General Certificate of Education
Advanced Subsidiary Examination
June 2014

General Studies (Specification A)

GENA2

Unit 2 AS Science and Society

Source Booklet

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

A

Section A

Source A for Questions **1.1** to **1.30**

Water, water everywhere …

(1) It's enough to make beer drinkers cry into their pints. Several factors, including rapid population growth, expanding food needs and unpredictable weather patterns, point to a global water crisis. Chronic water shortages are already hitting many regions, particularly in developing countries. Industry is increasingly concerned about what will happen when the taps run dry. Brewers are among the most vulnerable: a pint of beer is up to 95% water. Drinkers have been warned that, as water supplies dry up, prices could rise and supplies could be threatened.

(2) SABMiller is one of the world's largest brewing companies, a multinational with plants across six continents and producing nearly 37 billion pints of beer each year, including brands such as Peroni, Nastro Azzurro, Grolsch and Miller. (The total market in the UK is more than eight billion pints a year.) By contrast, Britain's oldest brewery is Shepherd Neame in Kent, a very different, family-run company which supplies mainly regional outlets. Both, however, are facing water supply challenges.

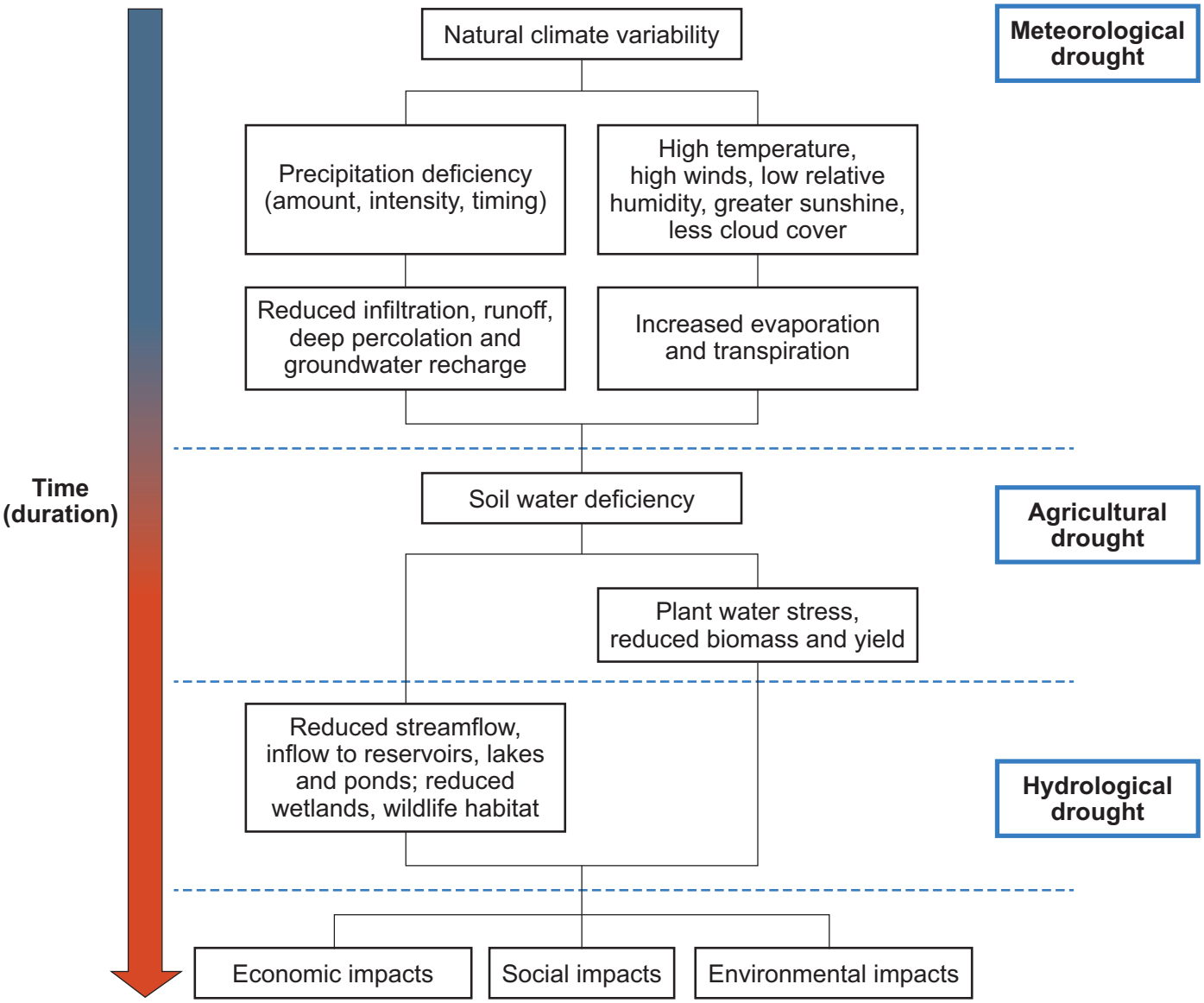
(3) Kent, particularly its south-eastern corner, is one of the driest parts of Britain, with less water available per capita in terms of volumes stored in wells and rivers than Ethiopia or Sudan. The Campaign to Protect Rural England (CPRE) says that already depleted water resources in the South East will be placed under further strain by government plans to build thousands of new houses in the area: by 2025 the region could be facing water shortages of more than a billion litres a day.

