



## **General Certificate of Education**

# **General Studies 6761** *Specification A*

**GSA5**      **Science, Mathematics and Technology**

## **Mark Scheme**

*2008 examination – June 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](http://www.aqa.org.uk)

Copyright © 2008 AQA and its licensors. All rights reserved.

#### COPYRIGHT

AQA retains the copyright on all its publications. However, registered centres for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to centres to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Set and published by the Assessment and Qualifications Alliance.

## Unit 5 Question 1

### (GSA5/1 Science, Mathematics and Technology)

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

1.1	A	1.11	B
1.2	A	1.12	B
1.3	A	1.13	C
1.4	D	1.14	D
1.5	A	1.15	A
1.6	C	1.16	B
1.7	B	1.17	B
1.8	D	1.18	A
1.9	A	1.19	A
1.10	A	1.20	A

## Unit 5 (GSA5/2 Science, Mathematics and Technology)

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** Communicate clearly and accurately in a concise, logical and relevant way.
- AO3** Marshal evidence and draw conclusions; select, interpret, evaluate and integrate information, data, concepts and opinions.
- AO4** Demonstrate understanding of different types of knowledge and of the relationship between them, appreciating their limitations.

All mark schemes will allocate a number or distribution of marks for some or all of these objectives for each question according to the nature of the question and what it is intended to test.

### **Note on AO2**

In all instances where quality of written communication is being assessed this must take into account the following criteria:

- select and use a form and style of writing appropriate to purpose and complex subject matter;
- organise relevant information clearly and coherently, using specialist vocabulary when appropriate; and
- ensure text is legible and spelling, grammar and punctuation are accurate, so that meaning is clear.

### **Note on AO4**

In previous General Studies syllabuses, there has been a focus on the knowledge and understanding of facts (AO1), and the marshalling and evaluation of evidence (AO3) – on what might be called ‘first-order’ knowledge. AO4 is about understanding what counts as knowledge; about how far knowledge is based upon facts and values; and about standards of proof – what might be called ‘second-order’ knowledge.

By ‘different types of knowledge’ we mean *different ways of getting knowledge*. We might obtain knowledge by fine measurement, and calculation. This gives us a degree of certainty. We might obtain it by observation, and by experiment. This gives us a degree of probability. Or we might acquire it by examination of documents and material remains, or by introspection – that is, by canvassing our own experiences and feelings. This gives us a degree of possibility. In this sense, knowledge is a matter of degree.

Questions, or aspects of them, which are designed to test AO4 will therefore focus on such matters as:

- analysis and evaluation of the nature of the knowledge, evidence or arguments, for example, used in a text, set of data or other form of stimulus material;
- understanding of the crucial differences between such things as knowledge, belief or opinion, and objectivity and subjectivity in arguments;
- appreciation of what constitutes proof, cause and effect, truth, validity, justification, and the limits to these;
- recognition of the existence of personal values, value judgements, partiality and bias in given circumstances;
- awareness of the effects upon ourselves and others of different phenomena, such as the nature of physical, emotional and spiritual experiences, and the ability to draw upon and analyse first-hand knowledge and understanding of these

## GENERAL MARK SCHEME FOR A2 ESSAYS

The essay questions in General Studies A are designed to test the four assessment objectives (see INTRODUCTION above) as follows:

AO1 – 6 marks    AO2 – 5 marks    AO3 – 7 marks    AO4 – 7 marks    **Total – 25 marks**

Each answer should be awarded two separate marks, comprising a mark out of 20 for content (Assessment Objectives 1, 3 and 4) and a mark out of 5 for communication (Assessment Objective 2).

The mark for content should be awarded on the basis of the overall level of the candidate's response in relation to the following general criteria and descriptors for each level.

Level of response	Mark range	Criteria and descriptors for Assessment Objectives 1, 3 and 4: knowledge, understanding, argument and illustration, evaluation.
LEVEL 4	16 – 20 (5)	<b>Good response to the demands of the question:</b> sound knowledge of material (AO1); clear understanding and appreciation of topic, nature of knowledge involved and related issues (AO4); valid arguments and appropriate illustrations, coherent conclusion (AO3).
LEVEL 3	11 – 15 (5)	<b>Competent attempt at answering the question:</b> relevant knowledge (AO1); reasonable understanding and appreciation of topic, nature of knowledge involved and related issues (AO4); some fair arguments and illustrations, attempt at a conclusion (AO3).
LEVEL 2	6 – 10 (5)	<b>Limited response to the demands of the question:</b> only basic knowledge (AO1); modest understanding and appreciation of topic, nature of knowledge involved and related issues (AO4); limited argument and illustration, weak conclusion (AO3).
LEVEL 1	1 – 5 (5)	<b>Inadequate attempt to deal with the question:</b> very limited knowledge (AO1); little understanding and appreciation of topic, nature of knowledge involved and related issues (AO4); little or no justification or illustration, inadequate overall grasp (AO3).
LEVEL 0	0	<b>No response or relevance to the question</b>

The mark for communication (AO2) should be awarded using the following scale and criteria.

