Version 1



General Certificate of Education (A-level) January 2011

**General Studies A** 

**GENA2** 

(Specification 2760)

Unit 2: Science and Society (AS)

# Final



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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  | D | 1.16 | D |
|------|---|------|---|
| 1.2  | В | 1.17 | Α |
| 1.3  | D | 1.18 | С |
| 1.4  | С | 1.19 | D |
| 1.5  | В | 1.20 | С |
| 1.6  | D | 1.21 | Α |
| 1.7  | Α | 1.22 | В |
| 1.8  | D | 1.23 | Α |
| 1.9  | В | 1.24 | В |
| 1.10 | С | 1.25 | С |
| 1.11 | С | 1.26 | С |
| 1.12 | Α | 1.27 | В |
| 1.13 | С | 1.28 | Α |
| 1.14 | D | 1.29 | D |
| 1.15 | В | 1.30 | В |

### 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.

| Question Numbers         |     | Q2 & Q3 | Q4 & Q5 | Q6 & Q7 | Total marks<br>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                           |

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

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

## 02 Explain how scientific research and space exploration have contributed to our knowledge of the universe and the solar system.

(17 marks)

The potential areas of response to this question are very wide. The following are some areas of research and exploration that candidates may cover:

- advances in physics and maths have advanced our understanding of the universe Newton, Rutherford, Einstein, quantum mechanics
- theoretical research on theory of relativity, the big bang, time, gravity, etc.
- particle colliders (LHC) are advancing our understanding
- space craft have landed on the Moon (along with some astronauts) and on Mars, gaining information on the geological composition and, in the case of Mars, searching for evidence of past water activity (and possibly life)
- analysis of soil and rock samples from the Moon and Mars
- space journeys using probes, sending back information on other planets via radio signals Cassini Huygens (Saturn), Galileo (Jupiter), Mars rover, etc.
- analysis of meteors which land on the Earth's surface
- understanding of geological processes on Earth enable us to understand and interpret information from space missions, the Hubble telescope, etc.
- SETI is a long-term project looking for intelligent life elsewhere in the universe (so far without result)

Explanation of our current understanding of the universe might include some of the following:

The most widely accepted modern theory for the **origin of the universe** is the 'Big Bang' theory. This is the idea that the universe has expanded from a primordial hot and dense initial condition at a finite point in time, estimated to be around 13.72 billion years ago, and is still expanding. Evidence for this includes Hubble's observations of distances to galaxies being proportional to their redshift. Further evidence in the 1960s was the discovery of cosmic microwave background radiation.

There are two scenarios for the **future of the universe** – either that the universe will expand to a maximum size, then begin to contract, ultimately leading to a 'Big Crunch'; or that the universe will continue expanding indefinitely, though eventually at a slower pace.

**Galaxies** are massive, gravitationally bound systems, consisting of stars, star systems, interstellar gas and dust, and the little-understood 'dark matter'. Galaxies range from dwarfs, with as few as ten million stars, to giants with up to a trillion stars, all orbiting the galaxy's centre of mass. There are approximately 125 billion galaxies in the observable universe. The Milky Way is the galaxy in which our sun and solar system are located.

It is known that **extra-solar planets** exist in other solar systems. About three hundred are currently known, but there may be as many as 100 billion in the Milky Way alone. Planets in a 'zone of habitability' in relation to their star, with similar temperature ranges to Earth, an atmosphere and water could potentially have simple lifeforms. There is speculation about the likelihood of possible civilisations on Earth-like planets.

The **solar system** consists of the Sun and planets and other objects bound to it by gravity. It was formed approximately 4.6 billion years ago. There are four terrestrial planets – Mercury, Venus, Earth and Mars – and four gas giants – Jupiter, Saturn, Uranus and Neptune.

The **asteroid belt** lies between Mars and Jupiter and consists of millions of small objects, mainly of rock and metal, thought to be remnants from the formation of the solar system. The Kuiper belt is similar, but is beyond the orbits of the gas giants. It consists mainly of ice, but some of its larger objects, such as Pluto, are classed as dwarf planets. **Comets** are small bodies, mainly of ice and dust, originating in the Kuiper belt or the much more distant Oort Cloud. The orbits of some comets bring them into the inner solar system and some are visible from Earth, characterised by the comet 'tail' (or coma) of gas and dust.

