THIS IS A LEGACY SPECIFICATION

OCR
RECOGNISING ACHIEVEMENT

H

To be opened on receipt

GCSE TWENTY FIRST CENTURY SCIENCE SCIENCE A

A214/02 Unit 4: Ideas in Context (Higher Tier)

RESOURCE BOOKLET

JANUARY 2013

A213880613

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 **Tuesday 22 January 2013** 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.

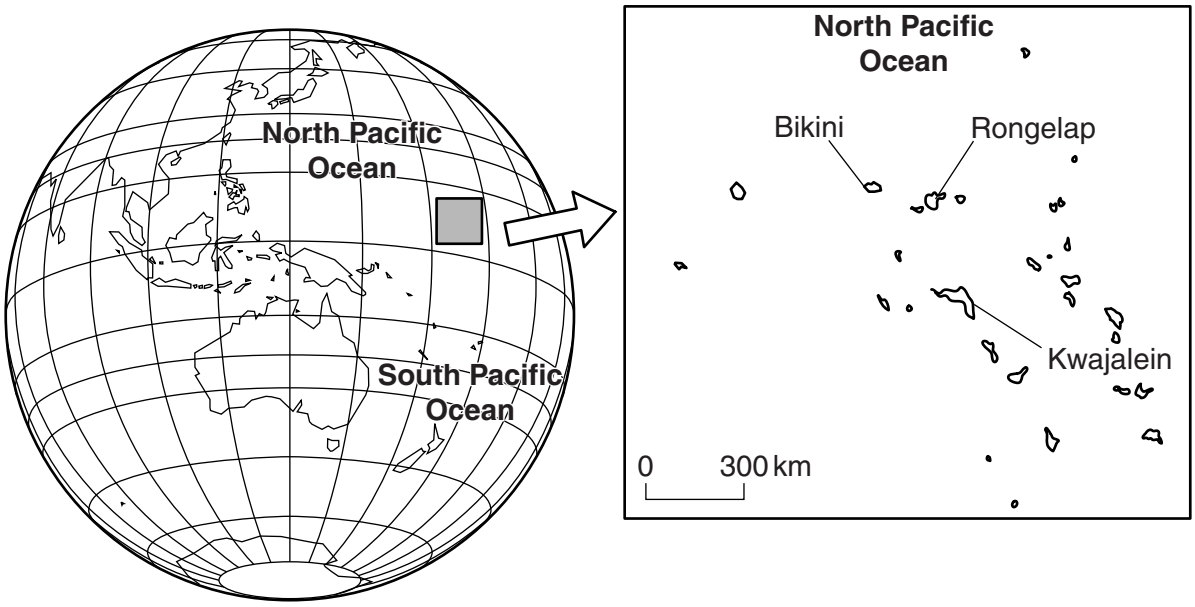
INFORMATION FOR CANDIDATES

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

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 bomb 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 contaminated with radioactive materials.