(4) Shepherd Neame is fortunate in that it has its own artesian well 30 m below its brewery, through a layer of London clay and chalk. "Traditionally breweries were established where there was a good supply of clean water," says David Holmes, Shepherd Neame's master brewer. "Obviously it's a tremendous commercial advantage having our own well and not paying a water company for supply. But these days we're very conscious of water usage. In former times water would be spraying everywhere as barrels and storage tanks were cleaned – it would take 12 or 14 pints of water to make one pint of beer. Now, with strict computer controls, we've got that ratio down to between five and six pints of water for one pint of beer." For SABMiller, with some of its brewing operations in regions facing water shortages, the need to secure adequate and reliable water supplies is all the more challenging.

(5) The scale of the world's water crisis is daunting. In terms of overall global water usage, agriculture accounts for about 70% of consumption, industry between 20% and 25% and domestic use 5% to 8%. According to the Stockholm International Water Institute (SIWI), water usage has tripled in the past 50 years as countries have struggled to feed themselves and rapidly expanding industrial sectors have made ever greater demands.

(6) Recent changes in rainfall patterns have exacerbated the problem. While much of the weather we experience is brief and short-lived, drought is a more gradual phenomenon, slowly taking hold of an area and tightening its grip with time. In severe cases, drought can last for many years, and can have devastating effects on agriculture and water supplies. Water tables in northern China and much of India are sinking dramatically. Great river systems in Central Asia, Australia and the western US are drying up. By 2030, says SIWI, nearly half the world's population will be living in areas described as being under 'water stress' – regions in which water resources in terms of quantity and quality are depleted more quickly than they are replaced.

