

THIS IS A NEW SPECIFICATION

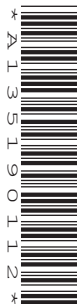
**F****Wednesday 18 January 2012 – Morning****GCSE TWENTY FIRST CENTURY SCIENCE
SCIENCE A****A142/01** Modules B2 C2 P2 (Foundation Tier)

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

TWENTY FIRST CENTURY SCIENCE DATA SHEET**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

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4

Answer **all** the questions.

1 This question is about materials that we use.

(a) Some materials are made from living things and others are synthetic.

Put rings around the **two** materials that are made from living things.**gold paper pottery silk steel**

[1]

(b) Crude oil is a raw material that is used to make other materials.

From where is crude oil obtained?

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

Crude oil is obtained...

... from synthetic materials

☐

... from nanotechnology

☐

... from the Earth's crust

☐

... from fractional distillation

☐

[1]

(c) Some materials that were used in the past have been replaced by new materials.

Polymers are an example of new materials.

Electric wires used to be insulated with cotton.

The table shows some properties of cotton and three polymers.

property	cotton	polypropene	PVC	melamine
flexibility	high	medium	high	low
electrical insulation	high	high	high	high
how long it lasts in years	10	20	20	20

(i) Which of the three polymers is the best material to replace the cotton insulation?

answer [1]

5

(ii) Explain your answer.

.....

.....

.....

..... [2]

(iii) Complete this table with your own example of an old material that has been replaced.

old material	new material	use

[1]

[Total: 6]

- 2 Some students are investigating how much different types of rubber will stretch.

This is how three students plan to do their investigation.



Kylie

I will hang a mass from each piece of rubber and measure the stretch. I will take turns with my partner to make the test fair.



Jake

I will make sure the rubber pieces are the same length and width. I will hang a 1 kg mass on each piece. I will wait until it has stretched and measure the length. I will repeat the test five times and work out the mean for each piece of rubber.



Lewis

I will cut out pieces of each type of rubber so that they are all the same size. I will hang masses on each piece until it stretches and then measure its length.

- (a) Whose plan is the best? Explain why you make this choice.



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

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..... [6]

7

(b) Here are some results for one type of rubber.

sample	1	2	3	4	5
stretch in cm	2.1	0.7	2.4	2.2	2.1

A student calculates the mean as the best estimate of the true value of their results.

The student does not use the value for **sample 2**.

(i) What is the mean of the other four results?

Put a ring around the correct answer.

1.9 2.2 2.3 2.4 8.8

[1]

(ii) Explain why the student does **not** use the value for **sample 2** in calculating the mean.

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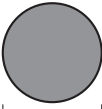
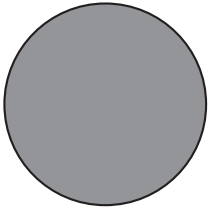
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[Total: 9]

8

3 (a) Which of the diagrams shows a nanoparticle?

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

 50 nanometres	
 250 nanometres	
 500 nanometres	

not drawn to scale

[1]

(b) Here are some sentences about nanoparticles.

Each sentence is either **true** or **false**.

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

	true	false
Nanoparticles have the same properties as larger particles.	☐	☐
Nanoparticles can occur naturally.	☐	☐
The use of nanoparticles is completely safe.	☐	☐
Nanoparticles can be made by scientists.	☐	☐

[2]

9

(c) Nanoparticles change the properties of materials.

Suggest **one** use of nanoparticles.

Describe how the properties of the material change when nanoparticles are added.

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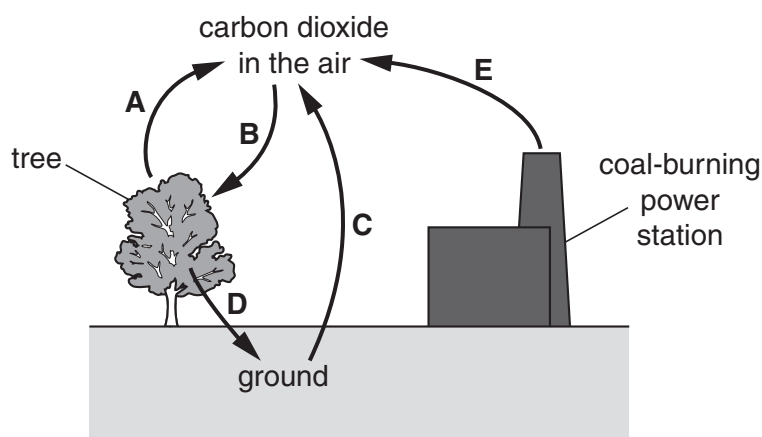
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..... [2]

