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| Centre Number | | Candidate Number | |
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| For Examiner's Use |
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General Certificate of Secondary Education
January 2008

SCIENCE B
Unit Physics P1

PHYSICS
Unit Physics P1

Higher Tier

Monday 21 January 2008 1.30 pm to 2.15 pm

| |
|---|
| <p>For this paper you must have:</p> <ul style="list-style-type: none"> a ruler. <p>You may use a calculator.</p> |
|---|

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.

PHY1H
H



| For Examiner's Use | | | |
|---------------------|------|----------|------|
| Question | Mark | Question | Mark |
| 1 | | 2 | |
| | | 3 | |
| | | 4 | |
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| Examiner's Initials | | | |

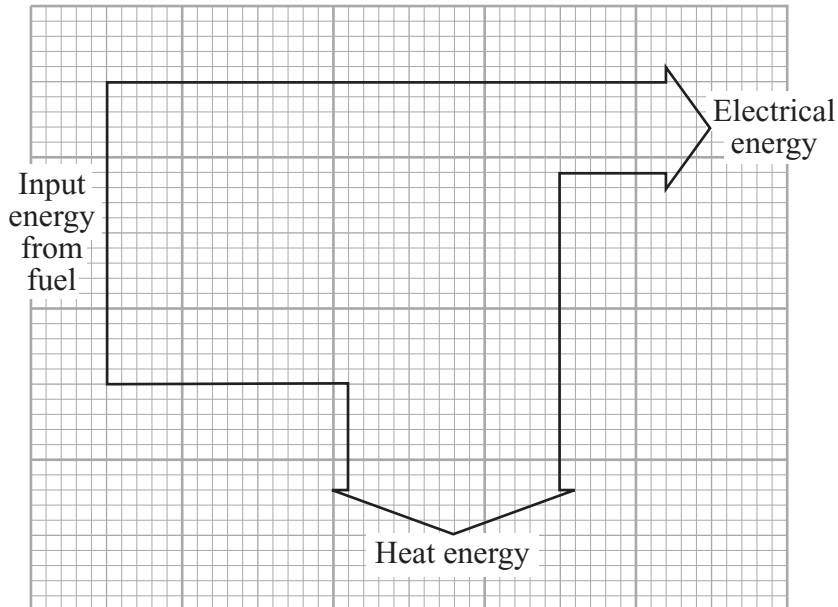


There are no questions printed on this page



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

- 1 (a) The diagram shows the energy transformations in a fuel burning power station.



- (i) Name **one** fuel that is burned to provide the energy source for a power station.

.....
(1 mark)

- (ii) Use the diagram and the equation in the box to calculate the efficiency of the power station.

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

Show clearly how you work out your answer.

.....
.....

Efficiency =
(2 marks)

- (iii) Name the process by which a nuclear fuel provides the energy needed to generate electricity in a nuclear power station.

.....
(1 mark)

Question 1 continues on the next page

Turn over ►



(b) Electricity is distributed from power stations to consumers along the National Grid.

(i) Transformers are part of the National Grid. Transformers are *efficient* devices.

What is meant by a device being *efficient*?

.....

(1 mark)

(ii) When electricity flows through a cable, some energy is transformed into heat.

Explain how the National Grid system reduces the amount of energy lost as heat.

.....

(2 marks)

(c) Read this information taken from a recent newspaper article.

- Researchers have found that children living close to overhead power cables are more likely to develop leukaemia.
- The researchers studied two groups of children. One group had developed leukaemia, the other group was healthy.
- Although the researchers found a link, they are unable to explain why it happened. They say that the results may have happened by chance.
- Other factors that have not been investigated, such as the environment, the geographical area or the children's genes, could be important.
- A cancer research charity said that childhood leukaemia was most likely to be caused by factors that parents were unable to control.

(i) Why did the researchers study a group of healthy children?

.....

(1 mark)



(ii) The information does not say how many children were studied.

Why should this data have been included in the article?

.....
.....

(1 mark)

(iii) The researchers could not be certain that the overhead power cables were responsible for the increased chance of children developing leukaemia.

Explain why.

.....
.....
.....
.....

(2 marks)

(iv) The results of the research carried out by scientists may worry some people.

What do you think scientists should do?

Put a tick (✓) in the box next to your choice.

Scientists should publish their research findings straight away.

Scientists should not publish their research findings until they have found out as many facts as possible.

Give a reason for your choice.

.....
.....

(1 mark)

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| |
| 12 |

Turn over ►



2 The diagram shows the label from a new freezer.

| | |
|--|--|
| Model Energy A | SALE See inside for details |
| More efficient A B C D E Less efficient | A |
| Energy consumption per year | 225 kWh |

(a) An old freezer has an energy consumption per year of 350 kWh.

