

Thursday 24 January 2013 – Morning**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

Candidate forename		Candidate surname	
Centre number		Candidate number	

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 (✎).
- The number of marks is given in brackets [] at the end of each question or part question.
- A list of useful relationships is printed on page 2.
- 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**

$$\text{distance} = \text{wave speed} \times \text{time}$$

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

Sustainable energy

$$\text{energy transferred} = \text{power} \times \text{time}$$

$$\text{power} = \text{voltage} \times \text{current}$$

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

Explaining motion

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

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

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$\text{change of momentum} = \text{resultant force} \times \text{time for which it acts}$$

$$\text{work done by a force} = \text{force} \times \text{distance moved in the direction of the force}$$

$$\text{amount of energy transferred} = \text{work done}$$

$$\text{change in gravitational potential energy} = \text{weight} \times \text{vertical height difference}$$

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

Electric circuits

$$\text{power} = \text{voltage} \times \text{current}$$

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

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

Radioactive materials

$$\text{energy} = \text{mass} \times [\text{speed of light in a vacuum}]^2$$

3

Answer **all** the questions.

1 This question is about different types of power station.

(a) (i) Which type of power station produces radioactive waste?

Put a ring around the correct answer.

fossil fuel **nuclear** **solar** **wind farm**

[1]

(ii) Explain why radioactive waste can be dangerous for living things.

.....

.....

..... [2]

(b) Different power stations use different components.

One possible combination of components is:



In the table below are three types of power station.

Each one uses some or all of these components.

Put ticks (✓) in the boxes to show **each** component used by each type of power station.

One component has been done for you.

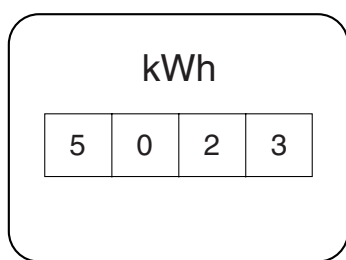
Type of power station	Reactor	Boiler	Turbine	Generator	Transformer
coal-burning					✓
hydroelectric					✓
nuclear					✓

[3]

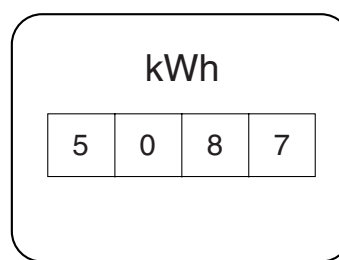
[Total: 6]

4

- 2 The diagrams below show an electricity meter on Monday and Friday.



Monday



Friday

- (a) Use the diagrams to find the number of kilowatt hours of electricity used between Monday and Friday.

number of kilowatt hours used = kWh [1]

- (b) The price of a kilowatt hour is 10p. Calculate the cost of the electrical energy used.

cost = [1]

- (c) Many houses have two electricity meters, one for daytime and one for night-time.

A kilowatt hour is cheaper on the night-time meter.

What are the reasons that electricity companies sell electricity cheaper at night?

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

To encourage people to use electricity at night instead of during the day.

☐

People mostly sleep at night.

☐

Most power stations continue to produce electricity at night.

☐

People go out to work in the day.

☐

To encourage people to use more electricity in the daytime.

☐

[2]

5

- (d) Ian has decided to use one electrical appliance at night-time when electricity is cheaper. He has a time switch to switch it on when he is sleeping.

Here are some appliances that Ian uses and the time each takes for one use.

He wants to decide which one to use at night-time.

Appliance	Power (watts)	Time taken for one use
washing machine	1900	2 hours
tumble dryer	2300	1 hour
heater	1000	1 hour

- (i) Choose which **one** of the appliances would be the best one to use in the night-time.

Use the data in the table to **explain** your choice.

appliance

explanation

.....

[2]

- (ii) Here is some information about a kettle.