[Total: 5]

4 The diagram shows part of the carbon cycle.



(a) Which arrow, **A**, **B**, **C**, **D** or **E**, is caused by the **burning of fossil fuels**?

answer [1]

(b) A student says that arrow **A** is caused by photosynthesis.

Is he correct?

Explain your answer.

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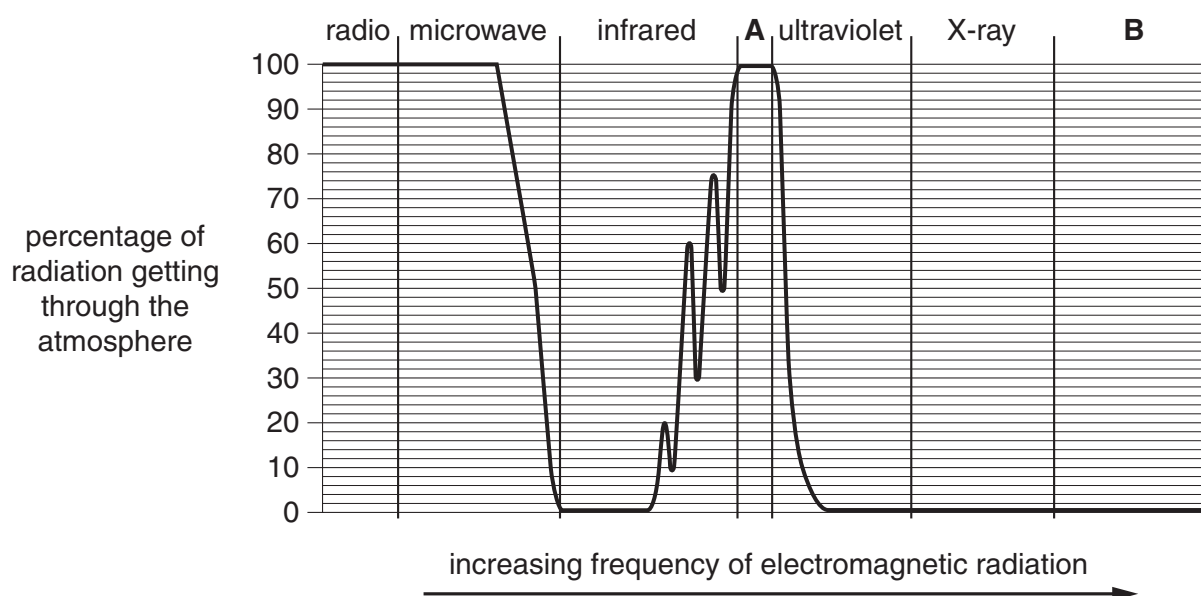
..... [1]

[Total: 2]

10

- 5 The graph shows the percentage of different regions of the electromagnetic spectrum which can get through the Earth's atmosphere.

Two regions of the electromagnetic spectrum are not named.



- (a) What are the names of regions **A** and **B** of the electromagnetic spectrum?

region **A**

region **B**[2]

- (b) (i) How does the graph show that higher frequency radiations are completely absorbed by the atmosphere?

.....
 [2]

- (ii) Use the graph to explain why radio and microwaves are used to send signals to satellites.

.....

 [2]

11

- (c) Look at the ultraviolet region of the graph.

Describe how the percentage of ultraviolet radiation reaching the Earth's surface depends on the frequency of the radiation.

.....

.....

..... [2]

[Total: 8]

12

- 6 Many British people sunbathe in the summer months, even though they know that it can be harmful.

(a) These statements are about the risk from sunbathing, but they are not all true.

