

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

For Examiner's Use
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General Certificate of Secondary Education  
January 2007



**SCIENCE B**  
**Unit Physics P1**

**PHY1H**  
**H**

**PHYSICS**  
**Unit Physics P1**

**Higher Tier**

Friday 26 January 2007 9.00 am to 9.45 am

<p><b>For this paper you must have:</b></p> <ul style="list-style-type: none"> <li>a ruler.</li> </ul> <p>You may use a calculator.</p>
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Time allowed: 45 minutes

**Instructions**

- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.

**Information**

- The maximum mark for this paper is 45.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

**Advice**

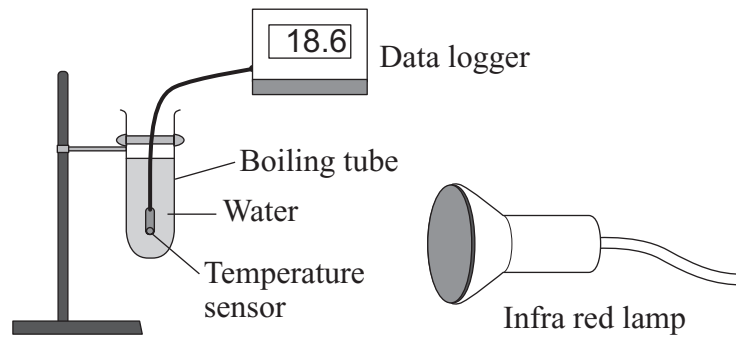
- In all calculations, show clearly how you work out your answer.

For Examiner's Use			
Question	Mark	Question	Mark
1		3	
2		4	
		5	
		6	
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

Answer **all** questions in the spaces provided.

- 1 A student had read about a glacier that had been covered in insulating material. The idea was to slow down the rate at which the glacier melts in the summer.

She investigated this idea using the apparatus shown in the diagram.



- (a) These are the steps taken by the student.

- Measure  $30\text{ cm}^3$  of cold water into a boiling tube.
- Place the boiling tube 25 cm from an infra red lamp.
- Record the temperature of the water.
- Switch on the infra red lamp.
- Record the temperature of the water every minute for 5 minutes.
- Repeat with boiling tubes covered in different insulating materials.

- (i) Why did she use an infra red lamp?

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(1 mark)

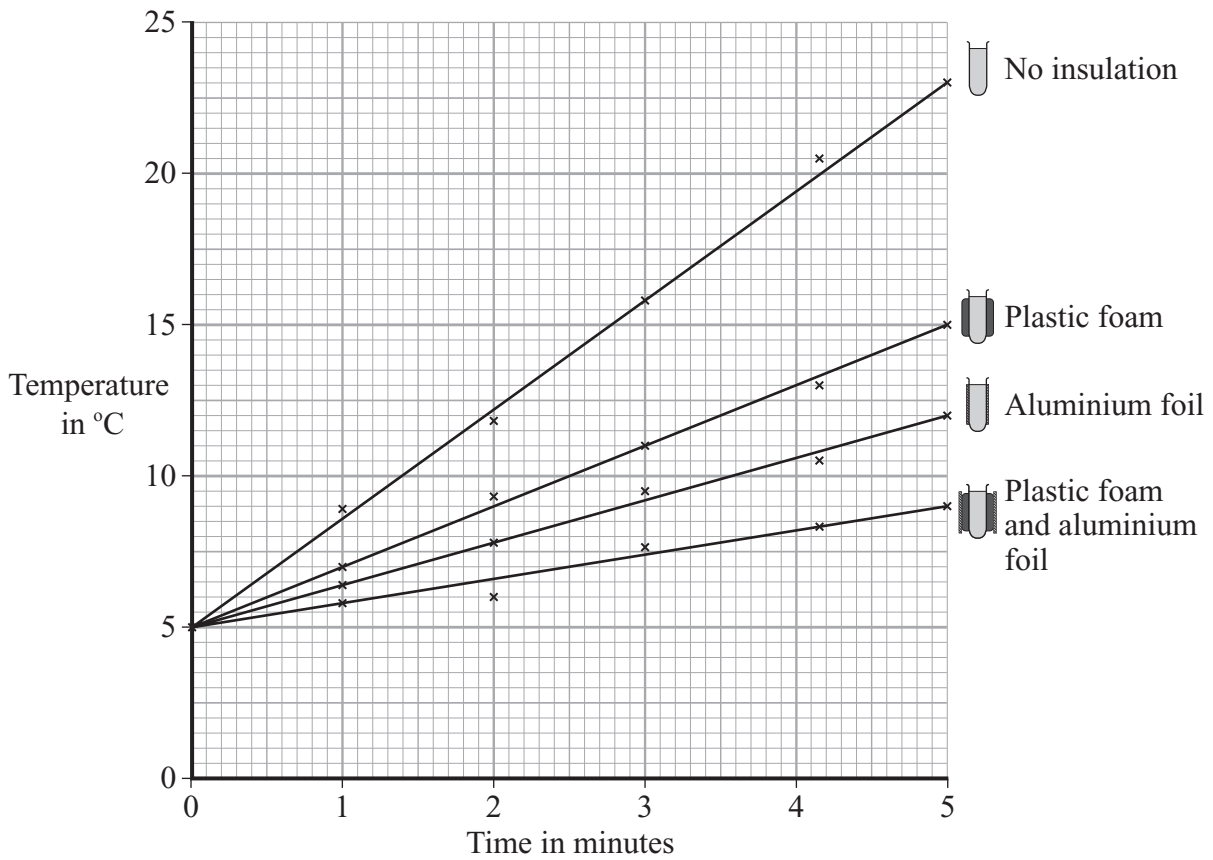
- (ii) Name **one** control variable in this investigation.