5 marks	Clear and effective organisation and structure, fluent and accurate expression, spelling, punctuation and grammar.
4 marks	Clear attempt at organisation and structure, generally fluent and accurate expression, spelling, punctuation and grammar.
3 marks	Some organisation and structure evident, variable fluency, occasional errors in expression, punctuation and grammar.
2 marks	Limited organisation and structure, little fluency, a number of errors in expression, spelling, punctuation and grammar.
1 mark	Lacking organisation, structure and fluency, frequent errors in expression, spelling, punctuation and grammar.
0 marks	No response

Note: A totally irrelevant response (Level 0) should also receive 0 marks for communication. A brief and inadequate response (Level 1) should be awarded not more than 2 marks and a limited response (Level 2) normally not more than 3 marks for communication. Responses at Level 3 and 4 for content may be awarded up to 5 marks for communication.

**2.1 More than one in five adults in the UK is clinically obese and the proportion is increasing.**

**Explain the suggested causes and effects of obesity and discuss what actions might be taken by individuals and public authorities to reduce obesity.**

**Obesity** is defined as having a Body Mass Index of more than 30 – determined by dividing weight (in kilograms) by height (in metres) squared. Excess body fat can also be defined as having a waist size of more than 88 cms (women) or 102 cms (men).

Excess body fat accumulates because the body's intake of calories exceeds its expenditure of calories. This may be for a number of **reasons**:

- genetic: some people have a tendency to gain weight which may have genetic causes;
- food intake: foods that are high in fat or energy (calories) are linked with excess weight – red meat, sweets, alcohol, etc; eating between meals, when bored, tired, emotional, etc, is also a factor;
- physical activity helps burn off calories – so, lack of exercise (too much TV, computer games, using cars for transport rather than walking) leads to the accumulation of fat;
- the lack of opportunities for physical exercise in schools and society generally may also be cited.

The **effects** of obesity include:

- high blood pressure and high cholesterol levels;
- increased risk of diabetes, heart attacks and strokes;
- negative self-image, depression, social exclusion, bullying.

**Individuals** who wish to reduce their weight or avoid putting on excess weight might do the following:

- eat a balanced diet, on a long-term basis (not a fad diet), reducing their fat intake, alcohol, etc;
- take more exercise (30 minutes a day, most days) – walk to school / work, sport, gym, etc;
- for some, surgery is a possibility – liposuction, stomach stapling.

The **government and public health authorities** could take some or all of the following actions:

- in schools – provide healthy meals, teach healthy cooking, increase the amount of time given to physical activities, provide 'walking bus' support;
- improve the 'public realm' – make town and city centres more pedestrian friendly, increase the number of cycle paths, increase the number of playing fields;
- make nutritional information on food packaging ('traffic lights') compulsory and / or replace the voluntary 'information' scheme operated by parts of the food industry;
- limit / ban advertising of excessively high calorie foods, especially those aimed at children;
- use the tax system to penalise high calorie foods, alcohol, car use, etc.

Credit should be given for the level of evaluation by candidates of these options.

---

## 2.2 Explain the nature and origin of comets and asteroids.

**Discuss the likely effects of an impact on the Earth, and suggest what actions might be taken to prevent such an event.**

Comets and asteroids are leftover debris from the formation of the solar system. It is thought that the planets, moons, comets and asteroids were all formed from the same cloud of dust and gas that initially condensed to form the Sun. As the Sun grew, its gravitational field condensed the remaining matter into a large, swirling flattened disc.

Comets consist of rock, dust and frozen gases. They follow a highly elliptical orbit around the Sun. When heated by the Sun, the gases produce a long tail which always points away from the Sun. There are two main types of comet:

- long-period comets, with an orbit of more than 200 years, which originate in the Oort cloud on the very fringes of the solar system;
- short-period comets, with an orbit of less than 200 years, which originate in the Kuiper Belt beyond the orbit of Pluto.

**Asteroids** are generally smaller than comets, contain less ice and are mostly found in the asteroid belt between the orbits of Mars and Jupiter.

The **effects of collisions** of comets and asteroids with the Earth include the following:

- in the early life of the Earth, there were many impacts; some, at least, of the Earth's water is believed to have come from impacting comets;
- it is believed that impacts of sufficiently large comets and asteroids may have contributed to the five known mass extinctions in the Earth's history;
- there is strong evidence that the Cretaceous-Tertiary event of 65 million years ago, which led to the extinction of dinosaurs, was the result of an asteroid impacting near the Yucatan peninsula in modern Mexico;
- large amounts of space debris regularly impact the Earth's atmosphere – most burn up (shooting stars) but some small meteorites reach the surface; the Tunguska event (Siberia 1908) was a small comet or asteroid exploding 5-10 kilometres above the surface, causing extensive damage to forest over 2200 square kilometres;
- future impacts could have equally significant effects on life on Earth, ranging from damage in a relatively small area to another mass extinction.

