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Friday 22 June 2012 – Afternoon

GCSE TWENTY FIRST CENTURY SCIENCE PHYSICS A

A181/01 Modules P1 P2 P3 (Foundation Tier)

A135830612

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

A181901

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 (✎).
- 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.

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TWENTY FIRST CENTURY SCIENCE EQUATIONS

Useful Relationships

The Earth in the Universe

distance = wave speed × time

wave speed = frequency × wavelength

Sustainable Energy

energy transferred = power × time

power = voltage × current

$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

Explaining Motion

$$\text{speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$

momentum = mass × velocity

change of momentum = resultant force × time for which it acts

work done by a force = force × distance moved in the direction of the force

amount of energy transferred = work done

change in gravitational potential energy = weight × vertical height difference

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times [\text{velocity}]^2$$

Electric Circuits

power = voltage × 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

energy = mass × [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 announced the discovery of 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 and 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 the distance to the star Epsilon Eridani have been measured?

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

using parallax	☐
sending a space ship	☐
comparing its relative brightness	☐
asking people who live there	☐
using a laser	☐

[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]

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

Why is this process important for the acceptance of the astronomers' findings?

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 at such an enormous distance.

These types of 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 objects that Paul might have added to his diagram.

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

[6]

[Total: 14]

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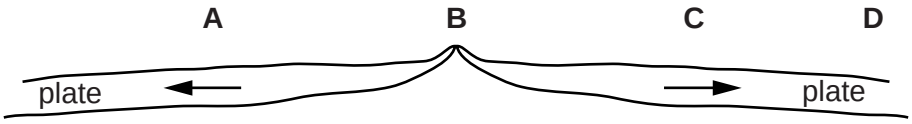
2 The diagram shows seafloor spreading at the boundary between two tectonic plates.

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) When Wegener presented his theory of continental drift it was not accepted by other scientists.

Which statements give reasons for the **rejection**?

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]

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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]

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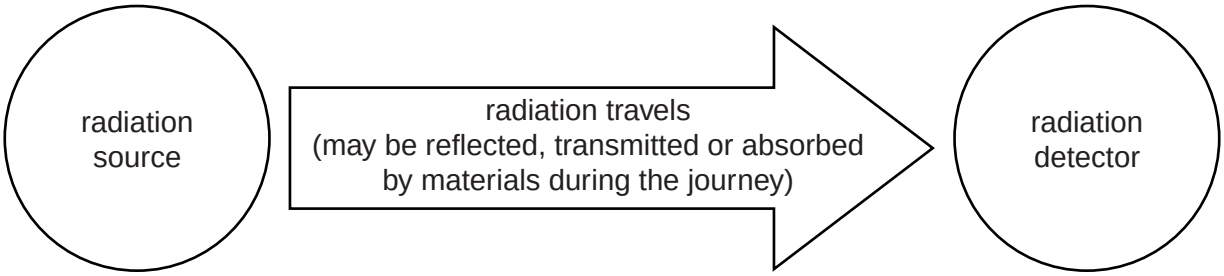
4 Scientists use models to help them think about difficult ideas. The diagram shows a general model for radiation.



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.

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..... **[6]**

[Total: 6]

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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.	☐
The ozone layer is in the Earth's atmosphere.	☐
The atmosphere reflects radiation from the Sun.	☐
The Earth absorbs some radiation and then emits radiation.	☐
The Earth is warmer than it would otherwise be.	☐
The North and South Poles are colder than the equator.	☐
Ultraviolet radiation comes from the Moon.	☐

[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.

increase	☐
stay the same	☐
decrease	☐

[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	☐
rising sea levels	☐
increasing skin cancer	☐
icecaps melting	☐

[1]

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(ii) Over the last century 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]

