

**GENERAL CERTIFICATE OF SECONDARY EDUCATION**  
**TWENTY FIRST CENTURY SCIENCE**  
**PHYSICS A**

Unit 1 Modules P1 P2 P3 (Higher Tier)

**WEDNESDAY 11 JUNE 2008**

Afternoon  
Time: 40 minutes

Candidates answer on the question paper  
**Additional materials (enclosed):** None

Calculators may be used.  
**Additional materials (required):**  
Pencil  
Ruler (cm/mm)



Candidate  
Forename

Candidate  
Surname

Centre  
Number

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Candidate  
Number

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**INSTRUCTIONS TO CANDIDATES**

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided.

**INFORMATION FOR CANDIDATES**

- The number of marks for each question is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **42**.

**FOR EXAMINER'S USE**

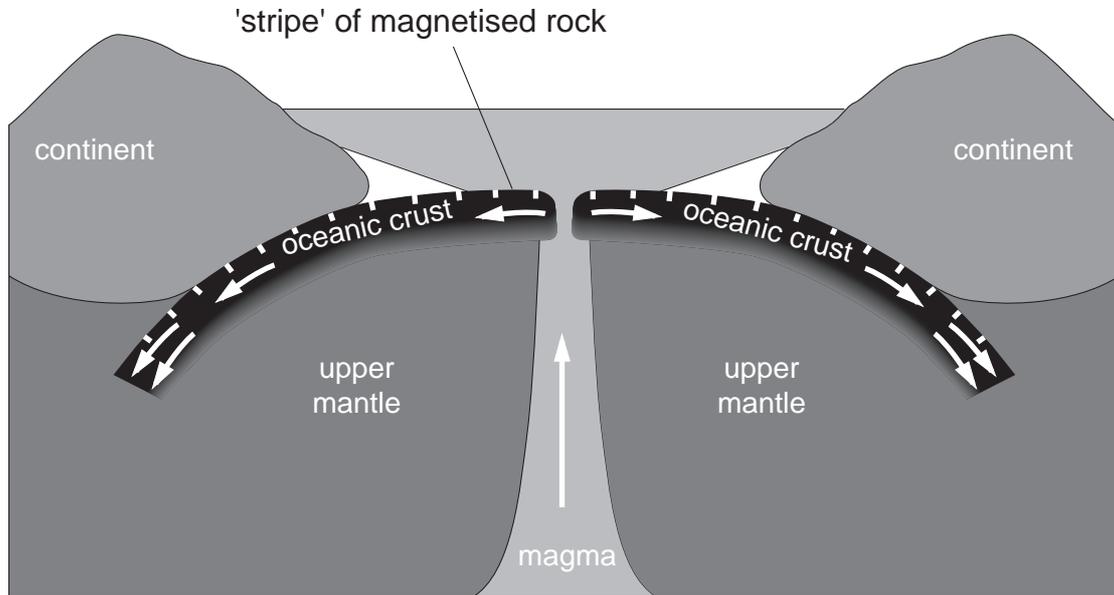
Qu.	Max	Mark
1	7	
2	9	
3	8	
4	4	
5	4	
6	10	
<b>TOTAL</b>	<b>42</b>	

This document consists of **15** printed pages and **1** blank page.

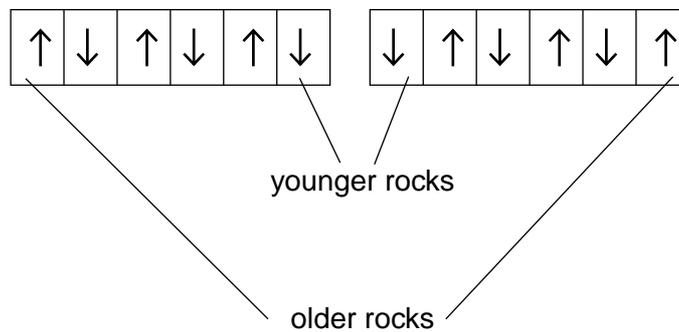
Answer **all** the questions.

