AQA GCSE PHYSICS (4451)

PHYSICS



EXAM QUESTION PACK

UNIT P1 FOUNDATION TIER PHY1F PAPERS

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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	
8	
TOTAL	

General Certificate of Secondary Education
Foundation Tier
June 2012

Science B
Unit Physics P1

PHY1F

F

Physics
Unit Physics P1

Wednesday 20 June 2012 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. 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.

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Do not write outside the box

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

1 Each letter, **A**, **B**, **C**, **D** and **E**, represents an energy transformation.

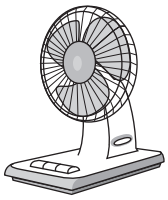
A electrical to chemical
B electrical to heat
C electrical to kinetic
D electrical to light
E electrical to sound

Match each of the following devices to the useful energy transformation that the device is designed to make.

Write the correct letter, **A**, **B**, **C**, **D** or **E**, in the box below each device.

Use each letter no more than once.

Fan



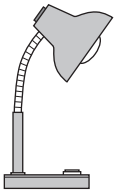
☐

Kettle



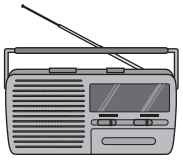
☐

Lamp



☐

Radio



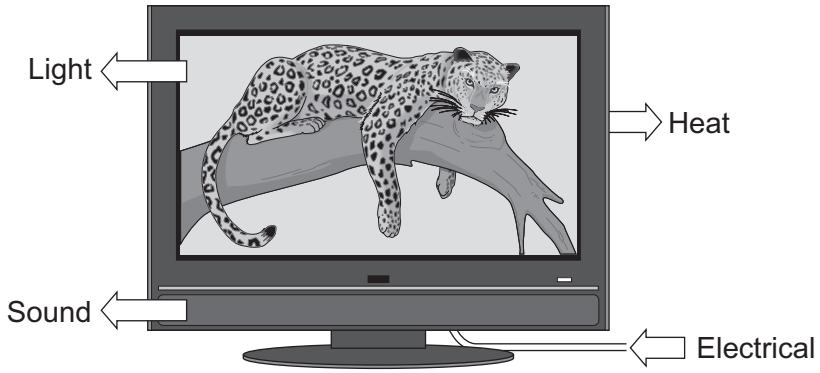
☐

(4 marks)

4

Do not write outside the box

2 (a) The diagram shows the energy transformations produced by a television.



When the television is working, 1200 joules of energy are supplied to the television every second. The useful energy transferred by the television is 720 joules every second.

2 (a) (i) Use the equation in the box to calculate the efficiency of the television.

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

Show clearly how you work out your answer.

.....

.....

Efficiency = ...

(2 marks)

2 (a) (ii) Use **one** word from the diagram to complete the following sentence.

The electrical energy that is **not** usefully transformed by the television is wasted as

..... .

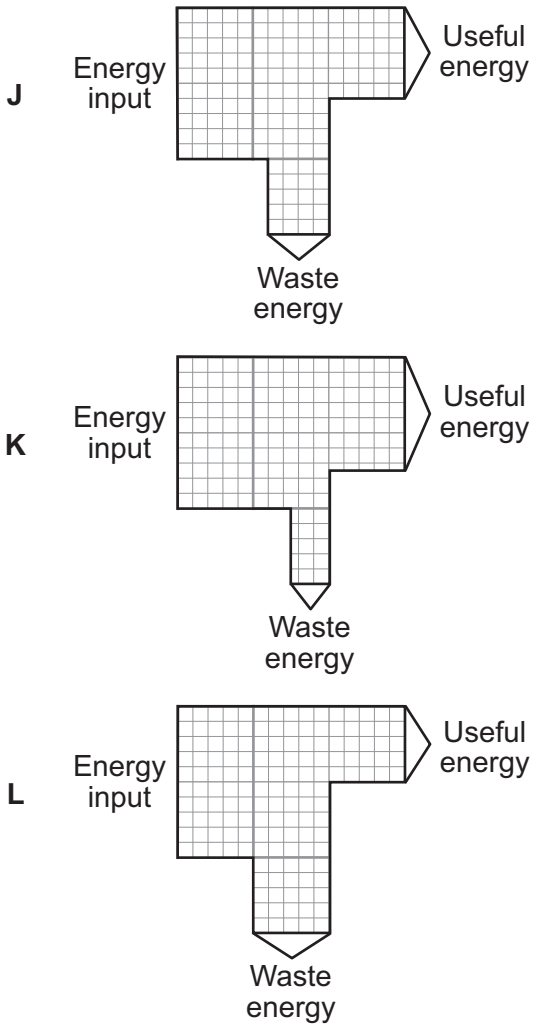
(1 mark)

Question 2 continues on the next page

Turn over ▶

Do not write outside the box

2 (b) Drawn below are the Sankey diagrams for three televisions, **J**, **K** and **L**.
The diagrams are drawn to the same scale.



Which **one** of the televisions, **J**, **K** or **L**, is the most efficient?

Write your answer in the box. ☐

Give a reason for your answer.

.....

.....

(2 marks)

Do not write outside the box

2 (c) A homeowner is sent an electricity bill every 3 months. The total amount of electrical energy used during one 3-month period was 800 kilowatt-hours.
Electrical energy costs 15p per kilowatt-hour.

Use the equation in the box to calculate the cost of the energy transferred from the mains electricity supply.

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

Show clearly how you work out your answer and give the unit.

.....

.....

Cost = ...

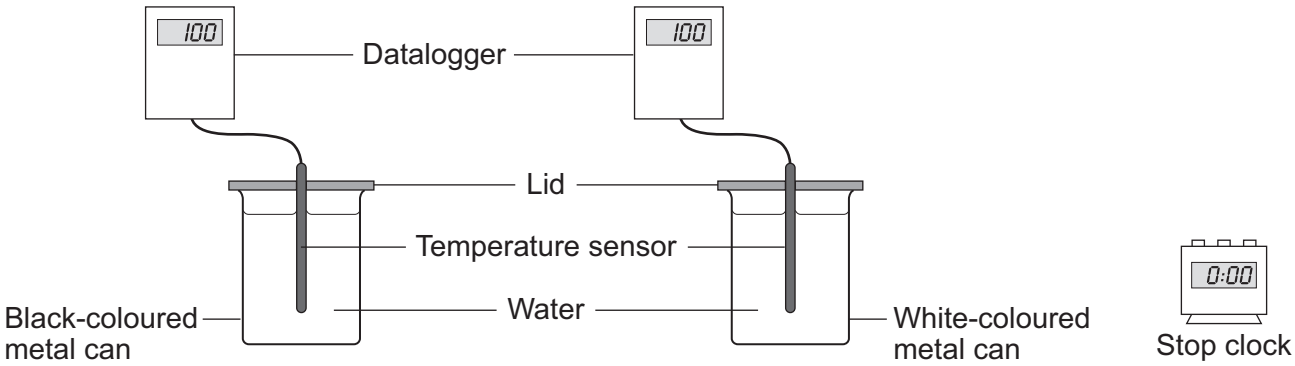
(2 marks)

7

Turn over for the next question

Do not write outside the box

3 The diagram shows the equipment a student used to investigate how the colour of a surface affects how fast it emits (gives out) heat.



An equal volume of boiling water was poured into each metal can. The student then recorded the temperature of the water in each can every minute for ten minutes.

3 (a) (i) Which of the following was a control variable in this investigation?

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

The volume of boiling water. ☐

The decrease in temperature of the water. ☐

The outside colour of the metal can. ☐

(1 mark)

3 (a) (ii) Give **one** advantage of using a temperature sensor and datalogger rather than a thermometer to measure the temperature of the water.

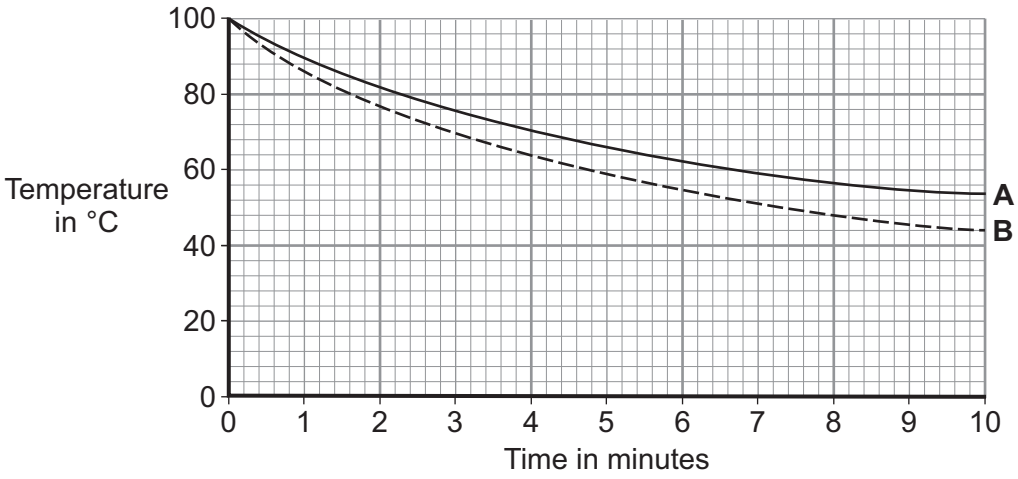
.....

.....

(1 mark)

Do not write outside the box

3 (b) The student's results for both cans are plotted on the graph.