.....  
(1 mark)

- (iii) Give **one** advantage of using a temperature sensor and data logger instead of a glass thermometer to measure temperature.

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.....  
(1 mark)

(b) The results of the investigation are shown in the graph.



(i) Why did the student use a boiling tube with no insulation?

.....

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(1 mark)

(ii) From her results, what should she recommend is used to insulate the glacier?

.....

(1 mark)

**Question 1 continues on the next page**

**Turn over ►**

(iii) Explain why the insulation recommended by the student will reduce the heat transfer from the Sun to the glacier.

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(2 marks)

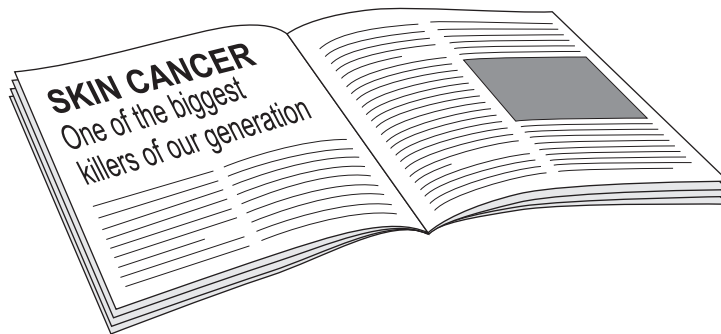
(c) Explain, in terms of particles, how heat is transferred through the glass wall of a boiling tube.

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(2 marks)

9

2 A headline from a recent magazine article is shown below.



(a) Complete the following sentence.

Skin cancer can be caused by exposure to excess ..... rays from the Sun.  
(1 mark)

- (b) Sunscreen should be used to protect your skin from the damaging effects of the Sun. A thick layer of sunscreen should be applied 30 minutes before sunbathing and re-applied every hour.

The protection factor of a sunscreen lets you work out roughly how long you can stay in the Sun without causing damage to your skin. For example, a ‘factor 10’ sunscreen lets you stay in the Sun for up to ten times longer than if you were not using the sunscreen.

- (i) Without sunscreen, a person with fair skin has found that she gets sunburn after 12 minutes of sunbathing.

What is the maximum time that she could sunbathe without burning if she used ‘factor 30’ sunscreen on her skin?

.....

Maximum time = .....  
(1 mark)

- (ii) Why does the protection factor give only a rough idea of how long you can sunbathe without getting sunburn?

.....

.....  
(1 mark)

- (iii) Another person has naturally dark skin.

Suggest why he can sunbathe with less risk of getting skin cancer than a fair-skinned person.

.....

.....