1 This question is about seafloor spreading.

The diagram shows the magnetic patterns that appear in the seafloor near mid-ocean ridges. These patterns were first found in the 1950s.



view from above showing magnetic field directions in stripes



(a) Here are five sentences showing the stages in the formation of the magnetic patterns.

They are in the wrong order.

- A Magma erupts and begins to cool.
- B The drop in pressure melts the solid mantle rocks.
- C The Earth's solid mantle rises slowly under the ridge.
- D After a few thousand years, the Earth's magnetic field changes direction.
- E As the magma solidifies into rock, it 'freezes in' the Earth's magnetic field direction.

Fill in the boxes to show the right order. The first one has been done for you.

C				
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(b) The discovery of magnetic patterns on the seafloor confirmed Wegener's theory of continental drift.

His theory had been rejected by other scientists before this discovery.

Which of the following statements is the best explanation for why scientists changed their minds?

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

Wegener was not a trained geologist.

Mountains are formed where tectonic plates meet.

Seafloor spreading can explain how continents might move.

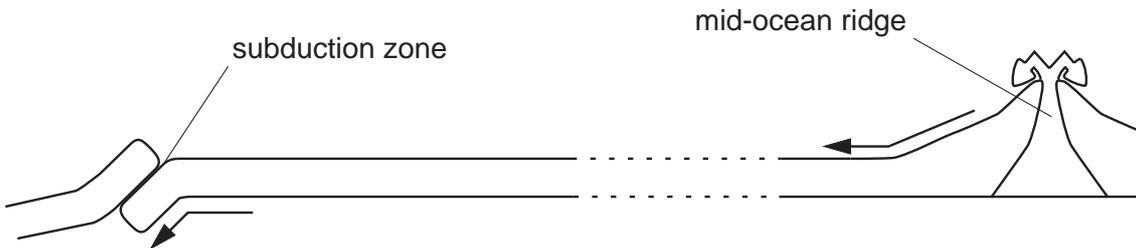
Similar fossils are found on each side of the Atlantic Ocean.

South America and Africa have shapes which could fit together.

[1]

(c) Where oceanic plates meet continental plates, they move underneath them.

This is called subduction.



Which of the following statements involve subduction?

Put a tick (✓) in the box next to **each** correct statement.

Magnetic stripes are produced at mid-ocean ridges.

Rocks in the Earth's crust are continuously recycled.

Mountain ranges are formed at the edges of tectonic plates.

The sediments on ocean floors are thinnest near mid-ocean ridges.

Earthquakes and volcanic eruptions happen at the edges of tectonic plates.

[3]

[Total: 7]

## 2 Read this extract from a newspaper.

### Space 'starshade' could provide clues to alien life

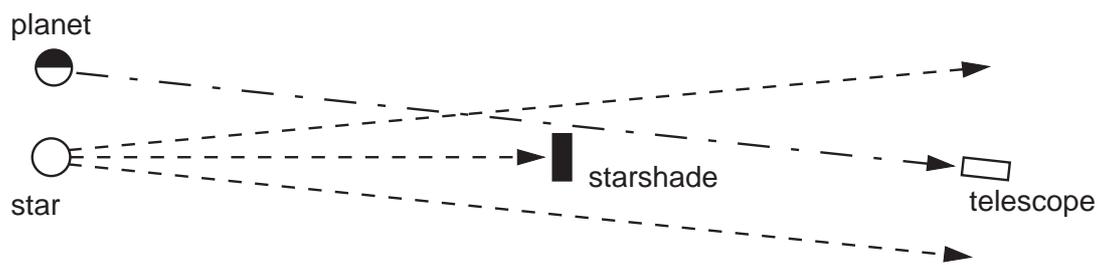
A giant 'starshade' in space could allow astronomers to see Earth-like planets orbiting distant stars.

The starshade and a space telescope would be launched together to orbit about a million miles from Earth.

