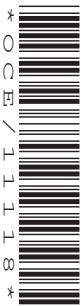


**GENERAL CERTIFICATE OF SECONDARY EDUCATION**  
**TWENTY FIRST CENTURY SCIENCE**  
**SCIENCE A**

Unit 3: Modules B3 C3 P3  
 (Foundation Tier)

A213/01



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 22 June 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 **24** pages. Any blank pages are indicated.

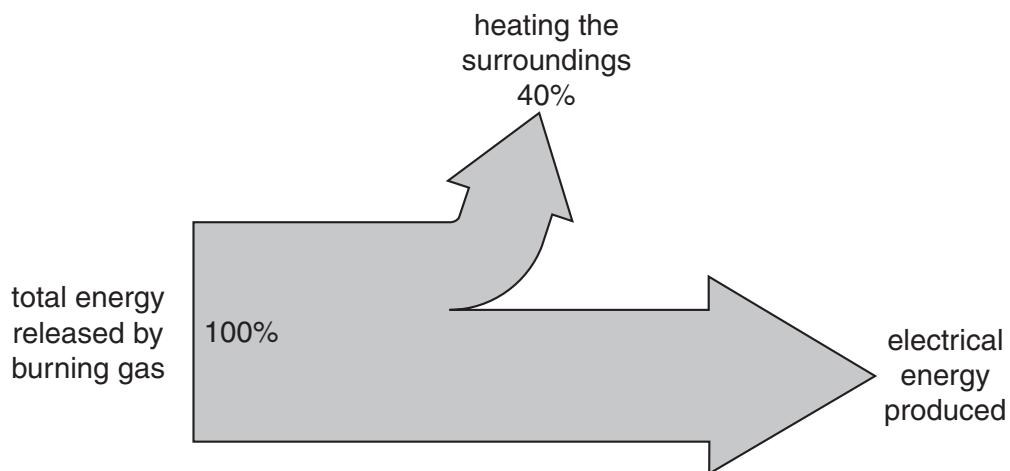
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Answer **all** the questions.

1 This question is about making good use of as much energy as possible from the primary fuel used in power stations.

(a) The diagram shows the efficiency of a modern gas-fired power station.



What percentage of the **total energy released by burning gas** is transferred to the **electrical energy produced**?

Put a **ring** around the **one** correct answer.

10%

30%

40%

60%

100%

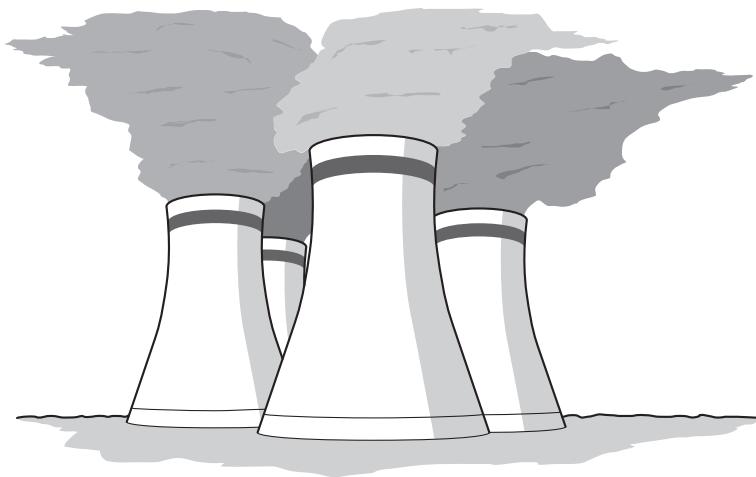
[1]

(b) Read this press release from an environmental group.

### Combined Heat and Power (CHP)

UK power stations throw away the same amount of energy as is needed to provide hot water and heating for every building in the UK.

How does this happen? Well, generating electricity produces huge amounts of 'waste' energy, which is lost by our power stations – for example, heating water into the steam which goes up the cooling towers.