Which line, **A** or **B**, shows how the temperature of the water inside the black-coloured metal can changed?

Draw a ring around your answer. **A** **B**

Explain the reason for your answer.

.....

.....

.....

.....

(2 marks)

Question 3 continues on the next page

Turn over ▶

Do not write outside the box

3 (c) Some gardeners make soil darker by digging black soot into the soil. Other gardeners use straw to protect plants from the cold.

3 (c) (i) Complete the following sentence by drawing a ring around the correct line in the box.

On a warm day, the temperature of darker coloured soil will increase

slower than
as fast as
faster than

the temperature of lighter coloured soil.

(1 mark)

3 (c) (ii) Give a reason for your answer to part **(c)(i)**.

.....

.....

(1 mark)

3 (c) (iii) The statement in the box is **false**.

Straw keeps plants warm by trapping air.

This is because air is a good conductor.

Change **one** word in the statement to make the statement **true**.

Write down your **new** statement. The answer has been started for you.

This is because air is a ..... .

(1 mark)

7

Do not write outside the box

4 Mobile phone networks send digital signals from one phone mast to another phone mast using microwaves.

4 (a) What type of radiation are microwaves?

Draw a ring around your answer.

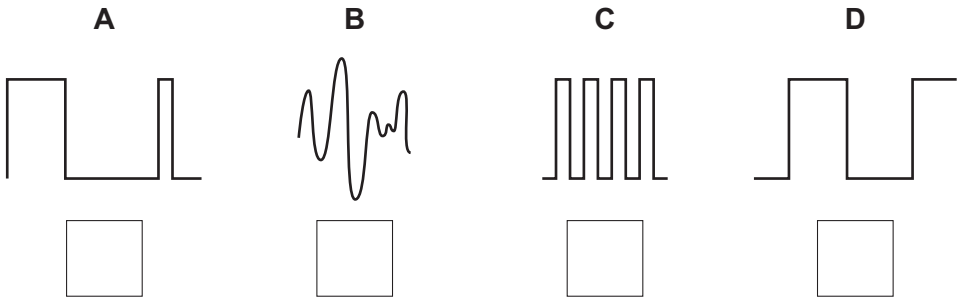
electromagnetic **nuclear** **thermal**

(1 mark)

4 (b) A mobile phone converts an analogue signal into a digital signal.

The diagrams show four signals, **A**, **B**, **C** and **D**.

Put a tick (✓) in the box below the analogue signal.



Give a reason for your choice.

.....

.....

(2 marks)

4 (c) Some schools are paid for allowing a mobile phone mast to be built in the school grounds.

Complete the following sentence by drawing a ring around the correct word in the box.

Accepting payment for allowing a mobile phone mast in school grounds raises ethical

and | economic / environmental / scientific | issues.

(1 mark)

4

Do not write outside the box

5 (a) Optical telescopes may be used to observe galaxies. Some optical telescopes are on the Earth and some are on satellites in space.

5 (a) (i) Give **one** advantage of having the telescope on the Earth rather than on a satellite in space.

.....

.....

(1 mark)

5 (a) (ii) Scientists have observed that the wavelengths of the light from galaxies moving away from the Earth are longer than expected.

What name is given to this observation?

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

blue-shift ☐

orange-shift ☐

red-shift ☐

(1 mark)

5 (b) The Earth's atmosphere absorbs X-rays from space.

Where should a telescope designed to detect X-rays be positioned?

.....

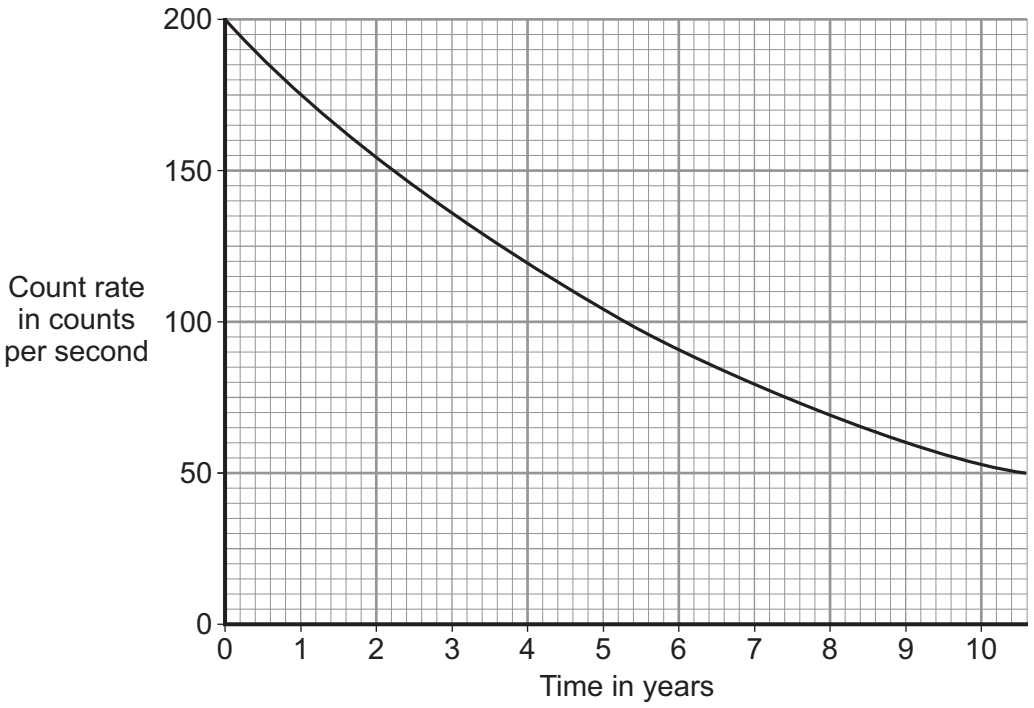
.....

(1 mark)

3

Do not write outside the box

6 (a) The graph shows how the count rate from a sample containing the radioactive substance cobalt-60 changes with time.



6 (a) (i) What is the range of the count rate shown on the graph?

From ..... counts per second to ..... counts per second.
(1 mark)

6 (a) (ii) How many years does it take for the count rate to fall from 200 counts per second to 100 counts per second?

Time = ... years
(1 mark)

6 (a) (iii) What is the half-life of cobalt-60?

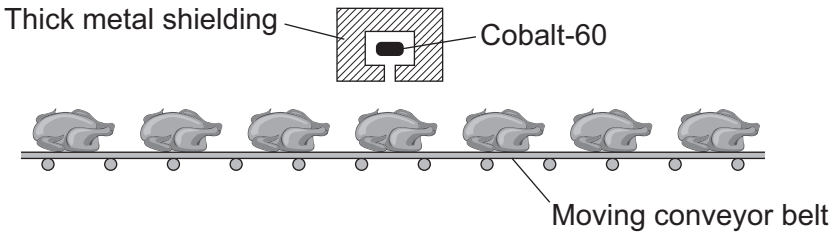
Half-life = ... years
(1 mark)

Question 6 continues on the next page

Do not write outside the box

6 (b) The gamma radiation emitted from a source of cobalt-60 can be used to kill the bacteria on fresh, cooked and frozen foods. Killing the bacteria reduces the risk of food poisoning.

The diagram shows how a conveyor belt can be used to move food past a cobalt-60 source.



6 (b) (i) Which **one** of the following gives a way of increasing the amount of gamma radiation the food receives?

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

Increase the temperature of the cobalt-60 source. ☐

Make the conveyor belt move more slowly. ☐

Move the cobalt-60 source **away** from the conveyor belt. ☐

(1 mark)

6 (b) (ii) To protect people from the harmful effects of the gamma radiation, the cobalt-60 source has thick metal shielding.

Which **one** of the following metals should be used?

Draw a ring around your answer.

aluminium **copper** **lead**

(1 mark)

Do not write outside the box

6 (c) A scientist has compared the vitamin content of food exposed to gamma radiation with food that has not been exposed.

The table gives the data the scientist obtained when she tested 1 kg of cooked chicken.

Vitamin	Food not exposed to gamma radiation	Food exposed to gamma radiation
	Mass in milligrams	Mass in milligrams
B6	1.22	1.35
B12	21.00	28.00
E	3.30	2.15
Niacin	58.00	55.50
Riboflavin	2.10	2.25

Considering only this data, which **one** of the following is a correct conclusion?

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

Vitamin content is not affected by gamma radiation. ☐

Gamma radiation completely destroys some types of vitamin. ☐

Exposure increased the content of some types of vitamin. ☐

(1 mark)

6

Turn over for the next question

Do not write outside the box

7 A farmer has installed a biogas electricity generator on his farm. This device generates electricity by burning the methane gas produced from rotting animal waste. Methane is a greenhouse gas. When methane burns, carbon dioxide and water are produced.

The animal waste rots in an anaerobic digester. The digester and the generator are kept inside a farm building and cannot be seen from the outside.

7 (a) The animal waste used in the anaerobic digester is a *renewable* energy source.

What is meant by an energy source being *renewable*?

.....

.....

(1 mark)

7 (b) Suggest **one** reason why farmers have been encouraged to install their own biogas generators.

.....

.....

(1 mark)

7 (c) The farmer's monthly electricity bill using the mains electricity supply was £300.
The biogas generator cost the farmer £18 000 to buy and install.

Assuming the biogas generator provides all of the farmer's electricity, what is the pay-back time for the generator?

.....

Pay-back time = ...