# 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.**

As a guide, the characteristics of answers at different levels are likely to be as follows:

#### A Level 3 answer (13–17 marks)

- identifies and explains a substantial range of examples of scientific research and space exploration
- OR identifies a more modest range of examples of research and exploration, but explains them in greater detail
- shows clear evidence of analysis and evaluation, leading towards a reasoned conclusion
- is well organised and fluently communicated.

#### A Level 2 answer (7–12 marks)

- identifies and explains a modest range of examples of scientific research and/or space exploration
- OR identifies a more limited range of examples of research and/or exploration, but explains them in some detail
- shows some evidence of analysis and evaluation, leading towards a conclusion
- has some organisation and is reasonably communicated.

- identifies and explains a very limited range of examples of scientific research and/or space exploration
- OR identifies a modest range of examples of research and/or exploration, but with little or no
  explanation
- shows little evidence of analysis or evaluation, with little in the way of a conclusion
- has variable levels of organisation and communication.

#### 03 'Space exploration has been a waste of money and scientific effort.'

Consider the view that the world's scientific, technological and financial resources would be better spent on dealing with such issues as global poverty and climate change rather than further space exploration.

(18 marks)

On the one hand, candidates could argue that scientific research and exploration of space have been important and valuable for humanity:

- knowledge is important for its own sake an understanding of our own world and other worlds enhances the human experience and knowledge
- we have a greater understanding of the origin and nature of the universe
- knowledge of other worlds can be beneficial in understanding our own
- we have gained a greater understanding of weather patterns, climate change, the ozone layer, etc, as a result of space technology and exploration
- many everyday systems rely heavily on space technology for example, television and communication systems, weather forecasting, satellite navigation systems
- many areas of technology have been originated or accelerated by the requirements of space exploration computers, remote monitoring used in healthcare, materials technology
- the cost of space exploration is relatively small compared with (e.g.) military expenditure
- in the future, space exploration might be necessary to secure new sources of energy and minerals in the event of the Earth running out of such resources
- also in the future, there is a view that colonisation of other planets might be a way of relieving pressure on the Earth's population or of escaping from man-made or other disasters on Earth

On the other hand, there are the arguments that scientific, technological and financial resources could be better spent on dealing with problems on the Earth:

- the costs of space exploration are massive, yet there are few practical benefits of, for example, the Moon programme or of sending space craft to Mars
- in the case of direct or indirect benefits from space research (e.g. communication satellites) it is argued that more specific, focused research could have produced results without the more wasteful forms of exploration
- space exploration is difficult and dangerous; there is a limit to what can be achieved, not least in terms of human physiology
- the colonisation of parts of the solar system is highly improbable it would be a waste of money and detract from other more urgent priorities
- a more caring use of resources would be to seek to alleviate the problem of global poverty (about 25,000 people die every day of hunger or hunger-related diseases); this is not a problem of lack of food, but of the unequal distribution of financial resources
- two million people a year die from AIDS, yet AIDS would be preventable and treatable if sufficient resources were devoted to solving the problem

- climate change is likely to affect the entire population of the world and may have a
  destructive effect on many economies and landscapes; at least part of the solution could be
  through the development of new technologies, using some of the resources devoted to
  space exploration
- space exploration has been, and is likely to be again, an arena for international rivalry and perhaps conflict; much space technology is directed towards or capable of being adapted for military use; this can be seen as a wasteful and dangerous use of resources

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.

#### As a guide, the characteristics of answers at different levels are likely to be as follows:

A Level 3 answer (13–18 marks)

- discusses a substantial range of scientific, technological and financial issues relating to space exploration and global concerns
- OR discussion is more narrowly focused, but has greater depth
- shows clear evidence of analysis and evaluation, leading towards a reasoned conclusion
- is well organised and fluently communicated.

#### A Level 2 answer (7–12 marks)

- discusses a modest range of scientific, technological and financial issues relating to space exploration and global concerns
- OR discussion is narrowly focused, but has some depth
- shows some evidence of analysis and evaluation, leading towards a conclusion
- has some organisation and is reasonably communicated.

