

Wednesday 24 May 2017 – Afternoon

**GCSE TWENTY FIRST CENTURY SCIENCE
PHYSICS A/SCIENCE A**

A181/01 Modules P1 P2 P3 (Foundation Tier)

Candidates answer on the Question Paper.
A calculator may be used for this paper.

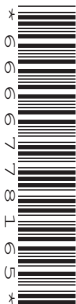
OCR supplied materials:

None

Other materials required:

- Pencil
- Ruler (cm/mm)

Duration: 1 hour



Candidate forename		Candidate surname	
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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. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with a pencil (✎).
- A list of physics equations 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 **16** 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

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

Answer **all** the questions.

1 The table below shows four different ages.

A	the age of the Sun
B	the age of the Earth
C	the age of the Universe
D	the age of the Milky Way

(a) Which one of these is the **oldest**?

Put a (ring) around the correct answer.

The oldest of the four ages is **A** **B** **C** **D**.

[1]

(b) Which one of these is the **youngest**?

Put a (ring) around the correct answer.

The youngest of the four ages is **A** **B** **C** **D**.

[1]

[Total: 2]

2 Liz is very interested in the possibility of life on other planets.



Liz
I heard on the television that scientists have found hundreds of new planets around distant stars. I can't understand why they haven't found out if there's life on one of them.

Explain to Liz why it is very hard to find out if there is anything living on these new planets.

.....

.....

.....

..... [2]

[Total: 2]

3 Below are four statements, **W**, **X**, **Y** and **Z**, about earthquake P-waves and S-waves.

Each statement is true.

Use these four statements to answer parts **(a)**, **(b)** and **(c)**.

W	P-waves move faster than S-waves.
X	Both P-waves and S-waves can travel through the Earth's mantle.
Y	P-waves can travel through the Earth's core, but S-waves cannot.
Z	Both P-waves and S-waves can be detected by seismometers on the surface of the Earth.

(a) Which one statement, **W**, **X**, **Y** or **Z**, shows that the Earth's core is liquid? [1]

(b) Which one statement, **W**, **X**, **Y** or **Z**, shows that the Earth's mantle is solid? [1]

(c) P-waves travel at a speed of 8000 m/s.

Which **one** of the following could be the speed of S-waves?

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

4000 m/s

8000 m/s

12000 m/s

[1]

[Total: 3]

5 This question is about earthquakes in Turkey.

- (a) P-waves travel at 8000 m/s from a small earthquake in Usak in Turkey. They are detected in Bursa 21 seconds later.



Calculate the distance from Usak to Bursa.

distance = m [2]

- (b) Earthquakes are common in Turkey but are very rare in Britain.

Which of the following statements is the best explanation for this difference?

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

There are no volcanoes in Britain.

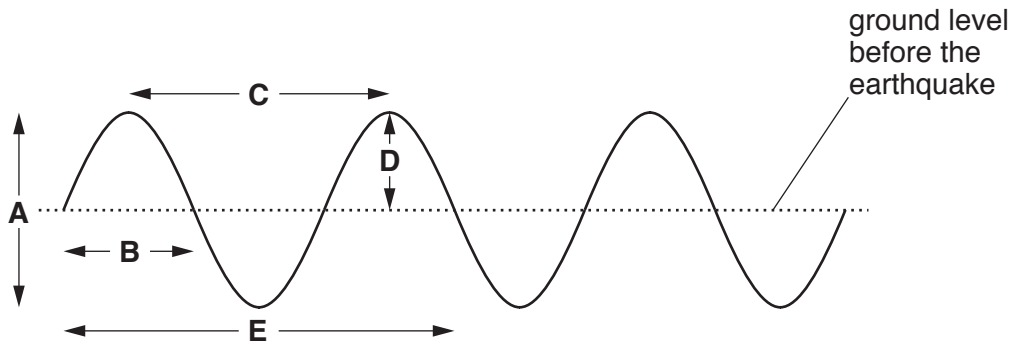
Turkey is at the edge of a tectonic plate.