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.....  
(2 marks)

- (c) Most people know that sunbathing can cause skin cancer. But most holidaymakers still like to come home with a suntan.

Why is it important that people understand that there are dangers involved in sunbathing?

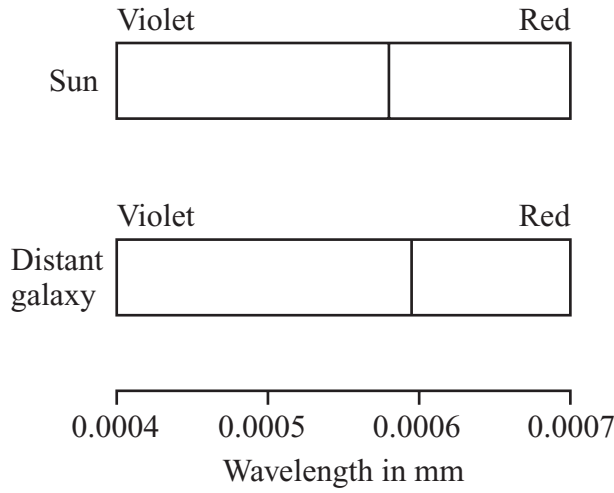
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(1 mark)

**There are no questions printed on this page**

3 The visible part of the electromagnetic spectrum from a star includes a dark line. This line is at a specific wavelength. The diagram shows the position of the dark line in the spectrum from the Sun and in the spectrum from a distant galaxy.



(a) Explain how the spectrum ‘shift’ of the dark line supports the theory that the Universe began from a very small point.

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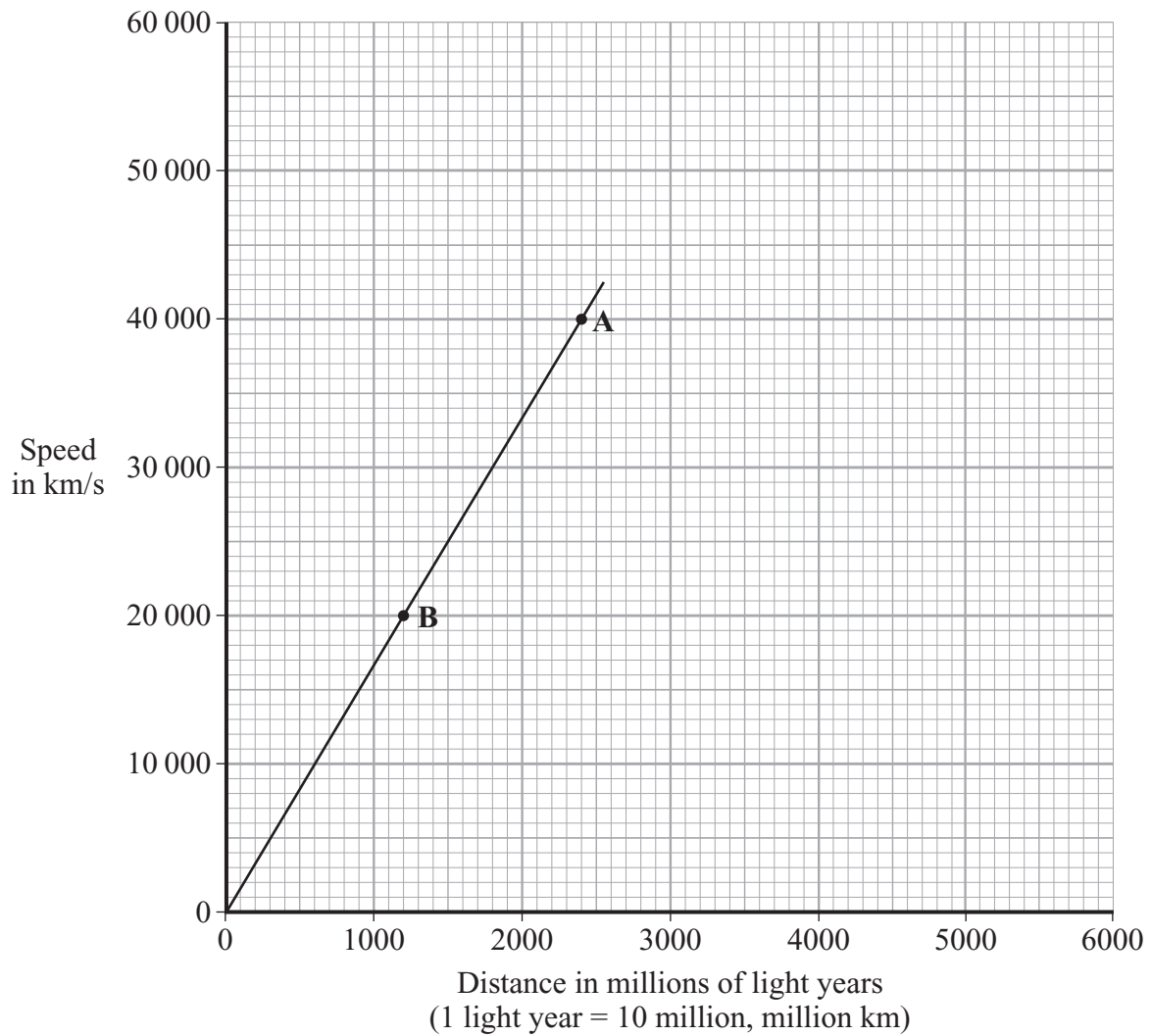
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(3 marks)

