

**Thursday 17 January 2013 – Afternoon**

**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	
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Centre number						Candidate number				
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**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 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

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

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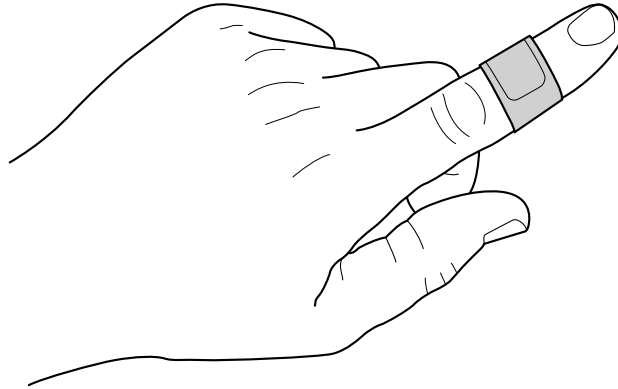
**Question 1 begins on page 4**

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Answer **all** the questions.

1 This is a question about nanoparticles.

Some first aid plasters contain nanoparticles of silver that can kill bacteria.



(a) Here are the sizes of some silver particles.

Two of them are nanoparticles.

Put rings around the **two** nanoparticles.

- 0.1 nm
- 10 nm
- 50 nm
- 500 nm
- 1000 nm

[1]

(b) Suggest why silver nanoparticles have different properties to a lump of silver.

.....

.....

.....

..... [2]

(c) Nanoparticles are used in a number of products.

There are worries about the use of nanoparticles.

Which two reasons explain this?

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

Nanoparticles are cheap to make.

Nanoparticles may be harmful.

Nanoparticles may kill bacteria.

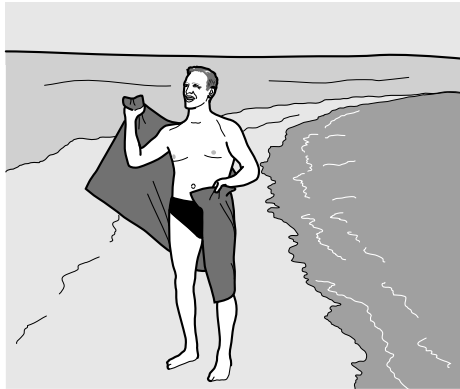
Nanoparticles are being used without being fully tested.

Nanoparticles are not natural.

[2]

[Total: 5]

2 Materials used for towels must absorb water.



(a) Some students are testing the absorbency of different materials.

They put pieces of different materials into water and then hang them out.

Once the pieces stop dripping they measure the mass of water absorbed.

(i) The students know they must control factors that may change the outcome.

This means the test will be fair.

Which factor should be controlled?

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

How often they repeat the test.

The number of students who do the test.

Writing the results in a table.

The size of the pieces of material.

[1]

(ii) The students test several samples of each material.

Why do they use more than one sample?

.....

.....

.....

.....

[2]

(b) Here are the results for five samples of one of the materials.

Sample number	1	2	3	4	5
Mass of water absorbed by material in g	95	102	94	96	103

(i) What is the range of these results?

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

**1 to 5**

**94 to 103**

**95 to 103**

**98**

[1]

(ii) Suggest **two** reasons why the results are not all the same.

.....

.....

.....

..... [2]

[Total: 6]

3 This is a question about plastics made from crude oil.

(a) Finish the sentences by choosing the correct words from this list.

**atoms**

**atmosphere**

**crust**

**hydrogen**

**oceans**

**oxygen**

**polymers**

Crude oil is found in the Earth's .....

Crude oil is a mixture of hydrocarbons.

Hydrocarbons are made only from atoms of carbon and .....

Small molecules made from crude oil can be joined together to make .....