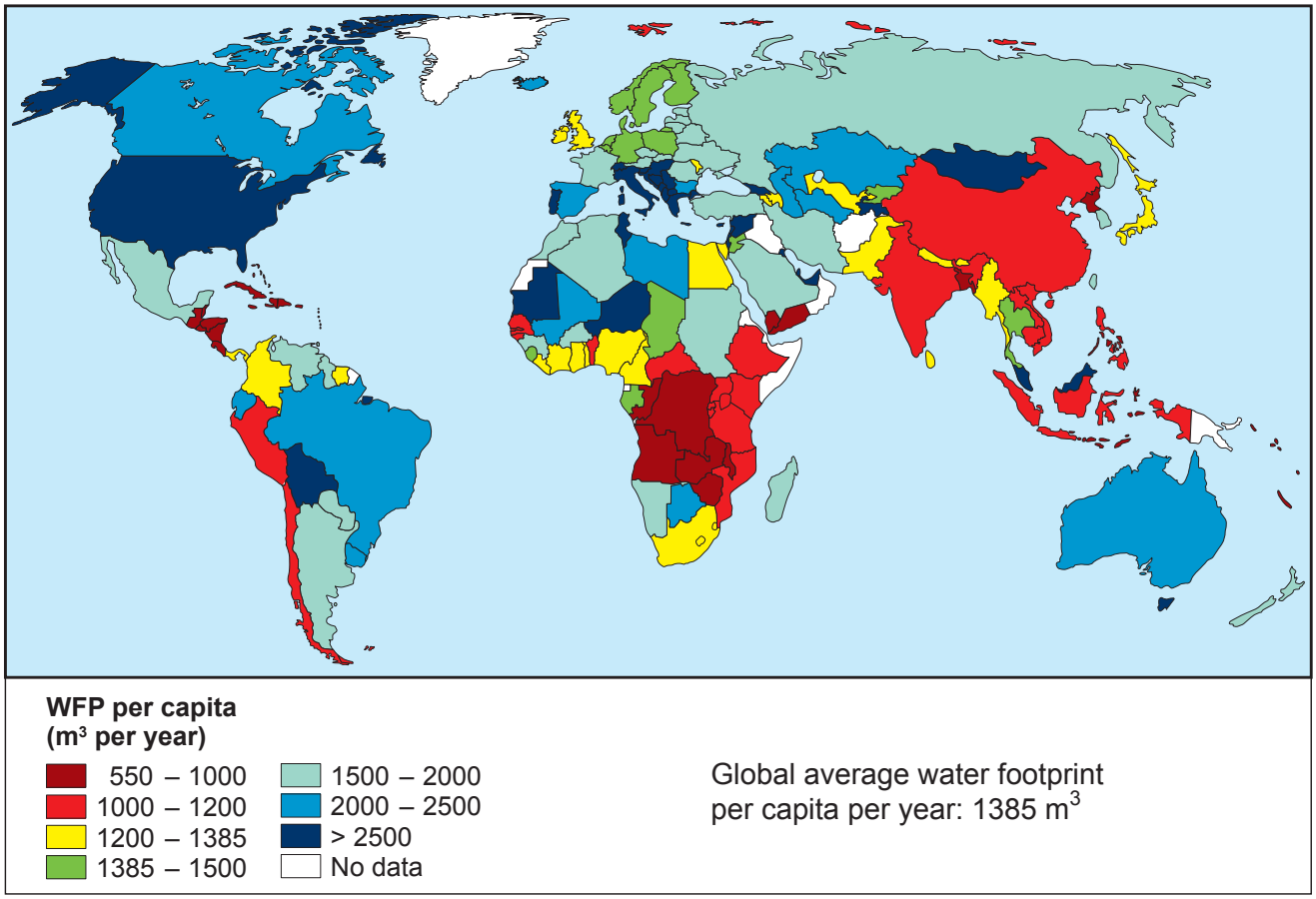
Figure 1: Drought and its effects



(7) In response to concerns over water supply, SABMiller joined forces with WWF (formerly the World Wide Fund for Nature) to use what is called 'water footprinting' to assess the risks posed to its operations by water shortages. Water footprinting is designed to help individual consumers, communities and industries to calculate total volumes of fresh water being used, not just from the tap but through all the elements of production of various goods. The water footprint (WFP) of a country is defined as the volume of water needed for the production of goods and services consumed by the inhabitants of the country. The water footprint of a country can be calculated as:
the national water use + (gross national virtual water import – gross virtual water export).

