

**Friday 22 June 2012 – Afternoon**

**GCSE TWENTY FIRST CENTURY SCIENCE  
PHYSICS A**

**A331/02** Unit 1: Modules P1 P2 P3 (Higher 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:** 40 minutes



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**

- 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 **42**.
- This document consists of **12** pages. Any blank pages are indicated.

Answer **all** the questions.

- 1** A supernova is the explosion of a star. It is one of the brightest astronomical objects, but only for a short time.

- (a) (i)** The first recorded observation of a supernova was by Chinese astronomers in 185 CE (it is now 2012 CE).

Recent observations by astronomers suggest the remains of this supernova are about 8200 light-years away.

How long ago did the supernova explode?

time ..... years ago **[2]**

- (ii)** The first observations by the astronomers were published in a peer reviewed scientific journal.

Why is this important for the acceptance of the scientists' findings?

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

It allows other astronomers to try and repeat the findings.

☐

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

☐

It shows the astronomers are scientists.

☐

Other astronomers can evaluate the findings.

☐

Only astronomers are allowed to write articles for the journal.

☐

**[2]**

- (b)** Supernovas are used to help find the distance to galaxies.

Put ticks (✓) in the boxes next to the **two** correct statements about galaxies.

Distant galaxies are moving away from us.

☐

Galaxies contain a maximum of 100 000 stars.

☐

The distances to galaxies are known very accurately.

☐

The most distant galaxies move away from the Earth the slowest.

☐

What we know about galaxies comes from the radiation from them.

☐

**[2]**

- (c) The Earth contains many different chemical elements. Some elements are made in stars and some in supernovas.

Here is information about some elements found on Earth.

Element	Number of protons	Relative mass
carbon	6	12
gold	79	197
hydrogen	1	1
helium	2	4
iron	26	56

Two of the elements may **not** have been made in either stars or supernovas.

Put a ring around these two elements.

**carbon**

**gold**

**helium**

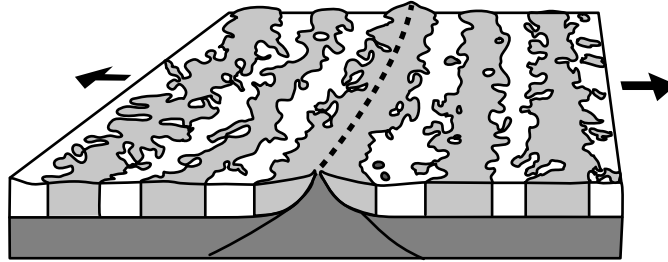
**hydrogen**

**iron**

[2]

[Total: 8]

- 2 The diagram shows seafloor spreading at the boundary between two tectonic plates. The arrows show the direction the plates are moving.



- (a) The seafloor in the diagram is spreading apart.

Approximately how fast are they moving apart?

Put a ring around the correct speed.

10 mm/century    1 mm/year    10 cm/year    1 cm/century    10 m/year    1 m/second

[1]

- (b) (i) The alternating light and dark bands show different magnetic fields in the rock.

What is the main difference between the magnetic fields in the light and dark bands?

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

The shape of the magnetic field.

☐

The direction of the magnetic field.

☐

The strength of the magnetic field.

☐

The type of magnetic field.

☐

[1]

- (ii) Explain how the magnetic pattern in the rocks is produced.

.....

.....

.....

.....

.....

..... [4]

- (iii) The discovery of the magnetic patterns happened many years after Alfred Wegener died. At first many geologists did not accept Wegener's theory of continental drift. How do the magnetic patterns show Wegener's idea was essentially correct? Put ticks (✓) in the boxes next to the **two** correct answers.

Magnetism pushes the continents apart.

☐

The magnetic patterns suggest that the seafloor spreads apart.

☐

The magnetic patterns show the continents fit together.

☐

There is a correlation between the magnetic patterns and the depth of the rock layer.

☐

They provide evidence for a mechanism for continental drift.

☐

[2]

[Total: 8]

- 3 (a) Sometimes people do not really understand what the **greenhouse effect** is.

