affect an individual's health.

(17 marks)

General guidance

We should expect candidates to explain the main elements of a healthy diet, and the importance of a balanced intake of food types. They should be able to show how some diets have negative health outcomes compared to others. Factual knowledge and quality of explanation should both 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

A healthy diet is also a balanced diet, since it is both the components and their relative quantities that make a diet healthy.

The **main constituents of a healthy diet** should include:

- protein – needed for repair and growth of the human body, eg muscles, skin, hair. Sources of dietary protein include meats, soy products, eggs, grains, legumes, dairy products (eg milk and cheese).
- fat – used in the body for forming cell membranes, for energy and can be stored for later use. There are a number of different types of fat:
    - unsaturated fat (found in plant oils, such as olive oil) which are best in the human diet;
    - saturated fats, usually from animal sources (such as butter and lard) which should be consumed only in moderation;
    - trans fats are particular types of unsaturated fat, known to increase the risk of coronary heart disease; they are found in processed foods and should be avoided if at all possible;
    - all fats contain fatty acids (such as omega-3 and omega-6) some of which are essential but cannot be manufactured in the body, so must be found in the diet; they are found in nuts, seeds, most vegetables and fish.
- carbohydrates – are chemicals that are made up of one or more saccharide (sugar) units:
    - simple carbohydrates (sugars) such as glucose, sucrose, lactose and fructose, are found in fruits and honey; they are absorbed quickly and provide energy;
    - complex carbohydrates (starch, cellulose, glycogen) take longer to digest; they release energy over a longer period; they are found in rice, noodles, bread and other grain-based products.

- minerals – for example, salt, calcium, iron.
- vitamins – for example vitamin A which assists vision, vitamin C which prevents scurvy.
- fibre – the indigestible part of plant foods, essential for the digestive process and thought to reduce the risk of cancers of the digestive system.   Fibre is found in whole grains, fruit and vegetables.
- water is also an essential part of a healthy diet.

There are many different forms of diet, some associated with particular geographic locations (eg the Mediterranean diet), others which are diets based on lifestyle choices, such as vegetarian or vegan diets.

The **typical diet in Britain and other western societies** tends to have an excessive calorific value and is unbalanced, consisting of an excess of red meat, sugar, fat (especially saturated and trans-fats), refined grains and dairy products. It is deficient in fruit and vegetables (and therefore vitamins and minerals).

This type of diet is associated with high incidences of high blood pressure, diabetes, obesity, cardiovascular diseases and cancer amongst the population.

A healthier, more balanced form of diet, often described as **the Mediterranean diet**, is characterised by olive oil as the principal source of fat, high consumption of unrefined cereals, high consumption of fruit and vegetables, moderate consumption of dairy products (cheese and yoghurt), moderate consumption of fish and poultry and low consumption of red meats.

This diet is low in saturated fat and high in dietary fibre. These elements of diet, combined with regular physical activity and other aspects of a healthy lifestyle, are associated with much lower levels of coronary heart disease and a lower incidence of cancers of the digestive system.

Candidates may mention other national or regional diets, such as the Japanese diet (rice, raw vegetables, raw fish, etc) which is associated with longevity; or the Finnish diet (high dairy content) associated with heart disease.

Candidates may also note that many people in some parts of the world suffer from undernourishment or malnourishment, which makes them more prone to illness and disease.

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

03   Discuss the possible environmental and economic consequences of implementing the recommendations of the Sustainable Development Commission report mentioned in the source.

(18 marks)

General guidance

Candidates will be able to identify the SDC recommendations and some possible consequences from the extract. We should expect them to develop these and to consider other possible outcomes. A balanced discussion of the likelihood and merits of both environmental and economic consequences should be appropriately 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

Cutting down on meat and dairy produce would:

- lower greenhouse gas emissions – through fewer animals (methane producers) and less transport and processing of animal products
- slow down the rate of deforestation in, for example, South America – much deforestation is to make way for cattle ranches
- free up land previously used for animals or growing animal fodder for alternative uses
- reduce pressure on water resources
- slow the rate of loss of biodiversity
- lead to cheaper diets and lower food prices
- (arguably) lead to higher employment – more workers needed for crop production than meat production
- also cause the UK and global livestock industry to decline with loss of employment opportunities
- possibly also cause increased deficiencies of some minerals, with less meat in the diet.