The starshade could be a simple solution to the problem of a star's light swamping the view of small rocky planets. The starshade would be positioned some 15 000 miles in front of the telescope. It would block the bright light from the star and let the small rocky planets be seen.

Scientists on Earth would fire small thruster rockets on the starshade to move it in front of the stars in which they are interested. Astronomers would then be able to see planets whose reflected light passes the edge of the starshade disc as bright specks.

'We will be able to study Earth-like planets tens of trillions of miles away and chemically analyse the infrared in their atmospheres for signs of life like methane, oxygen and water,' said Professor Webster Cash, who thought of the idea.



from the Daily Mail, 6 July 2006

(a) Read the following statements.

Put a tick (✓) in the box next to each of the **three** correct statements.

The starshade will block light from certain stars.

The starshade will be fixed to a space telescope.

The starshade is designed to block the light from distant planets.

The telescope is designed to study planets in our Solar System.

The light from a planet is much dimmer than the light from its star.

The light from a distant planet may show the gases in its atmosphere.

[3]

(b) Most telescopes are on the Earth's surface.

This telescope and starshade will be put in orbit around the Earth.

Which of these statements is a correct reason for doing this?

Put a tick (✓) in the box next to each of the **two** correct statements.

There will be no light pollution.

The starshade will not corrode or rot.

Telescopes do not need power to stay in orbit.

They will be closer to the distant planets they need to observe.

The Earth's atmosphere absorbs part of the electromagnetic spectrum.

[2]

(c) This is what two scientists say about this project.

**Professor Hilton**

This is an exciting and important project. It will be well worth the large amount of money spent on it.

If we find oxygen in the atmospheres of distant planets it will mean there's life there.

Don't forget that research done in developing new technology always has useful applications here on Earth.



**Dr Churchill**

This will cost a lot of money, and I don't see any value in it.

If we do find life on a distant planet, what difference will that make to us here on Earth? We'll never be able to go and visit them.

The money would be better spent on fighting disease and reducing global warming.



Which scientist makes each of the following claims?

Put a tick (✓) in **each** correct box.

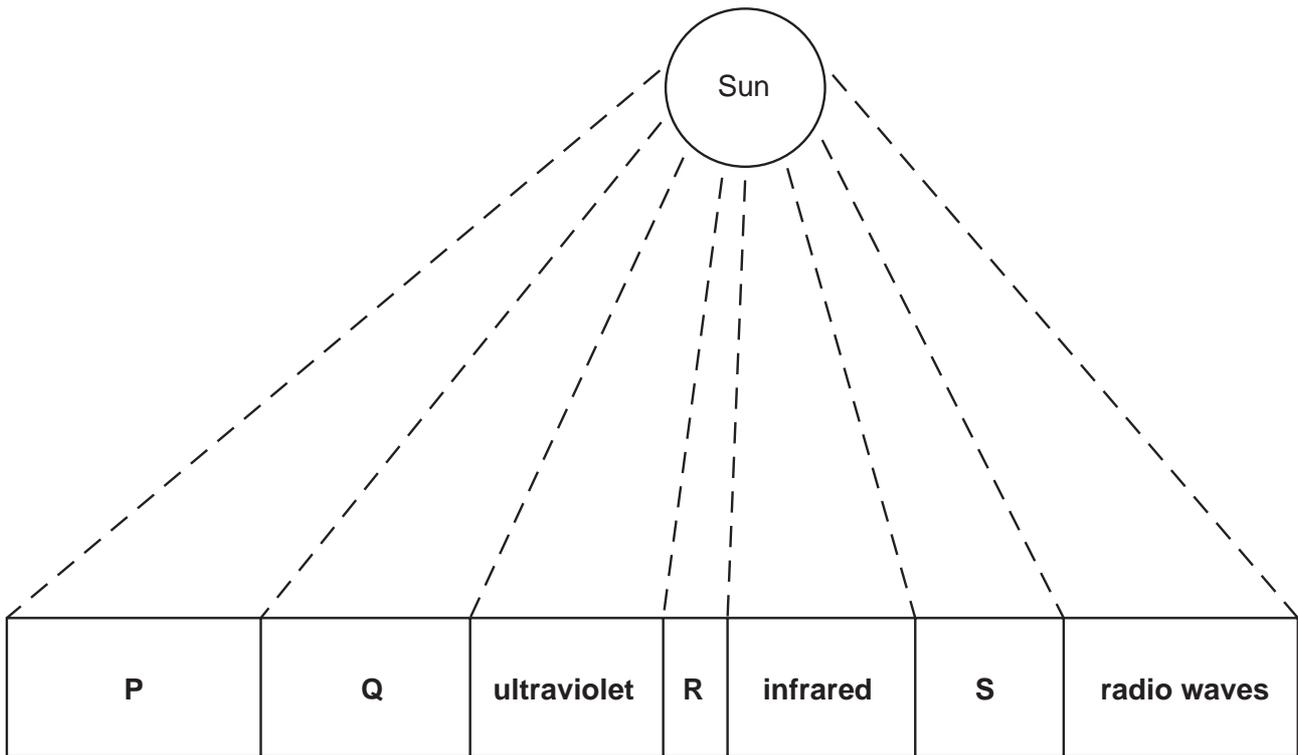
Each claim may have one tick, two ticks or no tick at all.

