THIS IS A NEW SPECIFICATION

OCR
RECOGNISING ACHIEVEMENT

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Friday 15 June 2012 – Afternoon

GCSE TWENTY FIRST CENTURY SCIENCE SCIENCE A

A143/01 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)

Duration: 1 hour

A143/01

Candidate forename		Candidate surname	

Centre number						Candidate number				

MODIFIED LANGUAGE

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- Your quality of written communication is assessed in questions marked with a pencil (✎).
- A list of useful relationships is printed on page 2.
- 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 **60**.
- This document consists of **20** pages. Any blank pages are indicated.

TWENTY FIRST CENTURY SCIENCE EQUATIONS

Useful relationships

The Earth in the Universe

distance = wave speed × time

wave speed = frequency × wavelength

Sustainable energy

energy transferred = power × time

power = voltage × current

$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

Explaining motion

$$\text{speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$

momentum = mass × velocity

change of momentum = resultant force × time for which it acts

work done by a force = force × distance moved in the direction of the force

amount of energy transferred = work done

change in gravitational potential energy = weight × vertical height difference

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times [\text{velocity}]^2$$

Electric circuits

power = voltage × current

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$$

Radioactive materials

energy = mass × [speed of light in a vacuum]^2

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Question 1 begins on page 4

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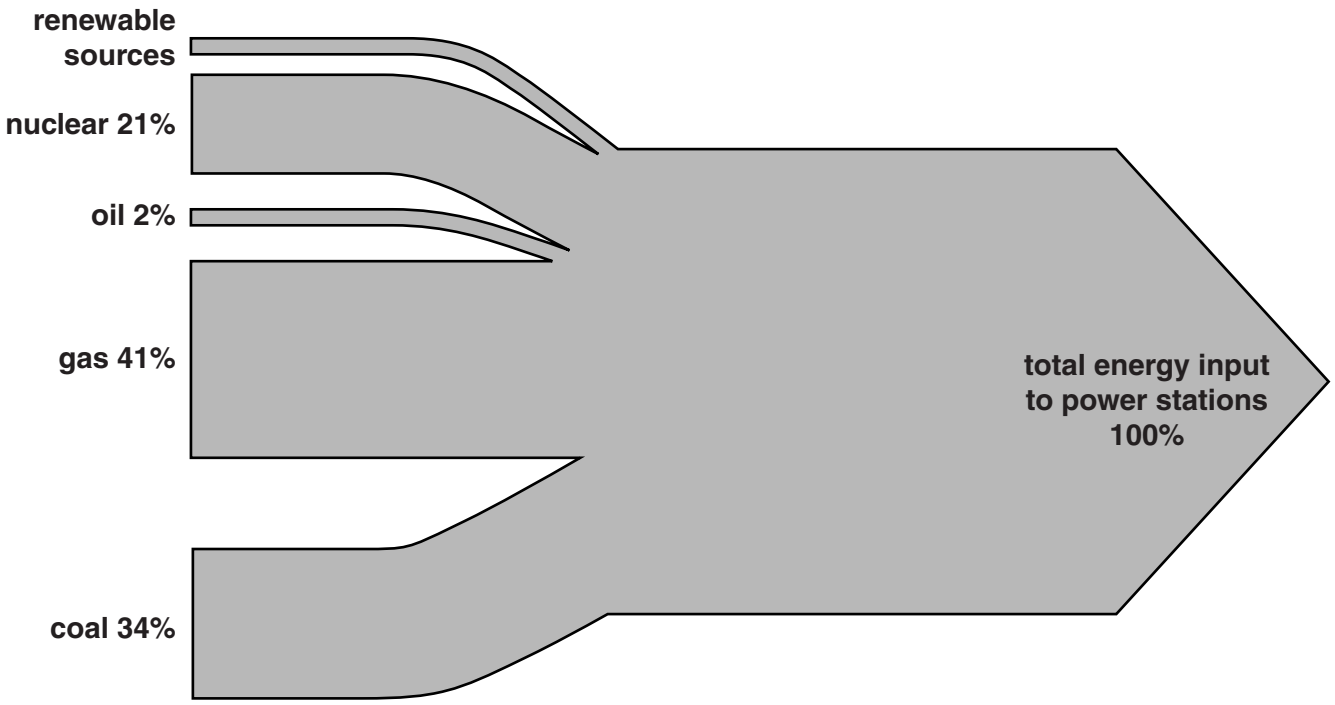
Answer **all** the questions.

