

**GENERAL CERTIFICATE OF SECONDARY EDUCATION
TWENTY FIRST CENTURY SCIENCE**

A213/01

SCIENCE A

Unit 3 Modules B3 C3 P3
(Foundation Tier)

Candidates answer on the question paper
A calculator may be used for this paper

OCR Supplied Materials:
None

Other Materials Required:

- Pencil
- Ruler (cm/mm)

**Monday 19 January 2009
Morning**

Duration: 40 minutes



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

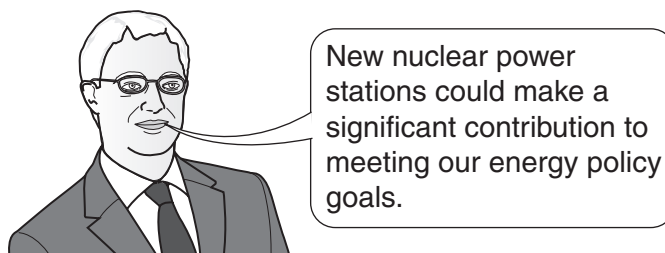
INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **42**.
- This document consists of **16** pages. Any blank pages are indicated.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	4	
2	6	
3	4	
4	5	
5	2	
6	7	
7	5	
8	4	
9	5	
TOTAL	42	

Answer **all** the questions.

- 1 (a) A government minister says that more nuclear power stations should be built.



- (i) What would be good 'energy policy goals'?

Put a tick (✓) in the box next to the **one** correct answer.

- | | |
|---|--------------------------|
| Producing less electrical power for Britain with less carbon dioxide. | <input type="checkbox"/> |
| Producing more electrical power for Britain with less carbon dioxide. | <input type="checkbox"/> |
| Producing less electrical power for Britain with more carbon dioxide. | <input type="checkbox"/> |
| Producing enough electrical power for Britain with more carbon dioxide. | <input type="checkbox"/> |

[1]

- (ii) Which of these is a good reason for building nuclear power stations instead of having more coal-burning power stations?

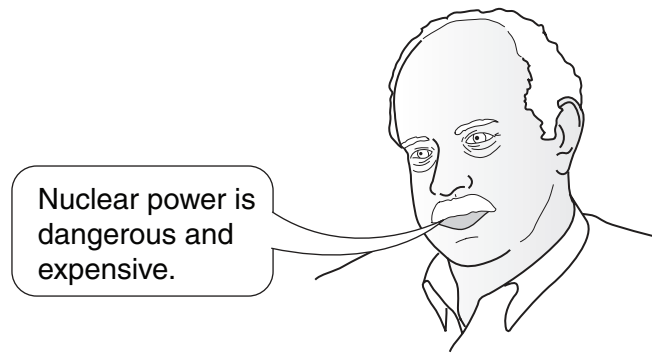
Put a tick (✓) in the box next to the **one** correct answer.

- | | |
|--|--------------------------|
| When coal burns, it produces carbon dioxide. | <input type="checkbox"/> |
| Nuclear power stations produce waste which will be radioactive for many centuries. | <input type="checkbox"/> |
| Nuclear fuel has to be brought in to Britain from other countries, while we have plenty of coal reserves in Britain. | <input type="checkbox"/> |

[1]

3

(b) The spokesman for an environmental group disagrees with the government minister.



Which of these statements support the environmental spokesman?
Put ticks (✓) in the boxes next to the **two** statements which support him.

Nuclear fuel is a much more concentrated source of energy than coal.

☐

Nuclear power stations do not produce carbon dioxide while they are running.

☐

An accident at a nuclear power station could result in the release of radioactive materials.

☐

People who live near coal-burning power stations are much more likely to get ill with chest complaints like asthma.

☐

Taking apart nuclear power stations at the end of their use will cost much more money than taking apart coal-burning power stations.

