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GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE SCIENCE A

A214/02/RB

Unit 4: Ideas in Context (Higher Tier)

RESOURCE BOOKLET

JUNE 2010

To be opened on receipt

OCE/16194

INSTRUCTIONS TO CANDIDATES

- This booklet contains three articles.
- Take these articles away and read them through carefully.
- Spend some time looking up any technical terms or phrases you do not understand.
- For the examination on **Friday 28 May 2010** you will be given a fresh copy of these articles, together with a question paper.
- You will **not** be able to take your original copy into the examination with you.

INFORMATION FOR CANDIDATES

- This document consists of **8** pages. Any blank pages are indicated.

To cull or not to cull?

Tuberculosis (TB) is a disease caused by a bacterium. It was once a very serious human disease but the discovery of antibiotics brought the disease under control. In recent years a new strain of TB has become resistant to many antibiotics. TB is making a comeback in the UK because fewer people are being vaccinated and many people travel to the UK from countries that do not vaccinate against TB. The human TB vaccine is not 100% successful and it does not provide lifetime immunity.

Cattle and badgers can also catch TB. Vaccines for badgers and cattle do not yet exist but are being developed. It is likely that these vaccines will also not be 100% effective.

Some farmers think that badgers may provide a reservoir of infection for TB. They are worried that if their cattle get infected with TB from the badgers, their herd will have to be destroyed. They want to reduce the number of badgers to prevent them from spreading the disease. This killing of badgers is called a cull.

Some conservationists do not believe that the badgers are spreading the disease. They believe that the disease is spread when farmers move their cattle around the country to other farms and markets.

In 1998, scientists started a five-year study to answer the question "Do badgers spread TB to cattle?" They decided to cull badgers in 30 high-infection areas of the country to see if the number of cattle catching TB dropped.

The scientists divided each high-infection area into three zones:

zone 1 all badgers culled

zone 2 no badgers culled

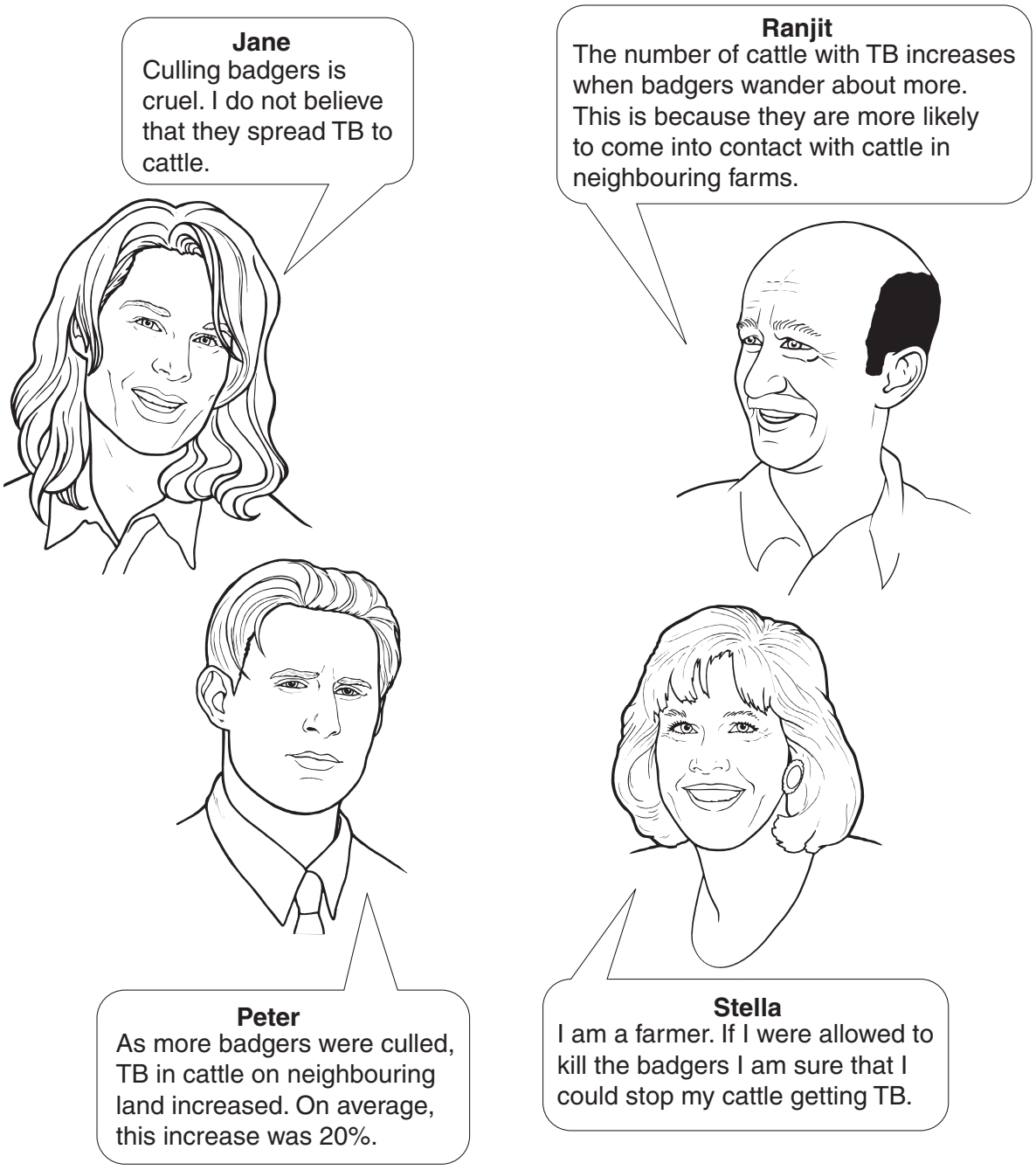
zone 3 badgers only culled around farms that have cattle with TB.

