For Examiner's Use

General Certificate of Secondary Education
June 2009

AQA

SCIENCE B
Unit Physics P1

PHYSICS
Unit Physics P1

PHY1H

H

Higher Tier

Friday 19 June 2009   9.00 am to 9.45 am

For this paper you must have:
- a ruler.
You may use a calculator.

Time allowed: 45 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Answers written in margins or on blank pages will not be marked.
- 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.

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

1 (a) The table lists the names of seven telescopes. Each one of the telescopes is designed to detect a different one of the seven types of electromagnetic wave.
The table is incomplete.

Name of telescope	Type of wave detected
HESS	Gamma
XMM Newton	X-ray
FUSE	Ultraviolet
William Herschel	Visible light
Spitzer	
SPT	Microwave
Lovell	Radio

1 (a) (i) Which **one** of the telescopes is designed to detect the type of wave with the shortest wavelength?

....
(1 mark)

1 (a) (ii) What type of wave is the Spitzer telescope designed to detect?

....
(1 mark)

1 (b) The William Herschel telescope is on the Earth's surface. Another telescope, the Hubble telescope, which also detects visible light, orbits the Earth.

How is the image produced by the Hubble telescope better than the image produced by the William Herschel telescope?

....

Give a reason for your answer.

....

....
(2 marks)

1 (c) Some types of electromagnetic wave are absorbed by water.
The SPT telescope is located in the Antarctic, which is a dry environment.

Explain why it is better to have this type of telescope in a dry environment rather than in a wet, humid environment.
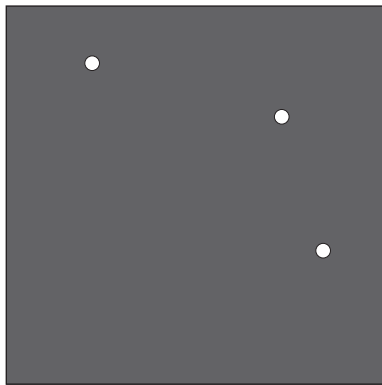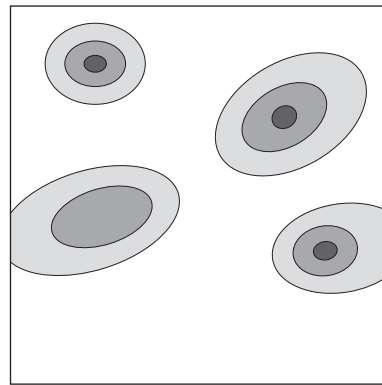
....

....

....

....
(2 marks)

1 (d) The pictures represent the images produced using a visible light telescope and a radio telescope. Both images are of the same part of the sky. The shading on the radio telescope image represents the strength of the radio signals.

Visible light image   Radio telescope image

Key	
■	Strong radio signal
▨	Weak radio signal
▢	Very weak radio signal
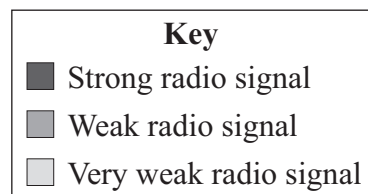
Suggest what extra information can be gained from the radio telescope image compared with the visible light image.

....

....
(1 mark)

7

Turn over ▶

2 (a) Mobile phone networks send digital signals using microwaves.

2 (a) (i) Give **one** advantage of sending information as a digital signal rather than as an analogue signal.

....

....

(1 mark)

2 (a) (ii) Give **one** other use of microwaves.

....

....

(1 mark)

2 (b) Some scientists think that there is a link between using a mobile phone and some types of illness. Other scientists disagree. They say that the evidence is limited and unreliable.

2 (b) (i) Suggest what scientists could do to show a link between using a mobile phone and illness.

....

....

(1 mark)

2 (b) (ii) How could scientists improve the reliability of the evidence?

....

....

