

Friday 22 June 2012 – Afternoon

**GCSE TWENTY FIRST CENTURY SCIENCE
PHYSICS 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	
Centre number		Candidate number	

MODIFIED LANGUAGE

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 (✎).
- 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 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** In 2000 some astronomers discovered a planet around the star Epsilon Eridani. Variations in the light from the star allowed the astronomers to detect the planet. The light took 10.5 years to reach the Earth.

The planet is about 380 times more massive than the Earth. The planet takes 7 years to complete one orbit around Epsilon Eridani.

- (a) (i)** How far away from us is the planet?

answer **[2]**

- (ii)** How could astronomers measure the distance to the star Epsilon Eridani?

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

- | | |
|-----------------------------------|--------------------------|
| using parallax | <input type="checkbox"/> |
| sending a space ship | <input type="checkbox"/> |
| comparing its relative brightness | <input type="checkbox"/> |
| asking people who live there | <input type="checkbox"/> |
| using a laser | <input type="checkbox"/> |

[2]

- (iii)** Put these distances, **A**, **B**, **C**, **D** and **E**, in order from smallest to largest.

- A** – The diameter of the Earth's orbit.
B – The diameter of the solar system.
C – The diameter of the Earth.
D – The distance from the Earth to Epsilon Eridani.
E – The diameter of the Sun.

One has been done for you.

smallest

C				
----------	--	--	--	--

 largest

[2]

- (b) The first report by the astronomers was published in a peer-reviewed scientific journal.

Why is this process important for the astronomers' findings to be accepted?

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

It allows other astronomers to try and repeat the finding.

☐

The astronomers' friends will be able to see their results.

☐

It shows the astronomers are scientists.

☐

The findings can be evaluated by other astronomers.

☐

Only astronomers are allowed to write articles for the journal.

☐

[2]

- (c) In 2010 astronomers discovered a new solar system with a large star and at least **three** large planets.

Paul works in a planetarium. His job is to draw a labelled diagram of the new solar system showing the planets' orbits.

He thinks that there are probably other smaller objects in the new solar system which the astronomers cannot detect because they are too far away.

These smaller objects are also found in our solar system. Paul adds these to his drawing.

Draw a labelled diagram of the new solar system, including some of the smaller objects that Paul might have added to his diagram.



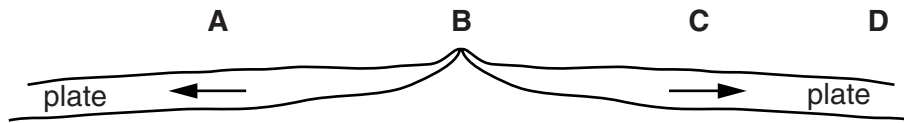
The quality of written communication will be assessed in your answer.

[6]

[Total: 14]

- 2 The diagram shows seafloor spreading at the boundary between two tectonic plates.

The arrows show the direction the plates are moving.



- (a) Where are the youngest rocks, at **A**, **B**, **C** or **D**?

answer [1]

- (b) (i) What causes the seafloor spreading?

.....

 [2]

- (ii) How does seafloor spreading provide support for Wegener's theory of continental drift?

.....

 [2]

- (c) At first, other scientists did not accept Wegener's theory of continental drift.

Which statements give reasons why other scientists did not accept the theory?

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

There was a geometric fit between continents.

☐

The movement of continents could not be detected.

☐

The same type of fossil could be found on different continents.

☐

Mountains are only found in the middle of continents.

☐

There were simpler explanations for the same evidence.

☐

[2]

[Total: 7]

3 Here is a list of some types of waves.

infrared

microwave

sound

ultraviolet

X-ray

(a) Use waves from the list to answer the following questions.

You may use each wave once, more than once or not at all.

(i) Which wave is **not** in the electromagnetic spectrum?

answer [1]

(ii) Which wave has photons with the lowest energy?

answer [1]

(iii) Which wave has the highest frequency?

answer [1]

(iv) Which wave can be used to find metal objects in a suitcase?

answer [1]

(v) Which wave is absorbed by the ozone layer in the atmosphere?

answer [1]

(b) Which **one** of the following properties is the same for all waves in the electromagnetic spectrum?