They then monitored the number of cases of TB in cattle in each zone. Different zones gave different results, but these results also varied from one high-infection area to another. For example, in one high-infection area the number of cattle with TB in zone 1 remained the same, but in another high-infection area the number of cattle with TB in zone 1 actually increased.

These results did not definitely prove that badgers spread TB. In fact, the incidence of TB in cattle increased in areas where badgers were culled. One possible explanation for this is that the surviving badgers wander much further in areas where badgers are being culled. This results in the TB being spread even more.

Some scientists think that a more effective way of reducing TB in cattle would be to have better cattle control measures such as moving cattle less often, testing cattle for TB before they are moved, quarantining purchased cattle and having more frequent TB tests.

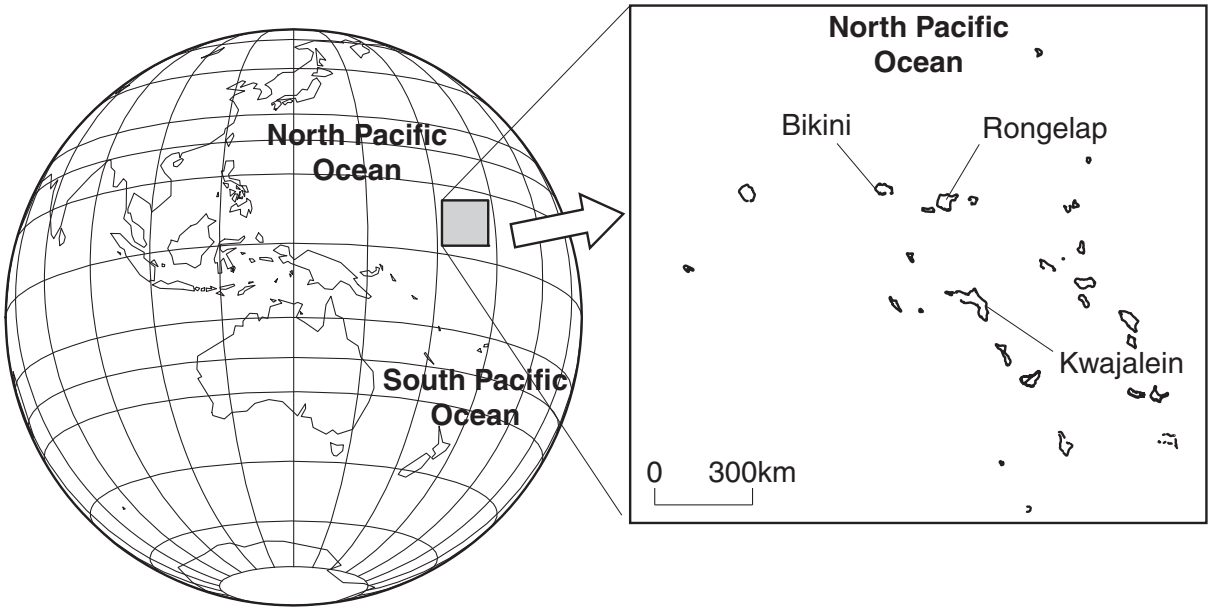
There are different opinions about culling badgers.



Cleaning up the Marshall Islands

Nuclear weapons in the 1950s and 1960s

In the years after the Second World War, the USA and the Soviet Union (now mostly Russia) developed powerful nuclear weapons. The USA tested many of its weapons on a tiny part of the Marshall Islands, called the Bikini Atoll, in the middle of the Pacific Ocean. At the time, these islands were governed by the United States. The few people who lived on Bikini were moved to islands many kilometres away.



