



General Certificate of Education  
Advanced Subsidiary Examination  
June 2013

# **General Studies (Specification A)**

# **GENA2**

**Unit 2 AS Science and Society**

## **Source Booklet**

Source for use with **Questions 1.1 to 1.30**

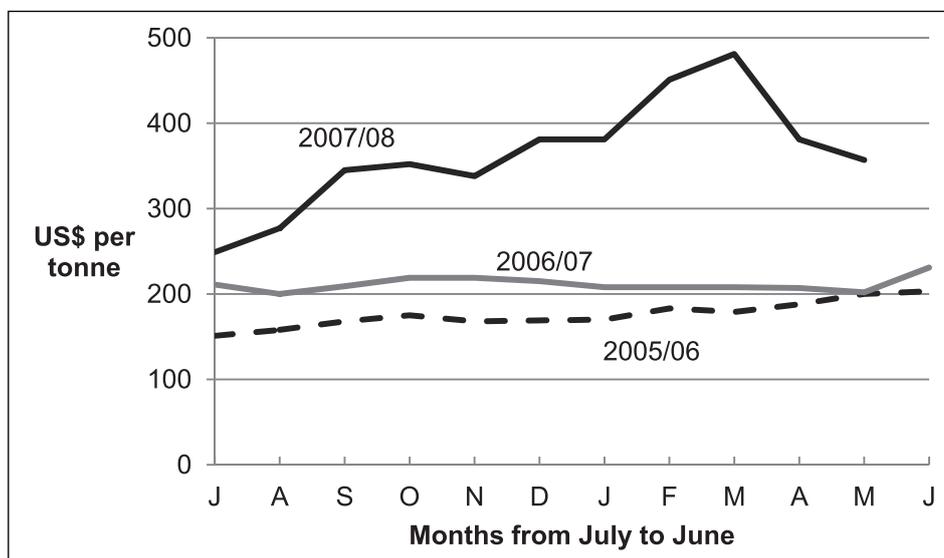
## Section A

### Source A for Questions 1.1 to 1.30

#### Why Britain faces a bleak future of food shortages

- (1) It was an ecological disaster that occurred on the other side of the planet. Yet the drought that devastated the Australian wheat harvest in 2008 had consequences that shook the world. It sent food prices soaring in every nation. Wheat prices across the globe soared by 130% while shopping bills in Britain leapt by 15%. A year later and the cost of food today has still to fall to previous levels. More alarmingly, scientists are warning that far worse lies ahead. A 'perfect storm' of food shortages and water scarcity now threatens to unleash public unrest and conflict in the next 20 years, the government's chief scientist, Professor John Beddington, has warned.

Figure 1: US wheat export prices from 2005 to 2008



- (2) In Britain, a global food shortage would drive up import costs and make food more expensive, just as the nation's farmers start to feel the impact of disrupted rainfall and rising temperatures caused by climate change. Next month, several agencies and the Department for Environment, Food and Rural Affairs will announce a taskforce that will channel the UK's efforts into feeding its own population and playing a full role in preventing starvation in other nations.
- (3) According to Professor Janet Allen (director of research, Biotechnology and Biological Sciences Research Council), "we will have to grow more food on less land using less water and less fertiliser while producing fewer greenhouse gas emissions". No-one said science was easy, of course. Nevertheless, the scale of the problem is striking. It is also unprecedented, says Professor Mike Bevan of the John Innes Centre in Norfolk. "We are going to produce as much food in the next 50 years as was produced over the past 5000 years. Nothing less will do."
- (4) Over the next 40 years, Britain's population will rise from 60 to 75 million while the world's will leap from 6.8 to 9 billion. Crop yields will have to jump, a goal that will have to be achieved in the middle of global climatic disruption. At the same time, farmers will find that many aids that they have come to rely on – in particular, chemical fertilisers – will no longer be available.

- (5) Consider the problems that affect just one crop: wheat, the most widely grown cereal in Britain. Today, yields in Britain average between 8 and 10 tonnes a hectare, some of the highest in the world. Yet only 50 years ago UK yields were only 4 or 5 tonnes a hectare. It took a green revolution in the 1960s that involved the development of new crop varieties, greater use of agro-chemicals and changes in farming practices to double production by the 1980s. Now a second revolution of equivalent magnitude is urgently required, say food scientists.