(1 mark)

2 **(b)** **(iii)** Complete the following passage by drawing a ring around the word in the box that is correct.

There has been little or no experimental research into the health of children who use mobile phones.

This is partly because of the

economic
environmental
ethical

issues involved in using

children in scientific research.

(1 mark)

2 **(c)** Before being sold, new mobile phones must be tested and given a SAR value.
The SAR value is a measure of the energy absorbed by the head while a mobile phone is being used.

The table gives the SAR value for three mobile phones made by different companies.
To be sold in the UK, a mobile phone must have a SAR value lower than 2.0 W/kg.

Mobile phone	SAR value in W/kg
J	0.18
K	0.86
L	1.40

2 **(c)** **(i)** All companies use the same test to measure a SAR value.

Why is using the same test important?

....

....

(1 mark)

Question 2 continues on the next page

Turn over ▶

2 **(c)** **(ii)** Would the companies that make the mobile phones, **J**, **K** and **L**, be correct to claim that these three phones are totally safe to use?

Answer yes or no. ....

Give a reason for your answer.

....

....

(1 mark)

2 **(d)** Devices designed to protect a mobile phone user from microwave radiation are now available.

Why is it important that these devices are tested by scientists who are **not** working for the company that makes the devices?

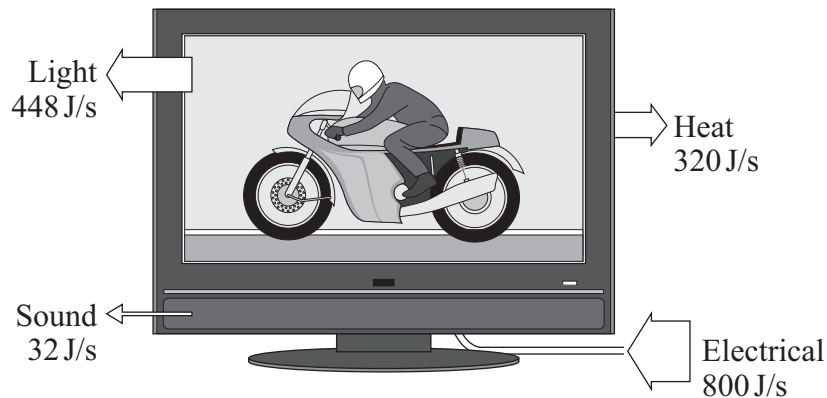...

....

(1 mark)

8

3 (a) The diagram shows the energy transformations produced by a TV.

Light
448 J/s

Heat
320 J/s

Sound
32 J/s

Electrical
800 J/s

3 (a) (i) Use the information in the diagram and the equation in the box to calculate the efficiency of the TV.

$$\text{efficiency} \ = \ \frac{\text{useful energy transferred by the device}}{\text{total energy supplied to the device}}$$

Show clearly how you work out your answer.

....

....

Efficiency = ...
(2 marks)

3 (a) (ii) What eventually happens to the useful energy transferred by the TV?

....