(1 mark)

7 (d) It would have been cheaper for the farmer to have bought and installed a small wind turbine.

Give **two** advantages of using the biogas generator rather than a wind turbine, to generate the electricity used on the farm.

1 .....

.....

2 .....

.....

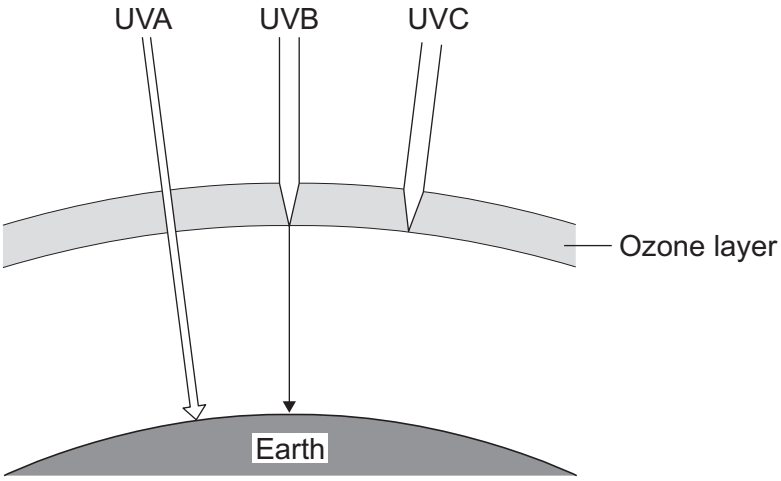
(2 marks)

5

Do not write outside the box

8 When outside, we need to protect our skin and eyes from the harmful effects of ultraviolet (UV) radiation. There are three types of UV radiation.

8 (a) The diagram shows the effect of the ozone layer on each of the three types of UV radiation. The width of the arrow represents the amount of UV radiation.



8 (a) (i) Which type of UV radiation will **not** have a harmful effect on our skin or eyes?

Draw a ring around your answer.

UVA **UVB** **UVC**

Give a reason for your answer.

.....

.....

(2 marks)

8 (a) (ii) The ozone layer above some places on the Earth's surface is very thin.

Explain the effect of a decrease in the thickness of the ozone layer on the risk to health from UV radiation, for people living at these places.

.....

.....

.....

.....

(2 marks)

Question 8 continues on the next page

Turn over ▶

Do not write outside the box

8 (b) Scientists have investigated the effect that the type of ground surface has on the amount of UV radiation entering the eye.

Two dummies, each fitted with UV sensors in the eyes, were used to measure the intensity of the UV radiation over the same period of time. The measurements were taken with one dummy facing the Sun, and the other dummy facing away from the Sun.

Measurements were taken in two places, one on a snow-covered area, the other on a sandy beach.

The results of their investigation are given in the table.

Position of the dummy head	Intensity of UV radiation in the snow-covered area in arbitrary units	Intensity of UV radiation in the sandy beach area in arbitrary units
Facing the Sun	650	250
Facing away from the Sun	520	50

8 (b) (i) What was the independent variable in this investigation?

.....

(1 mark)

8 (b) (ii) How could the reliability of the data collected in this investigation have been improved?

.....

.....

(1 mark)

8 (b) (iii) Some of the UV radiation measured by the sensors has been reflected from the surface of the ground.

Which surface is the best reflector of UV radiation, sand or snow?

Draw a ring around your answer. **sand** **snow**

Give **one** reason for your answer.

.....

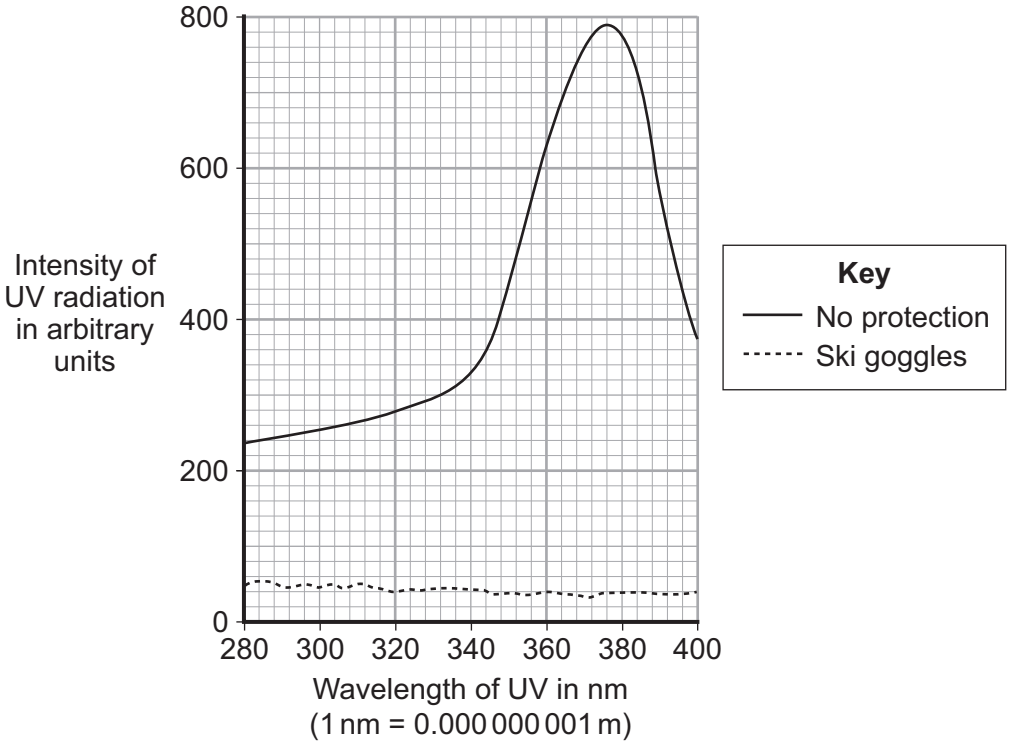
.....

(1 mark)

Do not write outside the box

8 (c) Ski goggles are designed to block UV radiation. The manufacturer of one brand of ski goggles claims that the goggles block 100 % of all UV radiation. These goggles were tested using UV radiation with a range of different wavelengths.

The results of the test are shown in the graph.



Do the results of the test support the claim made by the manufacturer?

Draw a ring around your answer. **Yes** **No**

Explain the reason for your answer.

.....

.....

.....

.....

(2 marks)

9

END OF QUESTIONS

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General Certificate of Secondary Education

Science B 4462 / Physics 4451

PHY1F **Unit Physics 1**

Mark Scheme

2012 examination – June series

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Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the students' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Student	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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Quality of Written Communication and levels marking

In Question 8 students are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Students will be required to:

- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: Basic

- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: Clear

- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: Detailed

- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

PHY1F

Question 1

question	answers		extra information	mark
1	Fan	C		1
	Kettle	B		1
	Lamp	D		1
	Radio	E		1
Total				**4**

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PHY1F

Question 2

question	answers	extra information	mark
2(a)(i)	0.6 **or** 60 %	 allow **1** mark for correct substitution ie $\frac{720}{1200}$ provided no subsequent step shown an answer of 0.6 / 60 with a unit gains **1** mark only an answer of 60 gains **1** mark only	2
2(a)(ii)	heat	allow thermal	1
2(b)	**K** smallest amount of wasted energy **or** largest amount of useful energy	reason only scores if **K** is chosen reasons must be comparative accept waste arrow is narrowest accept useful arrow is widest waste arrow is smallest is insufficient	1 1
2(c)	12 000 p **or** £120	 to score both marks the unit must be consistent with the numerical answer answers 12 000 and 120 gain **1** mark only allow **1** mark for correct substitution ie 800 × 15 **or** 800 x 0.15 provided no subsequent step shown	2
Total			**7**

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PHY1F

Question 3

question	answers	extra information	mark
3(a)(i)	The volume of boiling water.		1
3(a)(ii)	any **one** from: • (more) precise • accurate • reliable • removes human / reading error	 do **not** accept better (reading) do **not** accept thermometer is unreliable accept easier to read accept take temperature more frequently	1
3(b)	**B** temperature falls faster because black is a better / good emitter	marks are for the explanation this mark point cannot score if **A** chosen ignore reference to better absorber accept for both marks an answer in terms of why **A** is the white can	 1 1
3(c)(i)	faster than		1
3(c)(ii)	darker / black surfaces absorb heat faster	accept black is a better / good absorber dark surfaces attract heat negates this mark	1

Question 3 continues on the next page

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PHY1F

Question 3 continued

question	answers	extra information	mark
3(c)(iii)	air is a bad / poor conductor **or** air is a good insulator	 accept air is an insulator	1
Total			**7**

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PHY1F

Question 4

question	answers	extra information	mark
4(a)	electromagnetic		1
4(b)	**B** continuously varying (amplitude)	reason only scores if **B** is chosen accept others are only on or off accept others only have 2 values do **not** accept answers that simply describe shape	1 1
4(c)	economic		1
Total			**4**

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PHY1F

Question 5

question	answers	extra information	mark
5(a)(i)	any **one** from: • easier to maintain • can be built larger / heavier • cost less to maintain	 cheaper is insufficient	1
5(a)(ii)	red-shift		1
5(b)	on a satellite	accept in orbit / space accept in a high altitude balloon accept above the atmosphere do **not** accept on a plane do **not** accept on top of a mountain ignore any reason given, correct or incorrect	1
Total			**3**