1 This question is about the generation of electrical energy in the UK in 2009.

(a) The diagram below shows the different energy sources that made up the total energy input to power stations in 2009.



(i) The labels on the diagram show that gas provided more energy than any other source in 2009 (41%).

What **other** feature of the diagram shows that gas provided the most energy?

.....

..... **[1]**

(ii) It is claimed that renewable sources provided less energy than any of the other sources.

Is this correct?

Justify your answer.

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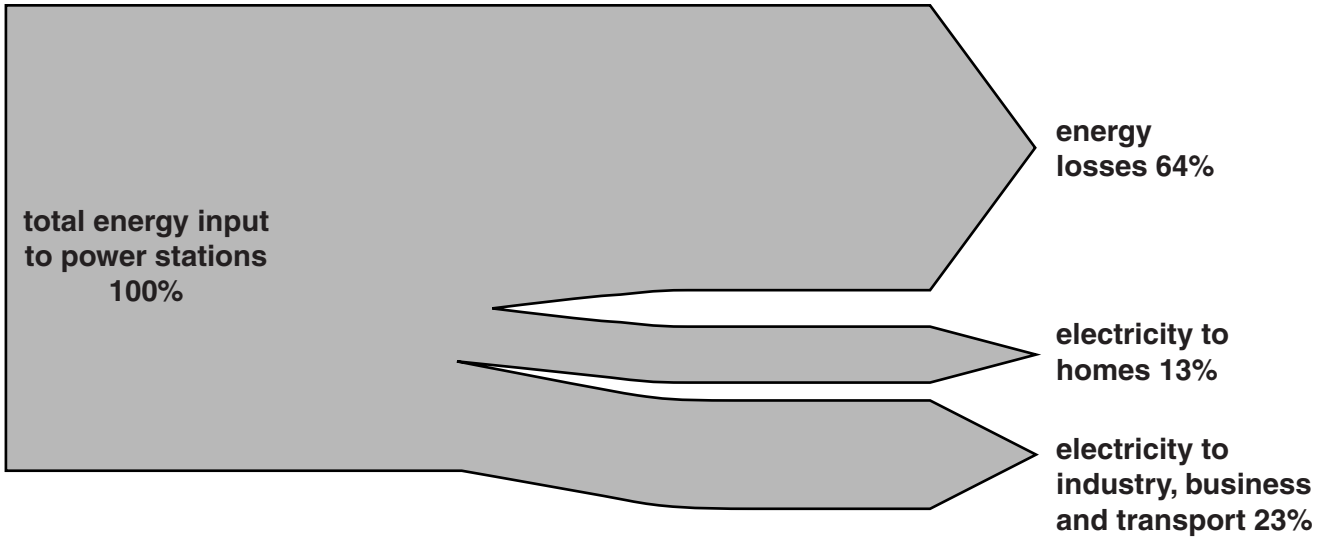
..... **[2]**

(b) The next diagram shows what happened to this energy in power stations in 2009.



(i) The energy losses from generating and distributing electricity were 64%.

Suggest **one** way in which energy may be lost.

.....

..... **[1]**

(ii) Which of the following figures was the efficiency of production of electricity in British power stations in 2009?

Put a (ring) around the correct value.

0.13 **0.23** **0.36** **0.64** **0.77**

[1]

(iii) The generators in power stations have large magnets.

Write down what else must be found in a generator, and describe how this works with the magnets to generate electricity.

.....

.....

..... **[2]**

[Total: 7]

2 This question is about the **advantages** and **disadvantages** of using nuclear power stations.

(a) The following statements about nuclear power stations are all **true**.

Put a tick (✓) in the correct box after each statement to show whether it is an advantage or a disadvantage.

statement	advantage	disadvantage
An accident could release radioactive materials.		
Each tonne of fuel gives a lot of energy.		
No carbon dioxide is given out by the fuel when the power station is working.		
Radioactive waste is produced.		
Nuclear fuel will last for many years.		

[2]

(b) People who work in nuclear power stations must take precautions because the fuel emits ionising radiation.

Write down the effect of ionising radiation on the body.