Appliance	Power (watts)	Time taken for one use
kettle	2000	5 minutes

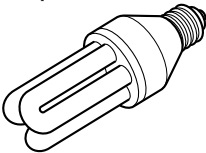
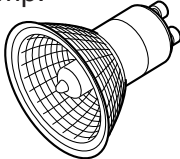
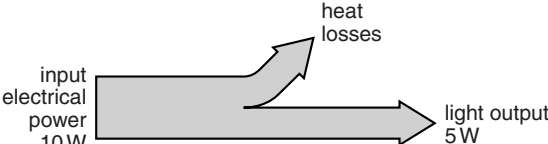
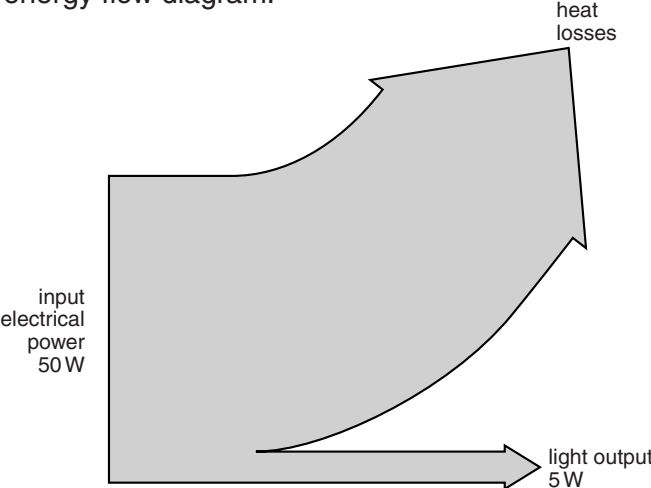
Give **two** reasons why the kettle would not be a good choice of an appliance to use at night-time.

.....

.....

..... [2]

[Total: 8]

low-energy lamp: 	quartz-halogen lamp: 
energy flow diagram: 	energy flow diagram: 
cost: £2.50 each	cost: £1.50 each
lifetime: 10 000 hours	lifetime: 2500 hours



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

..... [6

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7

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Question 4 begins on page 8

PLEASE DO NOT WRITE ON THIS PAGE

4 Read the following article.

The Decline of Natural Woodlands

Natural woodland supports more species than any other UK habitat. However, over the last century more than 50% of natural woodland has disappeared. Much has been replaced with conifer trees to supply us with timber.

As a result, the biodiversity of our woodlands has decreased. Conifers allow very little light to reach the ground and their leaves make the soil acidic. This means that fewer plants can grow under the trees.

Some organisations, such as the Woodland Trust, are very keen to conserve the natural woodlands of the UK. They encourage the planting of trees such as oak and beech.

(a) Here are some sentences about biodiversity.

Put a **(ring)** around the correct word to complete each sentence.

Biodiversity measures the **sameness / variety** of life.

This includes the **number / age** of different species and the

genetic **variation / testing** within species.

It also includes the range of **similar / different** types of organisms.

[2]**(b)** Replacing natural woodland with conifer trees decreases biodiversity.

Which two of the following statements, when taken together, give an explanation for this?

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

Conifer trees let more light through to the ground.

☐

The acidic soil helps plants on the ground grow more quickly.

☐

Conifer trees produce a dense shade.

☐

Ground plants can not photosynthesise as well.

☐

The conifer trees are cut down to provide us with timber.

☐

Oak and beech trees make the soil acidic.

☐
[1]

- (c) (i) The Woodland Trust is working to promote sustainability.

Complete the sentence to explain what is meant by sustainability.

Sustainability is meeting the needs of the people today without

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

- (ii) Use only information in the article to write down **two** ways in which the Woodland Trust is working to promote sustainability.

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

- (d) Look at the data.

	Forest area in thousand hectares	Total land area in thousand hectares	Forest as % of land area
UK	2 845	24 088	
Europe	145 589	385 135	37.8
World	3 952 025	13 052 852	30.3

- (i) Calculate the total amount of forest in the UK as a percentage of the total UK land area.

Put a ring around the correct answer.