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PHY1F

Question 6

question	answers	extra information	mark
6(a)(i)	200 to 50	accept either order	1
6(a)(ii)	5.3	accept values between 5.2 and 5.4 inclusive	1
6(a)(iii)	5.3 **or** their (a)(ii)	accept values between 5.2 and 5.4 inclusive	1
6(b)(i)	Make the conveyor belt move more slowly		1
6(b)(ii)	lead		1
6(c)	Exposure increased the content of some types of vitamin.		1
Total			**6**

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PHY1F

Question 7

question	answers	extra information	mark
7(a)	can be replaced as fast / faster than it is used	accept will not run out can be used again negates this mark	1
7(b)	any **one** from: • reduce demand on power stations / National Grid (system) • to <u>increase</u> the amount of electricity generated (from renewable energy) • to conserve fossil fuels • plenty of animal waste / fuel (available)	accept use less fossil fuels accept so animal waste can be used usefully accept to save money / sell the electricity produces less harmful gases / SO_2 is insufficient better for environment is insufficient	1
7(c)	60 (months) / 5 (years)	ignore any unit given	1

Question 7 continues on the next page

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PHY1F

Question 7 continued

question	answers	extra information	mark
7(d)	any **two** from: • reliable energy source **or** does not depend on the weather • uses up waste products • not visually polluting • concentrated energy source • quieter	answers must be in terms of the biogas generator accept works all of the time accept animal waste readily available ignore it is renewable do **not** accept generates more electricity (than wind turbine)	2
Total			**5**

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PHY1F

Question 8

question	answers	extra information	mark
8(a)(i)	UVC it is absorbed / stopped by the ozone layer	reason only scores if UVC is chosen accept atmosphere / air for ozone layer accept does not reach the Earth	1 1
8(a)(ii)	increases the risk due to higher levels of UV (radiation) **or** less UV (radiation) absorbed	accept more likely to get (skin) cancer / sun burn accept more people likely to be harmed (by UV radiation) specific reference to UVA / all three increasing negates this mark	1 1
8(b)(i)	(type of) surface	accept snow and sand accept place / location do **not** accept position (of dummy head)	1
8(b)(ii)	repeat measurements / investigation and take average(s) / mean	both parts required repeat measurements / experiment is insufficient	1

Question 8 continues on the next page

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PHY1F

Question 8 continued

question	answers	extra information	mark
8(b)(iii)	**snow** the intensity (facing the Sun) is higher, (so more must be reflected) **or** intensity hardly reduces when facing away from the Sun (so most UV entering sensor must be reflected)	mark is for reason, only scores if snow chosen accept results are higher (for snow than sand) accept white surfaces are good reflectors accept it's white	1
8(c)	**No** for all wavelengths shown some UV is reaching the sensor	 this mark point can score even if yes is chosen accept some UV is passing through (the goggles) accept the reading should be zero (but it isn't)	 1 1
Total			**9**

UMS Conversion Calculator www.aqa.org.uk/umsconversion

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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

General Certificate of Secondary Education
Foundation Tier
January 2012

Science B
Unit Physics P1

PHY1F

F

Physics
Unit Physics P1

Monday 30 January 2012 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.

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Do not write outside the box

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

1 (a) **List A** gives names of four types of wave. **List B** gives information about different types of wave.

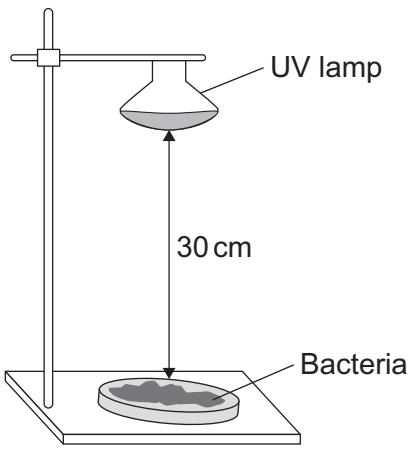
Draw a line to link each type of wave in **List A** to the information about that type of wave in **List B**.

Draw only **four** lines.

List A **Type of wave**	**List B** **Information about waves**
	is **not** part of the electromagnetic spectrum
infrared	
	used to produce images of broken bones
light	
	can cause sunburn
sound	
	can be used to cook food
X-rays	
	used by our eyes to see

(4 marks)

1 (b) A scientist investigated the use of ultraviolet (UV) radiation for killing one particular type of bacteria.



Do not write outside the box

The scientist exposed the bacteria to the UV radiation for different amounts of time. She then measured the amount of bacteria still living.

1 (b) (i) Which of the following was a control variable in this investigation?

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

the distance between the UV lamp and the bacteria ☐

the time the bacteria were exposed to the UV radiation ☐

the amount of bacteria still living after exposure to the UV radiation ☐

(1 mark)

1 (b) (ii) The results obtained by the scientist are given in the table.

Time of exposure to UV radiation in minutes	Percentage (%) of bacteria still living after exposure to UV radiation
1	100
5	95
20	40
30	15
45	0

What is the pattern linking the time of exposure to UV radiation and the percentage of bacteria still living after exposure?

.....

.....

(1 mark)

1 (b) (iii) The scientist concluded that:
'Exposure to UV radiation for 45 minutes will kill **all** types of bacteria.'

It is wrong to conclude that 45 minutes of exposure to UV radiation will kill **all** bacteria.

Why is it wrong to conclude this?

.....

.....

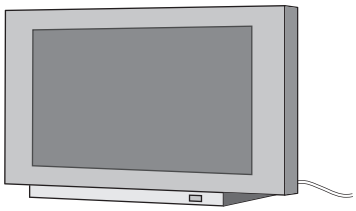
(1 mark)

7

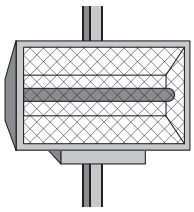
Turn over ▶

Do not write outside the box

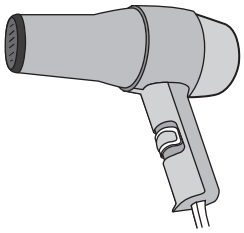
2 The data included in the diagrams gives the power of the electrical appliances.



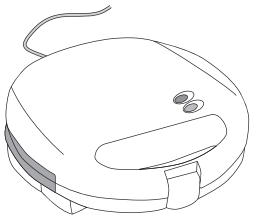
TV
160 W



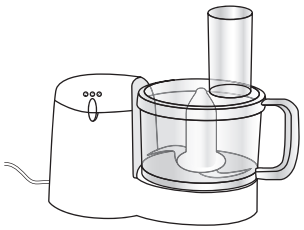
Radiant heater
1.0 kW



Hairdryer
1100 W



Sandwich toaster
1.1 kW



Food processor
0.4 kW

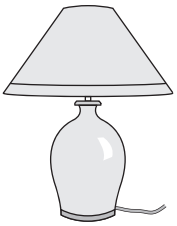


Table lamp
40 W

2 (a) (i) Which appliance is designed to transform electrical energy to light and sound?

.....

(1 mark)

2 (a) (ii) Which **two** appliances transform energy at the same rate?

..... and .....

(1 mark)

Do not write outside the box

2 (b) During one week, the food processor is used for a total of 3 hours.

2 (b) (i) Use the equation in the box to calculate the energy transferred, in kilowatt-hours, by the food processor in 3 hours.

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

Show clearly how you work out your answer.

.....

.....

.....

.....

Energy transferred = ... kWh

(2 marks)

2 (b) (ii) Electricity costs 15 pence per kilowatt-hour.

Use the equation in the box to calculate the cost of using the food processor for 3 hours.

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

Show clearly how you work out your answer.

.....

.....

.....

.....

Cost = ... pence

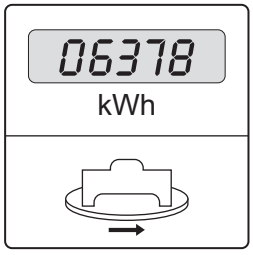
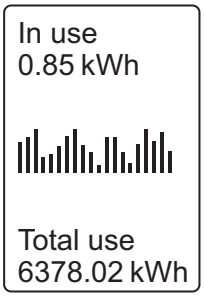
(2 marks)

Question 2 continues on the next page

Do not write outside the box

2 (c) A homeowner decides to monitor the amount of electrical energy used in his home.

He can do this by using an electricity meter or by using a separate electronic device.

Electricity meter	Electronic device
Records to the nearest kilowatt-hour	Records to the nearest 1/100th kilowatt-hour
	

2 (c) (i) Use one word from the box to complete the following sentence.

precise	**reliable**	**valid**

The reading given by the electronic device is more ..... than the reading given by the electricity meter.

(1 mark)

2 (c) (ii) Monitoring the electrical energy used in a home may help people to save money by encouraging them to use less electricity.

Explain why, apart from saving money, it is important for people to use less electricity.

.....

.....

.....

.....

(2 marks)

9

Do not write outside the box

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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3 The world's biggest offshore wind farm, built off the Kent coast, started generating electricity in September 2010.

3 (a) One advantage of using the wind to generate electricity is that it is a renewable energy source.

3 (a) (i) Give **one** other advantage of using the wind to generate electricity.

.....

.....