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

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

Ozone absorbs ultraviolet radiation in the Earth's atmosphere.

☐

Carbon dioxide absorbs some radiation in the Earth's atmosphere.

☐

The atmosphere reflects radiation from the Sun.

☐

The Earth emits radiation at a lower frequency than it absorbs.

☐

Ultraviolet radiation comes from the Sun.

☐

Gamma rays have very high energy photons.

☐

Radiation absorbed by the atmosphere may be radiated towards the Earth.

☐

[3]

- (b) Radiation from the Sun warms the Earth.

The surface temperature of the Sun is over 5000 °C.

The Earth has an average surface temperature of about 20 °C.

Which of the following statements explain this temperature difference?

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

The number of photons reaching the Earth's surface is less than the number leaving the Sun.

☐

Ionising radiation from the Sun breaks up molecules in the ozone layer.

☐

The average energy of photons reaching the Earth is less than the average energy of photons leaving the Sun.

☐

Most of the energy from the Sun is visible light, but some is in the microwave region of the spectrum.

☐

X-rays and gamma rays from the Sun pass straight through the Earth.

☐

Radiation from the Sun spreads out as it travels towards the Earth.

☐

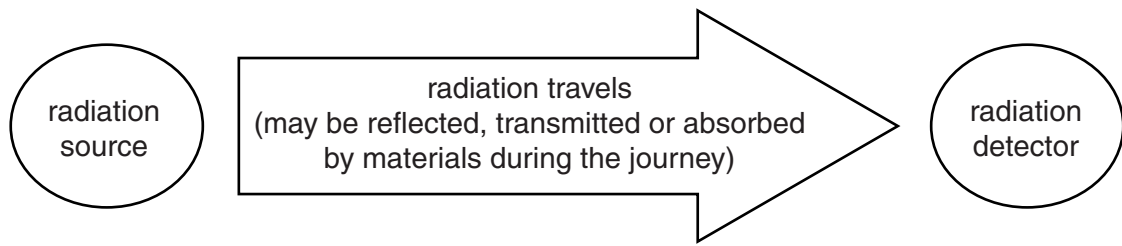
Some radiation from the Sun is reflected from the Earth.

☐

[3]

[Total: 6]

- 4 The diagram shows a general model for radiation.



Prinul lives in the countryside. It is very dark at night.  
He can see the Moon very clearly, even though the Moon does not produce visible light.

Describe how the general model for radiation can explain how Prinul sees the Moon.

.....

.....

.....

.....

.....

.....

.....

..... [4]

[Total: 4]

5 This question is about electromagnetic radiation.

(a) Why is it important that microwave ovens have metal walls?

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

Ionising radiation can damage body cells.

☐

Metals reflect microwaves.

☐

Microwaves heat up water molecules in body cells.

☐

Microwaves are ionising radiation.

☐

Microwaves are also used by mobile phones.

☐

When microwaves reflect from metal they become ultraviolet radiation.

☐

[2]

(b) Which of the following radiations will heat up an object?

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

infrared

☐

microwaves

☐

ultraviolet

☐

visible light

☐

[1]

[Total: 3]



- 6 Josie and Kevin are arguing about whose job has the **bigger risk** of radiation exposure.



**Kevin**

I work as an airline steward. Last year I flew to New Zealand and back twice a week on average. I do not have to worry about radiation exposure.

**Josie**

I work at the nuclear power station and I handle radioactive materials, but they monitor my exposure and keep it below a safe amount. I think you have a greater risk.



Maximum dose amount for a power station worker in mSv per year	Average exposure on an airplane flight from the UK to New Zealand in mSv
20.0	0.1

- (a) Who has the bigger risk?

Show your calculation.