**Figure 2: Statistics for wheat in the UK**

	2000	2001	2002	2003	2004	2005	2006	2007	2008
<b>Production (000s of tonnes)</b>	16 704	11 580	15 973	14 288	15 473	14 863	14 735	13 221	17 227
<b>Yield (tonnes per hectare)</b>	8.0	7.1	8.0	7.8	7.8	8.0	8.0	7.0	8.3
<b>Price (£ per tonne)</b>	74	82	71	76	87	76	77	108	151

- (6) However, farmers will have to increase yields using greatly reduced amounts of agro-fertilisers because their manufacture uses 3% of the world's energy. In a post-Copenhagen world, dominated by renewable energy, such carbon consumption is likely to be prohibited. "What we need are major research programmes to create new crop yields that make their own fertiliser and will also be disease-resistant and more resistant to droughts and rising temperatures," said Bevan.
- (7) One new research programme will exploit cutting-edge DNA technology to speed up wheat breeding projects to develop new drought resistant, low-fertiliser strains, though the programme will stop short of the creation of genetically modified strains.
- (8) The farmers of tomorrow will also have to be increasingly wary of new agricultural pests and diseases. As global temperatures have risen, more and more devastating varieties of viruses and fungi have spread around the globe. A classic example is bluetongue disease, which affects cattle, sheep, deer and goats and is spread by midges. Sheep are especially vulnerable and one in three can die if infected. This disease, which spread from Holland, was unknown in north-west Europe until 2006. "The problem is that the life cycles of diseases such as bluetongue speed up as temperatures go up. Other diseases like epizootic haemorrhagic disease (EHD) and African horse sickness are also spread by midges," said Dr Chris Oura of the Institute for Animal Health.
- (9) Globalisation itself threatens to bring infestation in its wake. According to Oura, African swine fever virus infects pigs. There is no cure and no vaccine. It kills every animal it infects. Emerging recently from Mozambique, the disease has spread along shipping routes around the coast of Africa and into central Asia. Were it to strike in China, where there is a massive consumption of pork, it would be a disaster and pig prices around the world would soar. The key to preventing such a scenario is science, according to Oura. "We had the right vaccine to deal with bluetongue when it hit Britain. We now need to develop vaccines that will halt diseases like EHD or African swine fever and contain them long before they ever hit our shores."

Turn over ►

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- (10) Changes are not confined to exotic foreign viruses. Many of the pests that have been part of the British agricultural scene for centuries are also likely to gain new leases of life as climate change takes a grip on the country. Aphids are a perfect example. “Aphids are one of the country’s main agricultural pests and they inflict about £100 m of damage to cereal crops a year,” said Richard Harrington of the Rothamsted agricultural research centre. “Aphids are now arriving in fields far earlier than they used to do, and that is bad news. Crops in early spring are younger and more susceptible to the damage inflicted both by the aphid itself and also by the viruses they carry. It’s a double whammy and it is leading to increases in crop loss unless we find new ways to tackle aphid infestation.”
- (11) One answer is to use an increased amount of pesticides. However, this solution is limited by the spread of pesticide-resistance and by the European Union’s antipathy to their use because of potentially toxic side effects. “It is quite clear that we need to take a more sustainable route to pest control,” added Harrington.
- (12) One ingenious solution involves planting nettles around wheat fields. Parasitic wasps arrive to feed off the aphids that are found in nettles. Then, as the neighbouring wheat grows and aphid infestation arrives, there is a ready supply of wasp predators to deal with them. “About 40% of crops in Britain are vulnerable to destruction by weeds, fungi and insects,” according to Rothamsted’s Dr Tom Hooper. “We have got to find sustainable ways to prevent that from happening if we want to maintain and increase food production in future.”
- (13) Of course, some answers to the threat of the forthcoming ‘perfect storm’ and the threat to our food security involve political and economic solutions as well. The end of cheap supermarket deals, restraints on water use and the need to change farming practices have all been suggested. But owners of small hill farms oppose the economists who argue that small farms are too inefficient and should be incorporated into larger outfits.
- (14) Economic or political changes will certainly be needed if Britain is to face the challenge ahead. However, it is now accepted that science will play the principal role in Britain’s battle to ensure that the nation can rely on food security in the future. Whether it has the funds to do so remains uncertain. A total of £600 m was cut from the nation’s science budget last week. Scarcely an auspicious start to our battle to survive the perfect storm.

Source: adapted from ROBIN McKIE, ‘Why Britain faces a bleak future of food shortages’,  
*The Observer*, 13 December 2009  
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Fig 1: Food and Agriculture Organisation of the United Nations,  
[www.fao.org/docrep/012/ak340e/ak340e06b.htm](http://www.fao.org/docrep/012/ak340e/ak340e06b.htm)

Fig 2: UK Agriculture  
[www.ukagriculture.com/crops/wheat.cfm](http://www.ukagriculture.com/crops/wheat.cfm)

## END OF SOURCES