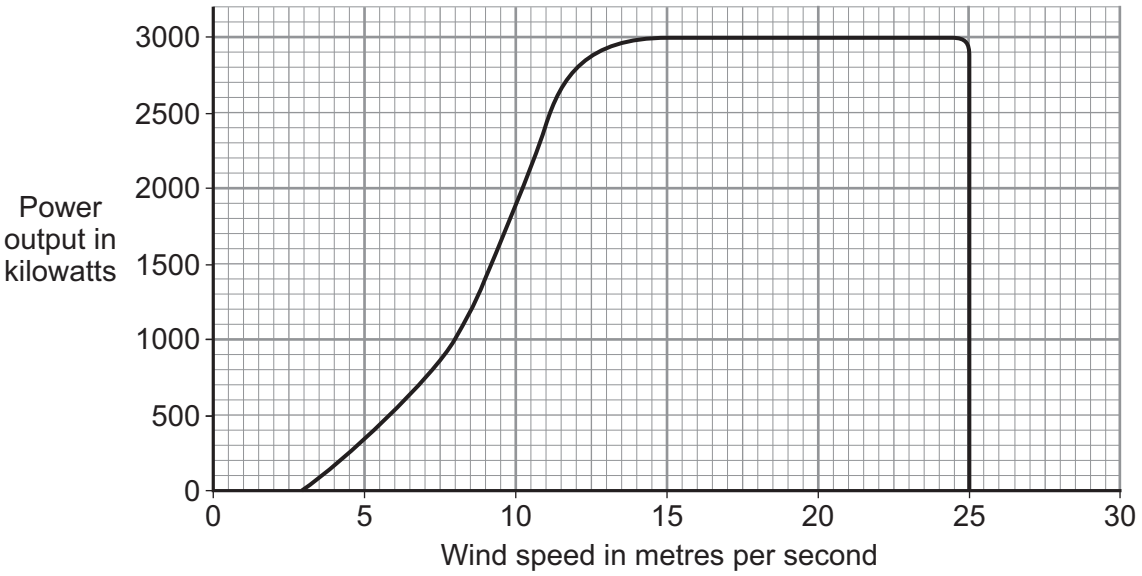
(1 mark)

3 (a) (ii) Name **one** other renewable energy source used to generate electricity.

.....

(1 mark)

3 (b) The graph shows how wind speed affects the power output from a large wind turbine.



3 (b) (i) What is the maximum possible power output from this wind turbine?

.....

(1 mark)

Do not write outside the box

3 (b) (ii) Read this part of a newspaper article.

Cold weather stops wind turbines

For the past two weeks, most of the UK's wind turbines have been generating less than one sixth of their maximum power output. To avoid major power cuts in the future, some experts have said that more nuclear power stations need to be built to provide a reliable source of energy.

Use the graph to explain why the power output from the wind turbines was less than one sixth of the maximum.

.....

.....

.....

.....

(2 marks)

3 (b) (iii) Having more nuclear power stations will help to avoid power cuts in the future.

Which **two** of these reasons explain why?

Put a tick (✓) in the boxes next to your answers.

A small amount of nuclear fuel generates a large amount of electricity. ☐

The radioactive waste produced must be stored for many years. ☐

Nuclear power stations do not depend on the weather to generate electricity. ☐

(1 mark)

6

Do not write outside the box

4 Certain types of atom emit alpha, beta or gamma radiation. The radiation is emitted from the centre of the atom.

4 (a) What name is given to the centre of an atom?

.....

(1 mark)

4 (b) The sign below is used to warn people that a radiation source is being used in a laboratory.



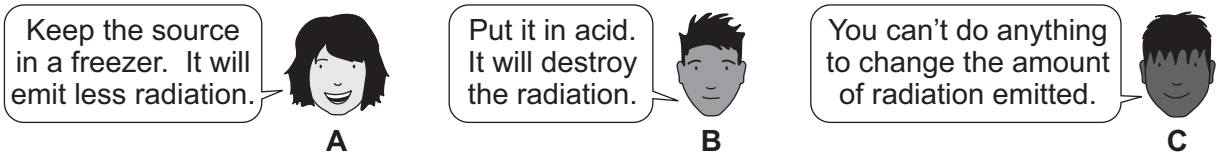
Why is it important to warn people that a radiation source is being used?

.....

.....

(1 mark)

4 (c) Before using a radiation source, a teacher asked her class whether there was any way that she could reduce the amount of radiation that the source emitted. Three students each gave an answer to the teacher.



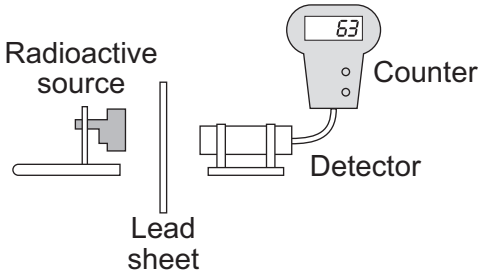
Which **one** of the students, **A**, **B** or **C**, is correct?

Write your answer in the box.

(1 mark)

Do not write outside the box

4 (d) The diagram shows the apparatus used by the teacher to demonstrate how one type of radiation is able to pass through lead.



One lead sheet, 2 mm thick, was placed between the source and the detector and a count rate was taken. Extra lead sheets were added. For each extra lead sheet, a new count rate was taken and recorded in the table.

Number of lead sheets	Count rate in counts per minute
1	226
2	220
3	210
4	190
5	185

Which type of radiation was the source emitting: alpha, beta or gamma?

.....

Give the reason for your answer.

.....

.....

.....

(2 marks)

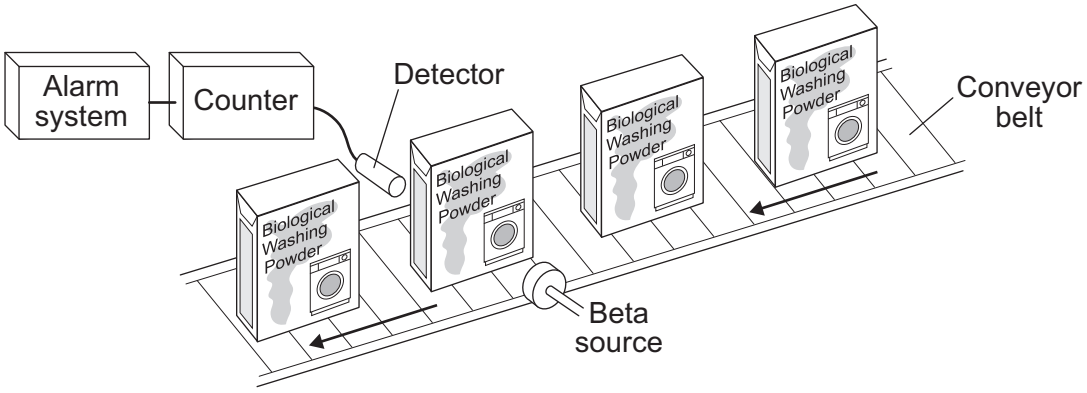
Question 4 continues on the next page

Turn over ▶

Do not write outside the box

4 (e) The diagram shows how a company detects any boxes left empty by an automatic filler.

When an empty box passes between the beta source and the detector, a buzzer sounds. A worker then removes the box from the conveyor belt.



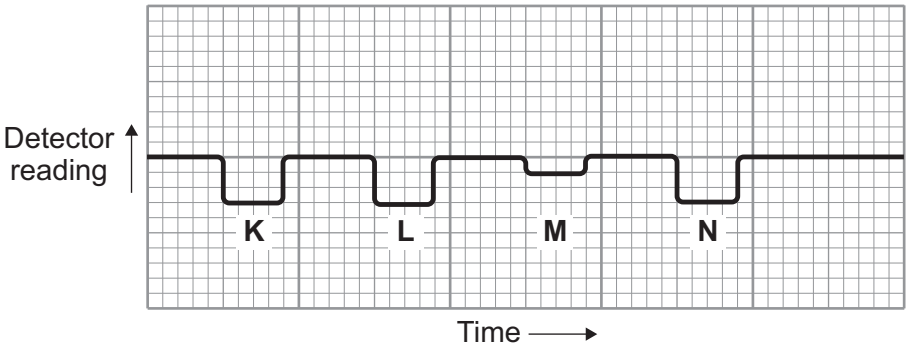
4 (e) (i) Why would this system **not** work if an alpha source were used instead of the beta source?

.....

.....

(1 mark)

4 (e) (ii) The chart shows how the detector reading changes as boxes pass along the conveyor belt.



Which part of the chart, **K**, **L**, **M** or **N**, shows that an empty box is passing between the beta source and the detector?

.....

Give a reason for your answer.

.....

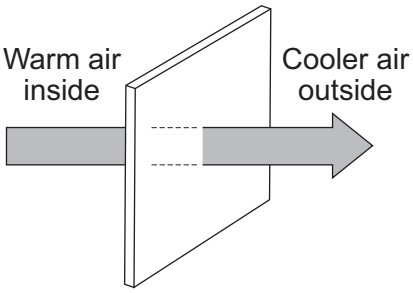
.....

(2 marks)

8

Do not write outside the box

5 The diagram shows the direction of heat transfer through a single-glazed window.



5 (a) (i) Name the process by which heat is transferred **through** the glass.

.....

(1 mark)

5 (a) (ii) Explain how heat is transferred **through** the glass.

.....

.....

.....

.....