After one particularly powerful test, named Bravo, in 1954, radioactive chemicals were spread much further than had been expected. People living on Rongelap Island, 150 km away from the blast, had to move away to the islands of Kwajalein Atoll because Rongelap was too radioactive.

Radioactive waste

Nuclear weapons produce radioactive waste just like nuclear power stations do. However, the waste from nuclear weapons is spread over a large area. The waste from the Bravo test contained radioactive forms of the elements plutonium and americium, which emit alpha radiation, and strontium and caesium, which emit beta radiation. All four of these also emit gamma radiation. A large enough dose of any of these forms of radiation can cause serious damage to living cells.

This is particularly serious if the radioactive chemicals are absorbed and used by the body.

Decontaminating Rongelap Island

The most contaminated soil was removed from the areas where people lived. Then two ways were used to clean up Rongelap Island.

1. Clean, crushed coral was used to cover the remaining soil.

Coral was used because it is better at absorbing ionising radiation than sand. It also stops dust containing radioactive elements from blowing about and getting into the food chain.

2. Fertilizer containing potassium was added to the ground.

It was found that 95 % of the radiation dose that Rongelap Islanders were getting was from caesium-137. This is because caesium is chemically very like potassium, which all plants and animals need. The soil in the Marshall Islands is very low in potassium, so the plants were absorbing radioactive caesium-137 from the soil. By putting plenty of potassium fertilizer on the soil, the plants absorb potassium instead of caesium. This greatly reduces the dose for anyone eating those plants. Caesium-137 has a half-life of about 30 years, although in practice the radioactivity of the soil dies away much faster than this, as caesium compounds are all soluble. This suggests that the caesium level in the soil now, 50 years after the Bravo test, is about 2 % of the high level in the 1950s.

The future for Rongelap

By the summer of 2002, the levels of radiation in Rongelap were no higher than the background radiation in most places in the world. Building is now taking place so that the people can return, although everyone will be tested for caesium-137 at regular intervals.

A new source of income for this tiny island is tourism. The waters around the tropical island of Rongelap have been undisturbed for half a century. They provide an untouched marine environment for tourists attracted by the ideal conditions for diving.

Call to ban food colourings

Between 5% and 10% of school-age children suffer some degree of ADHD – attention deficit hyperactivity disorder. Symptoms of ADHD include inability to concentrate, excessive activity and impulsive behaviour.

In 2008, the Food Standards Agency (FSA) advised that six artificial colourings should be banned from food and drink made in Britain by the end of 2010. They have asked for this ban because research has suggested that the additives may cause hyperactive behaviour in children. FSA representative, Dame Deirdre Hutton said, 'We have evidence that suggests it would be sensible for these colourings to be taken out of food.' Some supermarkets have already stopped using these additives in their own-brand products.

One study of food additives was carried out at Southampton University. Scientists gave drinks containing mixtures of some food colourings to 153 three-year-olds and 144 eight-year-olds. The drinks also contained the preservative sodium benzoate. The children were randomly given one of three soft drinks. Drink A and Drink B contained different mixtures of colourings with the preservative. These two drinks were designed to be like those that a typical child might have during a normal day. Drink C was water.

Drink A	Drink B
Carmoisine (E122)	Allura red (E129)
Ponceau 4R (E124)	Carmoisine (E122)
Sodium benzoate (E211)	Quinoline yellow (E104)
Sunset yellow (E110)	Sodium benzoate (E211)
Tartrazine (E102)	Sunset yellow (E110)

The children's hyperactivity levels were measured before and after they had the drinks.

The scientists found that some mixtures of colourings resulted in an increase in hyperactivity.

Results showed that, compared with water:

- in the sample of 3-year-old children, Drink A increased the average level of hyperactivity within the group, but Drink B did not
- in the sample of 8-year-old children, Drink B increased the average level of hyperactivity, but Drink A did not.

There were differences between children in their response to Drink A and Drink B. The mixtures had a large effect on some children but had no effect on others in the same group.

The British Soft Drink Association said in a statement, 'All additives, including colours used in food and drink, have been approved by the FSA as being safe for use and are carefully selected and monitored. They are included to meet the expectations of the public about the appearance and shelf-life of products and to enhance the choices that are available to them.'

Advisers to the European Food Standards Agency do not consider that the Southampton University research provided enough information to support changes to recommended intakes of food colourings. Scientists advise caution in using results from such a small study to judge effects on the whole UK population.

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