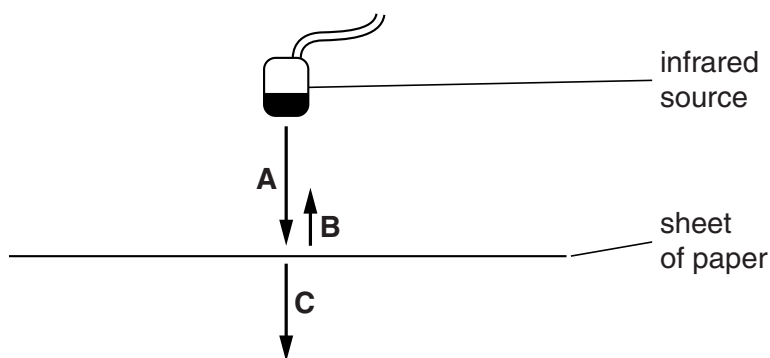
**[3]**





4 This question is about infrared radiation.

(a) The diagram below shows what happens when infrared radiation meets a sheet of paper.



Choose from the words in the list to complete the sentences describing this diagram.

- absorbed      emitted      reflected      transmitted**

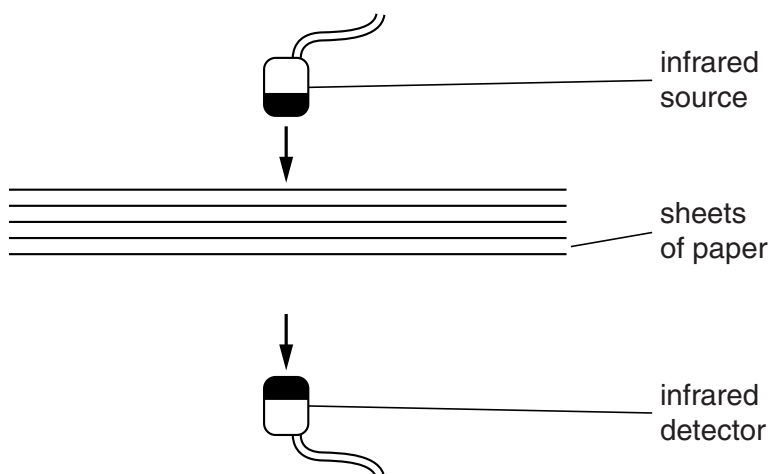
**A** is the infrared radiation which is ..... by the infrared source.

**B** is the infrared radiation which is ..... by the sheet of paper.

**C** is the infrared radiation which is ..... through the sheet of paper.

[3]

(b) Sam sets up an experiment to investigate how infrared radiation penetrates through paper.



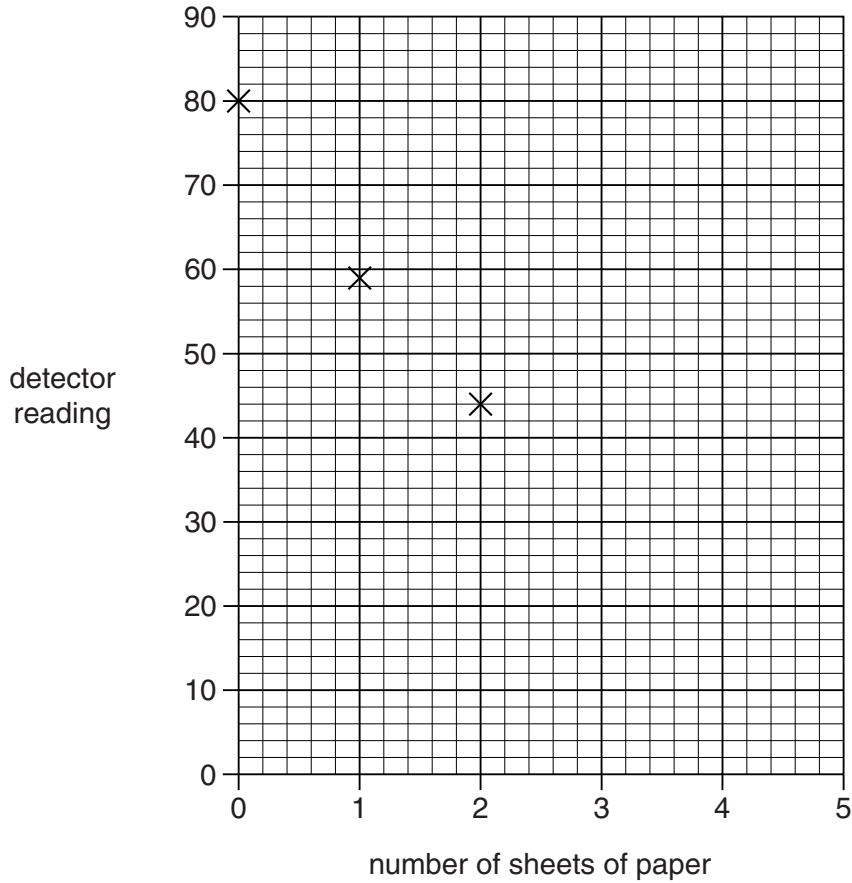
The table below shows the results of Sam's experiment.