Turn over ▸

Figure 2: Average national water footprint per capita



(8) Two areas of SABMiller's operations were chosen for the 'water footprinting' study – one in South Africa and the other in the Czech Republic. SABMiller's brewing business in South Africa is one of its biggest, producing 2.6 billion litres of beer a year, while its breweries in the Czech Republic annually account for almost 1.1 billion litres, making it one of the biggest producers in Europe. By tracing water consumption back through the supply chain, it is calculated that, for every litre of beer produced in South Africa, a total of 155 litres of water is used. In the Czech Republic the ratio is 45:1. In both countries about 90% of the total amount of water is used for the growing of crops. In South Africa higher temperatures mean that more water is needed for irrigation: crops in the Czech Republic, on the other hand, are fed mainly by rainwater and lower temperatures result in less evaporation. Also, about 30% of the ingredients of SABMiller's beer brewed in South Africa have to be imported, some from regions where crops need to be irrigated. Beer brewed in the Czech Republic is made almost entirely from local produce.

(9) Stuart Orr, the freshwater manager at WWF, says that water shortages do not only threaten human and wildlife populations, but also have considerable commercial implications. "While some industries have got the message, it is amazing how many still ignore these crucial supply-chain issues," says Orr. "Water shortages impact on so many sectors. If, for instance, I was running a company importing T-shirts from Pakistan, where the drying-up and depletion of the Indus river basin is creating enormous problems for cotton growers and others, I'd be very worried. In our interconnected world, water shortages in one area seriously influence another."

Figure 3: Water footprints of different products

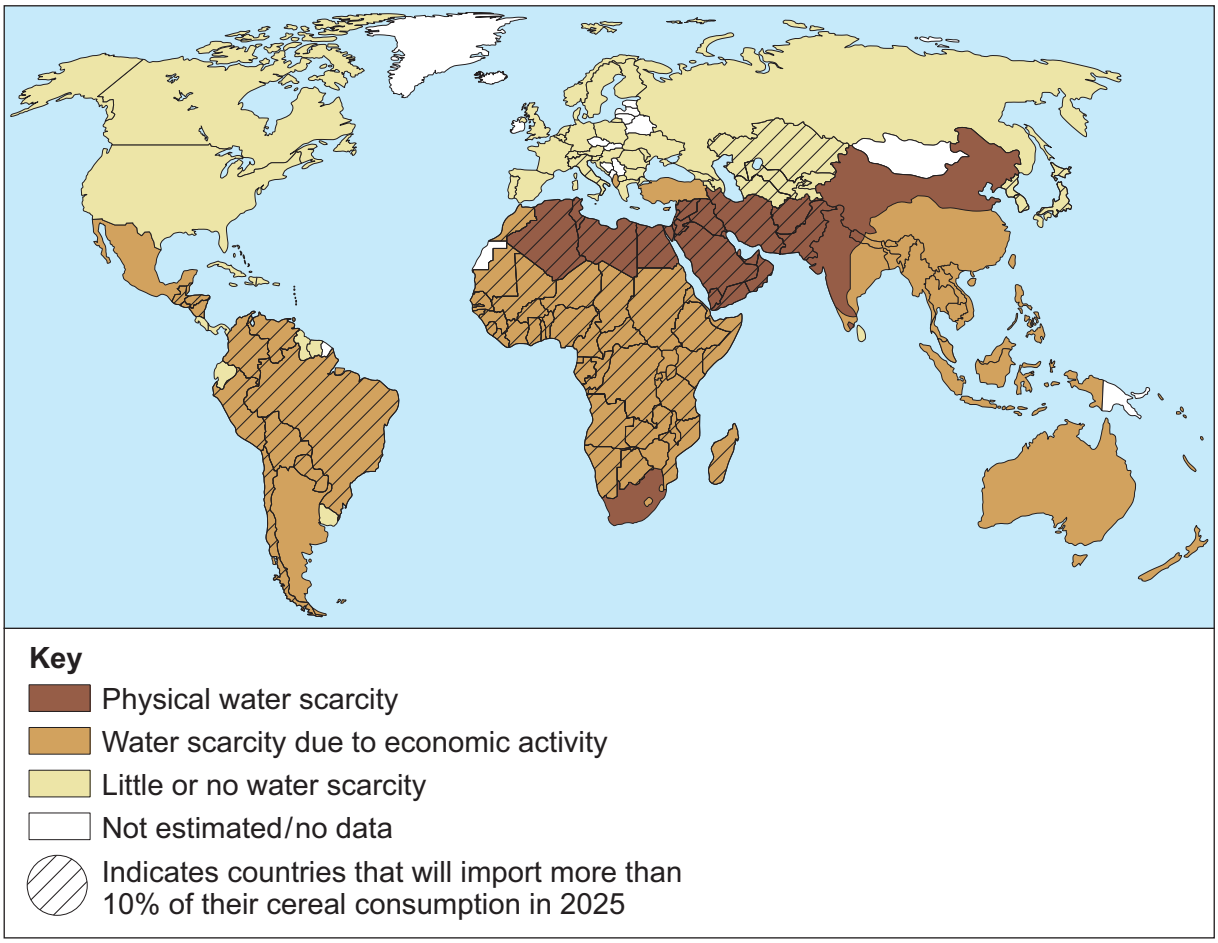
Wheat	1 300 litres	per kg
Rice	3 400 litres	per kg
Beef	16 000 litres	per kg
Poultry	3 900 litres	per kg
Corn	900 litres	per kg
Wine	120 litres	per glass
Cotton	2 700 litres	per shirt
Paper	10 litres	per A4 sheet
Automobile	400 000 litres	per vehicle