**Question 3 continues on the next page**

**Turn over ►**

- (b) From data collected, a graph can be drawn that links the speed of a galaxy with the distance of the galaxy from the Earth.



- (i) How does the visible light spectrum from galaxy **A** look different from the visible light spectrum from galaxy **B**?

.....  
 .....

*(1 mark)*



- (ii) A third galaxy, C, seems to be travelling away from the Earth at about 60 000 km/s.

Estimate how far galaxy C might be from the Earth, showing how you use the graph to do this.

.....  
 .....

Distance between galaxy C and the Earth = ..... million light years  
*(2 marks)*

- (c) Astronomers use telescopes to observe distant galaxies. Since 1990 the Hubble optical telescope has been in orbit around the Earth.

Explain why an optical telescope in space allows astronomers to see further and more clearly than an optical telescope on Earth.

.....  
 .....

*(2 marks)*

8
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**Turn over for the next question**

**Turn over ►**

4 (a) Alpha particles ( $\alpha$ ), beta particles ( $\beta$ ) and gamma rays ( $\gamma$ ) are types of nuclear radiation.

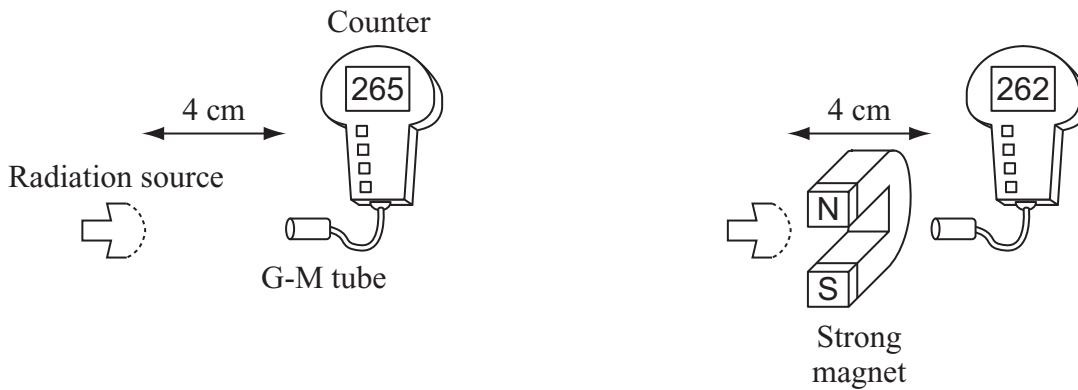
(i) Which of the three types of radiation is the most strongly ionising?

.....  
(1 mark)

(ii) What effect does nuclear radiation have on living cells?

.....  
(1 mark)

(b) The diagrams show a G-M tube and counter used to measure the radiation emitted from a source. Both diagrams show the reading on the counter one minute after it was switched on.



Explain why the counter readings show that the source is giving out only gamma radiation.

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(2 marks)

- (c) The box gives information about the radioactive isotope technetium-99.