.....

..... **[1]**

[Total: 3]

3 A Scottish island needs a new electricity supply.

Two different sources of energy have been suggested.

1 a small gas-burning power station

2 a large wind farm

Each will provide the same power.

The islanders have to decide which is better. They have to think about

- cost
- the environment
- the need for a steady energy supply.

Which source would you advise the islanders to choose?

Justify your advice.

The quality of written communication will be assessed in your answer.

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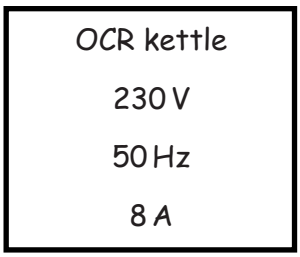
..... **[6]**

[Total: 6]

4 The diagram shows information written on the bottom of an electric kettle.



(a) What is the power of this kettle when it is being used?

Put a (ring) around the number closest to the power, measured in **kilowatts**.

1.5 **2.0** **2.5** **1500** **2000** **2500**

[1]

(b) A different kettle has a power of 1.2 kW.

(i) In a whole week, this kettle is used for a total of 45 minutes.

Calculate the amount of energy, in **kilowatt hours**, transferred to heat in this time.

Show your working.

energy = ... kilowatt hours **[1]**

(ii) It takes 1 minute to boil a cup of water for tea with this 1.2 kW kettle.

Calculate how much energy, in **joules**, is provided.

Show your working.

energy = ... joules **[2]**

[Total: 4]

5 Some organisms can be used to investigate changes in the environment.

These organisms are called **living indicators**.

Mayfly nymphs are an example of a living indicator.

The table shows the average number of mayfly nymphs found in three different rivers, **A**, **B** and **C**, over a period of five years.

	average number of mayfly nymphs		
year	river **A**	river **B**	river **C**
2007	0	94	135
2008	0	91	57
2009	0	92	12
2010	0	93	0
2011	0	91	0

Over the five years, there has been a significant environmental change in one of the rivers.

(a) Which river is this? Use the data to support your answer.

.....

.....

..... **[2]**

(b) Suggest what the environmental change might be.

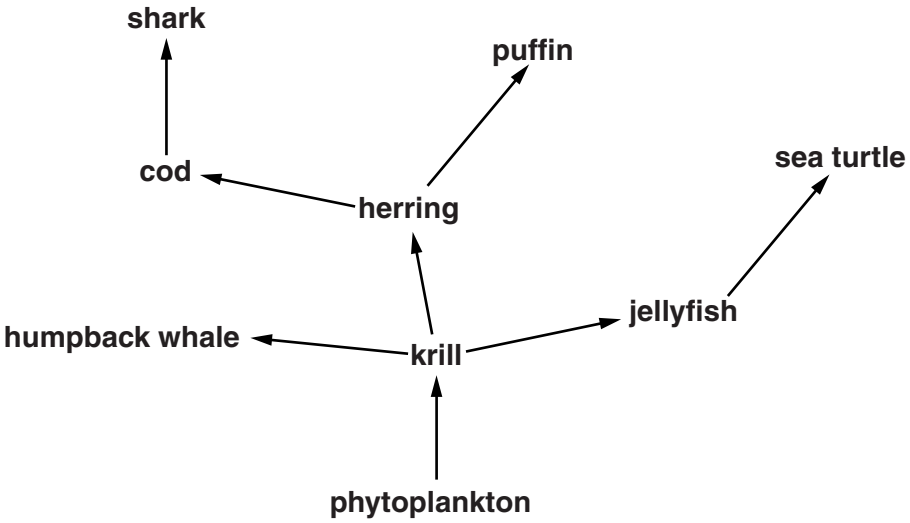
.....

..... **[1]**

[Total: 3]

6 **(a)** Sarah is learning about food webs.

She finds this food web in her science text book.



(i) Write down the name of the energy source for most food webs.

answer ..... **[1]**

(ii) Write down the name of an organism **from this food web** that competes with jellyfish for food.

answer ..... **[1]**

(iii) Seals are added to the food web. Seals eat herring.

Suggest what might happen to the number of cod.

Explain your answer.