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

colour

☐

intensity

☐

speed in a vacuum

☐

wavelength

☐

[1]

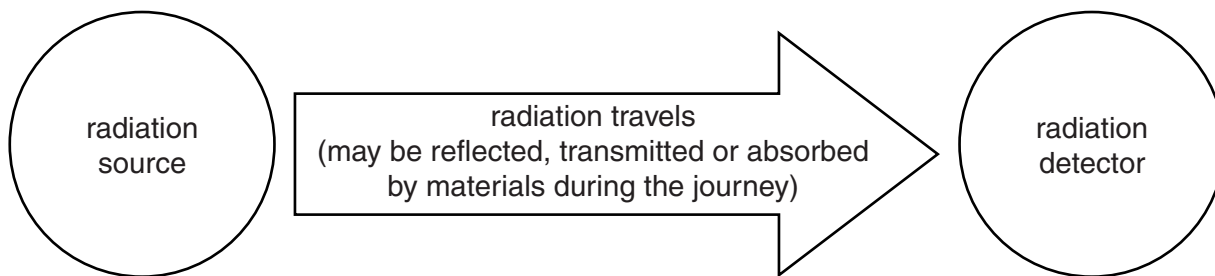
[Total: 6]

Turn over

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- 4 Scientists use models to help them think about difficult ideas. The diagram shows a general model for radiation.



Prinul lives in the countryside, where there are no street lights.

He thinks this model of radiation works well because it explains why he can see a road sign at night when he uses his car headlights.

Is he correct?

Justify your conclusion carefully.



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

..... [6

[Total: 6]

- 5 (a) Sometimes people get confused over what the greenhouse effect is.

Which three statements are parts of a description of the greenhouse effect?

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

- | | |
|--|--------------------------|
| Carbon dioxide absorbs some radiation in the Earth's atmosphere. | <input type="checkbox"/> |
| The ozone layer is in the Earth's atmosphere. | <input type="checkbox"/> |
| The atmosphere reflects radiation from the Sun. | <input type="checkbox"/> |
| The Earth absorbs some radiation and then emits radiation. | <input type="checkbox"/> |
| The Earth is warmer than it would otherwise be. | <input type="checkbox"/> |
| The North and South Poles are colder than the equator. | <input type="checkbox"/> |
| Ultraviolet radiation comes from the Moon. | <input type="checkbox"/> |

[3]

- (b) What will happen to the Earth's temperature if the energy reaching the Earth from the Sun is greater than the energy being radiated away from the Earth?

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

The Earth's temperature will ...

- | | |
|----------------|--------------------------|
| increase. | <input type="checkbox"/> |
| stay the same. | <input type="checkbox"/> |
| decrease. | <input type="checkbox"/> |

[1]

- (c) (i) Which **one** of the following is not **directly** caused by global warming?

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

- | | |
|------------------------|--------------------------|
| climate change | <input type="checkbox"/> |
| rising sea levels | <input type="checkbox"/> |
| increasing skin cancer | <input type="checkbox"/> |
| icecaps melting | <input type="checkbox"/> |

[1]

- (ii) In the last one hundred years global temperatures have increased. The number of people with mobile phones has also increased.

Which word best describes the relationship between global temperature and the number of people with mobile phones?

cause

correlation

evidence

variable

[1]

[Total: 6]

- 6 (a) Electricity is a very convenient form of energy.

Give two reasons why.

1

2

[2]

- (b) Why is electricity called a secondary energy source?

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

It is produced by motors.

☐

It was the second energy source discovered.

☐

It is used to power secondary schools.

☐

It is produced using another energy source.