☐

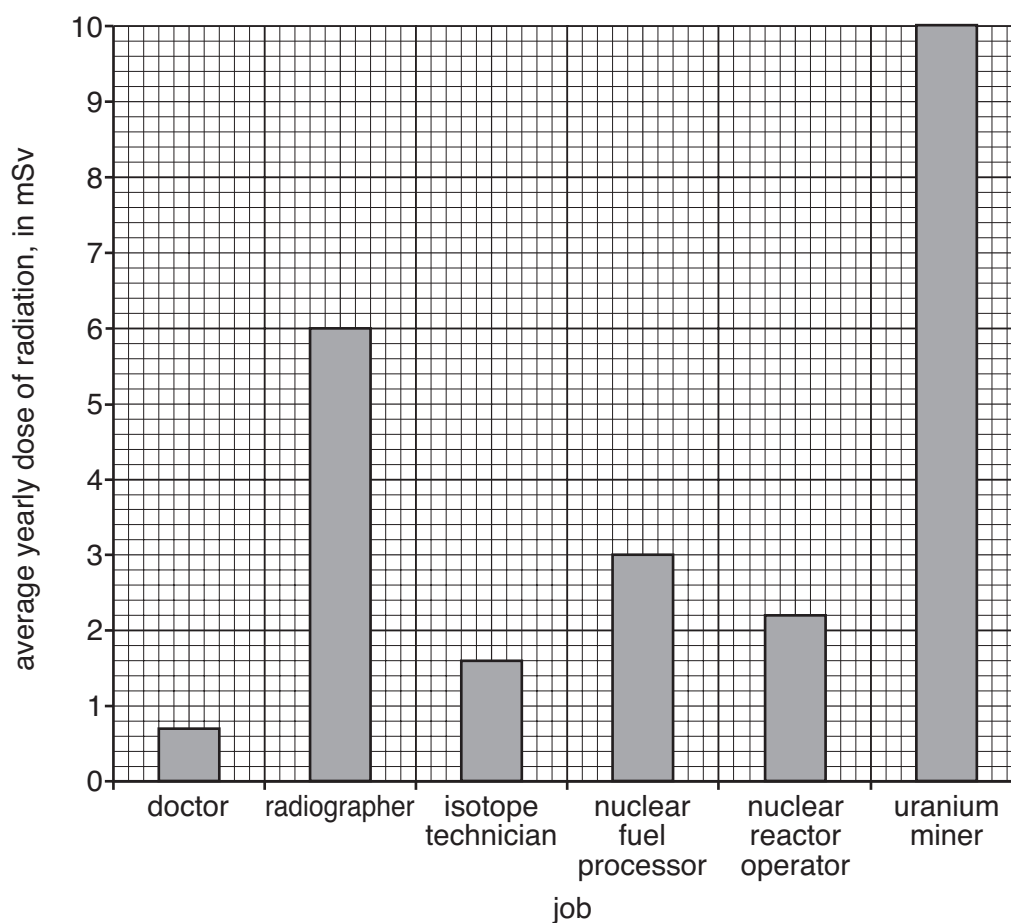
[2]

[Total: 4]

4

- 2 The table and bar chart shows the average yearly dose of radiation for seven different jobs where people work with radioactive materials.
There is a gap in the table.

job	average yearly dose in mSv
doctor	0.7
radiographer	6
isotope technician	
nuclear fuel processor	3
nuclear reactor worker	2.2
uranium miner	10



- (a) (i) Use the bar chart to find the average yearly dose of radiation for an isotope technician.

dose = mSv [1]

- (ii) Write down the range of average yearly doses for these jobs.

..... to mSv [1]

5

- (b) When a group of nuclear reactor workers had their average yearly dose measured, the following results were obtained.

average yearly dose in mSv						
Adel	Brian	Chloë	David	Elmira	Frank	Grant
2.1	2.3	1.9	2.2	2.1	2.0	7.0

- (i) The result for Grant is very different from the others. What is the name for a very different result of this sort?

answer [1]

- (ii) Which of the following statements could be the reason for the very different result for Grant's dose?

Put a tick (✓) in the box next to the **one** correct answer.

Grant has handled fewer radioactive materials than the others.

☐

Grant has worked fewer hours near the reactor than the others.

☐

Grant has been working much closer to the reactor than the others.

☐

[1]

- (iii) Use the data in the table to find the best estimate of the average yearly dose for all of the workers **except Grant**.
Show your working in this space.

best estimate = mSv [2]

[Total: 6]

- 3 Brenda has not been feeling well. Her doctor wants her to have a gamma scan to check whether her kidneys are working properly.

For this scan, a radiologist will inject a radioactive chemical called technetium-99m into Brenda. Technetium-99m gives off gamma radiation and has a half-life of 6 hours.


Brenda will be staying in hospital for a few days. She is very anxious about the gamma scan.

Brenda

I've heard that gamma radiation is dangerous. Is it possible that this treatment could give me cancer?