- discusses a very limited range of scientific, technological and financial issues relating to space exploration and global concerns
- OR discusses a modest range of issues, but with little or no depth or development
- shows little evidence of analysis and evaluation, with little in the way of a conclusion
- has variable levels of organisation and communication.

## 04 Explain how actions by individual motorists can reduce the impact of their journeys on the environment.

#### (17 marks)

According to the government 'green driving' website, the type of car you own, the way you drive it and the fuel you use can have a big impact on the emissions it produces. Personal car travel produces 13 per cent of the UK's total greenhouse gas emissions and it contributes to local air pollution and congestion.

Actions that individual motorists could take include:

- walk, cycle or use public transport, as an alternative to using their cars as a result, their 'carbon footprint' for that journey will be eliminated or significantly reduced
- join a car share club with work colleagues to reduce emissions per head for journeys to and from work
- buy a fuel efficient car generally one with a smaller engine size; new cars have fuel economy labels showing how fuel efficient each car is, based on CO<sub>2</sub> emissions in g/km – band A is <100, band G is >226
- use low-sulphur fuel
- convert an existing car, or buy a new one, to run on bio-diesel
- drive smoothly to reduce fuel consumption, avoiding harsh acceleration and braking
- shift gears at the right time travelling too fast in a lower gear significantly increases fuel consumption
- don't leave the engine running, or rev up unnecessarily; turn the engine off if the car will not be moving for some time
- check tyre pressures under-inflated tyres increase fuel consumption by up to 3%
- stick to speed limits travelling at 70mph can use 30% more fuel than travelling at 50mph
- remove unnecessary weight and roof racks from vehicles the extra weight and air resistance increases fuel consumption
- only use air conditioning and electrical devices when necessary as they increase fuel consumption
- keep the car serviced and in good condition well maintained cars tend to run more efficiently

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.** 

As a guide, the characteristics of answers at different levels are likely to be as follows:

#### A Level 3 answer (13–17 marks)

- identifies and explains a substantial range of actions motorists can take to reduce environmental impact
- OR identifies a more modest range of actions motorists can take, but explains them in greater detail
- shows clear evidence of analysis and evaluation, leading towards a reasoned conclusion
- is well organised and fluently communicated.

#### A Level 2 answer (7–12 marks)

- identifies and explains a modest range of actions motorists can take to reduce environmental impact
- OR identifies a more limited range of actions motorists can take, but explains them in some detail
- shows some evidence of analysis and evaluation, leading towards a conclusion
- has some organisation and is reasonably communicated.

- identifies and explains a very limited range of actions motorists can take to reduce environmental impact
- OR identifies a modest range of actions motorists can take, but with little or no explanation
- shows little evidence of analysis or evaluation, with little in the way of a conclusion
- has variable levels of organisation and communication.

## 05 Consider possible actions that both vehicle manufacturers and governments could take to attempt to reduce the overall impact of transport on the environment and discuss the problems they may face in doing so.

(18 marks)

#### Vehicle manufacturers could:

- end production of 'gas-guzzlers' and produce more efficient engines
- move away from the use of fossil fuels and introduce engines with less of an impact on the environment:
  - use biofuels
  - use electric engines
  - develop hybrid cars
  - develop hydrogen-powered cars
- more efficient designs, smaller cars, use of different materials (e.g. carbon fibre) to reduce weight
- change marketing tactics, with less emphasis on speed and power, more on responsible driving

On the other hand, the **problems manufacturers face** might include:

- possible wasted expenditure on systems or ideas which prove not to be practical
- high development costs that might not be recovered in sales
- resistance to new types of engine and car by potential customers

#### Governments could:

- legislate to enforce more environmentally-friendly car design and fuel usage
- increase taxes on less fuel-efficient cars
- encourage fuel-saving schemes (e.g. car-sharing) via tax breaks
- use congestion charging to discourage car use
- introduce road pricing (using satellite technology) to charge motorists by the number of miles they travel
- build more high-speed railways to give an alternative to car use for long journeys
- improve commuter trains in terms of frequency, comfort and capacity
- subsidise public transport
- build more cycle lanes and bus lanes

#### On the other hand, **arguments against government actions** include:

- over-regulation is an imposition on the freedom of choice of individuals and could impose significant financial burdens on manufacturers
- when given a choice, the public tend to reject additional charges (e.g. Manchester congestion charge)

 the use of satellite technology for road charging can be seen as an intrusion into individual privacy

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.** 

As a *guide*, the characteristics of answers at different levels are likely to be as follows:

A Level 3 answer (13–18 marks)

- considers a substantial range of actions that manufacturers and governments could take and the problems they may face
- OR discussion is more narrowly focused, but has greater depth
- shows clear evidence of analysis and evaluation, leading towards a reasoned conclusion
- is well organised and fluently communicated.