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

	true	false
If you don't feel hot while sunbathing you will not have any damage to your skin.	☐	☐
Ozone high in the atmosphere absorbs most of the ultraviolet from the Sun.	☐	☐
Ultraviolet radiation can damage the cells of the skin.	☐	☐
Using a cream which absorbs ultraviolet will protect the skin.	☐	☐
The British summer is not hot enough for sunbathing to be a risk.	☐	☐

[2]

(b) Many people still choose to sunbathe, even though they know about the risks.

Which of the following reasons can explain this?

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

They prefer to have pale skin.	☐
They think that a sun-tan is attractive.	☐
The weather is often cloudy in the summer.	☐
They are afraid that they might get skin cancer.	☐
They don't think skin cancer will happen to them.	☐

[2]

[Total: 4]

13

- 7 Over the last few years, television signals have been changed from analogue to digital.

Explain the differences between **analogue** and **digital** signals and suggest advantages of using digital signals for television.

You may draw diagrams to help your answer.



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

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..... [6]

[Total: 6]

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15

8 Microorganisms can enter the body and cause illness.

Vaccinations can provide protection against some microorganisms.

(a) Put a tick (✓) in the box next to the correct word to complete each sentence.

Vaccines usually contain a	harmful		form of a disease-causing microorganism.
	resistant		
	safe		

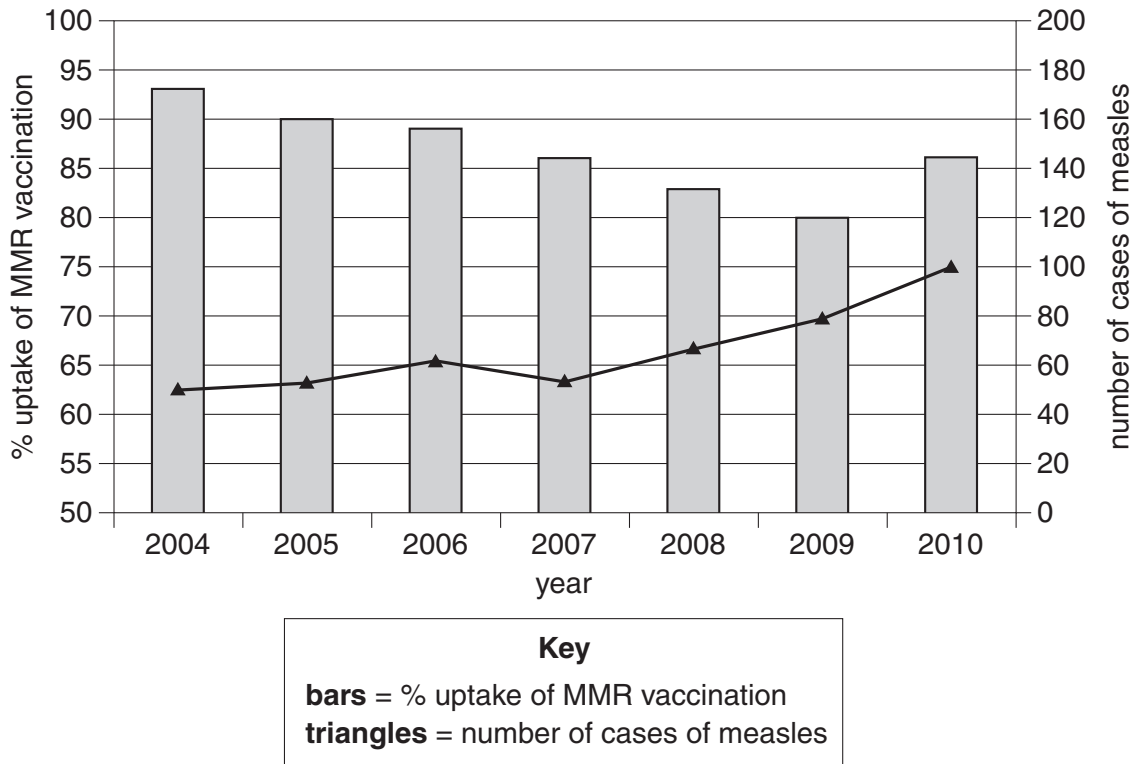
Vaccination establishes	dead		cells in the body.
	memory		
	stem		

On reinfection	antibiotics		are produced more quickly.
	antibodies		
	antigens		

[2]

- (b) The MMR vaccination provides protection against measles. Measles is a disease caused by a microorganism.