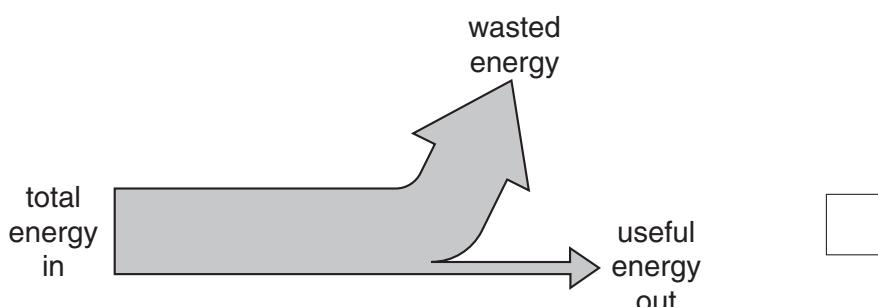
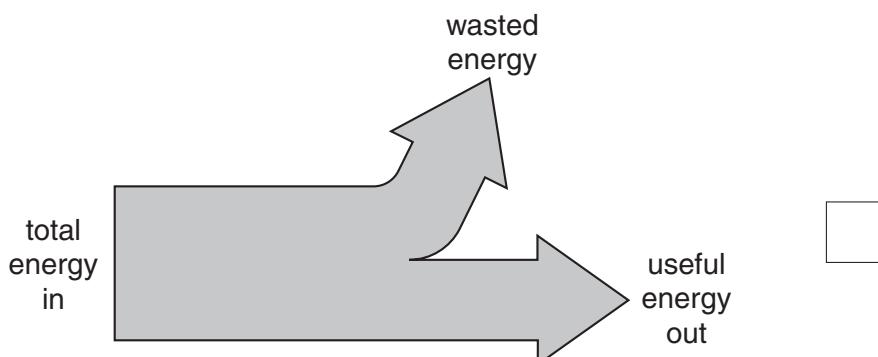
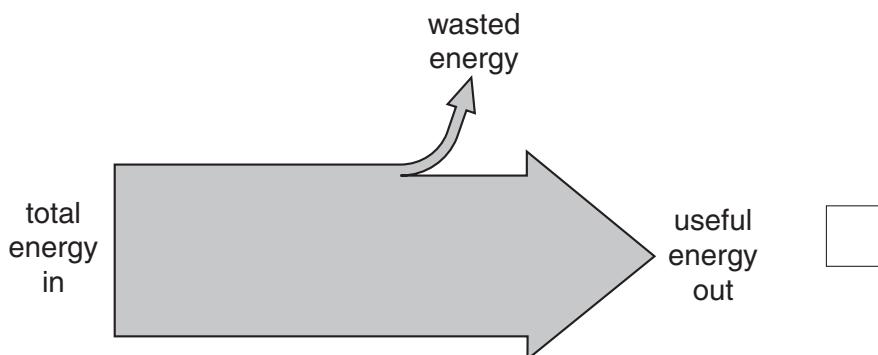
If power stations are built near towns or on industrial sites, this energy can be captured and supplied to heat homes and businesses or used in industrial processes.

This technology exists and is used in other countries. It's called Combined Heat and Power (or CHP), and CHP plants can be as much as 95 per cent efficient. That's more than twice as good as the old-fashioned power plants we use at the moment!

The press release explains that CHP plants are much more efficient than old-fashioned power plants.

Which of these diagrams is the **best** energy flow diagram for a CHP plant?

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



[1]

(c) Four different people have read the press release about CHP power stations.

**Anne**

It'll cost a lot to change the power stations we have at the moment to CHP. Why should I pay? I live far from the town.



**Milan**

We won't need so many power stations if they use CHP, as less energy is wasted.

**Richard**

If everyone just turned down the temperature of their central heating by 2 degrees, it would save plenty of energy.



**Penny**

We should concentrate on renewable energy sources. It's important that we can keep producing power for the future.

(i) Which of these people mentions an advantage of CHP?

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

Anne

Milan

Penny

Richard

[1]

(ii) Which of these people talks about sustainable development?

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

Anne

Milan

Penny

Richard

[1]

(iii) Which of these people talk about ways of wasting less energy?

Put ticks (✓) in the boxes next to the **two** correct names.

Anne

Milan

Penny

Richard

[2]

[Total: 6]

2 This question is about using gamma radiation to preserve soft fruit. This is done in the USA, but not in Britain.



Strawberries can be preserved with gamma radiation.

This kills microorganisms on the fruit. Provided that other microorganisms have no chance to get on to the irradiated fruit, the fruit cannot go bad.

(a) Here are four sentences that describe this procedure.

They are in the wrong order.

- A The strawberries are taken away from the radiation source.
- B The strawberries are put near a source of gamma radiation.
- C The container of strawberries is put into an airtight plastic bag.
- D The strawberries stay there for long enough to kill all bacteria and fungi.

Fill in the boxes to show the correct order.