Britain is surrounded by sea on all sides.

Turkey is nearer to the equator than Britain.

[1]

- (c) The diagram below shows the ground moving when an earthquake wave passes. The dotted line shows the ground level before the earthquake arrived.



The wave diagram has five different arrows labelled **A**, **B**, **C**, **D** and **E**.

- (i) Which arrow, **A**, **B**, **C**, **D** or **E**, shows the **amplitude** of the wave?

the amplitude is shown by arrow [1]

- (ii) Which arrow, **A**, **B**, **C**, **D** or **E**, shows the **wavelength** of the wave?

the wavelength is shown by arrow [1]

- (iii) The wave in the diagram has a wavelength of 1 km and a frequency of 2 Hz.

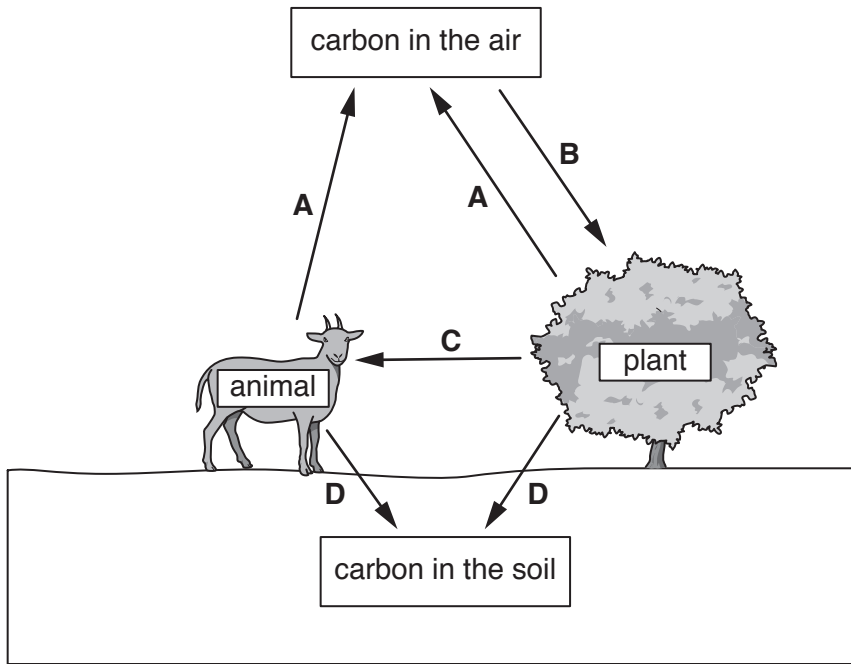
Calculate the speed of the wave in m/s.

Show your working.

speed =m/s [2]

[Total: 7]

6 The diagram shows part of the carbon cycle.



(a) For each of the following, the answer is one of the processes **A**, **B**, **C** and **D** in the diagram above.

(i) Which one is photosynthesis? answer [1]

(ii) Which one is respiration? answer [1]

(b) The amount of carbon dioxide in the atmosphere stayed constant for a very long time.

Use the correct scientific terms to explain why the amount of carbon dioxide did not change.

.....

 [2]

(c) Over the last two hundred years, the amount of carbon dioxide in the atmosphere has increased steadily.

Write down **two** reasons for this increase.

1
 2 [2]

[Total: 6]

- 7 This table shows the radiations of the electromagnetic spectrum.
Two of the radiations are labelled **A** and **B** instead of using their correct names.

radio waves	A	infrared	visible	B	X-rays	gamma rays
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- (a) What are radiations **A** and **B**?

A is **B** is

[2]

- (b) Which of the radiations in the table has the highest frequency?

The highest frequency radiation is

[1]

- (c) Write down the name of **two** radiations which are ionising.

..... and are both ionising radiations.

