

|                     |  |  |  |  |  |                  |  |  |  |  |
|---------------------|--|--|--|--|--|------------------|--|--|--|--|
| Centre Number       |  |  |  |  |  | Candidate Number |  |  |  |  |
| Surname             |  |  |  |  |  |                  |  |  |  |  |
| Other Names         |  |  |  |  |  |                  |  |  |  |  |
| Candidate Signature |  |  |  |  |  |                  |  |  |  |  |

|                     |      |
|---------------------|------|
| For Examiner's Use  |      |
| Examiner's Initials |      |
| Question            | Mark |
| 1                   |      |
| 2                   |      |
| 3                   |      |
| 4                   |      |
| 5                   |      |
| 6                   |      |
| 7                   |      |
| TOTAL               |      |



General Certificate of Secondary Education  
Foundation Tier  
June 2010

**Science B**  
Unit Physics P1

**PHY1F**  
**F**

**Physics**  
Unit Physics P1

**Thursday 24 June 2010 1.30 pm to 2.15 pm**

**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. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

**Information**

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 45.
- 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.



J U N 1 0 P H Y 1 F 0 1

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

**1** Four students are talking about the different energy sources used to generate electricity in the areas where they live.

**1 (a)** Draw **one** line from where each student lives (**List A**) to the energy source in their area (**List B**).

Draw only **four** lines.

**List A**

Where each student lives

Where I live is the sunniest part of the country.

Where I live, the land is very flat and it always seems to be windy.

Where I live, it is not safe to swim. The sea is always too rough.

Where I live, you can see steam coming out of the ground.

**List B**

Energy source

Wind

Waves

Solar

Tides

Geothermal

(4 marks)

**1 (b)** All of the energy sources given in part (a) can be used to generate electricity.

What else do all these energy sources have in common?

.....

.....

(1 mark)



**1 (c)** In a hydroelectric power station, the energy from falling water is used to generate electricity.

Which **one** of the following gives a **disadvantage** of a hydroelectric power station?

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

has a fast start-up time

large areas of land are flooded

polluting gases are produced

(1 mark)

|   |
|---|
|   |
| 6 |

**Turn over for the next question**

**Turn over ►**



- 2 The diagram shows the seven types of wave that make up the electromagnetic spectrum.

|            |        |                  |               |                |             |             |
|------------|--------|------------------|---------------|----------------|-------------|-------------|
| Gamma rays | X-rays | Ultraviolet rays | Visible light | Infra red rays | Micro-waves | Radio waves |
|------------|--------|------------------|---------------|----------------|-------------|-------------|

- 2 (a) (i) Microwaves and visible light can be used for communications.

Name **one** more type of electromagnetic wave that can be used for communications.

.....  
(1 mark)

- 2 (a) (ii) Name **one** type of electromagnetic wave that has a longer wavelength than microwaves.

.....  
(1 mark)

- 2 (b) Wi-Fi is a system that joins a laptop computer to the internet without using wires. A 2400 megahertz microwave signal is used to link a computer to a device called a router.

What quantity is measured in hertz?

Draw a ring around your answer.

**frequency**

**wavelength**

**wave speed**

(1 mark)

- 2 (c) A politician commented on the increasing use of Wi-Fi. He said: 'I believe that these systems may be harmful to children.'

- 2 (c) (i) Suggest **one** reason why more scientific research into the safety of Wi-Fi systems is needed.

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



**2 (c) (ii)** Complete the following sentence by drawing a ring around the correct line in the box.

What the politician said was

|               |
|---------------|
| a fact.       |
| an opinion.   |
| a prediction. |

(1 mark)

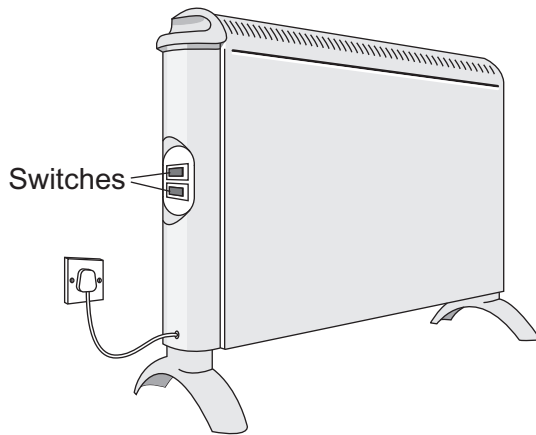
|   |
|---|
|   |
| 5 |

**Turn over for the next question**

**Turn over ►**



- 3 (a)** The diagram shows two switches on a room heater. The heater has three power settings. The power produced by two of the settings is given in the table.



| Setting | Power in kW |
|---------|-------------|
| Low     | 0.5         |
| Medium  | 1.5         |
| High    |             |

- 3 (a) (i)** When both switches are on, the heater works at the high power setting.