	<b>Prof. Hilton</b>	<b>Dr Churchill</b>
The project is worth doing.		
The project will be expensive.		
There must be life on distant planets.		
Space research benefits people on Earth.		

[4]

[Total: 9]

3 The diagram shows the spectrum of radiation given out by the Sun.



(a) Some regions of this spectrum are labelled with letters instead of their names.

Write the correct name for each letter.

**P** .....

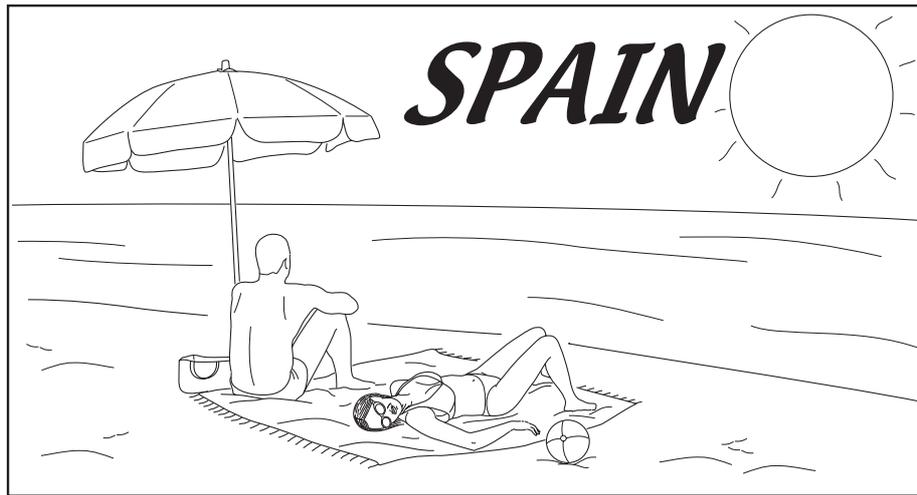
**Q** .....

**R** .....

**S** .....

[2]

(b)



A group of friends are going to sunny Spain for a summer holiday. They are talking about sunbathing and the risks from ultraviolet radiation.

**Alex**  
I always use plenty of sun lotion and wear a tee-shirt. A little ultraviolet is good for you - it gives you vitamin D!

**Beth**  
I've been to Spain often. I never burn in the sun. I'm not likely to suffer any damage from ultraviolet.

**Carys**  
I stay indoors reading between 11a.m. and 3p.m., when the sun is hottest. I get just enough sun to go nice and brown.

**Derek**  
My brother had skin cancer, but he used to sunbathe a lot. I have never done that. I'll just go about as I normally do.

(i) Which **two** people are taking action to reduce the risks from exposure to ultraviolet?

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

Alex

Beth

Carys

Derek

(ii) Who is talking about the **dangers** from exposure to ultraviolet?