The graph shows the percentage of children receiving the MMR vaccination and the number of cases of measles in a country over a period of 7 years.



- (i) Work out the difference in the number of cases of measles between 2004 and 2010.

answer = [1]

- (ii) The percentage increase in the number of cases of measles between 2004 and 2010 can be calculated using the formula

$$\frac{\text{difference in the number of cases of measles between 2004 and 2010}}{\text{number of cases of measles in 2004}} \times 100$$

Calculate the percentage increase in the number of cases of measles between 2004 and 2010.

Put a ring around the correct answer.

8% 25% 43% 75% 100%

[1]

- (c) Describe the pattern of uptake of the MMR vaccination between 2004 and 2010.

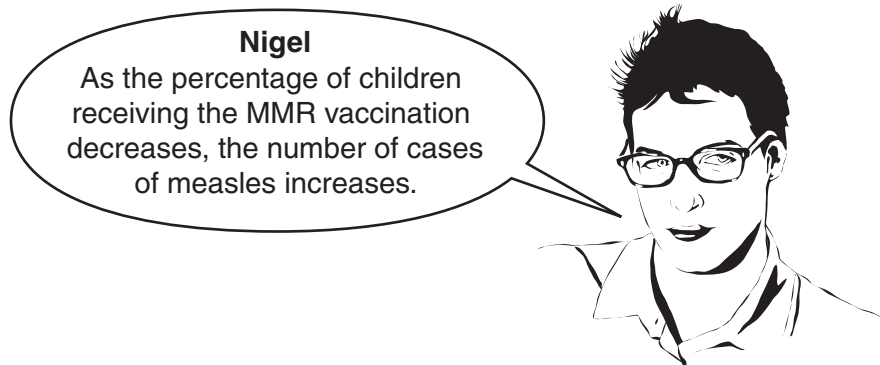
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..... [2]

- (d) Nigel thinks the graph shows a correlation.



Look at the number of children who had the MMR vaccination and the number of cases of measles between 2004 and 2010.

Suggest **and** explain what you think might happen to the number of cases of measles after 2010.

.....

.....

.....

..... [2]

[Total: 8]

9 Read the article about heart disease.

Working overtime can lead to heart disease

Scientists have found that people who work more than 8 hours per day have a much greater risk of developing heart disease than those working less than 8 hours per day.

This could be because they suffer from more stress or because they have less time to exercise.

- (a) The risk of suffering from heart disease could be reduced by working fewer hours.

How else could the risk of suffering from heart disease be reduced at work?

Put ticks (✓) in the boxes next to the **three** best answers.

Take fewer breaks so that you can go home earlier.

☐

Use the stairs instead of the lift.

☐

Snack on fresh fruit instead of crisps.

☐

Drink lots of tea and coffee.

☐

Take more cigarette breaks.

☐

Use the gym at lunchtime.

☐

[2]

- (b) Fatty deposits in the blood vessels that supply the heart muscle can lead to a heart attack.

Describe how these fatty deposits might lead to a heart attack.

.....

.....

..... [2]

19

- (c) (i) The results of this study are published in a scientific journal.

Before publication, the results are sent to other scientists for them to read.

Name this process.

..... [1]

- (ii) Why is this process carried out?

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

Scientists like sharing their results.

☐

The methods and results need to be checked.

☐

So other scientists can publish the work first.

☐

All scientists have to look at the results.

☐

[1]

[Total: 6]

20

- 10 Maintaining a balanced water level in the body is very important.

The amount of water entering Jessica's body is approximately the same every day.

The tables show the water **loss** from Jessica's body on two different days.

DAY 1

	volume of water lost in cm ³ per day
urine	1500
sweat	500
breathing	400
faeces	100

DAY 2

	volume of water lost in cm ³ per day
urine	1000
sweat	800
breathing	600
faeces	100

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