....
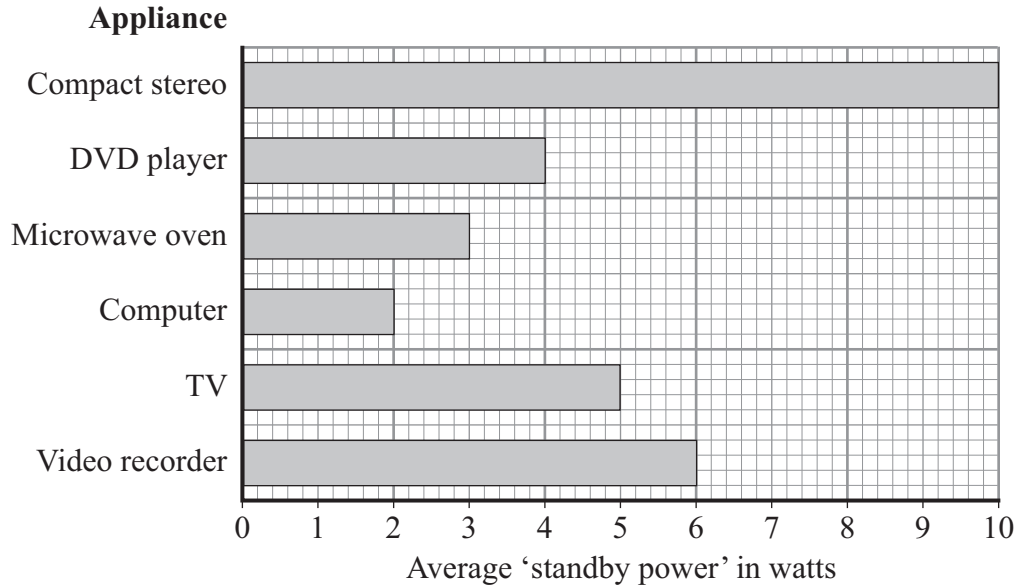*(1 mark)*

Question 3 continues on the next page

Turn over ▶

3 (b) Electrical appliances left on standby use energy.

The bar chart shows the power for the appliances that one family leaves on standby when they go on holiday.

Appliance

Average 'standby power' in watts

The family is on holiday for a total of 175 hours.

3 (b) (i) Use the information in the bar chart and the equation in the box to calculate the energy wasted by leaving the compact stereo on standby while the family is on holiday.

energy transferred (kilowatt-hour, kWh) = power (kilowatt, kW) × time (hour, h)

Show clearly how you work out your answer.

....

....

Energy wasted = ... kilowatt-hours
(2 marks)

3 (b) (ii) Electricity costs 12 p per kilowatt-hour.

Use the equation in the box to calculate the cost of leaving the compact stereo on standby while the family is on holiday.

| total cost = number of kilowatt-hours × cost per kilowatt-hours |

Show clearly how you work out your answer.

....

Cost = ... p

(1 mark)

3 (c) A headline from a recent newspaper article is shown below.

Leaving appliances on standby damages the environment
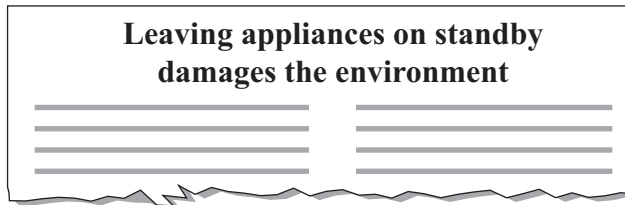
Explain why leaving appliances on standby damages the environment.

....

....

....

....

(2 marks)

8

Turn over for the next question

Turn over ▶

4 The pie charts show the relative proportions of electricity generated in Japan from different energy sources in 1975 and 2005.
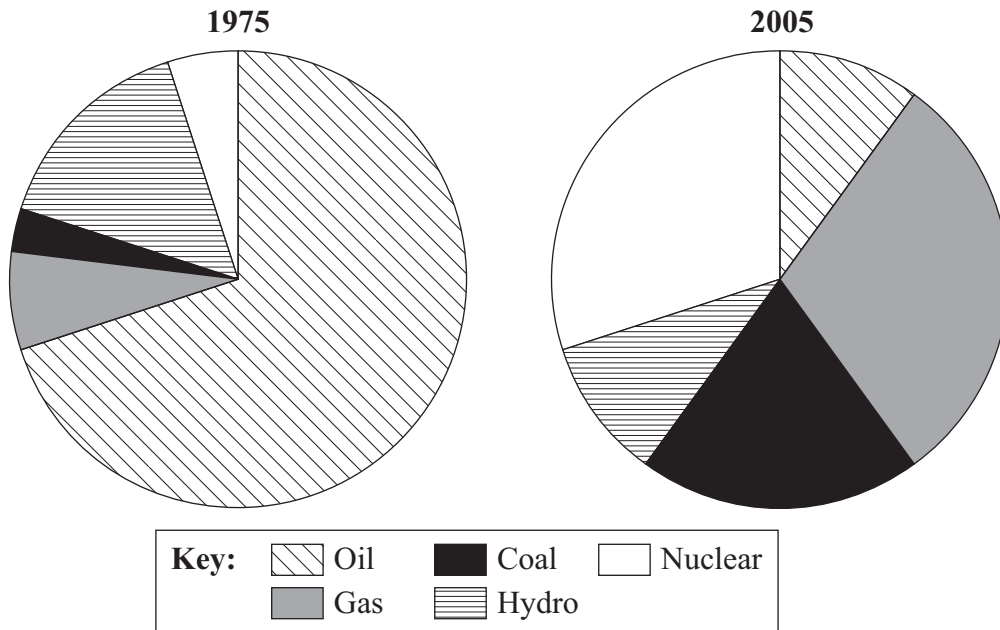