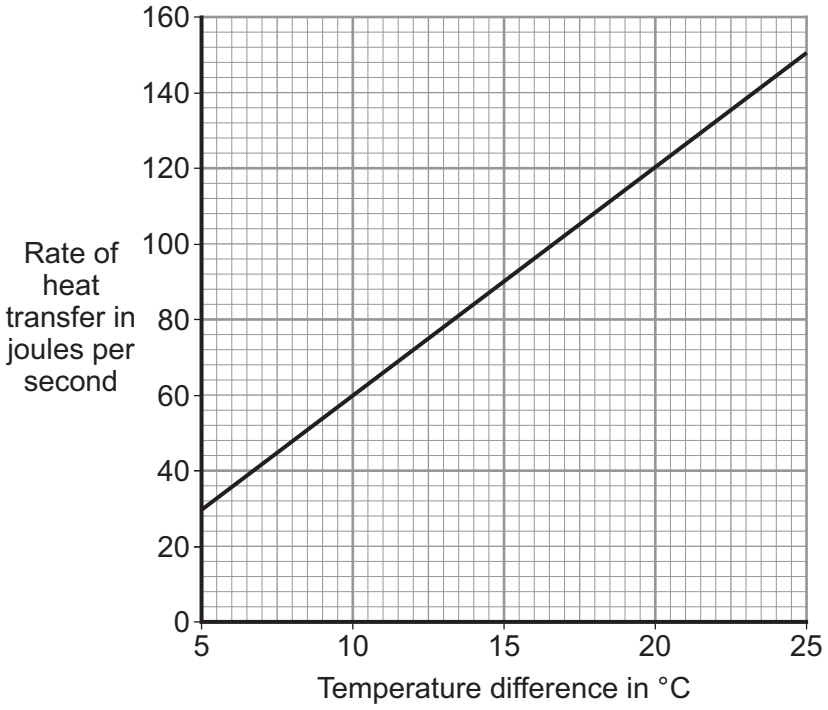
(2 marks)

Question 5 continues on the next page

Do not write outside the box

5 (b) The rate of heat transfer through a window depends on the difference between the inside and outside temperatures.

The graph shows the rate of heat transfer through a $1m^2$ single-glazed window for a range of temperature differences.



5 (b) (i) What is the range of temperature differences shown in the graph?

From ..... to .....

(1 mark)

5 (b) (ii) A student looks at the graph and concludes:

'Doubling the temperature difference doubles the rate of heat transfer.'

Use data from the graph to justify the student's conclusion.

.....

.....

.....

.....

(2 marks)

Do not write outside the box

5 (b) (iii) A house has single-glazed windows. The total area of the windows in the house is 15 m^2.

On one particular day, the difference between the inside and outside temperatures is 20 °C.

Use the graph to calculate the total rate of heat transfer through all of the windows on this particular day.

Show clearly how you work out your answer.

.....

.....

.....

.....

Rate of heat transfer = ... J/s

(2 marks)

5 (c) A homeowner plans to replace the single-glazed windows in his home with double-glazed windows. He knows that double-glazed windows will reduce his annual energy bills.

The table gives information about the double glazing to be installed by the homeowner.

Cost to buy and install	Estimated yearly savings on energy bills	Estimated lifetime of the double-glazed windows
£5280	£160	30 years

Explain, in terms of energy savings, why replacing the single-glazed windows with these double-glazed windows is not cost effective.

To gain full marks you must complete a calculation.

.....

.....

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.....

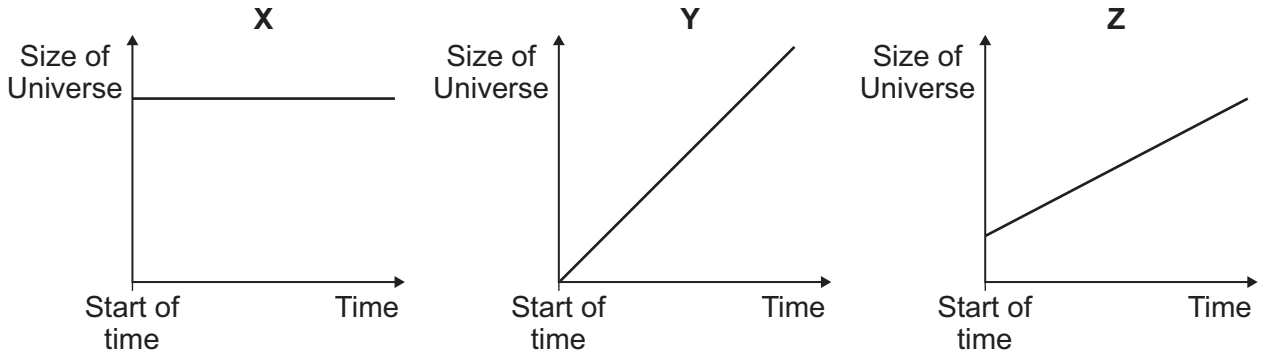
(2 marks)

10

Do not write outside the box

6 The 'big bang' theory is one theory explaining the origin of the Universe.

6 (a) The graphs **X**, **Y** and **Z**, show how the size of the Universe may have changed with time.



Which graph would the 'big bang' theory suggest is correct?

Write your answer, **X**, **Y** or **Z**, in the box. ☐

Explain the reason for your answer.

.....

.....

.....

.....

(3 marks)

6 (b) In 1948, an alternative to the 'big bang' theory, called the 'steady state' theory, was developed.
The 'steady state' theory suggested that the Universe, although expanding, has always existed without a beginning in time.

6 (b) (i) Complete the following sentence by drawing a ring around the correct line in the box.

The measurement of red-shift in the light from distant galaxies provides evidence

to support

only the 'big bang' theory.
only the 'steady state' theory.
both the 'big bang' and 'steady state' theories.

(1 mark)

Do not write outside the box

6 (b) (ii) In 1965, scientists rejected the 'steady state' theory in favour of the 'big bang' theory.

Suggest what might cause scientists to stop supporting one theory and to start supporting an alternative theory.

.....

.....

.....

(1 mark)

5

END OF QUESTIONS

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Version1.0: 29/02/2012

General Certificate of Secondary Education

Science B 4462 / Physics 4451

PHY1F Unit Physics 1

Mark Scheme

2012 Examination – January Series

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Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the students' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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Marking Guidance for Examiners

GCSE Science Papers

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:

where consequential marking needs to be considered in a calculation;

or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Student	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Student	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

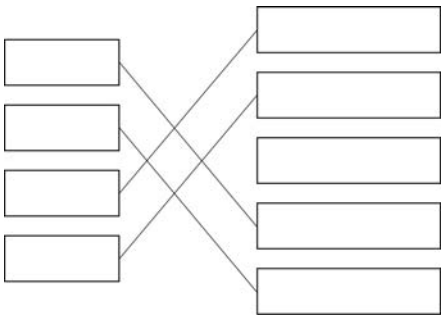
3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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PHY1F

Question 1

question	answers	extra information	mark
1(a) G	all 4 lines correct 	allow **1** mark for each correct line if 2 or more lines are drawn from any box in **List A** then all those lines are incorrect	4
1(b)(i) A	The distance between the UV lamp and the bacteria.		1
1(b)(ii) E	longer the exposure / time smaller % living	accept number for % accept longer the exposure / time larger % / number killed allow negative correlation do **not** accept inversely proportional	1
1(b)(iii) E	only 1 type of bacteria tested **or** not tested all types of bacteria	accept some bacteria not affected by UV only one set of data / results is insufficient did not repeat experiment is insufficient not enough evidence to support conclusion is insufficient	1
Total			**7**

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PHY1F

Question 2

question	answers	extra information	mark
2(a)(i) G	TV		1
2(a)(ii) G	hairdryer and sandwich toaster	both required either order but no others	1
2(b)(i) E Clip with 2(b)(ii)	1.2	allow **1** mark for correct substitution ie 0.4 × 3 provided that no subsequent step is shown	2
2(b)(ii) E Clip with 2(b)(i)	18 **or** their (b)(i) × 15 correctly calculated	accept £0.18 for both marks an answer 0.18 scores **1** mark allow **1** mark for correct substitution ie 1.2 or their (b)(i) × 15 provided that no subsequent step is shown	2
2(c)(i) G	precise	accept any correct indication	1

Question 2 continues on the next page . . .

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PHY1F

Question 2 continued . . .

question	answers	extra information	mark
2(c)(ii) E	any **two** from: • less electricity needs to be generated • less fuels needed • less air / atmospheric pollution • (non-renewable) energy sources last longer • slows global warming / greenhouse effect	 accept a named fuel used in any type of power station accept named pollutant eg CO_2 accept reduces carbon / carbon dioxide emissions accept reduces radioactive waste accept running out of fossil fuels / a named fossil fuel do **not** accept stops global warming environmentally friendly is insufficient less pollution is insufficient	2
Total			**9**

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PHY1F

Question 3

question	answers	extra information	mark
3(a)(i) E	any **one** from: • produces no (air / atmospheric) pollution • energy (source) is free	 accept named pollutant eg CO_2 accept no harmful gases accept produces no emissions accept does not add to global warming environmentally friendly is insufficient accept no fuel costs accept the wind / it is free	1
3(a)(ii) E	any **one** from: • waves • tides • <u>falling</u> water • solar • geothermal • biofuel / biomass	 accept hydroelectric do **not** accept water (flow) accept Sun / sunlight accept solar panels / cells accept a named biofuel	1
3(b)(i) G	3000 (kilowatts)	accept 3 <u>megawatts / MW</u> accept 3 000 000 <u>watts / W</u>	1

Question 3 continues on the next page . . .