[1]

- (d) Write down the name of **one** radiation in the table which is used to carry information along optical fibres.

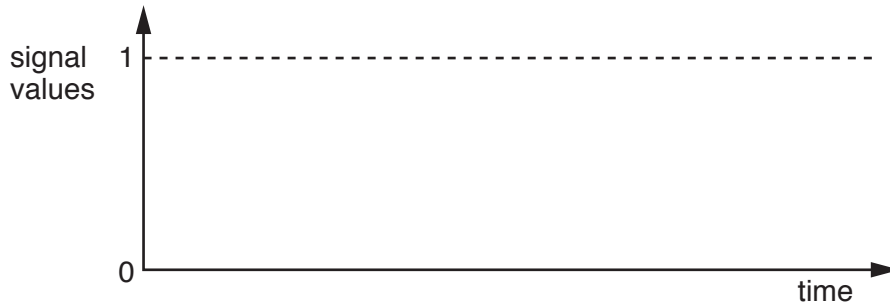
..... is used in optical fibres.

[1]

[Total: 5]

8 This question is about digital signals.

(a) On the graph axes below, sketch a graph to show how a digital signal changes with time.



[1]

(b) Radio and television are now both sent as digital signals.

Explain why a half-hour television programme and a half-hour radio programme need different numbers of bytes of information.

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

[Total: 3]

10 Complete the sentences below.
Use the best words from the list.

fossil primary secondary solar

Energy sources, such as coal, are used to make electricity, so electricity is called a energy source.

Coal is the remains of long-dead plants, so it is called a fuel.

[2]

[Total: 2]

11 A small hydroelectric power station is generating electricity.

For every 2000 J of total energy input, the energy wasted is 1200 J.

(a) Calculate the energy usefully transferred.

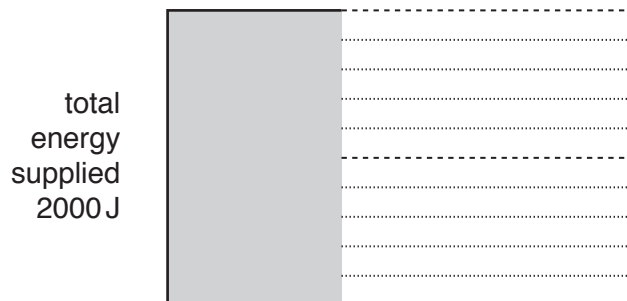
energy usefully transferred =J [1]

(b) Calculate the efficiency of the power station expressed as a percentage.

efficiency = % [2]

(c) Complete the following Sankey diagram (energy flow diagram) for the 2000 J supplied to this power station.

Make sure the output energies are drawn to the same scale as the energy supplied and are correctly labelled. The dotted lines are included to help you draw the energy outputs correctly.



[2]

[Total: 5]

12 (a) A washing machine, of power 2 kW, is being used all day.

(i) How many kWh of electrical energy are transferred in 12 hours?

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

- 2 6 12 24

[1]

(ii) On a different day, the washing machine transfers 18 kWh of electrical energy.

Each kilowatt hour costs 15p.

What is the cost of the electrical energy transferred on this day?

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

- £1.20 £2.70 £120 £270

[1]

(b) A heater draws a current of 10A from the 230V mains electricity supply.

Calculate the energy transferred **in kilowatt hours** (kWh) when the heater is left on for 30 minutes.

energy transferred = kWh [3]

(c) The lamp in a torch draws a current of 0.6A from a 3.0V battery.

Calculate the energy transferred **in joules** (J) when the torch is left on for 5 minutes.

energy transferred =J [2]

[Total: 7]

Turn over

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

A large area of lined paper for writing. It consists of a vertical solid line on the left side, creating a margin. To the right of this line, there are numerous horizontal dotted lines extending across the width of the page, providing space for writing answers.

A large area of the page is reserved for writing, featuring a vertical solid line on the left side and horizontal dotted lines extending across the page.



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