Key: ⬜ Oil ⬛ Coal ⬜ Nuclear
⬜ Gas ⬜ Hydro

4 (a) Describe the main differences in the energy sources used in 2005 compared with 1975.

....

....
(1 mark)

4 (b) In the UK, nuclear fuels are used to generate about 21% of the total electricity supply.

4 (b) (i) What is the name of the process by which a nuclear fuel produces heat?

....
(1 mark)

4 (b) (ii) Explain how the heat released from a nuclear fuel is used to generate electricity in power stations.

....

....

....

....
(2 marks)

4 (b) (iii) Some people have suggested that more nuclear power stations should be built in the UK.

Give **two** reasons to support this suggestion.

1 ....

....

2 ....

....

(2 marks)

4 (b) (iv) Nuclear power stations create dangerous waste.

Why is the waste from a nuclear power station dangerous?

....

....

(1 mark)

4 (c) A headline from a newspaper article is shown below.

Police arrest 38 people during a climate change protest outside Britain's largest coal-burning power station

Explain the possible link between *climate change* and *coal-burning power stations*.

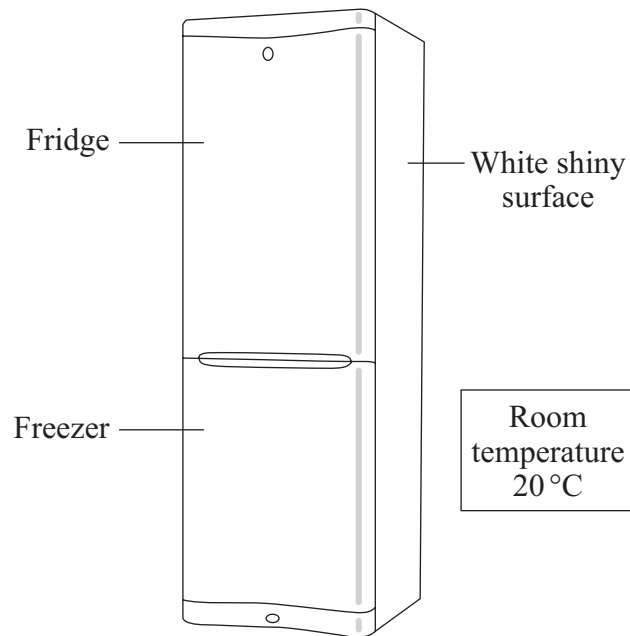...

....

....

....

(2 marks)

9

Turn over ▶

5   The diagram shows a fridge-freezer.

Fridge —

White shiny surface

Freezer —

Room temperature 20 °C

5   (a)   By which method is heat transferred through the walls of the fridge-freezer?

....
(1 mark)

5   (b)   The inside of the fridge is at 4 °C. The inside of the freezer is at −18 °C.

Into which part of the fridge-freezer will the rate of heat transfer be greater?

Draw a ring around your answer.

the fridge   **the freezer**

Give a reason for your answer.