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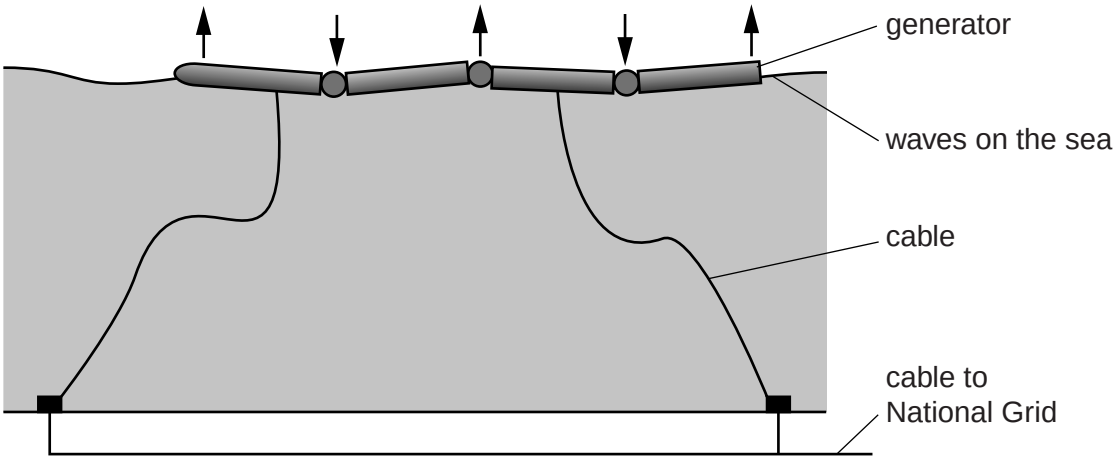
7 A type of wave power generator is being tested in the North Sea.



As the waves pass the generator they make it bend.

This bending movement is used to produce electricity.

The electricity can then be distributed using 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 whether or not the wave generator will work with these waves.

Show any calculation.

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

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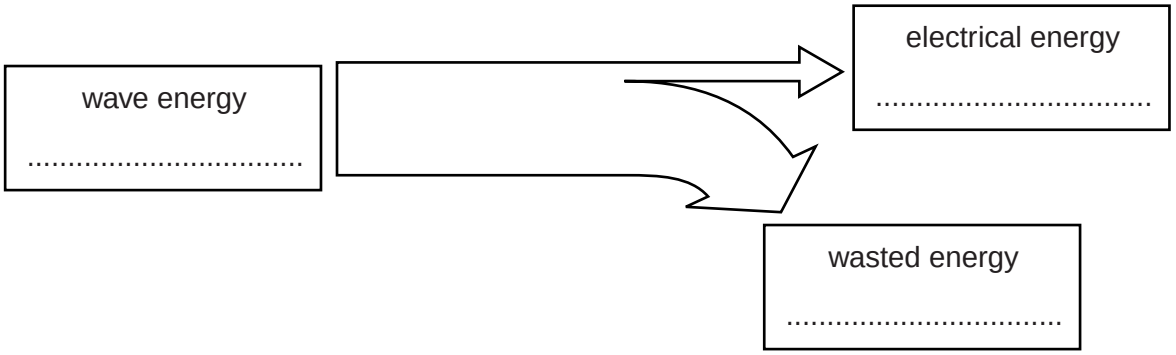
(c) The wave generator is 150 m long. When it is working, it produces 750 kJ of electrical energy from a wave energy input of 8250 kJ each second.

(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 750 kW.

(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 can the generator earn in one day?

answer = ... **[2]**

[Total: 11]

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8 A small island in the South Atlantic Ocean needs to produce more electricity than it can at present.

Here is some information about the electricity production on the island.

Electricity consumption	15 880 000 kWh
Electricity production	16 000 000 kWh
Produced by burning oil and peat	100%
Produced by hydroelectricity	0%
Produced by nuclear	0%
Produced by wind	0%
Produced by waves/tides	0%
Oil imported	248.9 barrels/day
Peat used for fuel	13 000 ton/year

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

Justify your suggestions.

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

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..... **[6]**

[Total: 6]

END OF QUESTION PAPER

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