Put a tick (✓) in the box next to **each** correct name.

Alex

Beth

Carys

Derek

[2]

(iii) Who is talking about the **benefits** from exposure to ultraviolet?

Put a tick (✓) in the box next to **each** correct name.

Alex

Beth

Carys

Derek

[2]

[Total: 8]

4 Terahertz radiation is a part of the electromagnetic spectrum.

Here are some properties of terahertz radiation.

- A Terahertz radiation is invisible.
- B Terahertz radiation is non-ionising.
- C Many chemicals absorb certain parts of the terahertz spectrum only.
- D Terahertz radiation can penetrate fabrics and plastics but not metals.
- E Terahertz radiation can penetrate several centimetres of body tissue and reflect back.

(a) Here are some uses of terahertz radiation.

Each one depends on two of the properties above.

Draw a straight line from each use of terahertz radiation to the one correct pair of properties.

use of terahertz radiation	properties
analysing the drugs present in capsules	A and B
secretly scanning luggage for hidden weapons	A and D
detecting breast cancer with less risk than X-rays	B and E
	C and D
	C and E

[3]

(b) In which region of the electromagnetic spectrum should terahertz radiation be placed?

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

- gamma rays
- infrared
- visible light
- x-rays

[1]

[Total: 4]

5 Many wind farms are being planned to generate electricity for Britain.

A plan is made for a wind farm of 150 turbines. Construction, maintenance and operating costs are involved.

(a) The total cost to make 1 MWh of electrical energy, from the wind farm, is estimated as £80. In its 20 year lifetime, this wind farm will generate about 6 000 000 MWh.

Which one of the following is the best estimate of the cost of running the wind farm for **one** year?

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

**£300 000**

**£24 000 000**

**£80 000 000**

**£480 000 000**

**£9 600 000 000**

[1]

(b) Sonya and Trevor are worried about plans for a large wind farm in their area.

**Sonya**  
 Our area is very beautiful. Rows of noisy, ugly wind turbines will spoil it for the local people and will stop tourists from coming here.



**Trevor**  
 Evidence from Scotland seems to show that many birds are killed by flying into wind turbines, so I'm worried about migrating birds. And it's not always windy here – we have lots of still days.



Put a tick (✓) in **each** correct box.

	<b>Sonya</b>	<b>Trevor</b>	<b>neither Sonya nor Trevor</b>
Who talks about environmental cost?			
Who talks about economic cost?			
Who talks about efficiency?			

[3]