....

....
(1 mark)

5 (c) The outside surface of the fridge-freezer is white and shiny.

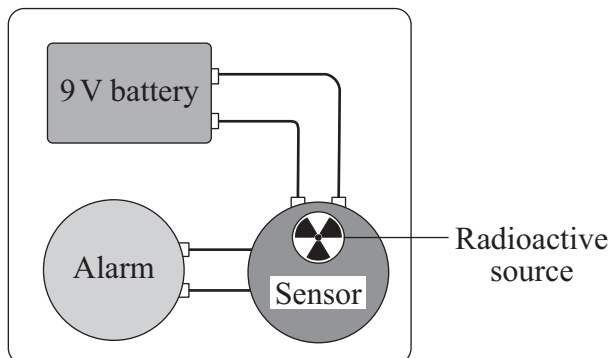Give **two** reasons why this type of surface is suitable for a fridge-freezer.

1 ....

....

2 ....

....

(2 marks)

4

Turn over for the next question

Turn over ▶

*Areas outside
the box will
not be scanned
for marking*

6 (a) The diagram shows the parts of a smoke detector. The radioactive source emits alpha particles.

The alpha particles ionise the air inside the sensor which causes a small electric current. Any smoke getting into the sensor changes the current. The change in current sets the alarm off.

6 (a) (i) The smoke detector would **not** work if a radioactive source that emitted only gamma rays was used.

Why not?

....

....

(1 mark)

6 (a) (ii) Curium-242 is a radioactive isotope with a half-life of 160 days. It emits alpha particles.

Why is curium-242 **not** suitable for use inside smoke detectors?

....

....

(1 mark)

6 (a) (iii) Curium-242 and curium-244 are two of the isotopes of the element curium.

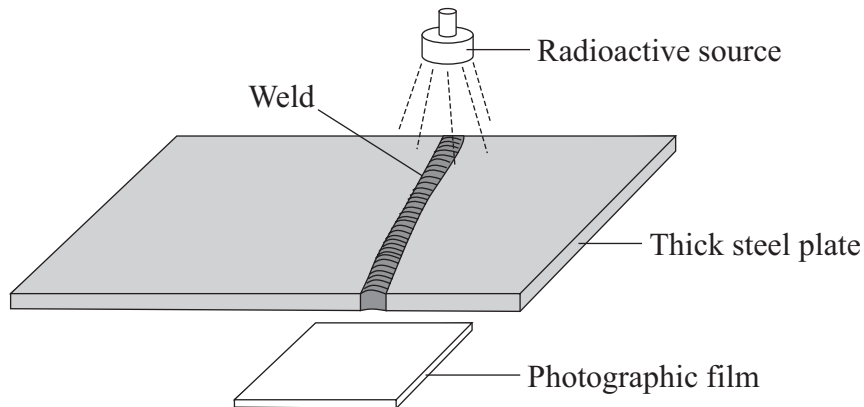How is an atom of curium-242 different from an atom of curium-244?

....

....

(1 mark)

6 (b) Sections of steel are often joined by welding them together. The diagram shows how a radioactive source can be used to check for tiny cracks in the weld.

Cracks in the weld will be shown up on the photographic film below the thick steel plate.

6 (b) (i) Which type of source, alpha, beta or gamma, should be used to check the weld?

....

(1 mark)

6 (b) (ii) Give a reason why the other two types of source **cannot** be used.

....