#### A Level 2 answer (7–12 marks)

- considers a modest range of actions that manufacturers and/or governments could take and the problems they may face
- OR discussion is narrowly focused, but has some depth
- shows some evidence of analysis and evaluation, leading towards a conclusion
- has some organisation and is reasonably communicated.

- considers a very limited range of actions that manufacturers and/or governments could take and the problems they may face
- OR discusses a modest range of actions, but with little or no depth or development
- shows little evidence of analysis and evaluation, with little in the way of a conclusion
- has variable levels of organisation and communication.

## 06 Explain which scientific and social elements should be included in an effective programme of sex and relationship education for young people.

(17 marks)

The principal elements of a sex and relationship education (SRE) programme for teenagers could include information on:

#### puberty and menstruation

- puberty is the process of physical changes by which a child's body becomes an adult body capable of reproduction. SRE in schools is intended to ensure that children will know and understand that they will change and develop and will have confidence in managing their physical and emotional changes.
- menstruation occurs when the lining of the uterus is shed; the onset of menstruation varies between individuals, but usually begins around age 11 or 12; research shows that about a third of girls are not told about periods by their parents. SRE programmes are intended to include preparation for menstruation.

#### intercourse and reproduction

 human reproduction takes place through sexual intercourse. SRE programmes should explain the physical processes, but also the emotional and relationship issues which arise. Levels of teenage pregnancy in Britain are very high. Individuals should understand the legal issues involved (age of consent), risks to health, greater dependency and the undermining of potential achievement in education and employment of early pregnancy.

#### contraception

 there are a variety of methods of contraception, including barrier methods (condom, diaphragm) and hormonal methods (the pill, implants). SRE programmes should be able to give young people full information about different types of contraception, including emergency contraception, and their effectiveness. Some schools will wish to emphasise their own values and beliefs in relation to the use of contraception.

#### abortion

 abortion is the termination of a pregnancy by the removal of the foetus from the uterus; abortion can be spontaneous (miscarriage) or induced. Induced abortions can be medical (by the use of drugs, usually in the early stages of pregnancy) or surgical, involving the physical extraction of the foetus. There are strongly held views and religious beliefs about abortion and some schools will wish to impose a religious ethos in their teaching. However, an SRE programme should enable young people to know and understand about abortion and should enable them to consider the moral and personal dilemmas involved.

#### Sexually Transmitted Infections and HIV/AIDS

- examples of STIs include gonorrhoea and Chlamydia (which is the most common STI in the UK). Chlamydia affects both sexes, with young women more at risk. It often has no symptoms and so can remain undetected and untreated, with the possibility of infertility as a consequence.
- HIV is a virus which attacks cells in the immune system; over a period of time the immune system is so weakened that AIDS develops.

 STIs, including HIV, are spread by unprotected sexual intercourse – i.e. by not using a condom. SRE programmes will enable young people to be aware of the risks of contracting STIs and of how to prevent infection.

**Social issues** that might be part of SRE programmes include:

- parenting skills the role and responsibilities of parents detailed consideration of the effects on one's life of having children
- access to advice and counselling on issues to do with sex, pregnancy, STIs, contraception needs to be free, confidential and approachable
- discussion of sexuality in an open and non-judgemental way issue of homophobia, leading to self-harm, suicide, educational under-achievement
- discussion of body image and the pressure to conform to stereotypes and media images.

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.** 

As a guide, the characteristics of answers at different levels are likely to be as follows:

#### A Level 3 answer (13–17 marks)

- identifies and explains a substantial range of scientific and social elements of an SRE programme
- identifies a more modest range of scientific and social elements, but explains them in greater detail
- shows clear evidence of analysis and evaluation, leading towards a reasoned conclusion
- is well organised and fluently communicated.