--	--	--	--

[1]

(b) Katy, Jon and Liz are discussing whether or not preserving strawberries with gamma radiation should be done in the UK.

**Katy**

This would allow us to eat strawberries all the year round without flying them in from distant countries. I would not like to work in a place that used radioactive substances, because gamma radiation can cause cancer.

**Jon**

Gamma radiation can be used to kill living things on the fruit. Some of the gamma radiation may still be in the fruit when I eat it.

**Liz**

I would worry that some of the bacteria and fungi on the fruit were not killed by the gamma radiation.

For each of the following questions, put ticks (✓) in the boxes to indicate the correct people.

The questions may have one, two or three ticks.

	Katy	Jon	Liz
(i) Which people state an advantage of preserving fruit in this way?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(ii) Which people are not happy about eating fruit preserved in this way?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(iii) Which <b>one</b> person says something about gamma radiation which is not true?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

[3]

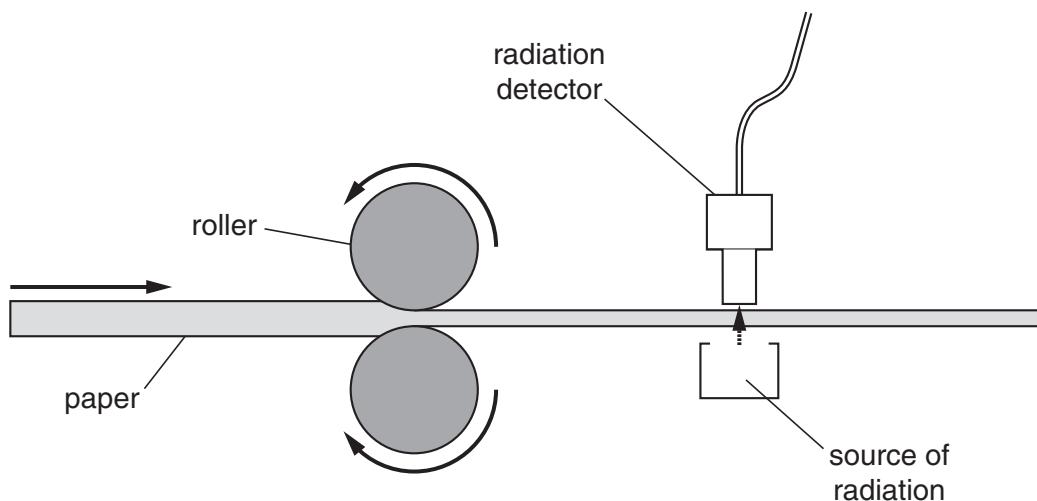
[Total: 4]

Turn over

3 When paper is made, it is squeezed into thin sheets by passing it between two rollers.

The paper must be of the same thickness all the time.

The paper thickness can be tested with radiation, as the diagram shows.



(a) The radiation used is one of the types emitted by radioactive materials.

Finish the sentences below by using the words from the list.

Use each word once only.

**alpha**

**beta**

**gamma**

..... radiation is stopped completely by a thin sheet of paper. This means no radiation would get through the paper at all.

..... radiation is very penetrating, so it is not absorbed by paper at all. This means that the radiation detector would give the same reading for thin paper as for thick paper.

Because ..... radiation is partly absorbed, it is used to check the thickness of the paper. If the paper is too thin, the radiation count will go up.

[2]

11

(b) Here are some statements about the risk from radiation to people who work in the paper factory.

Which **two** of the statements are correct?

Put a tick (✓) in the box next to each of the **two** correct statements.

There is no risk at all from radiation in the paper factory.

People a long way from a radioactive source have more risk from radiation than people close to it.

Following official regulations ensures that the risk to people who work with the radioactive source is very small.

People who work near the paper tester have a very large risk from radiation.

The benefits from the use of this paper tester mean that the very small risk to workers is acceptable.

[2]

[Total: 4]

4 Jane and her father are shopping in a supermarket.

Jane looks at the label on a tin of baked beans. It shows the ingredients in the tin.



(a) The sentences below explain why chemicals are added to the beans.

Draw a straight line from the **beginning** of each sentence to the correct **ending**.

Each **ending** may be used once, more than once, or not at all.

**beginning**

Preservatives ...

**ending**

... give a better taste.

Artificial sweeteners ...

... stop the growth of harmful microorganisms.

Flavourings ...

... prevent the beans and the sauce separating.

[2]

13

(b) Food labels usually give information about proteins and carbohydrates.