....
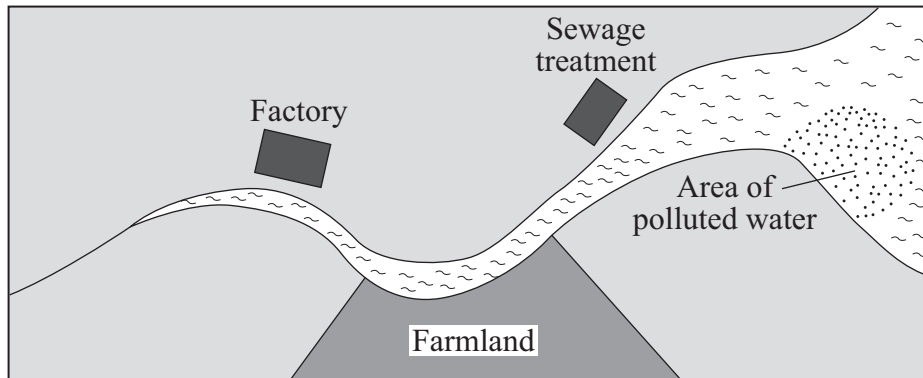
(1 mark)

Question 6 continues on the next page

Turn over ▶

6 **(c)** The diagram shows a map of a river and its estuary.

Environmental scientists have found that the water flowing into one part of the river estuary is polluted. To find where the pollution is coming from, the scientists use a radioactive isotope, gold-198.

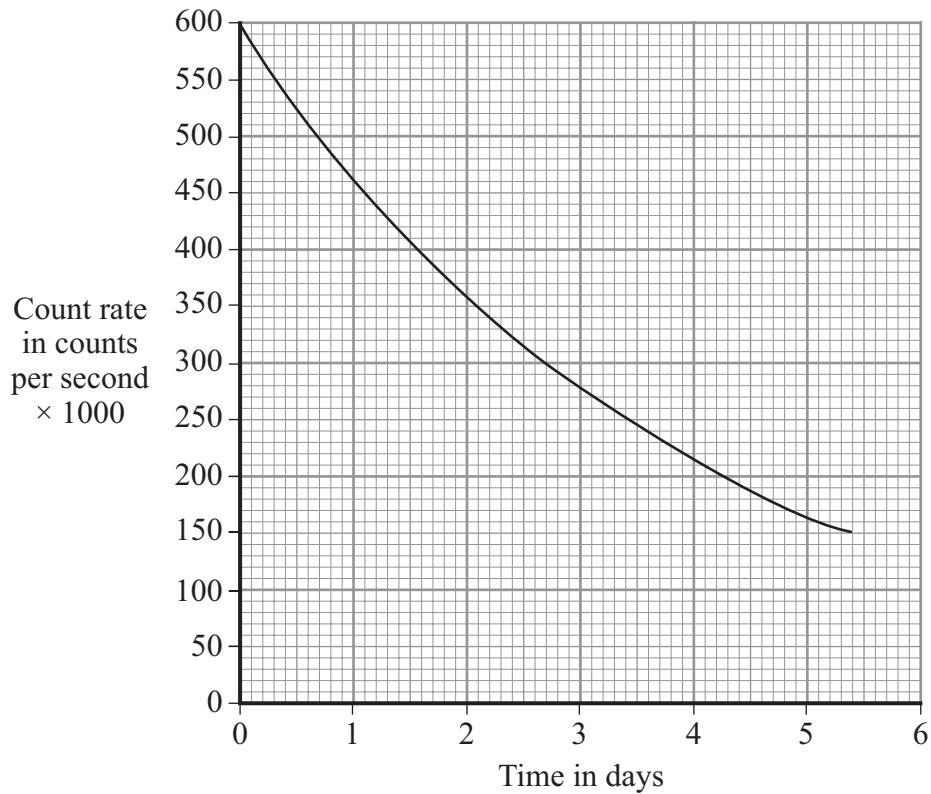**6** **(c)** **(i)** Explain how the gold-198 is used to find where the pollution is coming from.

....

....

....

....

(2 marks)

6 **(c)** **(ii)** The graph shows how the count rate from a sample of gold-198 changes with time.

Use the graph to calculate the half-life of gold-198.

Show clearly on the graph how you obtain your answer.

....

....

Half-life = ... days

(2 marks)

9

END OF QUESTIONS

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1 8

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