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PHY1F

Question 3 continued . . .

question	answers	extra information	mark
3(b)(ii) E	(average) wind speed below 6 m/s	answers giving a wind speed greater than 3 but less than 6 m/s gain both marks allow **1** mark for calculating the output as 500 kW (maximum) and allow **1** mark for wind speed too low or wind not strong enough do **not** accept wind above 25 m/s do **not** accept the turbines are frozen	2
3(b)(iii) A	A small amount of nuclear fuel generates a large amount of electricity. Nuclear power stations do not depend on the weather to generate electricity.	both required	1
Total			**6**

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PHY1F

Question 4

question	answers	extra information	mark
4(a) G	nucleus	do **not** accept core / centre / middle	1
4(b) E	radiation damages our cells	accept radiation is dangerous / poisonous / harmful / toxic accept radiation can cause cancer / kills cells / change DNA / cause mutations / harm health accept so precautions can be taken accept so they know they may be exposed to / harmed by radiation it refers to radiation (source) to stop people being harmed is insufficient	1
4(c) A	**C**		1
4(d) E	gamma gamma will pass through the <u>lead</u> **or** alpha <u>and</u> beta will not pass through <u>lead</u>	 reason only scores if gamma chosen accept correct symbols for alpha, beta and gamma	1 1

Question 4 continues on the next page . . .

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PHY1F

Question 4 continued . . .

question	answers	extra information	mark
4(e)(i) E	range of alpha too short **or** alpha absorbed whether box is full or empty	accept alpha would not reach detector accept alpha (always) absorbed by box / card accept alpha will not pass through the box / card alphas cannot pass through objects / solids is insufficient alpha not strong enough is insufficient	1
4(e)(ii) E	**M** less radiation / beta (particles) absorbed **or** more radiation absorbed by full boxes	 reason only scores if **M** chosen accept more radiation / beta particles pass through accept reading is higher	1 1
Total			**8**

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PHY1F

Question 5

question	answers	extra information	mark
5(a)(i) G	conduction		1
5(a)(ii) E	atoms gain (kinetic) energy **or** atoms vibrate with a bigger amplitude **or** atoms collide with neighbouring atoms	accept particles / molecules for atoms do **not** accept electrons for atoms accept vibrate faster / more do **not** accept start to vibrate	1
	transferring energy to (neighbouring / other) atoms **or** making these other atoms vibrate with a bigger amplitude	do **not** accept heat for energy accept faster / more for bigger amplitude mention of (free) electrons moving and passing on energy negates this mark	1
5(b)(i) G	5 (^{o}C) to 25 (^{o}C)	either order	1
5(b)(ii) E	a correct example of doubling temperature difference doubling heat transfer eg going from 5 to 10 (^{o}C) difference doubles heat transfer from 30 to 60 (J/s)	accept for heat transfer number of joules / it allow **1** mark for correctly reading 1 set of data eg at 5 ^{o}C the heat transfer is 30 **or** for every 5^{o}C increase in temperature difference heat transfer increases by 30 (J/s) no credit for stating they are directly proportional	2

Question 5 continues on the next page . . .

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PHY1F

Question 5 continued . . .

question	answers	extra information	mark
5(b)(iii) E	1800	allow **1** mark for obtaining heat transfer value = 120	2
5(c) E	payback time calculated as 33 years this is greater than lifetime of windows **or** total savings (over 30 years) = £4800 (1) this is less than cost of windows (1) **or** 5280 / 30 = 176 (1) this is more than the yearly savings (1)	calculations must be correct to score the first mark point explanations must relate to it not being cost effective	1 1
Total			**10**

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PHY1F

Question 6

question	answers	extra information	mark
6(a) E	**Y**	accept cannot be **X** as size is increasing	1
	shows Universe expanding	this scores if **Y** or **Z** is chosen accept exploding outwards	1
	from a (very small) point	this only scores if **Y** is chosen accept from zero (size)	1
		answers in terms of planets negate the last two mark points	
6(b)(i) A	both the 'big bang' and 'steady state' theories		1
6(b)(ii) E	(new) evidence that supports / disproves a theory **or** (new) evidence not supported by current theory	accept proves for supports accept there may be more evidence supporting one (theory) than the other (theory) accept new evidence specific to this question eg measurement of CBR **or** some types of star only found in distant parts of Universe (steady state suggests should be same throughout Universe)	1
Total			**5**

UMS Conversion Calculator
http://web.aqa.org.uk/UMS/index.php

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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	
8	
TOTAL	



General Certificate of Secondary Education
Foundation Tier
June 2011

Science B
Unit Physics P1

PHY1F

F

Physics
Unit Physics P1

Friday 17 June 2011 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.

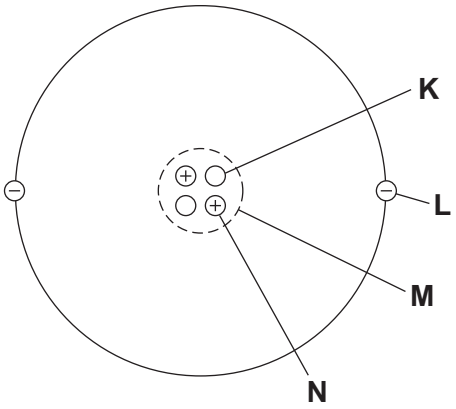


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Do not write outside the box

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

1 (a) The diagram represents a helium atom.



1 (a) (i) Which part of the atom, **K**, **L**, **M** or **N**, is an electron?

Part ☐

(1 mark)

1 (a) (ii) Which part of the atom, **K**, **L**, **M** or **N**, is the same as an alpha particle?

Part ☐

(1 mark)

1 (b) A radioactive source emits alpha particles.

What might this source be used for?

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

to monitor the thickness of aluminium foil as it is made in a factory ☐

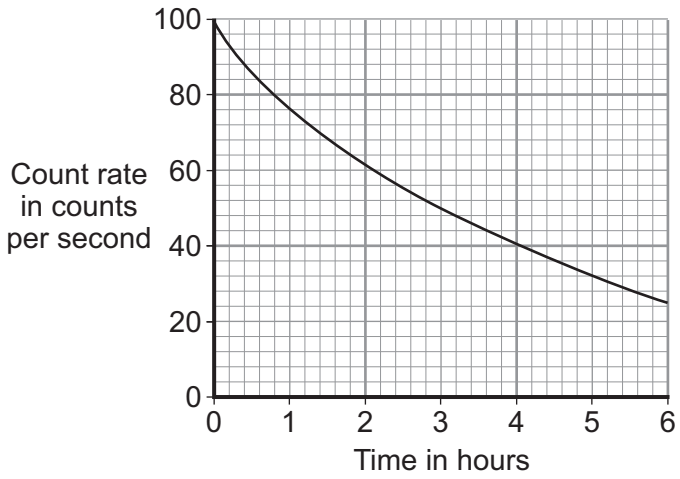
to make a smoke detector work ☐

to inject into a person as a medical tracer ☐

(1 mark)

Do not write outside the box

1 (c) The graph shows how the count rate from a source of alpha radiation changes with time.



What is the count rate after 4 hours?

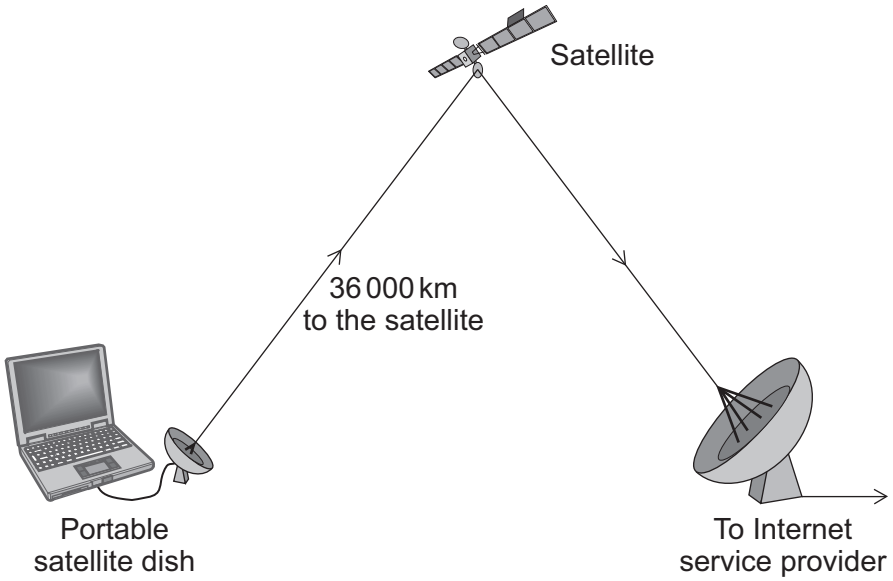
..... counts per second
(1 mark)

4

Turn over for the next question

Do not write outside the box

2 (a) The diagram shows a computer connected to the Internet using a satellite link.



2 (a) (i) Which **one** of the following types of electromagnetic wave is used to send information to the satellite?

Draw a ring around your answer.

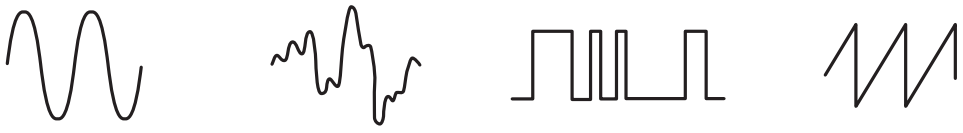
microwave **radio** **visible light**

(1 mark)

2 (a) (ii) The information is sent to the satellite using a digital signal.