Below are four statements about proteins and carbohydrates.

Put a tick (✓) in the **one** correct box for each statement.

statement	true for carbohydrates	true for proteins	true for neither
Starch and sugars belong to this food group.			
They contain carbon, hydrogen, oxygen and nitrogen atoms.			
Muscle consists mainly of these.			
Digestion breaks them down to fatty acids.			

[3]

[Total: 5]

5 Read this article from a website.

### Kids aren't doing enough exercise

A recent study looked at physical exercise in 11-year-olds. Only one in forty meets the national target of an hour of physical exercise a day. 95% of boys and 99.6% of girls did not meet the target.

Scientists studied the physical activity levels of more than 5500 children for two years.

"It's a worrying fact that children and young people aren't doing enough exercise" said an advisor from Diabetes UK. "If we don't put the emphasis back on exercise and healthy lifestyle, children and young people in the UK may face a lifetime of ill health."

The increase of type 2 diabetes in children is linked to rising levels of obesity. The increase in obesity is caused by lack of exercise and diets that are high in fat, salt and sugar.

(a) (i) From the article, what percentage of 11-year-old **boys** are **reaching** the national target for physical exercise?

Put a **ring** around the correct answer.

2.5%      5%      95%      99.6%

[1]

(ii) Name **two** chemicals in food which are linked to increasing cases of diabetes.

1 .....

2 .....

[1]

(b) Which **two** statements, when put together, explain why lack of exercise is a risk factor for diabetes?

Put a tick (✓) in the box next to each of the **two** correct answers.

People who do not exercise can become overweight.

More girls than boys have diabetes.

There is a risk of developing diabetes when a child is 11 years old.

Obesity is a risk factor for type 2 diabetes.

Boys exercise more than girls.

[2]

15

(c) Insulin controls the level of sugar in the blood.

It allows sugar molecules in the blood to move into the cells, where they can be used for energy.

What happens in type 2 diabetes?

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

Blood will not carry sugar around the body.

Insulin cannot be moved around the body.

There is too much fat in the blood.

The cells do not respond to insulin.

[1]

[Total: 5]

6 Read this guide to healthy eating.

Acrylamide is a chemical found in large amounts in starchy foods that have been cooked at high temperatures. These foods include crisps, chips and bread.

Acrylamide causes cancer in animals and so may also harm people's health in the same way. However, the Food Standards Agency (FSA) has not set a limit for acrylamide in food.

You do not need to change your diet or the way in which you cook your food – but you should continue to eat a healthy, balanced diet.

Remember that food, especially meat, needs to be cooked properly to destroy the bacteria that cause food poisoning.



(a) Use this guide to answer these questions.

(i) Why may acrylamide be dangerous?

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

It is not part of a balanced diet.

It may cause cancer in humans.

It has a high energy value.

It doesn't have a nice taste.

[1]

(ii) How can you reduce the risk of harm from acrylamide?

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

Eat crisps instead of chips.

Cook all food at a high temperature.

Eat a balanced diet.

Don't eat cooked meats.

[1]

(b) Foods from crops may contain chemicals that are harmful to health.

Draw a straight line from each **harmful chemical** to the **reason it is in the food**.

One has been done for you.

<b>harmful chemical</b>	<b>reason it is in the food</b>
aflatoxins made by mould growing on food	the way the crop is farmed
pesticides and herbicides left on crops after spraying	the way the crop is stored
toxins present inside the food	starch is cooked at high temperatures
acrylamides in the food	the crop plant itself produces poisonous chemicals

[2]

**[Total: 4]**

7 This question is about life on Earth.

(a) Finish the sentences by choosing the best words or numbers from this list.

35

3500

14 000

copy

complex

grow

simple

Scientists think that life on Earth started about ..... million years ago.

The first living things developed from molecules that could ..... themselves.

All the living and extinct species of living things on Earth evolved from very ..... living things.

[3]

(b) Scientists perform investigations to obtain evidence.

What do scientists investigate to provide evidence about evolution?

Put a tick (✓) in the box next to each of the **two** correct answers.

books

DNA

fossils

newspapers

the internet

[2]

19

(c) Charles Darwin looked at breeding and selection in two types of birds.

He studied domestic pigeons and Galapagos finches.

Domestic pigeons have been bred by people for hundreds of years.

Galapagos finches live in the wild.

Draw straight lines to link the boxes to join each **type of bird** to the **type of selection** each bird illustrates, and then to the correct **description**.

