

**Monday 20 May 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

**MODIFIED LANGUAGE**



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

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

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**Question 1 begins on page 4**

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Answer **all** the questions.

**1** This is a question about plastics.

Plastics are made from crude oil.

**(a)** Finish the sentences about crude oil by putting a tick (✓) next to the correct word or words.

Crude oil is <b>found</b> in the	atmosphere.	
	Earth's crust.	
	sea.	

Crude oil is <b>made</b> of	a mixture of hydrocarbons.	
	a mixture of carbon and water.	
	one type of hydrocarbon.	

Crude oil is <b>refined</b> by	distillation.	
	drilling.	
	filtering.	

[2]

- (b) A company makes plates for camping.

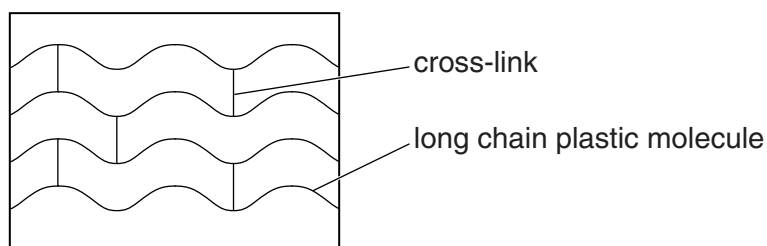
Sixty years ago the plates were made of aluminium.

Now the plates are made of plastic.

- (i) Suggest **one** property that makes **both** metal and plastic suitable materials for these plates.

..... [1]

- (ii) The company buys material for the plates.  
They heat the material with other chemicals.  
This makes a plastic with **cross links**.



How does cross-linking change the properties of a plastic?  
Put ticks (✓) in the boxes next to the **two** correct answers.

The plastic ...

... is easier to stretch.

☐

... has a lower melting point.

☐

... is made transparent.

☐

... is harder.

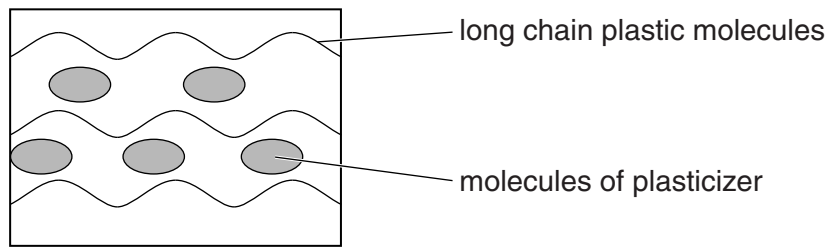
☐

... is less flexible.

☐

[2]

- (c) A different plastic has a plasticizer added to it.



Explain how adding plasticizer to a plastic lowers its melting point.  
You should use ideas about the distance and forces between long chain molecules in your answer.

.....

.....

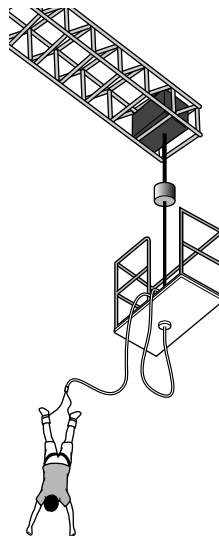
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..... [2]

[Total: 7]

- 2 This is a question about cords made for bungee jumping.

In bungee jumping you jump from a high structure.  
You are connected to the structure by an elastic cord. You fall until the cord stretches and then you rebound.  
After that you bounce up and down.



- (a) Lee needs to choose a cord for bungee jumping.

Suggest **two** properties of a good bungee cord.

1 .....

2 .....

[2]

- It must not break when a mass of 130 kg is hung on it.
- The mass of 5m of cord is 1 kg.
- The mass of the person jumping will extend the cord between 110% and 140%.

The table gives properties of four cords **A**, **B**, **C** and **D**.

	A	B	C	D
Minimum mass to break cord in kg	125	235	250	300
Mass of 10 m cord in kg	2	2	2	3
Mass to extend cord by 50% in kg	65	30	40	100
Mass to extend cord by 100% in kg	120	60	70	190
Mass to extend cord by 150% in kg	cord broke	80	90	280

Lee has a mass of 80 kg.

Which bungee cord should he choose for his jump?

Use the properties in the table to explain why he should use this cord and not the others.



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

..... [6

- (c) Students test the mass needed to break a **different** bungee cord.  
Here are their results for five pieces of this cord.

Piece	1	2	3	4	5
Mass in kg	235	248	231	251	245

- (i) What is the minimum mass needed to break this cord?

answer ..... kg [1]

- (ii) Why is it more useful to show the **minimum** mass to break the cord rather than a range or the mean?

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

- (iii) Why do the students test five pieces of the cord and not just one piece?