☐

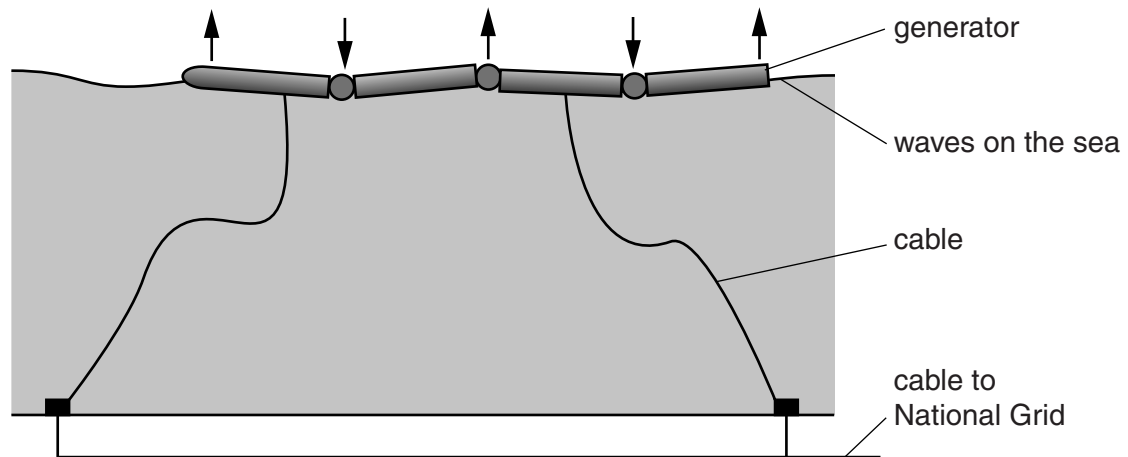
[1]

- (c) What is the electricity mains supply voltage to homes in the UK?

voltage =V [1]

[Total: 4]

- 7 A wave power generator is being tested in the North Sea.



When the waves pass the generator, the waves make the generator bend.

This bending movement is used to make electricity.

The electricity can then be distributed through the National Grid.

- (a) Waves are a **renewable** energy source.

What is meant by 'renewable energy source'?

.....
 [1]

- (b) The wave generator only works when the wave speed is under 10 m/s.

Waves passing the generator have a frequency of 0.2 Hz and a wavelength of 40 m.

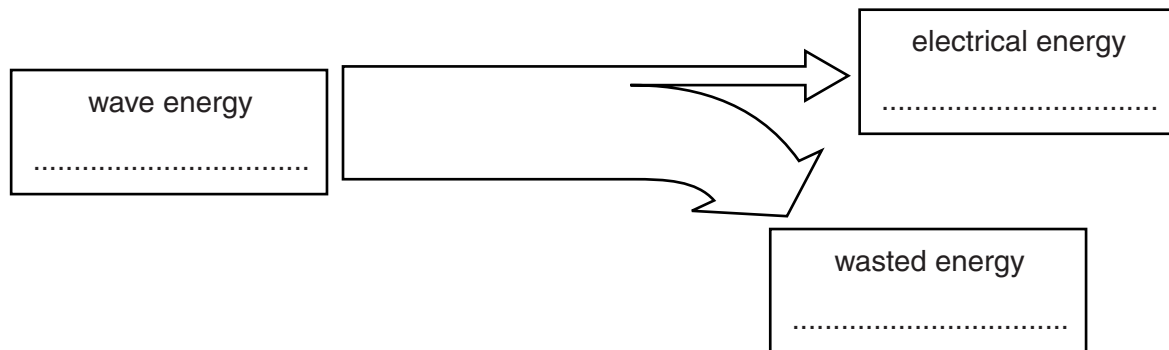
Use the data above to show if the wave generator will or will not work with these waves.

Show any calculation.

..... [2]

- (c) The wave generator is 150m long. When it is working, it makes 750kJ of electrical energy from a wave energy input of 8250kJ each second.

- (i) Complete the Sankey diagram for the generator.



[2]

- (ii) Calculate the efficiency of the generator.

Show your calculation.

efficiency = % [2]

- (d) The average power output of the generator is 750kW.

- (i) How much energy will it produce in one day?

Give your answer in kilowatt hours.

Show your calculation.

energy = kWh [2]

- (ii) The electricity from the generator can be sold for 11p per kWh.

How much money can the generator earn in one day?

answer = [2]

[Total: 11]

Turn over

Use the data in the table and your knowledge of energy sources to suggest an energy production plan for the island to make more electricity.

Justify your suggestions.



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

..... [6]

[Total: 6]

END OF QUESTION PAPER

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