What is the power of the heater when it is switched to the **high** power setting?

.....

Power = ..... kW  
(1 mark)

- 3 (a) (ii)** The heater is used on the **medium** power setting. It is switched on for three hours.

Use the equation in the box to work out the energy transferred from the mains to the heater in three hours.

|  |   |                         |   |                   |
|--|---|-------------------------|---|-------------------|
| energy transferred<br>(kilowatt-hour, kWh) | = | power<br>(kilowatt, kW) | × | time<br>(hour, h) |
|--|---|-------------------------|---|-------------------|

Show clearly how you work out your answer.

.....

.....

Energy transferred = ..... kWh  
(2 marks)



**3 (a) (iii)** Electricity costs 12 pence per kilowatt-hour.

Use the equation in the box to calculate how much the heater costs to use on **medium** power for three hours.

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

Show clearly how you work out your answer.

.....  
.....

Total cost = ..... pence  
(2 marks)

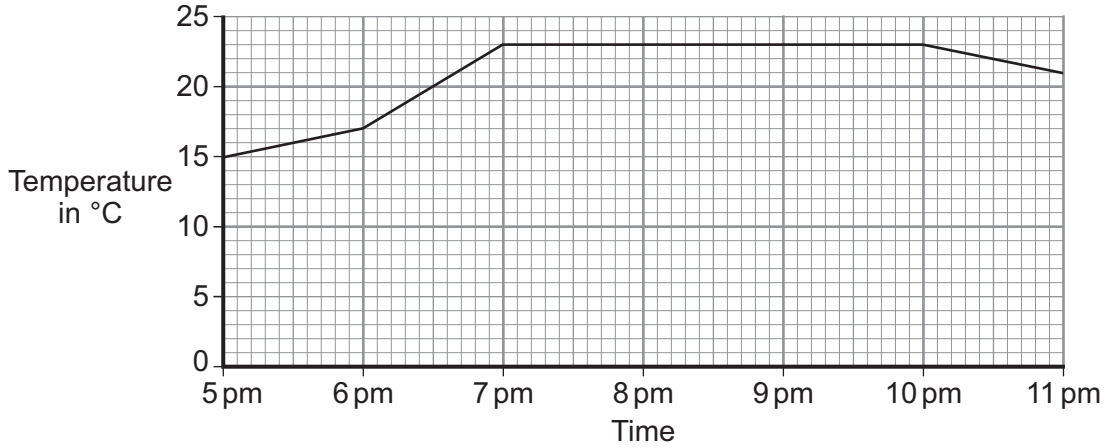
**Question 3 continues on the next page**

**Turn over ►**



3 (b) The heater is used to warm a room.

The graph shows how the temperature of the room changes from the moment the heater is switched on.



The heater was first used on the medium setting.

3 (b) (i) At what time was the heater setting changed to the **high** setting?

.....

Give a reason for your answer.

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

(2 marks)

3 (b) (ii) From 7 pm until 10 pm, the temperature of the room is **not** changing.

Which **one** of the following statements gives the reason why the temperature of the room is **not** changing?

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

The room is losing energy slower than the heater supplies energy.

The room is losing energy as fast as the heater supplies energy.

The room is losing energy faster than the heater supplies energy.

(1 mark)