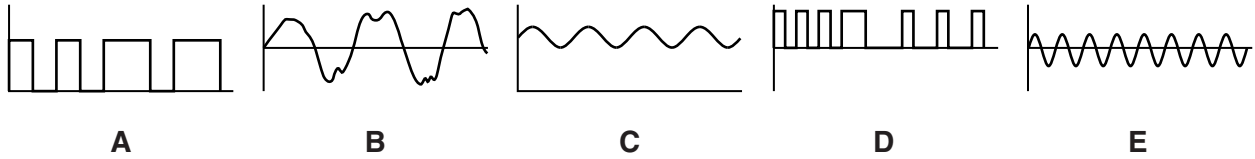
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[Total: 13]



**3** This question is about digital and analogue signals.

**(a)** Each of the five signals below is **either** digital **or** analogue.



Put the letters **A**, **B**, **C**, **D** and **E** in the correct boxes in the table below.

Digital signals	Analogue signals

[2]

**(b)** Digital signals are now used much more than analogue signals.

Describe the advantages of using digital signals.

.....

.....

.....

..... [2]

[Total: 4]

4 In the first months of 2011 the layer of ozone over the North Pole was the thinnest on record.

(a) The ozone layer in the atmosphere protects living organisms.

Put rings around the correct words below to complete the sentences.

The Sun **absorbs** / **emits** / **transmits** ultraviolet radiation.

This can damage living cells if they **absorb** / **emit** / **reflect** the radiation.

This damage to living cells can cause **broken bones** / **cancer** / **radiation**.

[3]

(b) Ultraviolet radiation can damage living cells, but radio waves of the same intensity cannot damage living cells.

Which of the following is the best explanation for this?

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

Radio waves do not damage living cells because ...

... radio photons do not have enough energy.

☐

... radio waves are not part of the electromagnetic spectrum.

☐

... radio waves do not consist of photons.

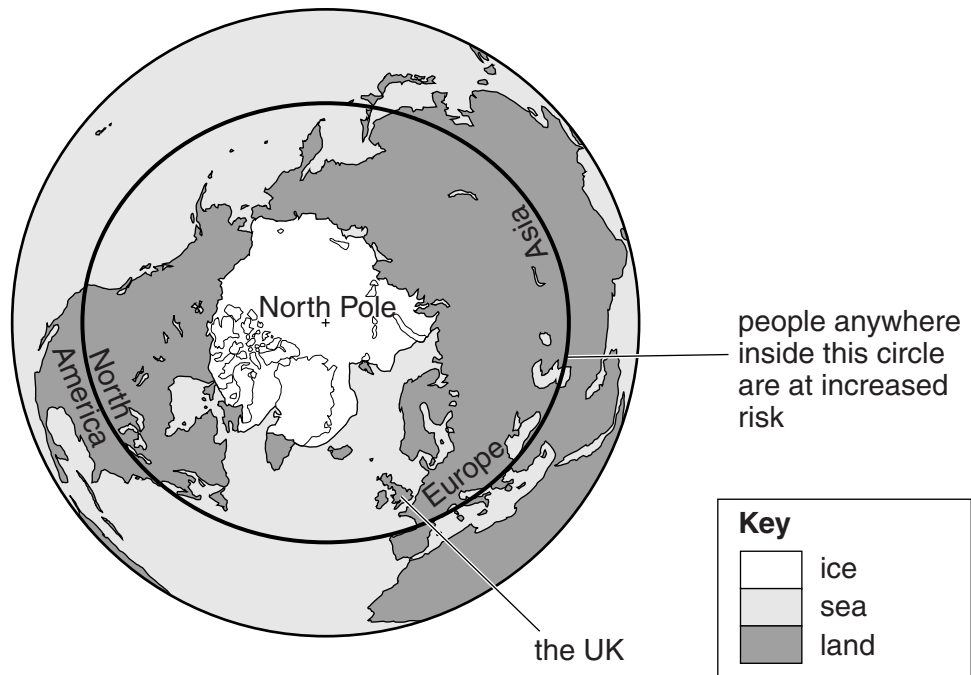
☐

... radio waves have too high a frequency.

☐

[1]

- (c) As the ozone layer over the North Pole becomes thinner, there are increased health risks to people in the area shown on the diagram.



Describe and explain one way in which people living in this area can reduce these risks.

.....

.....

.....

..... [2]

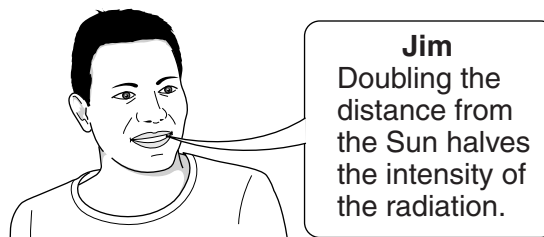
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5 This question is about the effect of the Sun's energy on planets closest to the Sun.

(a) Jim has found some information about the intensity of the Sun's radiation on two planets.

Planet	Mercury	Venus
Distance from Sun in millions of km	50	100
Intensity of radiation in $\text{W/m}^2$	12 000	3000

(i) Jim thinks he sees a pattern in these numbers.