Number of sheets of paper	0	1	2	3	4	5
Detector reading	80	59	44	33	24	18

(i) Use the data to complete the graph opposite, drawing a curve of best fit.

Three points have been plotted for you.

[2]



(ii) Sam says that each sheet of paper stops about a quarter of the radiation that falls on it.

Is Sam right?

Use the data in the table or the graph to check Sam's idea.

.....

.....

.....

.....

..... [2]

[Total: 7]

5 This question is about mobile phones.

(a) Many people worry that mobile phones can cause brain cancer.

Read what these students have to say about this.

**Amy**  
I've read that brain cancer has become more common at the same time as more and more people have mobile phones.

**Barry**  
The energy given out by mobile phones is not enough to damage the brain.

**Chris**  
I only use my mobile for sending texts. I don't go around all day with it right next to my ear like some people.

**Donna**  
I don't know how I'd manage without my mobile. It's important to keep in touch with your friends.

(i) Who suggests a benefit from mobile phones?

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

- Amy
- Barry
- Chris
- Donna

[1]

(ii) Who is trying to reduce the risk from mobile phones?

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

- Amy
- Barry
- Chris
- Donna

[1]

(iii) Who is talking about a correlation?

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

- Amy
- Barry
- Chris
- Donna

[1]

(iv) Who explains why mobile phones cannot cause brain cancer?

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

- Amy
- Barry
- Chris
- Donna

[1]

(b) Mobile phones use digital signals to send text messages and images.

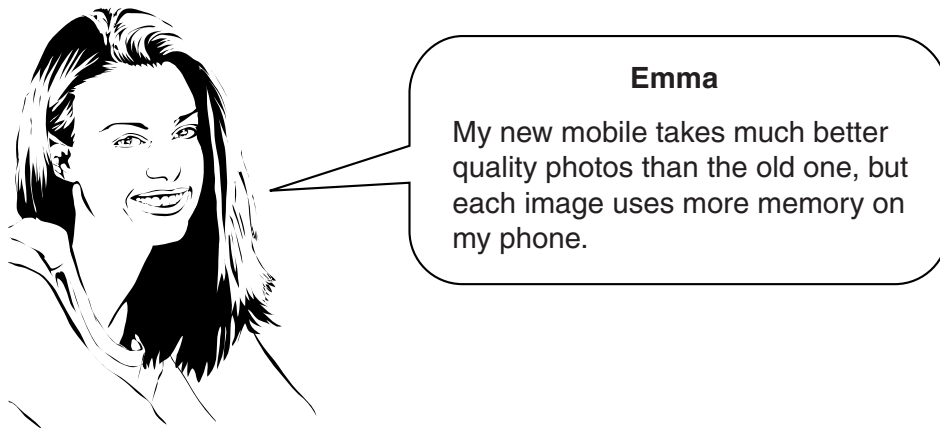
(i) Look at the data below about a typical text message and a typical image.