|   |
|---|
| 8 |
|---|





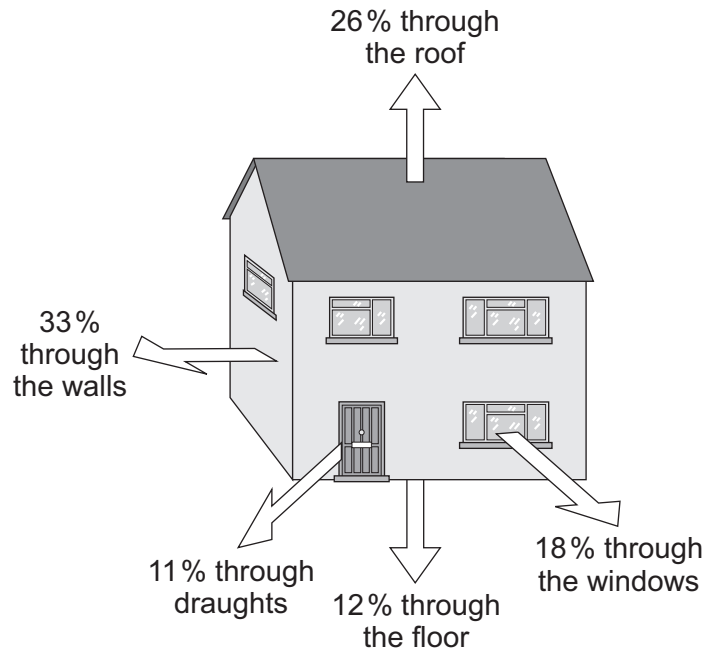
**Turn over for the next question**

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**

**Turn over ►**



- 4 The diagram shows where heat is lost from a house that is **not** insulated.



- 4 (a) (i) Through which part of the house is most heat lost?

.....  
(1 mark)

- 4 (a) (ii) How can the heat loss through the windows be reduced?

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



**4 (b)** A homeowner wants to reduce her energy bills and make her home more energy efficient. The table shows five ways this could be done. The table also shows how much money each way would save the homeowner each year.

|                                    | <b>Cost</b> | <b>Money saved each year</b> |
|------------------------------------|-------------|------------------------------|
| Installing loft insulation         | £175        | £60                          |
| Fitting draught-proofing           | £45         | £20                          |
| Installing cavity wall insulation  | £300        | £80                          |
| Adding a hot water tank jacket     | £15         | £20                          |
| Using energy efficient light bulbs | £60         | £30                          |

**4 (b) (i)** Which **one** of the five ways of reducing energy bills would reduce the yearly energy bill the most?

.....  
(1 mark)

**4 (b) (ii)** This year the homeowner has only got £60 to spend to improve the energy efficiency of her home.

Use the information in the table to explain what the homeowner should spend this money on.

.....  
.....  
.....  
.....  
(2 marks)

|   |
|---|
| 5 |
|---|

Turn over ▶



- 5 (a)** Scientists use telescopes to observe stars and galaxies.  
Some telescopes are on Earth, but some are on satellites in space.

Why do telescopes in space give better images than telescopes on the Earth?

.....  
.....

(1 mark)

- 5 (b)** Scientists have observed that the wavelengths of the light given out from galaxies that are moving away from the Earth are longer than expected.

- 5 (b) (i)** What name is given to this observation?

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

blue-shift

green-shift

red-shift

(1 mark)

- 5 (b) (ii)** Complete the following sentence by drawing a ring around the correct line in the box.

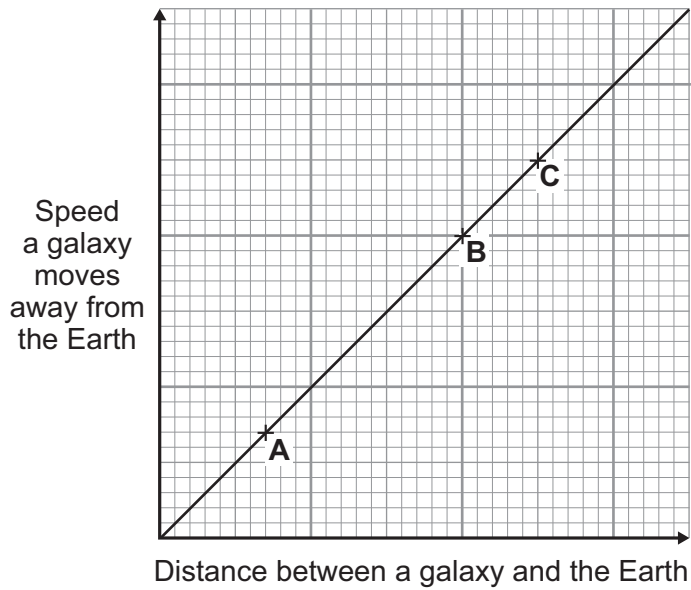
This observation gives evidence for the idea that the universe is

shrinking.  
not changing.  
expanding.

(1 mark)



5 (c) Use the graph to answer the following questions.



5 (c) (i) What is the link between the speed that a galaxy moves away from the Earth and the distance between the galaxy and the Earth?

.....  
 .....

(1 mark)

5 (c) (ii) The positions of three galaxies, **A**, **B** and **C**, are marked on the graph.

From which galaxy, **A**, **B** or **C**, would the wavelength of the light reaching the Earth seem to have changed the most?

Galaxy .....

Give a reason for your answer.