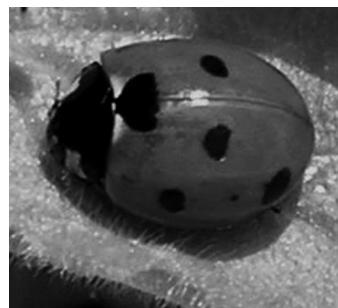
type of bird	type of selection	description
domestic pigeon	variable selection	individuals better suited to their environment are more likely to breed
Galapagos finch	natural selection	individuals with certain characteristics are chosen for breeding
	selective breeding	individuals are chosen at random for breeding

[2]

[Total: 7]

8 Read the newspaper article.

### British ladybirds lose out to Harlequins



native British ladybird



Harlequin ladybird

In September 2004 the Asian Harlequin ladybird arrived in Essex.

In three years, Harlequin ladybirds have spread across the whole of England.

90% of ladybirds in London parks are now Harlequins, not native British ladybirds.

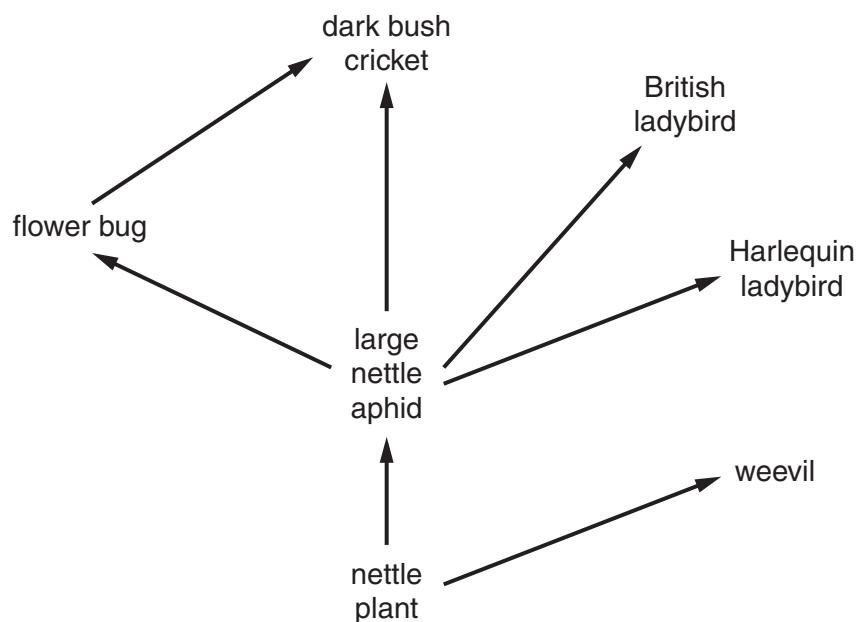
(a) Harlequin ladybirds and British ladybirds both feed on the same types of insects.

Write down the term scientists use to describe the struggle between two species for a limited resource in a habitat.

..... [1]

(b) There are **parasitic wasps** which feed only on British ladybirds.

(i) Add these parasitic wasps to the food web. [1]



Some scientists think that Harlequin ladybirds will replace British ladybirds in the UK because both feed on the same types of insects.

What effect would this have on other species of insects?

Finish the sentences by using the words or phrases in the list.

**decrease      increase      stay the same**

(ii) The population of the parasitic wasps will ..... [1]

(iii) If the population of large nettle aphids decreases, the population of weevils  
will ..... [1]

**[Total: 4]**

9 Read this article on puffins.

**Disastrous decline of puffins**

- 1 The biggest colony of puffins in Britain is in trouble.
- 2 Thousands of puffin chicks have failed to hatch or have starved to death.
- 3 There has been a two degree rise in ocean temperatures.
- 4 Some scientists claim this has driven sand eels, the puffins' favourite food, to move to cooler waters so the puffins don't have enough food.
- 5 Puffins have been seen feeding their chicks on pipefish.
- 6 Other scientists think the deaths are due to unusually bad storms.



(a) Sentence 5 contains data (observations or measurements).

Write down the number of **two** other sentences that report data.

5 has been written in already.

sentences 5, ..... and ..... [1]

(b) Sentence 2 describes the fall in numbers of puffin chicks.

Write down the numbers of **two** sentences that contain explanations for this fall in numbers.

sentences ..... and ..... [2]

[Total: 3]

**END OF QUESTION PAPER**

23

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