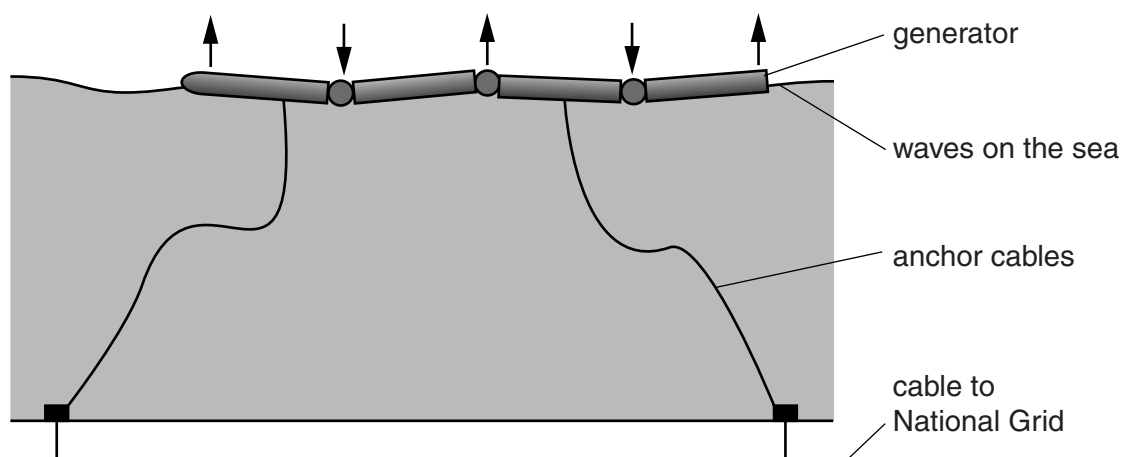
answer ..... [3]

- (b) How do Josie or Kevin's views show the difference between perceived risk and actual risk?

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

[Total: 4]

- 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.

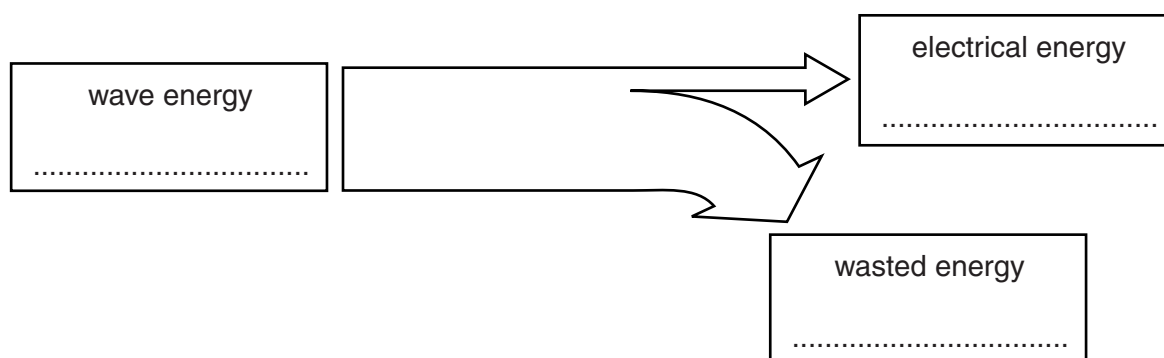
- (a) Waves are a **renewable** energy source.

What is meant by renewable energy source?

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

- (b) (i) The 150 m long wave generator produces 750 kJ of electrical energy from a wave energy input of 8250 kJ each second.

Complete the Sankey diagram for the generator.



- (ii) Calculate the efficiency of the generator.

Show your calculation.

efficiency = ..... [2]

- (c) This use of wave energy is called a **sustainable development**.

What is meant by sustainable development?

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

It can keep being developed.

☐

It can be used without damaging the environment for the future.

☐

It is made from materials that are sustainable.

☐

It will work in the developing world.

☐

[1]

[Total: 6]

- 8 This question is about electrical power production.

- (a) Complete the sentence describing electrical power production.

In a power station a primary fuel is used to heat water to produce .....

which drives a ..... which is connected to a generator. [2]

- (b) Many power stations of the type described in part (a) produce large amounts of carbon dioxide.

Suggest a type of primary fuel used in a power station that does **not** produce carbon dioxide while producing electricity.

..... [1]

[Total: 3]

**END OF QUESTION PAPER**

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