.....  
 .....

(2 marks)

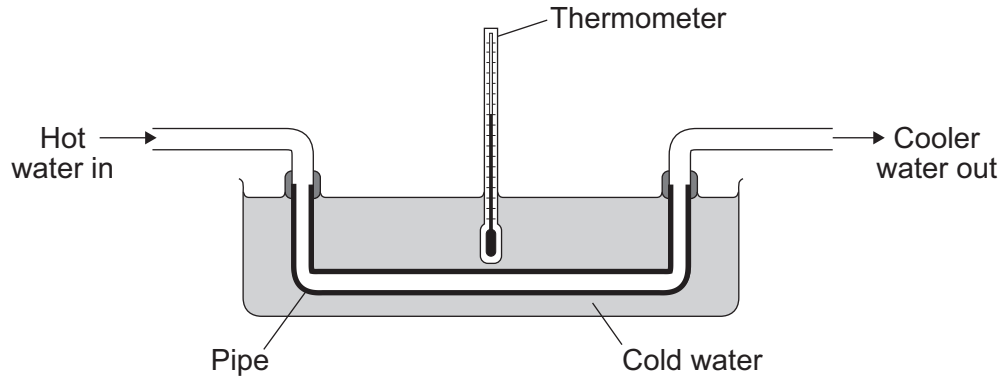
|   |
|---|
| 6 |
|---|

Turn over ►



**6** Heat exchangers are devices that are used to transfer heat from one place to another.

The diagram shows a simple heat exchanger used by a student in an investigation. Heat is transferred from the hot water inside the pipe to the cold water outside the pipe.



**6 (a)** By which process is heat transferred from the hot water inside the pipe to the cold water outside the pipe?

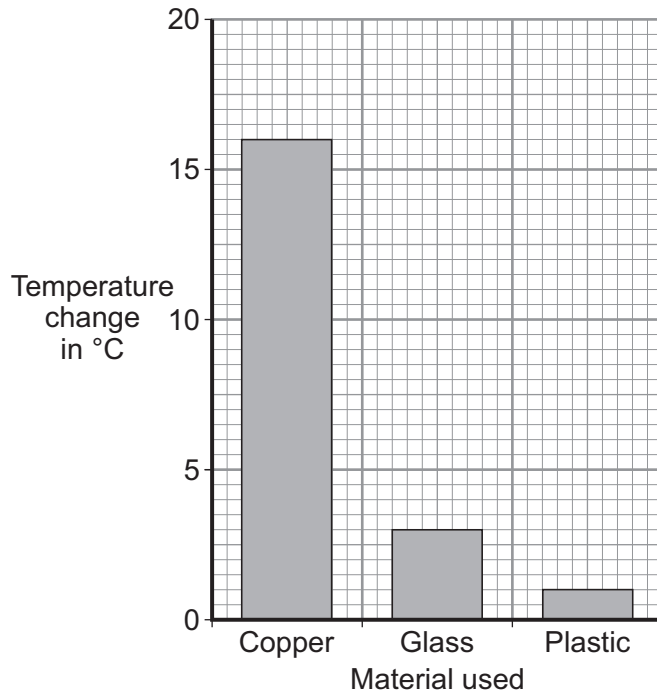
.....  
(1 mark)

**6 (b)** The student wanted to find out if the efficiency of a heat exchanger depends on the material used to make the pipe. The student tested three different materials. For each material, the rate of flow of hot water through the pipe was kept the same.

The results obtained by the student are recorded in the table and displayed in the bar chart.

| Material | Temperature of the cold water at the start in °C | Temperature of the cold water after 10 minutes in °C |
|----------|--|--|
| Copper   | 20   | 36   |
| Glass    | 20   | 23   |
| Plastic  | 20   | 21   |





6 (b) (i) The rate of flow of hot water through the pipe was one of the control variables in the investigation.

Give **one** other control variable in the investigation.

.....  
(1 mark)

6 (b) (ii) Why did the student draw a bar chart rather than a line graph?

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

6 (b) (iii) Which **one** of the three materials made the best heat exchanger?