When I get home again, won't I be dangerous to be near if I've got radioactive chemicals in me?

I see that the radiologist wears protective clothing. Why is it needed if the chemicals are safe enough to inject into my body?



Which of the following statements could the doctor say to best answer each of Brenda's questions?

- (a) "I've heard that gamma radiation is dangerous. Is it possible that this treatment could give me cancer?"

Put a tick (✓) in the box next to the **one** best statement.

Only alpha radiation and beta radiation cause cancer.

☐

Gamma radiation is used to cure cancer, so it can't be bad for you.

☐

The benefit you get from an accurate diagnosis makes the slight risk of cancer worthwhile.

☐

Gamma radiation goes straight through matter, so it will all pass out of your body without causing any damage.

☐

[1]

7

- (b) "When I get home again, won't I be dangerous to be near if I've got radioactive chemicals in me?"

Put ticks (✓) in the boxes next to the **two** correct reasons the doctor could give Brenda to explain why she will not be a danger to her family.

The radioactivity of the technetium-99m becomes very small within a few days.

☐

Immediately after the gamma scan is over, the radioactive chemical stops being radioactive.

☐

The gamma radiation will all be absorbed by your body, so there is no risk to your family.

☐

When the treatment is over, the technetium-99m is chemically treated and stops being radioactive.

☐

Your family are not as close to the source of radiation as you are, so they will have a much smaller dose than you.

☐

[2]

- (c) "I see that the radiologist wears protective clothing. Why is it needed if the chemicals are safe enough to inject into my body?"

Put a tick (✓) in the box next to the **one** best reason the doctor could give Brenda.

The protective clothing is part of the hospital's uniform.

☐

The protective clothing stops all the gamma radiation from reaching the radiologist.

☐

There are Government regulations which make radiologists wear protective clothing.

☐

Unlike patients, radiologists use radioactive chemicals every day. Protective clothing keeps the risk to them within safe limits.

☐

[1]

[Total: 4]

- 4 This question is about human evolution. Read the article on Neanderthals.

Cold weather could have killed off the Neanderthals.

Neanderthals are thought to have died out in most parts of Europe about 35 000 years ago.

The last Neanderthals, who lived in what is now southern Spain, probably died out about 24 000 years ago.

The climate became colder killing off some of the animals that Neanderthals hunted.

- (a) Here are reasons for the Neanderthals dying out.
Which two of these are mentioned in the article?
Put ticks (✓) in the **two** boxes next to the correct reasons.

reasons

The environmental conditions changed.

☐

Other organisms in the food web died out.

☐

Animals which killed Neanderthals arrived in Spain.

☐

Modern humans reached Spain and replaced the Neanderthals.

☐

[2]

- (b) Complete the sentences by putting a ring around the correct word in each group of three alternative words

Modern humans and Neanderthals are both species of hominids.

They share a **common** / **different** / **similar** ancestor.

Natural selection caused populations of this ancestor to **diverge** / **converge** / **merge** into two species.

Over time, one population evolved into modern man and one into Neanderthal man.

All but one of the many hominid species became **evolved** / **extinct** / **similar**.

[3]

[Total: 5]

5 This is a question about theories.



Trofim Lysenko was an agricultural scientist in the Soviet Union, which later became modern Russia.

He said that his experiments showed that organisms could pass on characteristics they had developed in their lifetime.

In the 1920s, the Soviet Union strongly supported Lysenko's work, which promised to produce much more wheat to feed the people. By 1964 the Soviet Union had abandoned Lysenko's theory.

Here are some of the reasons why the Soviet Union abandoned Lysenko's theory.

Put ticks (✓) in the boxes next to the **two** best **scientific** reasons.

Lysenko's results could not be repeated.

☐

The new leader of the Soviet Union wanted to make changes.

☐

Lysenko's theory dated from fifty years ago and was out-of-date.

☐

Breeding experiments with wheat showed that only genetic variation can be passed on.

☐

Other countries that did not use Lysenko's theory were growing more crops.

☐

[2]

[Total: 2]

6 This is a question about evolution.

The picture shows a clouded leopard.



Read the article about clouded leopards.

1. There has been new research into clouded leopards on the island of Borneo.
2. Until this research, clouded leopards in Borneo and in mainland Asia were thought to be the same species.
3. However, DNA analysis showed there were 40 genetic differences between clouded leopards from Borneo and clouded leopards from mainland Asia.
4. Some scientists now think that these two species of clouded leopards are different because they have evolved separately for a long time.