Type of message	Number of bytes	Time taken to send it (seconds)
text	100	less than 1
image	1 000 000	100

Use the data in the table to explain the difference in the time taken to send each type of message.

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

(ii) Emma has bought a new mobile phone.



Suggest why the new images use more memory.

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

[Total: 7]



7 (a) Look at the statements about antimicrobials.

Put a tick (✓) in one box next to each statement to show whether it is **true** or **false**.

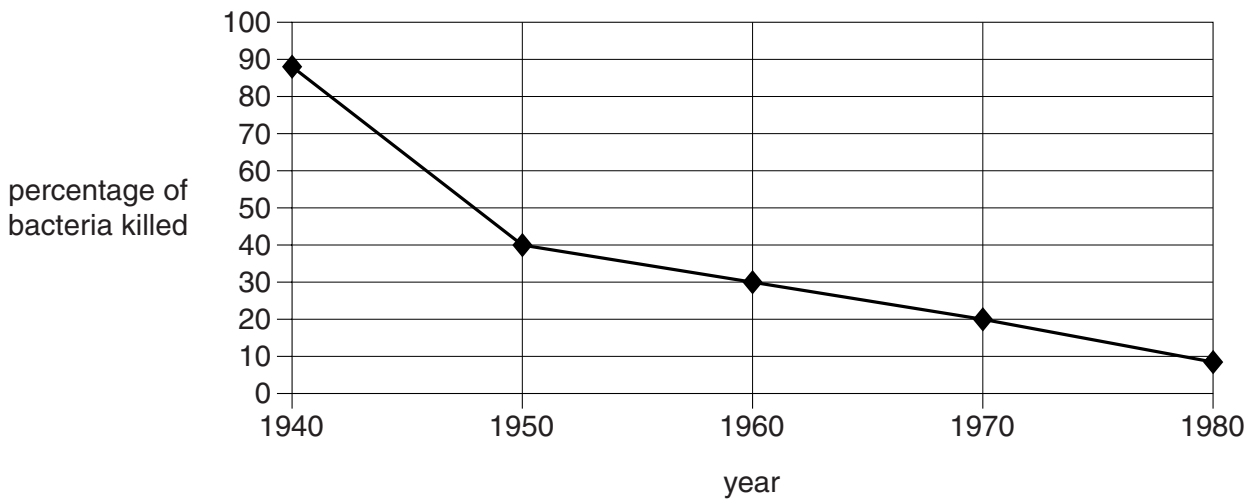
	true	false
Antibiotics are a type of antimicrobial.	<input type="checkbox"/>	<input type="checkbox"/>
Antimicrobials produce memory cells.	<input type="checkbox"/>	<input type="checkbox"/>
Antimicrobials are chemicals.	<input type="checkbox"/>	<input type="checkbox"/>
Antimicrobials are all risk free.	<input type="checkbox"/>	<input type="checkbox"/>

[2]

(b) Penicillin is an example of an antibiotic.

A scientist researches the effect of penicillin on bacteria from 1940 to 1980.

The graph shows the percentage of bacteria killed by penicillin.



(i) Describe the pattern shown by the graph.

.....

.....

.....

..... [2]

(ii) Suggest an explanation for the pattern shown by the graph.

.....