#### A Level 2 answer (7–12 marks)

- identifies and explains a modest range of scientific and/or social elements of an SRE programme
- OR identifies a more limited range of scientific and/or social elements, but explains them in some detail
- shows some evidence of analysis and evaluation, leading towards a conclusion
- has some organisation and is reasonably communicated.

- identifies and explains a very limited range of scientific and/or social elements of an SRE programme
- OR identifies a modest range of scientific and/or social elements, but with little or no explanation
- shows little evidence of analysis or evaluation, with little in the way of a conclusion
- has variable levels of organisation and communication.

## 07 'Parents bring up children, not government. Schools, however, can play a vital role in teaching essential skills for learning and life.'

To what extent do you think it is the case that schools and government are taking over the responsibilities of parents in raising their children?

(18 marks)

The quote from the Secretary of State is intended to open up a discussion on the changing balance between personal and family responsibility on the one hand and the role of the state and other agencies on the other.

Candidates might draw attention to the traditional roles of families:

- socialisation the process of learning necessary skills and habits for participating in society
- education families assist children in both formal and informal education, for example with homework, access to reading and reference materials, extra-curricular activities
- gender roles children learn the behaviour and attitudes considered appropriate for their sex primarily through the family, with parents as role models
- social control children learn rules relating to authority from their family
- economic assistance families support children financially through to adulthood, and often beyond, while children may support their parents in old age
- families also offer physical, emotional and financial security to their members, including children

However, **family structures have undergone significant change**, especially in the second half of the twentieth century, which may well have had an effect on traditional family roles:

- changing gender roles women are more likely to be in employment and to be more financially independent, although this does not always equate to a more equal role at work or in the home
- higher divorce rates approximately 40% of marriages now end in divorce, with consequent disruption to family arrangements
- single parent families are more common, with children being born outside of permanent relationships, or following divorce
- cohabitation refers to partners living together without a formal marriage
- same sex families can be created by adoption of children, by IVF, or as a form of reconstituted family
- families have become 'atomised' as a result of the use of technology for entertainment (TVs, games, computers) leading to less family contact, for example at mealtimes

**Schools and government** (at both local and national levels) have, arguably, taken on many of the responsibilities previously associated with the family:

- schools
  - SRE many parents now regard schools as primarily responsible for sex education

- personal, social, health and economic education many of the issues covered in PSHE might be considered to be areas of family responsibility
- diet the Healthy Schools initiative is teaching children the importance of healthy eating, while school meals (and breakfast clubs) are directly aimed at giving children a healthier diet than some of them might receive at home
- exercise schools are required to ensure specific provision of exercise through PE and sports, often the only exercise received by children who may be more used to TV, computer games and social networking
- government (both local and national)
  - Sure Start aims to assist children and families by child care provision, early education, health and family support, including parenting skills
  - working tax credits are aimed at assisting parents with child care costs, to enable them to undertake employment
  - health campaigns on tobacco, alcohol, diet and exercise are intended to change and improve the practices of families who do not have healthy lifestyles
  - safeguarding arrangements are in place to support families in rearing their children, and to take children into care if their families are negligent or abusive in their parenting practice

# 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.**

As a guide, the characteristics of answers at different levels are likely to be as follows:

A Level 3 answer (13–18 marks)

- discusses a substantial range of issues relating to responsibilities of parents, schools and government
- OR discussion is more narrowly focused, but has greater depth
- shows clear evidence of analysis and evaluation, leading towards a reasoned conclusion
- is well organised and fluently communicated.

#### A Level 2 answer (7–12 marks)

- discusses a modest range of issues relating to responsibilities of parents, schools and/or government
- OR discussion is narrowly focused, but has some depth
- shows some evidence of analysis and evaluation, leading towards a conclusion
- has some organisation and is reasonably communicated.

- discusses a very limited range of issues relating to responsibilities of parents, schools and/or government
- OR discusses a modest range of reasons, but with little or no depth or development
- shows little evidence of analysis and evaluation, with little in the way of a conclusion
- has variable levels of organisation and communication.