Use the equation in the box to calculate the extra cost of using the old freezer for one year compared with using a new 'A' rated freezer.

$$\text{total cost} = \text{number of kilowatt-hours} \times \text{cost per kilowatt-hour}$$

Assume 1 kilowatt-hour (kWh) of energy costs 12p.

Show clearly how you work out your answer.

.....
.....

Extra cost per year = £
(2 marks)



(b) The price of the new freezer was reduced in a sale.

Reducing the price reduces the payback time for replacing the old freezer from 12 years to 9 years.

Calculate, in pounds, how much the new freezer was reduced in the sale.

Show clearly how you work out your answer.

.....
.....

Price reduced by = £
(2 marks)

(c) An advertisement in a shop claims that:

‘Replacing an old freezer with a new ‘A’ rated freezer will benefit the environment.’

Do you agree that replacing the freezer will benefit the environment?

Answer yes or no.

Explain the reasons for your answer.

.....
.....
.....
.....

(2 marks)

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| 6 |

Turn over for the next question

Turn over ►



3 (a) In winter, energy is transferred from the warm air inside a house to the air outside.

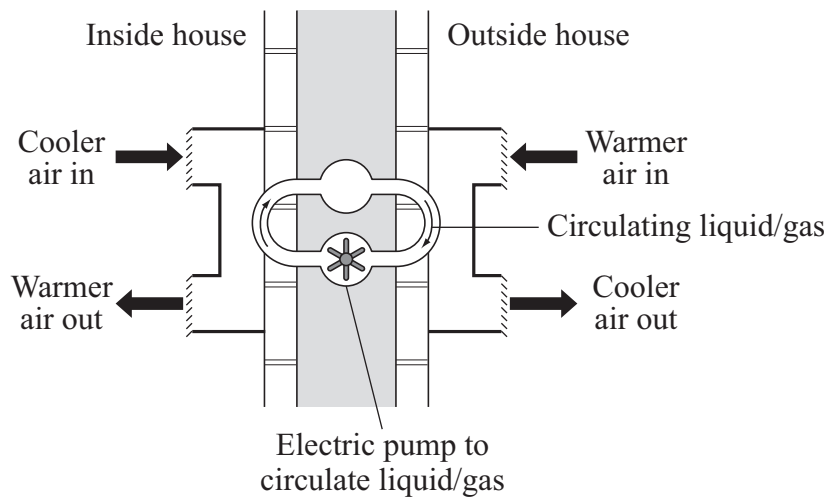
(i) What effect will the energy transferred from the house have on the air outside?

.....
(1 mark)

(ii) What would happen to the energy transfer if the temperature inside the house were reduced? Assume the temperature outside the house does not change.

.....
(1 mark)

(b) To increase energy efficiency, a householder installs a heat exchanger to an outside wall of the house. The heat exchanger uses heat from the air outside to warm the inside of the house. The diagram shows the idea of the heat exchanger.



(i) Why does the heat exchanger cost money to run?

.....
(1 mark)

(ii) The heat exchanger is cost effective in reducing energy consumption. Explain why.

.....
.....
.....
.....

(2 marks)

| |
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| 5 |
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4 (a) A radioactive source emits alpha (α), beta (β) and gamma (γ) radiation.

(i) Which **two** types of radiation will pass through a sheet of card?

.....
(1 mark)

(ii) Which **two** types of radiation would be deflected by an electric field?

.....
(1 mark)

(iii) Which type of radiation has the greatest range in air?

.....
(1 mark)

(b) A student suggests that the radioactive source should be stored in a freezer at -20°C .
The student thinks that this would reduce the radiation emitted from the source.

Suggest why the student is wrong.