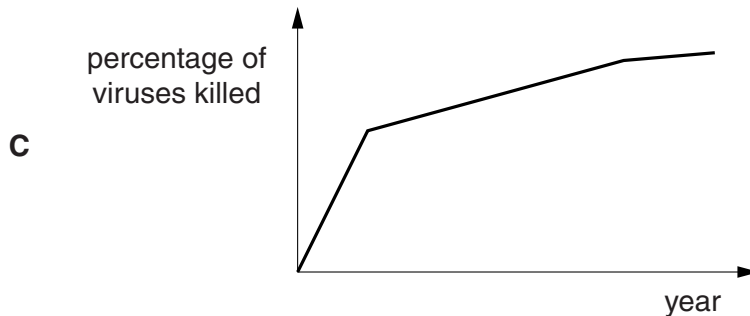
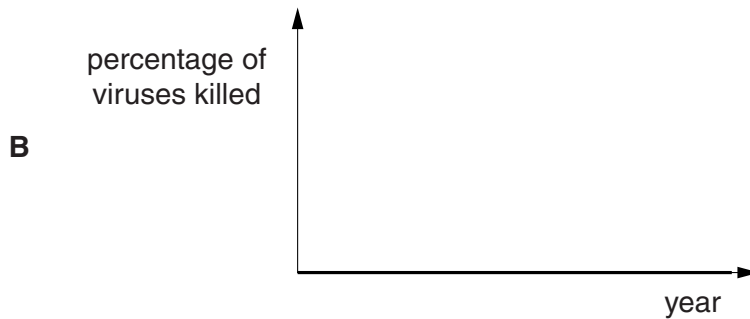
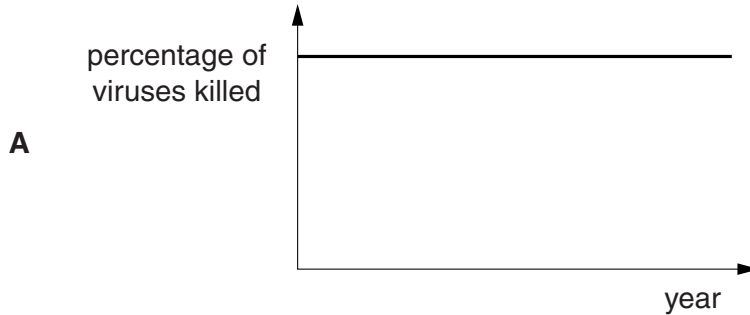
..... [1]



(iii) Both bacteria **and** viruses can cause disease.

The graph showing the percentage of viruses killed by penicillin would differ from the graph for bacteria shown on the previous page.

Look at the graphs **A**, **B** and **C**.



Which graph correctly shows the expected effect of penicillin on a population of viruses?

graph ..... [1]

(iv) Explain your choice of graph.

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

[Total: 7]

- 8 (a) The risk of getting heart disease is affected by different lifestyle factors.

One of these factors is stress.

Complete the sentence to describe the correlation between stress and the risk of suffering from heart disease.

As the amount of stress in your life ..... , the risk of getting heart disease .....

[1]

- (b) The table shows some information about the lifestyles of five different people.

Name	Age	Job	Diet	Hobbies	Smoker
Anne	22	PE teacher	low fat	playing football	yes
Mark	36	postman	medium fat	watching TV	no
Norman	51	builder	high fat	going to the cinema	yes
Olive	43	office worker	high fat	going to the pub	yes
Polly	19	student	low fat	jogging	no



9 New drugs are always tested before they are given to patients.

Many of these tests are carried out on animals and on human cells grown in a laboratory.

(a) Write down **two** reasons why it is important for new drugs to be tested before they are given to patients.

1 .....

2 .....

[2]

(b) In 2006, a group of women took part in trials to test a new drug for treating skin cancer.

All of the women had skin cancer.

None of these women had much chance of surviving another year.

The new drug had many side effects.

There was no guarantee that the new drug would work.

Write down **one** benefit and **one** risk of taking this drug.

benefit .....

.....

risk .....

.....

[2]

(c) Some drug trials use placebos.

Suggest why placebos were **not** used in the trials of this skin cancer treatment.

.....

.....

.....

..... [2]

[Total: 6]

END OF QUESTION PAPER

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