Is Jim correct?  
Justify your answer.

.....

.....

.....

..... [2]

(ii) The distance from the Sun to the Earth is 150 million km.

Here are some possible values for the intensity of the Sun's radiation at the Earth.

**1500  $\text{W/m}^2$**       **3000  $\text{W/m}^2$**       **6000  $\text{W/m}^2$**

Which one of these values could be correct?

Justify your answer.

.....

.....

..... [2]

Gas	Percentage of gas in the atmosphere	
	Earth	Venus
Carbon dioxide	0.04	97
Nitrogen	78	3
Oxygen	21	0



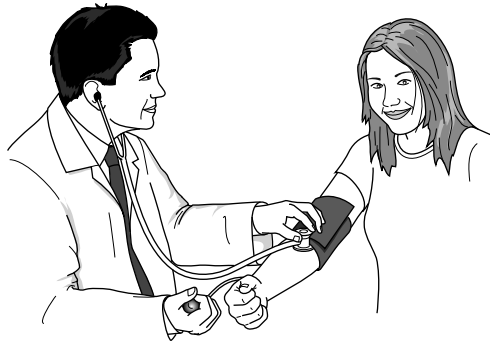
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**Turn over**

- 6 Joanne goes to the doctors for a check-up.

The doctor measures Joanne's blood pressure.



- (a) Blood pressure measurements record the pressure of blood on the walls of which one of the following structures?

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

- |             |                          |
|-------------|--------------------------|
| a capillary | <input type="checkbox"/> |
| a vein      | <input type="checkbox"/> |
| an artery   | <input type="checkbox"/> |
| the heart   | <input type="checkbox"/> |

[1]

- (b) The doctor says that Joanne's blood pressure is 115 over 62.

Complete the sentences to explain why there are two different values.

The higher value is the pressure when the heart .....

The lower value is the pressure when the heart .....

[1]

- (c) People's blood pressure can be placed in different categories.

High blood pressure is called hypertension.

Look at the table.

Higher value of blood pressure in mm Hg	Lower value of blood pressure in mm Hg	Blood pressure category
> 160	> 100	severe hypertension
140 – 160	90 – 99	moderate hypertension
120 – 139	80 – 89	mild hypertension
90 – 119	60 – 79	normal
< 90	< 60	low

- (i) Use the table to make a conclusion about Joanne's blood pressure.

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

- (ii) Joanne's brother, Andrew, is in the moderate hypertension category.

His blood pressure is 159 over 90.

Calculate by how much he will need to reduce the **lower** value of his blood pressure to move down to the normal category.

Show your working.

**lower** value needs to be reduced by .....mmHg [1]

- (iii) Andrew's doctor gives him a drug.

The drug lowers both of the values of his blood pressure by 10mmHg.

How effective has this drug been at reducing Andrew's hypertension?

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

- (iv) Write down **one** way in which Andrew's health could benefit by reducing his blood pressure.

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

- (d) Andrew finds a scientific article on the internet.

... scientists suggest that the higher the number of fizzy drinks you drink per day, the higher the risk of having high blood pressure ...

- (i) The article describes a correlation.

Draw a line on the axes to represent the correlation.



[1]

- (ii) Andrew does not drink any fizzy drinks and he has high blood pressure.

Does this prove that the claim in the article is not correct?

Explain your answer.

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

[Total: 10]



- 7 A vaccine has been developed against cancer of the cervix.

The vaccine protects against the human papilloma virus (HPV), the most common cause of this cancer.

The vaccine was given to teenage girls for the first time in September 2008.

- (a) Describe how the vaccine will work to protect the girls against the HPV virus.

In your answer include:

- what the vaccine contains
- how the body responds to the vaccine
- what happens if the HPV virus then enters the body.



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

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..... [6]

(b) Three mothers of teenage girls are discussing the vaccination.



**Liz**

I don't believe vaccinations are needed. I think it's wrong to vaccinate children. So there's no way I will let my daughter have it.

**Tracy**

My doctor says it's really important to make the right decision for my daughter. There are obviously no risks so I want her to have the vaccination.



**Anne**

It's important to protect my daughter against this cancer. The risks from side effects are likely to be minor. I'm happy for her to have the vaccination.



Suggest which person is most likely to be basing her decision on scientific facts.

Explain your answer.

.....

.....

.....

..... [2]

- (c) In September 2009, a teenage girl died shortly after being given the cervical cancer vaccination.

Despite this, the vaccination programme has continued.

Put ticks (✓) in the boxes next to the **two best** reasons why the vaccination programme has continued.

Vaccination programmes should never be stopped.

☐

This individual case does not prove that the vaccine is dangerous.

☐

Some parents want the vaccination programme to stop.

☐

It is too expensive to stop the vaccination programme.

☐

Tests proved that the girl did not die from the vaccination.

☐

[2]

[Total: 10]

**END OF QUESTION PAPER**

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