(a) (i) Write down the number, **1**, **2**, **3**, or **4**, of a sentence in the article which contains **data**.

answer

(ii) Write down the number, **1**, **2**, **3**, or **4**, of a sentence in the article which contains an **explanation** of the DNA differences in the two species of clouded leopards.

answer

[2]

(b) The article continues:

The fact that Borneo's top predator is now considered a separate species emphasises the need for **sustainable** development of the island which has a particularly high **biodiversity**.

Use straight lines to join each **term**, sustainable and biodiversity, to its correct **definition**.

term	definition
	the variety of living things within and between species
sustainable	using resources in the best and most profitable way
biodiversity	using resources so that they can continue to be used in the future
	the gradual change of a population over time

[2]

(c) Natural selection and selective breeding are different ways in which species can change. Here are some statements about these changes.

Put a tick (✓) in the correct box after each statement to show whether it is about **natural selection** or about **selective breeding**.

The first one has been done for you.

statement	natural selection	selective breeding
Changes are affected by the environment, not by careful planning.	✓	
Over many generations, humans can produce changes in plants or animals.		
Humans choose which individuals to breed from because of their desirable characteristics.		
Plants or animals best suited to their environment are more likely to survive and breed.		

[3]

[Total: 7]

7 Carbohydrates and proteins are chemicals made from atoms of different elements.

- (a) Complete the table by putting ticks (✓) to show the elements in carbohydrates and proteins. The table has been started for you.

	carbon	hydrogen	nitrogen	oxygen
carbohydrate	✓	✓		
protein	✓	✓		

[2]

- (b) Here are five sentences that show what happens to proteins in your body. They are in the wrong order.

- A Urea passes out of your body in urine.
- B Urea is removed from the blood by the kidneys.
- C Amino acids are absorbed into the blood.
- D Excess amino acids are broken down by liver cells to form urea.
- E Digestion breaks down proteins to amino acids.

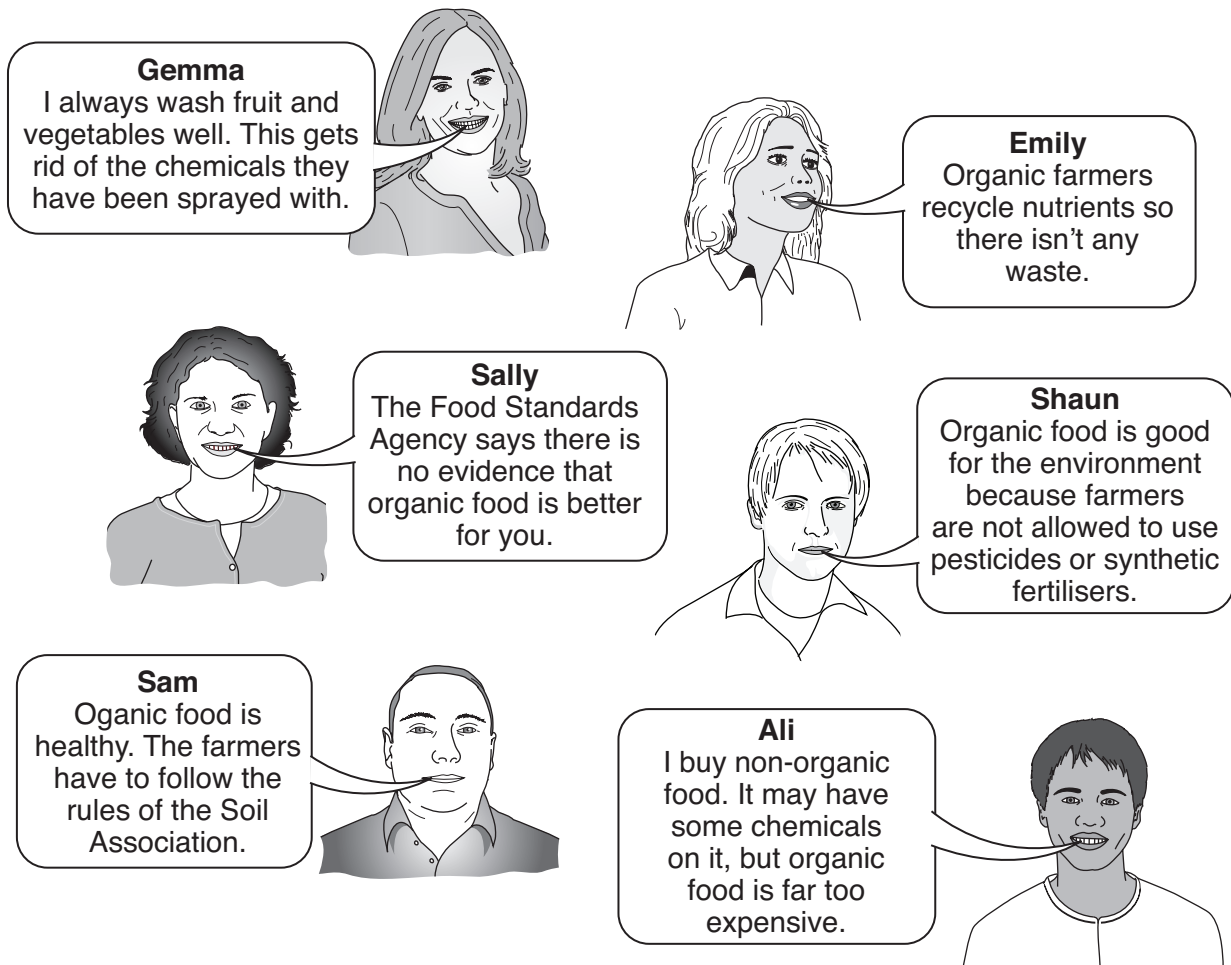
Fill in the boxes to show the correct order. The first one has been done for you.