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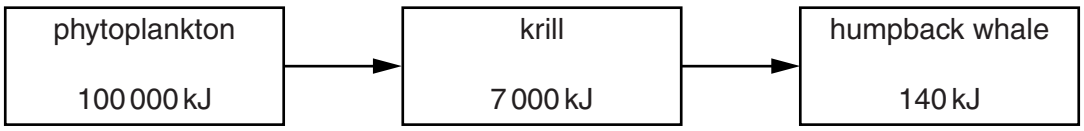
..... **[2]**

(b) Look at the food chain, which is part of the food web.

The figures show the energy transferred through each stage of the food chain.



(i) Sarah calculates that the percentage efficiency of energy transfer between the phytoplankton and the krill is 7%.

Calculate the percentage efficiency of energy transfer between the **krill** and the **humpback whale**.

Show your working.

efficiency = ... % **[2]**

(ii) At each stage of the food chain, energy passes out of the food chain.

Write down two ways in which energy passes out of the food chain.

1 .....

2 .....

[2]

[Total: 8]

7 **(a)** In 1831, Charles Darwin sailed around the world on the ship HMS Beagle.

During his trip, Darwin collected data about various plants and animals. He later suggested explanations for the data.

Read the following statements.

Which statements are **data** and which are **explanations**?

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

	data	**explanation**
All living things change over time by natural selection.	☐	☐
The same fossils can be found in different locations on Earth.	☐	☐
Both plants and animals show variation within a species.	☐	☐
Different birds have different types of beak.	☐	☐
Dinosaurs became extinct many years ago.	☐	☐
Environmental changes can cause species to become extinct.	☐	☐

[3]

(b) In 1859, Charles Darwin proposed his theory of evolution by natural selection.

Describe how Darwin thought the process of natural selection occurred.

The quality of written communication will be assessed in your answer.

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..... **[6]**

[Total: 9]

8 Read this newspaper article.

NEW TARGETS FOR SALT IN FOODS

The Government has set new targets for salt in foods. Scientists have discussed the targets with consumer groups and food companies.

Some examples of these targets are

food	g salt in 100 g food
bacon	2.88
bread	0.68
cereals	1.00

Food labelling will show how much salt is in the food

- **high** salt = more than 1.5 g of salt in 100 g of food
- **low** salt = less than 0.3 g of salt in 100 g of food.

The Guideline Daily Amount (GDA) of salt is 6 g. This is the maximum amount of salt you should eat in one day.

(a) Use the article to answer these questions.

(i) Which food or foods will be labelled '**high** salt'?

Put a (ring) around each correct answer.

bacon **bread** **cereals** **all of them** **none of them**

[1]

(ii) Which food or foods will be labelled '**low** salt'?

Put a (ring) around each correct answer.

bacon **bread** **cereals** **all of them** **none of them**

[1]

(b) For his breakfast Tom eats 100 g cereals, 50 g bread and 50 g bacon.

Work out how much salt is in his breakfast.

Show your working.

answer = ... g salt

Is this more than the Guideline Daily Amount?

.....

[2]

(c) (i) The Government tries to make sure food is as safe as possible for the public.

How is this done?

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.....

.....

..... **[2]**

(ii) Use ideas about **risk** and **benefit** to explain why the Government does not ban salt in processed foods.

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..... **[2]**

[Total: 8]

9 Coal, limestone and salt are resources found in the Earth's crust in Britain.

They were formed millions of years ago in different ways.

(a) There are large deposits of rock salt in the north west of England.

Explain how rock salt is formed.

.....

.....

..... **[2]**

(b) Tom is a geologist.

He uses features in rocks to work out how and where they were formed.

Look at the photos of two sedimentary rocks.

rock **A**

rock **B**

Explain what the photos tell you about the origin of the rocks.

The quality of written communication will be assessed in your answer.

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..... **[6]**

[Total: 8]

10 (a) Alkalis are used in many industrial reactions.

Some reactions are listed below.

Which reactions **use** alkalis?

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

changing fats to soap	☐
electrolysis of sodium chloride	☐
mining salt	☐
heating limestone	☐
making glass	☐

[2]

(b) A tanker carrying acid overturns on a major road.

Acid spills onto the road.

An alkali is sprayed onto the acid.

This makes the road safe.

Explain why an alkali is sprayed onto the acid.

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..... **[2]**

[Total: 4]

END OF QUESTION PAPER

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