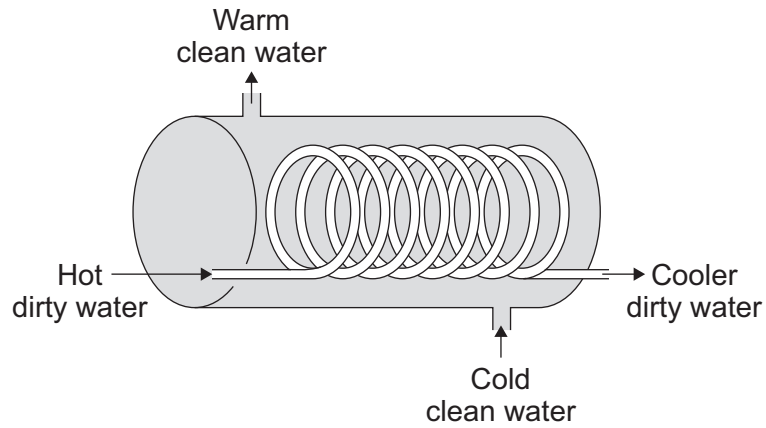
.....  
Give a reason for your answer.  
.....  
.....  
(2 marks)

Question 6 continues on the next page

Turn over ►



- 6 (c)** The student finds a picture of a heat exchanger used in an industrial laundry. The heat exchanger uses hot, dirty water to warm cold, clean water.



Why does this heat exchanger transfer heat faster than the heat exchanger used by the student in the investigation?

.....  
.....

(1 mark)

|   |
|---|
| 6 |
|---|

Turn to page 18 for Question 7





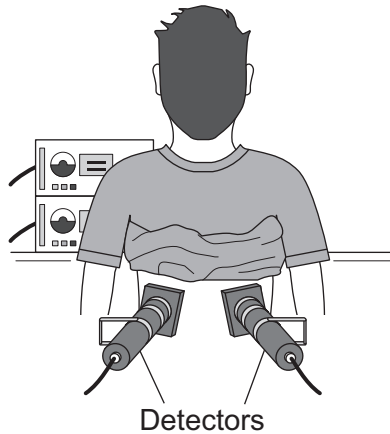
**Turn over for the next question**

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**

**Turn over ►**



7 (a) A doctor uses the radioactive isotope technetium-99 to find out if a patient's kidneys are working correctly.



The doctor injects a small amount of technetium-99 into the patient's bloodstream.

Technetium-99 emits *gamma radiation*.

Give **two** reasons why an isotope that emits gamma radiation is injected into the patient rather than an isotope that emits alpha radiation.

- 1 .....
- .....
- 2 .....
- .....

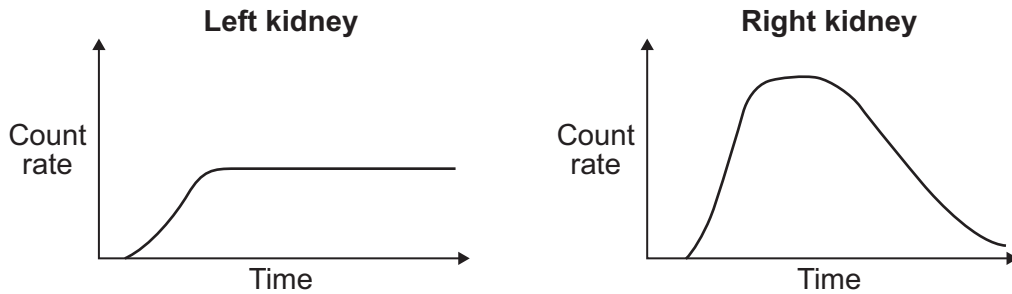
(2 marks)



**7 (b)** If the patient's kidneys are working correctly, the technetium-99 will pass from the bloodstream into the kidneys and then into the patient's urine.

Detectors are used to measure the radiation emitted from the kidneys.

The level of radiation emitted from each kidney is recorded on a graph.



**7 (b) (i)** How do the graphs show that technetium-99 is passing from the bloodstream into each kidney?

.....  
 .....

(1 mark)

**7 (b) (ii)** By looking at the graphs, the doctor is able to tell if there is a problem with the patient's kidneys.

Which **one** of the following statements is correct?

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

Only the right kidney is working correctly.

Only the left kidney is working correctly.

Both kidneys are working correctly.

Explain the reason for your answer.

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

(3 marks)

**Question 7 continues on the next page**

**Turn over ►**



**7 (c)** The patient was worried about having a radioactive isotope injected into their body. The doctor explained that the risk to the patient's health was very small as technetium-99 has a short *half-life*.

**7 (c) (i)** What does the term *half-life* mean?

.....  
.....

(1 mark)

**7 (c) (ii)** Explain why it is important that the doctor uses an isotope with a short half-life rather than an isotope with a long half-life.

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

(2 marks)

|   |
|---|
| 9 |
|---|

**END OF QUESTIONS**