There are about 1000 near-Earth asteroids which pose a potential danger of collision with the Earth. Some of the **strategies** for dealing with potentially dangerous asteroids include:

- attempting to destroy the object with a nuclear explosion – however, it is thought that this may increase rather than decrease the destructive potential of the object;
- attaching a solar sail to the object to harness the power of solar radiation to gradually move the object out of its collision-course;
- using a spacecraft to nudge it out of its course, perhaps cushioned by a 'cosmic airbag';
- attaching a rocket motor to the object to apply gradual thrust over time.



**2.3 Developments in information and communication technologies have led to the introduction of mobile phones, PDAs and similar devices.**

**Explain how such devices encourage the transmission of data around the globe.**

**Assess the effects of these technologies on the collection and dissemination of news, comment and opinion.**

Candidates might give some **context** to this question by explaining these technologies:

- the internet – a worldwide, openly accessible network of interconnected computer networks – domestic, academic, business and governmental;
- computers are machines for manipulating digital data. They can perform office tasks, organise and edit digital photographs and videos, and access the internet.

**Specific devices** that could be identified and explained include:

- personal digital assistants (PDAs) – handheld computers which run versions of computer software, and may include email, global positioning systems (GPS), mobile phones, media players;
- digital cameras and videos take and store photographs electronically instead of using film; the pictures can be transferred to computers for editing and storage as computer files;
- mobile phones enable personal voice and text communication over long distances and are increasingly including additional features such as still and video cameras, email links, the ability to stream and download video, etc;
- portable media players, initially used primarily as music players, but now capable of playing video, films and games.

These technologies and devices have had a major **effect** on the collection and dissemination of news, comment and opinion:

- ‘user-generated’ content – the easy transmission of digital photographs/videos from mobile phones/digital cameras of ‘breaking news’ events, e.g. terrorist incidents, accidents, freak weather, etc;
- easy transmission of comments to news and other TV/radio programmes by email and text;
- ‘citizen journalism’ – wide range of political blogs, with influence on the mainstream media;
- internet TV, not constrained by impartiality regulations;
- podcasts – transmission of audio (and, sometimes, video) material via the internet by enthusiastic amateurs and, increasingly, media organisations.

---

**2.4 Explain the importance for human beings of the ozone layer in the Earth's atmosphere, and the changes in it caused by human activity in recent decades.****Discuss the benefits and dangers of exposure to sunlight for human beings.**

The **ozone layer** is part of the Earth's atmosphere which contains relatively high levels of ozone – a few parts per million. It is mainly located in the lower part of the stratosphere, approximately 15-35 kms above the Earth's surface. Ozone is created by UV light striking oxygen (O<sub>2</sub>) molecules, splitting them, some of which then recombine with unbroken molecules to form ozone (O<sub>3</sub>).

Although the concentration of ozone is very small, it is important to life on Earth because it absorbs biologically harmful UV radiation emitted from the Sun. UV-C is entirely screened; UV-B is largely screened, though some reaches the surface; most UV-A reaches the surface, but is less harmful.

Ozone levels can be depleted by free radical catalysts (e.g. nitric oxide) in the atmosphere. These do occur naturally, but concentrations have increased due to the release of man-made compounds, especially chlorofluorocarbons (CFCs). These were used as propellants in aerosols, in foam packaging, as refrigerants, etc. As a result of their widespread use, ozone levels have been dropping, especially over the poles, where seasonal declines have led to 'ozone holes'.

Since the effect of CFCs became known and accepted in the 1980s, an international agreement (the Montreal Protocol) was reached to end their production and use by the 1990s. This has largely been achieved. However, as CFCs have very long atmospheric lifetimes (50 to 100 years), the final recovery of the ozone layer is expected to take many decades.

Ozone depletion has the effect of increasing UV levels in the sunlight reaching the Earth's surface. Sunlight has both benefits and dangers for human beings.

**Benefits** include:

- it is a main source of vitamin D, which is beneficial for the bones, muscles and immune system;
- vitamin D may also combat the development of some cancers – e.g. breast, colon, bladder, prostate;
- sunlight stimulates a gland in the brain, producing mood-improving chemicals.

**Dangers**, which are exacerbated by increased UV levels, include:

- UV radiation is a major cause of skin cancer, malignant melanoma being the most dangerous form; about half of all Australians are expected to develop some form of skin cancer;
- exposure to sunlight increases the risks of developing cataracts in the eyes;
- some people develop allergic reactions to sunlight.