846.7% **11.8%** **8.5%** **50.0%**

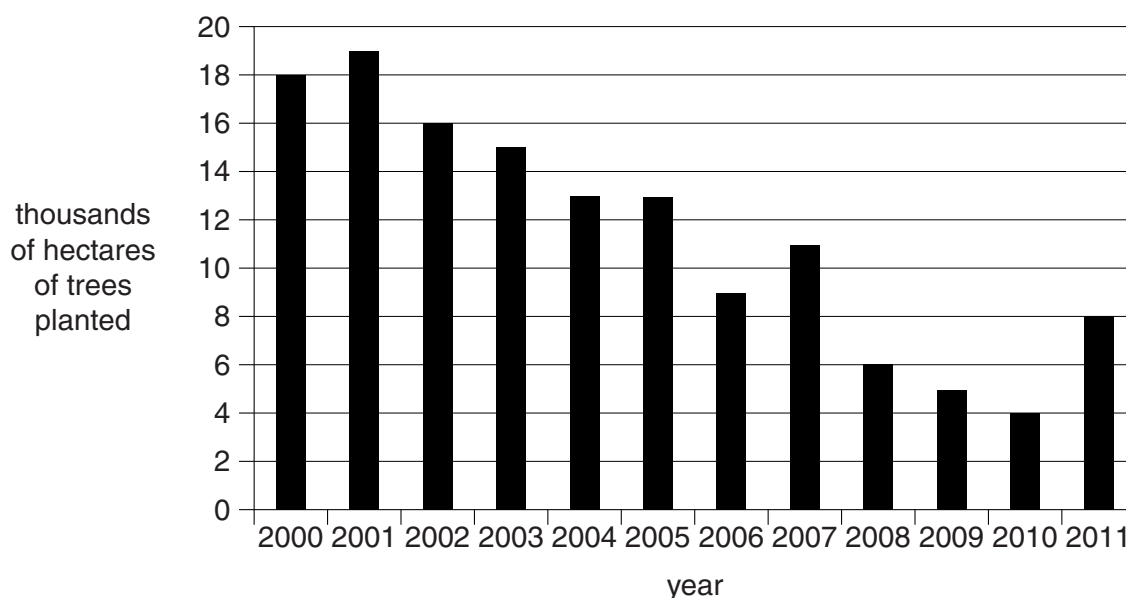
[1]

- (ii) Use the data to suggest why the Woodland Trust is encouraging tree planting.

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

10

- (e) The bar chart shows the amount of tree planting that has taken place in the UK over the last 12 years.



Bob and Stu are monitoring the effect of a campaign to promote the planting of trees.

The campaign started in 2010.

Bob believes the bar chart confirms that the campaign is working.

Stu does not think the bar chart provides enough evidence to be certain that the campaign is working.

Look at the table.

Put one tick (✓) in each row to show whether the statement supports Bob, Stu or neither of them.

	Supports Bob	Supports Stu	Supports neither of them
There was the same amount of tree planting in 2004 and 2005.			
There has been a steep increase in tree planting since 2010.			
The most tree planting took place in 2001.			
There has been an increase in tree planting since 2010, but this also happened in 2007 and was then followed by a decrease.			

[2]

[Total: 10]

- 5 Richard Owen was a geologist who lived at the same time as Charles Darwin.

Like Darwin, he was interested in the diversity of life.

Both scientists tried to explain how the large diversity of life had occurred.

Darwin used fossils and the structure of living animals and plants as evidence for his theory of evolution.

Owen also studied fossils, including some brought back by Darwin, yet refused to accept Darwin's theories.

- (a) Suggest why, despite having the same fossil evidence, Owen's and Darwin's explanations for the diversity of life were different.

.....

.....

..... [2]

- (b) Archaeopteryx was a bird that had some features of a reptile.

Archaeopteryx is now extinct, but fossil evidence of its existence has been found.



Darwin believed that living things gradually changed to become new species.

Suggest how **Archaeopteryx** fossil evidence supports Darwin's theory.

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.....

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..... [2]

[Total: 4]

The diagram illustrates the nitrogen cycle with three rectangular boxes arranged vertically. The top box is labeled "nitrogen compounds in animals". The middle box is labeled "nitrogen compounds in plants". The bottom box is labeled "nitrogen compounds in the soil". An upward arrow labeled "A" points from the soil box to the plants box. Another upward arrow labeled "B" points from the plants box to the animals box. A curved arrow labeled "C" points from the animals box back down to the soil box. A second curved arrow labeled "D" also points from the animals box back down to the soil box, representing a different pathway for nitrogen return.



[6]

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Question 7 begins on page 14

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7 Chlorine has been used to treat drinking water for more than 100 years.

(a) Why is chlorine added to water?

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

It makes water taste better.

☐

It is a bleach.

☐

It kills bacteria.

☐

It makes the water green.

☐

[1]

(b) Some students talk about the benefit and risk of treating drinking water with chlorine.

Martha
When water is treated with chlorine there is a rapid decrease in typhoid cases.