Radioactive waste

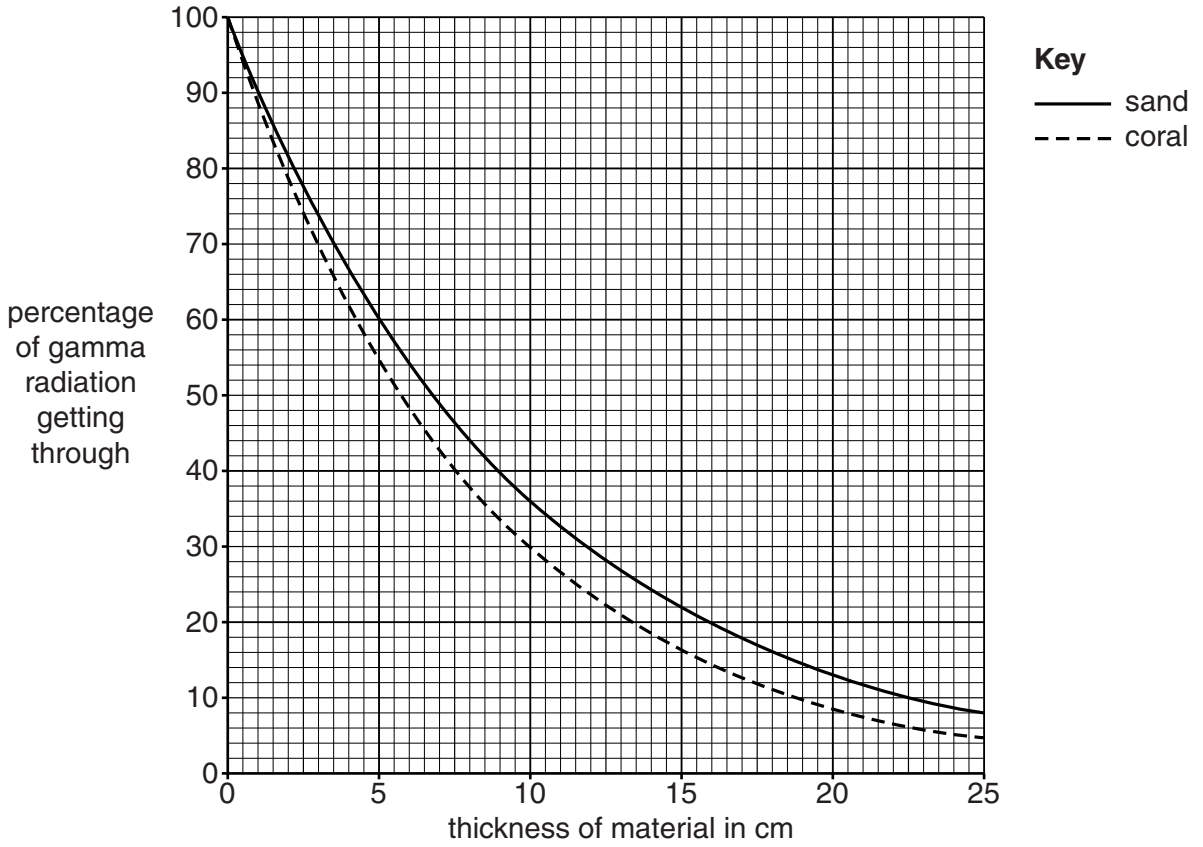
Nuclear weapons produce radioactive waste just like nuclear power stations do. However, the waste from nuclear weapons is spread over a large area. The waste from the Bravo bomb test contained radioactive forms of the elements plutonium and americium, which emit alpha radiation, and strontium, caesium and xenon, which emit beta radiation. All five of these also emit gamma radiation. These forms of radiation can damage living cells. This is particularly serious if the radioactive materials are absorbed and used by the body.

Decontaminating Rongelap Island

The most contaminated soil was removed from the areas where people lived. Then clean, crushed coral was used to cover the remaining soil.

Coral was used because it is better at absorbing ionising radiation than sand, as shown in the graph.

Penetration of gamma radiation through sand and through coral



The future for Rongelap

By the summer of 2002, the levels of radiation in Rongelap were no higher than the background radiation in most parts of the world. Building is now taking place so that the people can return.

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 its ideal conditions for diving.

Carbon monoxide – the invisible killer

Carbon monoxide is a colourless and odourless gas so you cannot easily tell if it is present. It is also very poisonous. Even small concentrations are harmful.

The World Health Organisation gives these guidelines for the maximum exposure time for different maximum concentrations of carbon monoxide.

Table 1

Maximum carbon monoxide concentration		**Maximum exposure time**
in mg/m^3	in ppm	
100	87	15 min
60	52	30 min
30	26	1 hour
10	9	8 hours

Carbon monoxide pollution

The main source of carbon monoxide pollution is exhaust gas from motor vehicles. When the hydrocarbons in petrol and diesel fuels burn completely, the only products are carbon dioxide and water. But in car and lorry engines, incomplete combustion takes place, producing carbon monoxide. When carbon monoxide is released into the air, it reacts slowly with oxygen to form carbon dioxide.

$$2CO + O_2 \longrightarrow 2CO_2$$

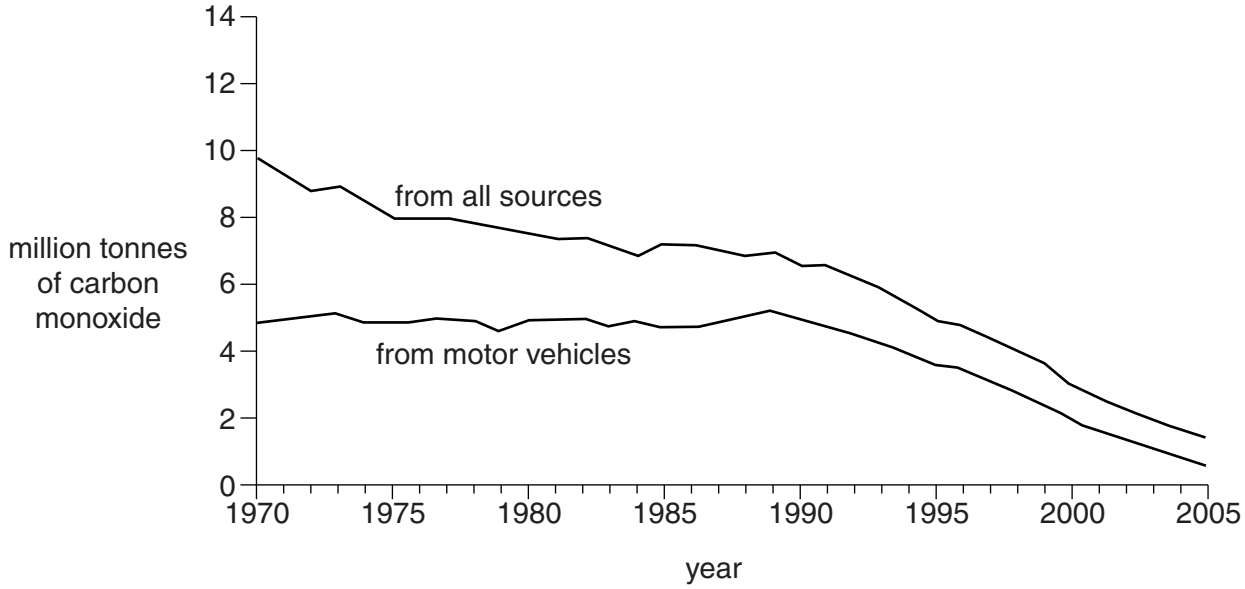
In cities, where high buildings reduce air movement, harmful levels of the gas can build up. To reduce this pollution, cars are banned from the centres of some cities. In other cities, drivers must pay to enter the city centre. These measures encourage more people to use public transport, which is not always popular.