E				
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[3]

[Total: 5]

8 Some people in a supermarket are talking about buying organic food.



Gemma
I always wash fruit and vegetables well. This gets rid of the chemicals they have been sprayed with.

Emily
Organic farmers recycle nutrients so there isn't any waste.

Sally
The Food Standards Agency says there is no evidence that organic food is better for you.

Shaun
Organic food is good for the environment because farmers are not allowed to use pesticides or synthetic fertilisers.

Sam
Organic food is healthy. The farmers have to follow the rules of the Soil Association.

Ali
I buy non-organic food. It may have some chemicals on it, but organic food is far too expensive.

(a) Which two people are talking about organisations which regulate the standard of food production?

answer and [1]

(b) Who has explained why organic farming is sustainable?

answer [1]

(c) Who has given a reason to accept a risk?

answer [1]

(d) Who refers to the pollution caused by intensive farming?

answer [1]

[Total: 4]

9 Read this newspaper article about preservatives in food.

WATCH WHAT YOU EAT

Preservatives are used to keep food safe for longer, but watch the ones you eat.

Microorganisms cannot grow in food that is too sweet, too salty or too acidic. Sugar, salt and vinegar have been used for centuries to preserve food. Although salt and sugar are now linked to health problems, small amounts of them won't harm you.

This may not be true for modern preservatives. The Food Standards Agency has reported that sodium benzoate (E 211) can make symptoms of asthma and eczema worse in children that already have these conditions.

(a) Why are preservatives used in food?

Put a tick (✓) in the box next to the **best** answer.

They make food salty.

☐

They make food look more attractive.

☐

They have been used in food for centuries.

☐

They prevent the growth of microorganisms.

☐**[1]****(b)** What do numbers like E 211 show about the additives?

Put a tick (✓) in the box next to the **best** answer.

It is dangerous to eat.

☐

It has passed a safety test.

☐

It gives over 200 kJ energy per kg.

☐

It is a food colouring.

☐**[1]**

15

- (c) What is the role of the Food Standards Agency?
Put a tick (✓) in the box next to the **best** answer.

To control the cost of food.

☐

To make sure all foods are tasty.

☐

To protect the health of the public.

☐

To control the foods sold in supermarkets.

☐

[1]

- (d) Sadie and Tom have children who have asthma.
Which **two** sentences below, taken together, state how they can keep the risks to their children as low as possible?
Put ticks (✓) in the boxes next to the **two best** answers.

They buy organic vegetables.

☐

They know that microorganisms are dangerous.

☐

They can read the list of additives on food labels.

☐

They know which additives may harm their children.

☐

They always buy their food from the same supermarket.

☐

They can find out the energy in food in kilojoules from the label.

☐

[2]

[Total: 5]

END OF QUESTION PAPER

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