(10) A more common drink than beer is coffee. Coffee is, in dollar terms, the most important agricultural product traded in the world and producing coffee requires a lot of water. To produce one 125 ml cup of coffee requires 140 litres of water, or 1100 drops of water for one drop of coffee. Altogether, the world population requires about 110 billion cubic metres of water per year in order to be able to drink coffee, which is 1.5 times more water than the entire annual run-off from the Rhine.

(11) Analysing the issue is one thing, but coming up with solutions is another. SABMiller says that it has set itself the target of cutting water consumption by 25% by 2015, while at the same time increasing beer production and sales. In South Africa, substituting imports of barley with local, less water-hungry crops such as cassava is one alternative. Encouraging more efficient water use among farmers through possible changes in water-charging systems is another possibility. However, such moves are highly sensitive. Conflicts over water resources have broken out in several African countries, particularly where communities suffering acute shortages live close to industries that are big water users. In India, such arguments, some involving multinationals, have also led to violence. In areas of China there is growing unrest about industry taking water needed for domestic use and food production.

Source A continues on the next page

Figure 4: World water shortage; projected water scarcity in 2025



(12) According to United Nations' estimates, one third of the world's population already lives in areas with water shortages, 1.1 billion people lack access to safe drinking water and 2.6 billion people are without adequate water for sanitation. Consequently disease and significant deaths arise from people using contaminated water supplies; these effects are particularly pronounced in children in underdeveloped countries, where 3900 children per day die of diarrhoea alone.

(13) While the world's population tripled in the 20th century, the use of renewable water resources has grown sixfold. Within the next fifty years, the world population will increase by another 40% to 50%. This population growth – coupled with industrialisation and urbanisation – will result in an increasing demand for water and will have serious consequences on the environment, as well as raising significant economic and political challenges for all.

Source: article adapted from Kieran Cooke, 'Why beer needs watering down' © The Times, March 2010
Figure 1, National Drought Mitigation Center, University of Nebraska-Lincoln, USA
Figure 2, Hoekstra & Mekonnen (2012), The water footprint of humanity, PNA5, 109:3232-3237
Figure 4, International Water Management Institute © IWMI, 2000

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