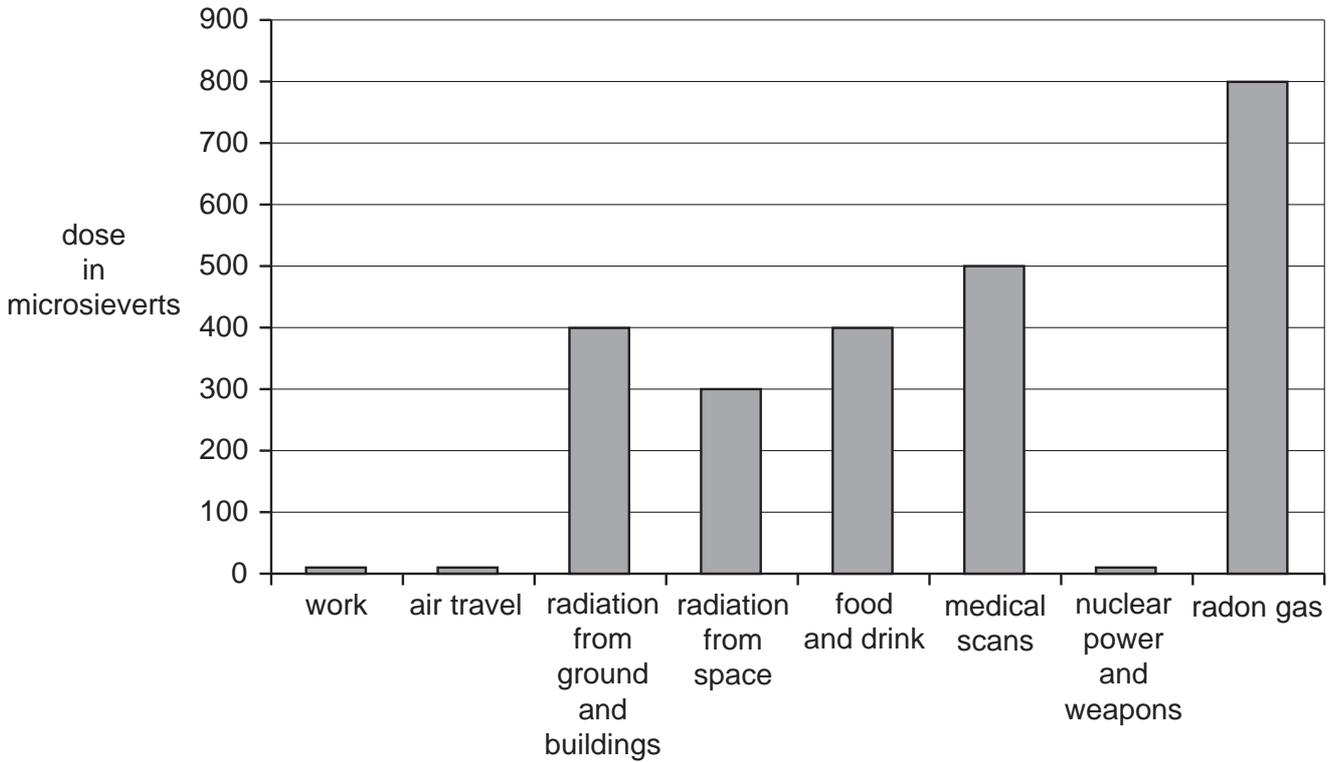
[Total: 4]

**13**  
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**Question 6 starts on page 14**

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6 The bar chart shows the typical yearly radiation dose for a person in Britain from different sources.



(a) What radiation dose would a typical person get from the ground, buildings and medical scans?

Put a **ring** around the correct answer. All values are in microsieverts.

- 300      400      500      800      900

[1]

(b) The total for all sources is 2430 microsieverts.

Which of the following statements is a correct conclusion **from the bar chart**?

Put a tick (✓) in the box next to **each** correct statement.

Not everyone will have medical scans.

Radon gas provides more than half the total dose.

The fraction of dose received from nuclear power stations is tiny.

The dose from radon gas will be different in different parts of Britain.

The dose from food and drink is less than a quarter of the total dose.

[2]

- (c) Radon gas provides the largest percentage of the total dose.

What percentage of the total dose comes from radon gas?

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

22%

33%

67%

80%

[1]

- (d) The major risk identified in the table is from radon gas, which is breathed in.

Here are four possible actions you could take to reduce the risk from inhaling this gas.

- A Move to a part of the country with very little radon.
- B Wear a radiation badge to monitor the dose you receive.
- C Have a regular check-up with a medical radiation specialist.
- D Keep the house well-ventilated to blow away the radon gas.

- (i) Which actions, **A**, **B**, **C** or **D**, will reduce the risk from breathing in radon?

Put a **ring** around **each** correct answer.

A

B

C

D

[1]

- (ii) Which **one** action is based on the 'precautionary principle'?

Put a **ring** around the **one** correct answer.

A

B

C

D

[1]

- (e) The following statements describe how radon can cause cancer.

They are in the wrong order.

- A People inhale radon gas.
- B Living cells become cancerous.
- C Radon is given out by the rocks.
- D Alpha particles break up molecules in the body.
- E Ions cause unwanted chemical reactions in the body.
- F Unstable radon atoms change into polonium atoms and give out radiation.

Fill in the boxes to show the right order. The first one has been done for you.

C					
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[4]

[Total: 10]

**END OF QUESTION PAPER**

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Q.2 Daily Mail, 6 July 2006

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