---

**2.5 Explain the main principles and applications of genetic testing.****Discuss ethical issues that might be encountered in undertaking genetic testing.****Principles:**

Genes are hereditary units consisting of DNA which determine particular characteristics in an organism. They are passed on from parent to child and are believed to be an important part of what decides looks and behaviour. Genetic characteristics are increasingly being shown to play a part in various disorders.

Genetic tests are performed on samples of blood, hair, skin or amniotic fluid to check for specific changes in chromosomes, DNA or proteins which may identify the specific characteristic or disorder being tested for.

Genetic testing is undertaken to determine the vulnerability of individuals to various inherited diseases. It can also be used to test for paternity and ancestry, and for forensic purposes.

**Applications** of genetic testing include:

- prenatal testing – detection of changes in the genes or chromosomes of a foetus prior to birth; it is used to give certainty to parents whose foetus is at risk of a genetic disorder, and may inform their choice on abortion
- screening of newborn children for some disorders is widespread in the US, though less so in the UK
- diagnostic testing for specific conditions can take place at any time during a person's life, and may inform their choices of health care
- carrier testing is used to identify individuals who carry a copy of a gene mutation that, when present in two copies, causes a genetic disorder; it can inform couples of the chances of having children with a genetic condition
- predictive testing is used for individuals who have no symptoms of a disorder, but can identify their chances of developing disorders with a genetic basis
- forensic testing is used to identify victims and/or suspects from genetic material.

The **ethical issues** that may arise include:

- the need for those taking part to give informed consent, by having an understanding of the possible implications of a test
- foetal testing carries some risk of damage to the unborn baby – this risk must be balanced against the knowledge to be gained
- the results of genetic testing may lead to difficult choices – e.g. whether or not to abort a foetus, whether to undertake dangerous or disfiguring treatments
- there are emotional and social risks to the knowledge gained from genetic tests – the impact on the individual concerned, the consequences for other family members who may be affected by the same genetic condition
- the knowledge of existing or future genetic disorders could give rise to genetic discrimination in employment or for insurance purposes, if not kept fully confidential
- the availability of 'over-the-counter' genetic testing kits for various disorders, e.g. via the internet, has caused ethical concerns, particularly over the potential for misinterpretation and possible ill-advised or dangerous responses to badly-understood information.

---

**2.6 Explain what is meant by environmental sustainability.****Discuss the measures a household in Britain might take in order to develop an environmentally-friendly lifestyle.**

Each society and each individual household can be said to leave an 'ecological footprint' – a metaphor for the amount of land and water a human population hypothetically needs to support itself and its wastes. It is used as an indicator of the environmental sustainability of individuals, households, regions and nations. The average ecological footprint available to each human citizen is approximately 1.9 global hectares; the average in the UK is 5.45 gha per head. Sustainability would be achieved when each individual or household is consuming at the global average.

There are many possibilities that can be mentioned to reduce the footprint and move towards sustainability. It is important in this question that any such ideas are justified in scientific or technological terms.

In relation to **housing**, the answer might include the following points:

- insulation to minimise heat loss and reduce energy use;
- installation of a condensing boiler which uses the heat in exhaust gases to improve the efficiency of water heating;
- turn off TVs and lights, do not use standby facility, use energy-efficient light bulbs;
- buy electricity from companies which generate it from renewable sources;
- install solar heating panels to heat water and/or a domestic wind turbine to reduce dependency on non-renewable energy sources;
- take showers instead of a bath, use a water-limiter in toilet cisterns.

In relation to **transport**, the answer might include the following points:

- use a smaller car, a hybrid car, or a car which uses an alternative fuel source (e.g. biodiesel);
- use a car club, to share journeys with others, for a more efficient use of vehicles;
- use public transport;
- reduce or eliminate aircraft flights for holidays, business, etc;
- make contributions to carbon-offset schemes;
- walk or cycle wherever possible.

In relation to **consumption** of food, clothes, etc, the answer might include the following points:

- use local shops rather than large supermarkets;
  - buy local produce and eat seasonally to reduce the consequences of transporting food across countries or continents (though NB the alternative ethical arguments about promoting fair trade);
  - buy organic food products – not necessarily because of the quality of the food, but because of lesser use of chemical fertilisers and pesticides;
  - use lemons, vinegar, baking soda and similar products for cleaning rather than chemical cleaners with a more toxic effect on the environment;
  - grow your own food in a garden or allotment;
  - buy clothes which are long-lasting rather than cheap, frequently replaced clothes which have a high cost in terms of chemicals and water used in production and transport costs (though the fair trade argument might apply here also);
  - resist buying products with excessive, non-biodegradable packaging;
  - reuse and recycle wherever possible.
-