Julian
There are minor problems with treating water with chlorine, but it stops so much disease that it must continue.

Kate
Chlorine can react with other substances in the water to make harmful chemicals.

Hannah
I can smell chlorine when I turn on the tap. I don't like that at all.

Lee
People have been drinking water treated with chlorine for years. There is no risk at all.

(i) Who thinks the benefit outweighs the risk? [1]

(ii) Who is giving an explanation of the risk? [1]

15

(iii) Who is making an untrue statement? Explain why you think it is untrue.

.....

.....

.....

..... [2]

[Total: 5]

Question 8 begins on page 16

16

- 8 We get salt from underground by mining with machines.

We can also get salt by evaporating water from salt solution.

- (a) (i) Draw a straight line from each **method** to the **purity of salt made** and from the **purity of salt made** to its **use**.

method	purity of salt made	use
mining with machines	99% salt	put in food
evaporating water from salt solution	80% salt 20% grit	put on roads in winter

[1]

- (ii) Some people say that salt mining damages the environment.

Describe **two** ways this may happen.

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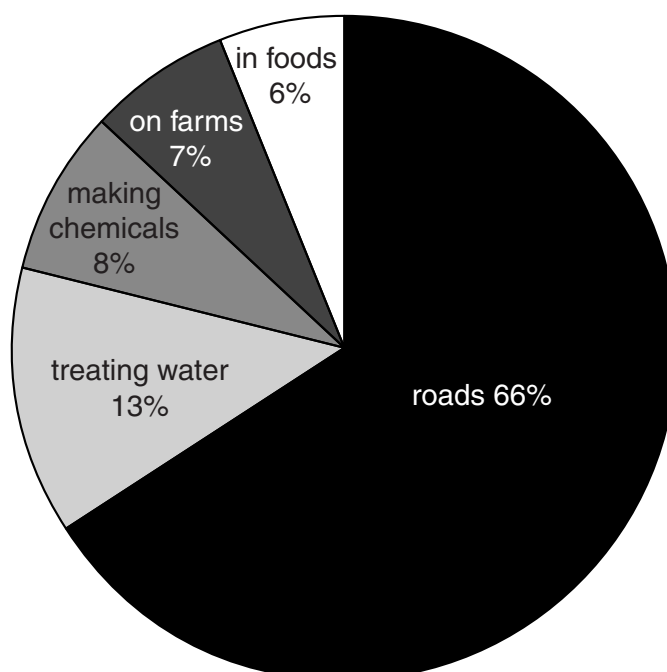
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..... [2]

- (b) 6000 000 tonnes of salt are extracted in the UK each year.

The chart shows uses of this salt.



17

(i) Use the chart to find out if the statements below are **true** or **false**.

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

	true	false
More salt is used on farms than in food.	☐	☐
Less than half of the salt is used on the roads.	☐	☐
480 000 tonnes of salt are used to make chemicals.	☐	☐
10 times more salt is used on roads than in food.	☐	☐

[2]

(ii) Why is salt added to food?

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

Eating salt may be bad for your health.	☐
Salt will neutralise acids in food.	☐
Ice melts when salt is added to it.	☐
Salt is a preservative.	☐

[1]

(c) Chemicals are made from salt by electrolysis of salt solution.

Sodium hydroxide and hydrogen are two of the products.

Give **one** use for sodium hydroxide and **one** use for hydrogen.

.....

.....

.....

..... [2]

[Total: 8]

9 This is a question about PVC.

(a) PVC is a polymer made from atoms of carbon, hydrogen and one other element.

What is the other element?

Put a ring around the correct element.

chlorine

nitrogen

oxygen

sulfur

[1]

(b) John is building a new house.

He can choose window frames made of wood or PVC.

He wants to compare wood and PVC window frames by carrying out a Life Cycle Assessment (LCA).

He finds some energy data on the internet.

Energy use is only one part of the Life Cycle Assessment.

	Energy used in MJ	
	PVC	Wood
Obtaining the material	12.2	6.6
Making the window frames	3.0	3.9
Transport	3.6	5.3
Maintenance	0.1	1.1
Disposal	3.4	3.4

19

What can be concluded from this energy data and what further data does John need for a complete Life Cycle Assessment?



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

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..... [6]

[Total: 7]

END OF QUESTION PAPER

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