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

Question 4 continues on the next page

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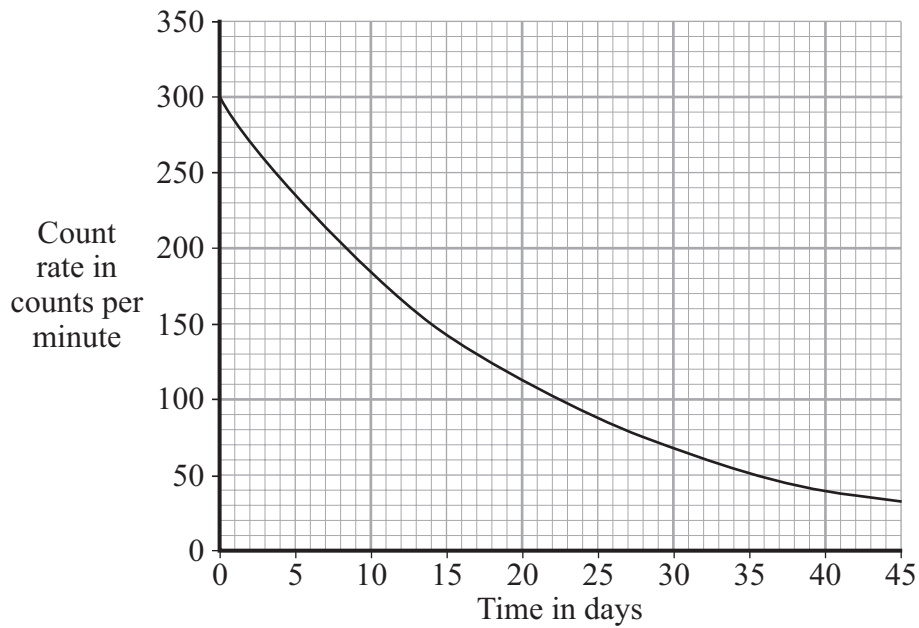
(c) Phosphorus-32 is a radioactive isotope that emits beta radiation.

(i) How is an atom of phosphorus-32 different from an atom of the stable isotope phosphorus-31?

.....
.....

(1 mark)

(ii) The graph shows how the count rate of a sample of phosphorus-32 changes with time.



Use the graph to calculate the half-life of phosphorus-32.

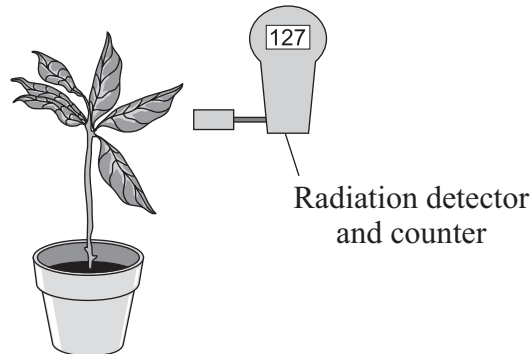
Show clearly how you used the graph to obtain your answer.

.....
.....

Half-life = days
(2 marks)



- (iii) Plants use phosphorus compounds to grow. Watering the root system of a plant with a solution containing a phosphorus-32 compound can help scientists to understand the growth process.



Explain why phosphorus-32 is suitable for use as a tracer in this situation.

.....

.....

.....

.....

(2 marks)

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| 9 |

Turn over for the next question

Turn over ►



- 5 (a) The wavelengths of four different types of electromagnetic wave, including visible light waves, are given in the table.

| Type of wave | Wavelength |
|---------------|------------|
| Visible light | 0.0005 mm |
| A | 1.1 km |
| B | 100 mm |
| C | 0.18 mm |

Which of the waves, **A**, **B** or **C**, is an infra red wave?
(1 mark)

- (b) A TV station broadcasts at 500 000 kHz. The waves travel through the air at 300 000 000 m/s.

Use the equation in the box to calculate the wavelength of the waves broadcast by this station.

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

Show clearly how you work out your answer.

.....
.....

Wavelength = m
(2 marks)

- (c) What happens when a metal aerial absorbs radio waves?

.....
.....
.....
.....

(2 marks)



- (d) Stars emit all types of electromagnetic waves. Telescopes that monitor X-rays are mounted on satellites in space.

Why would an X-ray telescope based on Earth not be able to detect X-rays emitted from distant stars?

.....
.....

(1 mark)

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Turn over for the next question

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6 The ‘steady state’ theory was once a popular alternative to the ‘big bang’ theory.

The ‘steady state’ theory suggested that the universe, although expanding, had no origin and it has always existed. As the universe expands, a small amount of matter is created to keep the universe looking exactly the same all of the time.

(a) When considering the origin of the universe, what is the difference between the ‘big bang’ theory and the ‘steady state’ theory?

.....
.....
.....
.....

(2 marks)

(b) The light from distant galaxies shows a *red-shift*.

(i) What is *red-shift*?

.....
.....

(1 mark)

(ii) Why does red-shift provide evidence to support both the ‘big-bang’ theory and the ‘steady state’ theory?

.....
.....
.....
.....

(2 marks)

(c) The ‘steady state’ theory was important in encouraging new research into the universe.

Suggest a reason why scientists were keen to carry out new research.

.....
.....

(1 mark)



(d) Scientists can answer many questions about the universe, but not the question:

‘Why was the universe created?’

Suggest a reason why this question cannot be answered by scientists.

.....

.....

(1 mark)

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| 7 |

END OF QUESTIONS



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