Type of radiation emitted: gamma

*Half-life*: 6 hours

Used as a medical tracer

What is meant by the term *half-life*?

.....  
.....  
(1 mark)

- (d) To study the blood flow in a patient's lungs, a doctor injects a small quantity of a technetium-99 compound into the patient. The radiation emitted by the technetium-99 atoms is detected outside the patient's body.

Explain why a doctor would not use a radioactive isotope with a very short half-life, such as 2 seconds, as a medical tracer.

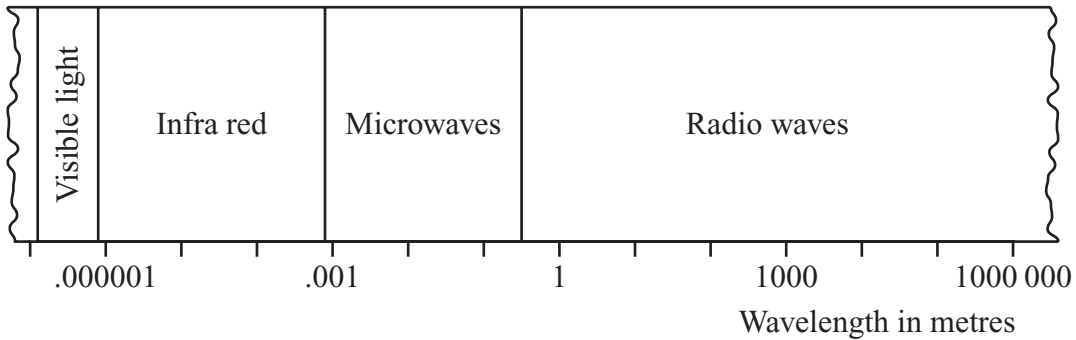
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(2 marks)

7

**Turn over for the next question**

**Turn over ►**

5 (a) The diagram represents part of the electromagnetic spectrum.



(i) Visible light travels through air at 300 000 000 m/s.

Why can we assume that radio waves travel through air at the same speed as light?

.....  
(1 mark)

(ii) A radio station broadcasts at a frequency of 200 kHz.

Use the following equation to calculate the wavelength of the waves broadcast by this radio station. Show clearly how you work out your answer.

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

.....  
.....

Wavelength = ..... m  
(2 marks)

(iii) Draw a vertical line on the diagram above to show the position of this radio wave in the electromagnetic spectrum.  
(1 mark)

(b) Many radio stations now broadcast digital signals instead of *analogue* signals.

(i) What is an *analogue* signal?

.....  
(1 mark)

- (ii) Give **one** reason why a radio station would broadcast digital signals instead of analogue signals.

.....  
.....

(1 mark)

- (c) A student thinks that because energy cannot be destroyed it is not possible to waste energy. So he leaves his radio, TV and computer on all the time, even when there is no one in the house.

Explain why he is wrong about not being able to waste energy.

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(2 marks)

<b>8</b>

**Turn over for the next question**

**Turn over ►**

6 There is an increasing demand for electricity and the reserve of fossil fuels is decreasing. A way to meet increasing demand for electricity is to build new nuclear power stations. Some people feel that no new nuclear power stations should be built because of the risks associated with nuclear fuels.

- (a) Outline the arguments that a scientist working in the nuclear power industry could use to justify the building of more nuclear power stations in the future.

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*(3 marks)*

- (b) Nuclear waste is a problem that must be dealt with. One possible solution would be to bury the waste deep underground.

Suggest **one** reason why some people are against burying nuclear waste.

.....

.....

*(1 mark)*

(c) Electricity can also be generated using renewable energy sources.

Look at this information from a newspaper report.

- The energy from burning bio-fuels, such as woodchip and straw, can be used to generate electricity.
- Plants for bio-fuels use up carbon dioxide as they grow.
- Farmers get grants to grow plants for bio-fuels.
- Electricity generated from bio-fuels can be sold at a higher price than electricity generated from burning fossil fuels.
- Growing plants for bio-fuels offers new opportunities for rural communities.

Suggest why, apart from the declining reserves of fossil fuels, power companies should use more bio-fuels and less fossil fuels to generate electricity.

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*(3 marks)*

7
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**END OF QUESTIONS**

**There are no questions printed on this page**