Cutting the consumption of processed food and drinks would:

- reduce greenhouse gas emissions (fewer factories, less transport needed)
- free up land previously used for food processing
- reduce intake of trans-fats and increase intake of fibre – hence reducing cost to NHS of the health consequences of a poor diet
- decrease the amount of packaging used, easing the problem of waste disposal
- but also cut the size of the UK food and drink industry, with consequent loss of jobs.

Reducing food waste would:

- reduce greenhouse gas emissions (methane in landfill)
- reduce waste in agriculture
- reduce the size of the UK food and drink industry (less need to produce excess amounts of food)
- reduce the amount of imported food (and hence transport emissions) – but therefore also reduce trade with developing countries, to their economic disadvantage.

Shopping on foot would:

- reduce greenhouse gas emissions by reducing the number of car journeys to and from supermarkets
- contribute to a healthier population by increasing the amount of exercise undertaken.

Shopping via the Internet would:

- reduce greenhouse gas emissions by reducing the number of car journeys to and from supermarkets
- contribute to a less healthy population by reducing the amount of exercise taken
- create more jobs in product delivery – but reduce jobs if local shops closed.

Drinking tap, rather than bottled, water would:

- reduce greenhouse gas emissions by reducing the transportation of large quantities of bottled water by road
- reduce the amount of plastic waste going into landfill
- also cause job losses in the bottled water industry.

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

04 Explain the process by which human characteristics and disorders are genetically inherited.

(17 marks)

General guidance

We should expect candidates to be able to demonstrate their knowledge of genetics. Strong answers will use appropriate examples to illustrate their explanation of how genes can have effects on human characteristics and disorders. Candidates may also consider the extent to which environmental and other factors can affect health and behavioural characteristics.

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

Our understanding of inheritance of characteristics is based on Gregor Mendel's studies in the 19th century. More recent research has confirmed and expanded our understanding:

- inheritance depends on discrete units of inheritance, known as genes
- a gene is a sequence of DNA that codes for a type of protein that has a function in the organism
- different forms of a particular gene are known as alleles
- a dominant allele can pass on characteristics, disease or disorder even when present singly
- a recessive allele can only pass on a characteristic, disease or disorder if both parents pass on the allele to the child
- some characteristics are sex-linked and are passed on through the female line but usually only affect males.

Genes can have both major and minor effects on human characteristics:

- it is likely that genes have some influence on human behaviour, intelligence and sexual orientation
- there is, however, a debate about the relative influence of 'nature' and 'nurture' in these areas
- it is well established that genetic factors are the cause of a variety of disorders and diseases, including Huntington's disease, cystic fibrosis, haemophilia, sickle cell anaemia, achondroplasia
- more recently, researchers are seeking to identify the genetic component of particular types of, for example, cancers and, more controversially, genes responsible for aspects of behaviour such as obesity or homosexuality.

The Human Genome Project worked out the sequence of all the bases in human chromosomes. It is hoped that this will allow researchers to identify the specific genes associated with specific inherited disorders and diseases, and help develop treatments.

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

05 Discuss ethical dilemmas facing patients and doctors considering the use of genetic testing.

(18 marks)

General guidance

The extract suggests some potential dilemmas facing patients and doctors who might use genetic testing. Candidates should be expected to consider these and other possible issues. Examiners should look for a balanced discussion of ethical (and possibly other) concerns arising from these situations.

A **good** answer will be in **Level 3 (13 – 18 marks)**.
A **reasonable** answer will be in **Level 2 (7 – 12 marks)**.
An **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

Candidates should be able to write thoughtfully on issues arising from some or all of the following situations:

- Individuals may have a difficult choice in deciding whether or not to have a genetic test. Do they really want to know? What, if anything, will they be able to do about it if there is a positive result?
- If a test indicates a possibility or probability of, for example, breast or bowel cancer, the individual is faced with the dilemma of whether or not to have pre-emptive surgery, such as breast removal.
- If a test indicates that an individual has a genetically inherited condition, they have the dilemma of deciding whether or not to tell other relatives who may, potentially, be affected.
- If the individual chooses not to tell relatives of their potential genetic condition, doctors are faced with the dilemma of whether or not to break their patient's confidentiality in order to warn relatives of the risk to them.
- If the individual can potentially pass on a genetic condition to their children, they are faced with the dilemma of whether or not to have children in those circumstances.
- If a test indicates that a foetus has a serious genetic condition, the mother may be faced with the dilemma of aborting the foetus or giving birth to a child with serious disabilities. If she chooses abortion (or is advised to do so) there is an argument that this reflects badly on social attitudes to people currently living with the same disabilities in our society.
- The doctors' dilemmas consist of having to advise patients in any or all of the circumstances described above – it may be that they need counselling skills as well as medical expertise.
- Doctors must also be aware that genetic testing indicates a degree of risk rather than any certainties – their advice has to reflect this.
- From a different point of view, there is the issue of whether or not employers, insurance companies or mortgage providers have a right to know of a person's genetic condition when deciding on a job, life insurance policy or mortgage.