As well as motor vehicles, there are other sources of carbon monoxide pollution. The most important of these is the burning of coal. Coal can be burned to heat homes. It can also be burned in power stations to generate electricity.

Reducing pollution from cars

Annual emissions for carbon monoxide in the United Kingdom have been falling since the 1970s. But the number of cars on the road has been steadily increasing in this time.

Carbon monoxide emissions by source: 1970 to 2005 – United Kingdom



One way of removing carbon monoxide from car and lorry exhaust fumes is to use a catalytic converter (CAT). In a CAT, carbon monoxide reacts with nitrogen monoxide. The products of this reaction are carbon dioxide and nitrogen.

$$2CO + 2NO \longrightarrow 2CO_2 + N_2$$

During the 1970s and 1980s, only luxury cars were manufactured with catalytic converters. Since January 1993 all new petrol cars sold in the UK have been fitted with CATs. Each year, more new cars fitted with CATs are sold and old cars without CATs are scrapped. Therefore, the proportion of cars fitted with CATs increases each year.

It has been suggested that the emission of carbon monoxide could be reduced much further if more people used electrically powered vehicles. The batteries used to run these vehicles can be charged up during the night when there is a low demand for the electricity produced by power stations.

Other ways to reduce carbon monoxide pollution

When oil or gas is used as a fuel, much less carbon monoxide is produced than when a solid fuel such as coal is burned. During the past 50 years, the use of gas and oil for heating homes has increased, and the use of coal for heating has decreased. Many power stations have also switched from burning coal to burning oil or gas.

Fires and central heating boilers that burn oil or gas can produce carbon monoxide if they are not serviced regularly. Many people take a risk by choosing **not** to have fires or central heating boilers serviced. In the UK, 4 people died and 117 fell ill as a result of carbon monoxide poisoning at home in the year to June 2010. Heaters that are serviced regularly are likely to produce little or no carbon monoxide.

Does homeopathy really work?

Homeopathy is a controversial form of alternative medicine. Homeopathic doctors believe in treating 'like with like'. This means an illness is treated with a substance that causes similar symptoms to the illness.

This could, of course, be dangerous so the substances are diluted using large quantities of water or alcohol. The substances are diluted so much that there is very little chance of any molecules of the substance being left in a dose of the medicine.

Homeopathic doctors say that a treatment may make the symptoms of the illness worse at first, but this is part of the healing process.

Dilution Table

	typical number of molecules of substance present in 1 cm^3	
	1 000 000 000	original solution
diluted by 100	10 000 000	
diluted by 100	100 000	
diluted by 100	1000	
diluted by 100	10	
diluted by 100	0	1 cm^3 dose of medicine

Homeopathic doctors believe that homeopathy is safe for everyone including the young and the old. They explain that the medicine works because the 'memory' of a diluted substance stays in the water or alcohol. Homeopathic doctors say the treatment restores health by stimulating the body's own healing powers. A survey of ten patients who have used homeopathic treatments reports that seven of them say that it has helped with their illness.

Conventional doctors say there is no evidence to support homeopathy. There is no known mechanism for water or alcohol to keep the 'memory' of a substance that was once dissolved in it. These doctors believe that any benefit experienced by the patient is not due to homeopathy but is due to a placebo effect. Some experiments show that when patients are given a placebo (a dummy pill) they still think they are getting better. Another possibility is that patients simply recover due to natural processes (the patient's own immune system). Conventional doctors say that patients who are seriously ill are just given false hope which possibly prevents them from receiving a scientifically proved conventional treatment.

Read the statements of these people.