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

06   Explain ways in which robots can be used in industry and other areas of modern life.

(17 marks)

General guidance

Candidates should have some understanding of the nature of robot technology. There are a number of examples of the uses of this technology in the extract and we should expect candidates to offer a range of other appropriate applications. However, excessive speculation, verging on science fiction, should not be credited.

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

A robot is a mechanical artificial agent. It is usually an electro-mechanical system which in some cases may appear (because of its movement) to have an intent of its own.

A **robot** can include some of the following features:

- it can sense its environment and manipulate and interact with it
- it may display some degree of 'intelligence', in the sense of an ability to make choices based on its environment, for example through pre-programmed sequences
- it is programmable
- it moves through one or more axes of rotation and translation
- it makes dexterous coordinated movements
- it may appear to have agency or intent.

The **application** of robot technology falls into two basic categories:

- activities which can improve on the abilities of humans (eg strength and reach) – to increase productivity, accuracy and endurance;
- activities which are dirty, dull or dangerous for humans, or which are inaccessible.

Ways in which robots can be used in **industry** can include the following:

- car assembly lines, carrying out tasks including welding, gluing, spray-painting and assembling
- packaging products – binding, palletising, etc
- electronics – printed circuit boards are manufactured by robots picking components from trays and placing them at great speed with great accuracy
- automated guided vehicles (AGVs) are mobile robots which can transport goods around warehouses, container ports, etc.

Ways in which robots can be used in **other areas of modern life** can include the following:

- in the home, vacuum cleaning, floor cleaning, lawn mowing
- military uses, including defusing bombs and mines
- drones and 'smart' bombs can be considered as being robots
- in medicine, may be used in surgery and other invasive treatments
- in leisure, with toys and games
- in social care, providing assistance for elderly or disabled people.

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

07 Discuss the likely benefits and problems of the widespread adoption of robot technologies.

(18 marks)

General guidance

The extract identifies military, industrial and domestic applications of robot technology. There are other potential areas of use, such as healthcare, leisure and education. A balanced discussion of the likelihood of both positive and negative outcomes in some or all of these areas should be rewarded. Approaches could include social, economic and political issues.

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

In **industry**, robots do not get tired, need breaks or go on strike. They can work more quickly and accurately than human workers. Products (eg cars) may be more reliable, and services (eg despatch of products from warehouses) may be more efficient. Productivity and economic growth may both increase.

On the other hand, the widespread adoption of robot technology may result in the loss of manufacturing and service jobs, leading to long-term unemployment in some areas. This could in turn lead to social unrest and/or an increase in crime and anti-social behaviour. On an international scale, it could lead to a widening of the gap between more and less developed economies.

Domestically, robots may act as labour-saving devices, further reducing the burden of domestic work on families.

However, these devices are not likely to be cheap, at least for the foreseeable future, so a consequence might be that inequality between households of different incomes could increase.

In **warfare**, the use of robots, drones and 'smart' technology can be seen as increasing military capacity, while reducing the risk of death and serious injury for military personnel.

On the other hand, many of these technologies cause significant death and destruction when applied, and have a record of causing high levels of accidental casualties or 'collateral' damage. Furthermore, the belief that military action can be taken without serious loss to the armed services might encourage politicians to undertake military adventures that they might not have otherwise considered.

In **healthcare**, advanced techniques using robot technology can increase the number of patients who can be treated and improve their survival and recovery rates.

However, some patients may regret the lack of personal attention in healthcare. The costs of more advanced technologies could increase the burden of cost on the NHS and/or lead to increased rationing of some types of treatment. More indirectly, higher survival rates can impose increased costs on the pension system and the economy generally.

Similar arguments relating to social care, education, leisure and recreation or other areas of modern life should be appropriately credited.

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

UMS conversion calculator www.aqa.org.uk/umsconversion