Which **one** of the signals, **A**, **B**, **C** or **D**, is a digital signal?

Write your answer, **A**, **B**, **C** or **D**, in the box.



Signal ☐

(1 mark)

Do not write outside the box

2 (a) (iii) It is better to send information as a digital signal rather than as an analogue signal.

Which **one** of the following statements explains why?

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

Digital signals travel faster. ☐

Digital signals can be switched on and off. ☐

Digital signals are less affected by interference. ☐

(1 mark)

2 (b) Since 2009, people in some parts of Kenya have been able to connect to the Internet using signals sent through an optical fibre cable rather than via a satellite link.

2 (b) (i) Complete the following sentence by drawing a ring around the correct line in the box.

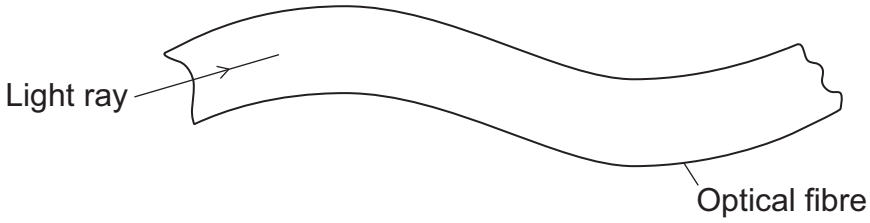
Visible light and

infra red
radio
ultraviolet

can be used to send signals along an optical fibre.

(1 mark)

2 (b) (ii) The diagram shows part of an optical fibre.



Complete the diagram to show how the light ray travels through the optical fibre.

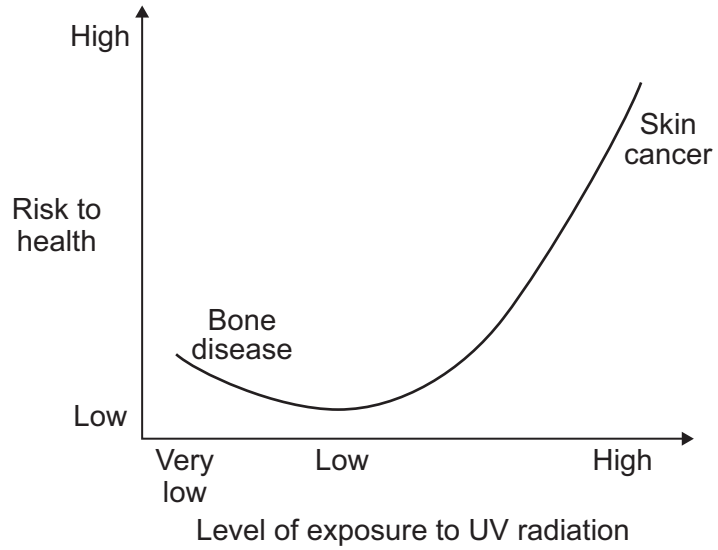
(2 marks)

6

Do not write outside the box

3 Exposure to ultraviolet (UV) radiation can harm a person's health.

The graph shows how the risk to health depends on the level of exposure to UV.



3 (a) What level of exposure to UV radiation gives the highest health risk?

Draw a ring around your answer.

very low **low** **high**

(1 mark)

3 (b) The body needs vitamin D to prevent bone disease. The ultraviolet radiation in sunlight enables the body to produce vitamin D. Some people hardly ever go outside into direct sunlight.

3 (b) (i) Complete the following sentence by drawing a ring around the line in the box that is correct.

Staying inside will

reduce
not affect
increase

the risk of developing skin cancer.

(1 mark)

Do not write outside the box

3 (b) (ii) How will staying inside affect the risk of developing bone disease?

.....

Give a reason for your answer.

.....

.....

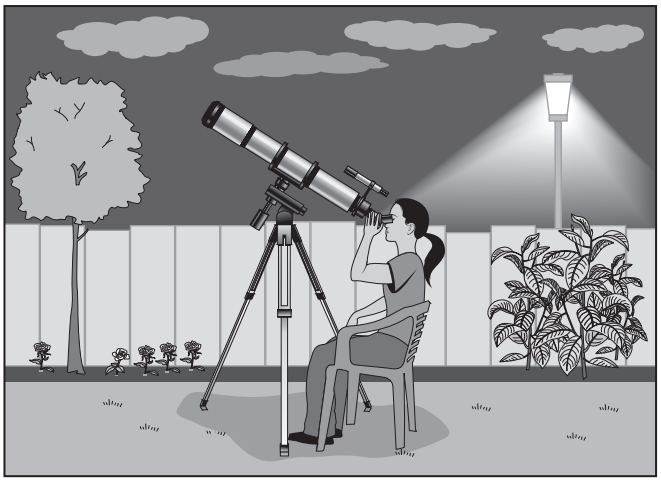
(2 marks)

4

Turn over for the next question

Do not write outside the box

4 (a) The picture shows a person using an optical telescope to look at stars.



Give **two** reasons why it can be difficult to see distant stars using this type of telescope.

1 .....

.....

2 .....

.....

(2 marks)

4 (b) As well as optical telescopes, other types of telescope are on satellites in orbit above the Earth.

Give **one disadvantage** of having a telescope in orbit above the Earth.

.....

.....

(1 mark)

Do not write outside the box

4 (c) In 2008, a new gamma ray telescope, called Fermi, was launched into space. The telescope orbits 560 km above the Earth.

4 (c) (i) Which statement gives a reason why gamma ray telescopes are usually in orbit above the Earth?

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

The telescopes need to be closer to the stars. ☐

The atmosphere absorbs gamma rays. ☐

The telescopes can be used to look at the Earth. ☐

(1 mark)

4 (c) (ii) Some theories predict that particles called WIMPs exist. The theories predict that WIMPs produce a background of gamma rays in very distant galaxies.

Complete the following sentence by drawing a ring around the line in the box that is correct.

If a background of gamma rays in very distant galaxies is detected using the Fermi telescope, this will

- prove that WIMPs exist.
- support the theories that predict that WIMPs exist.
- make scientists change the existing theories.

(1 mark)

5

Turn over for the next question

Do not write outside the box

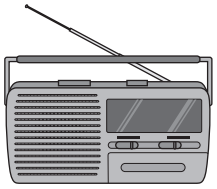
5 The diagram shows four electrical appliances. Each appliance is designed to transform electrical energy into one form of output energy.



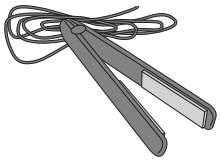
Kettle



Toaster



Radio



Hair straighteners

5 (a) Which **one** of the appliances is designed to give a different form of output energy from the other three appliances?

.....

Give a reason for your answer.

.....

.....

(2 marks)

5 (b) The power of each appliance is given in the table.

Appliance	Power
Kettle	2.5 kW
Toaster	920 W
Radio	15 W
Hair straighteners	75 W

Each appliance is switched on for 5 minutes.

Which appliance transforms the most energy?

.....

(1 mark)

Do not write outside the box

5 (c) The 75 watt hair straighteners are switched on for a few minutes each day.
In one year, the amount of energy transferred from the mains electricity supply to the hair straighteners is 4 kilowatt-hours.

Electricity costs 15 p per kilowatt-hour.

Use the equation in the box to calculate the yearly cost of using the hair straighteners.

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

Show clearly how you work out your answer.

.....

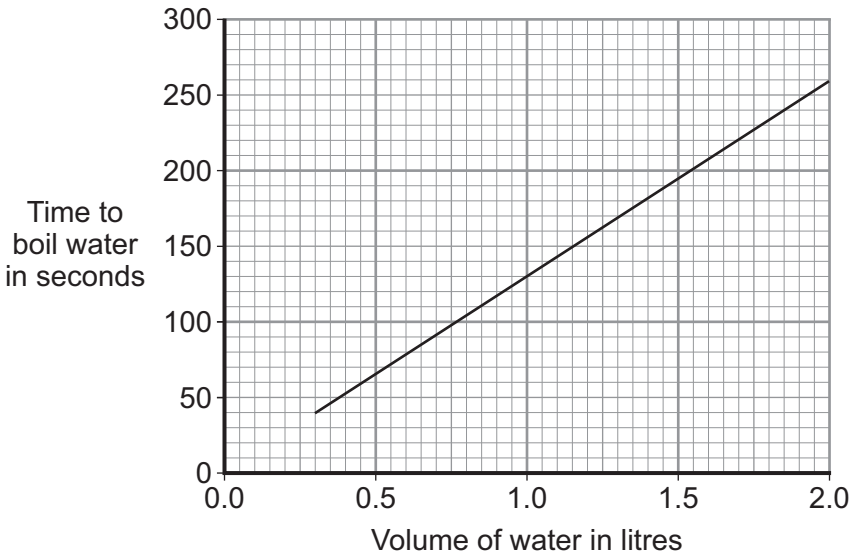
.....

Total cost = ... pence
(2 marks)

Question 5 continues on the next page

Do not write outside the box

5 (d) The graph shows how the time to boil water in an electric kettle depends on the volume of water in the kettle.



A householder always fills the electric kettle to the top, even when only enough boiling water for one small cup of coffee is required.

Explain how the householder is wasting money.

.....

.....

.....

.....

.....

.....

(3 marks)

8

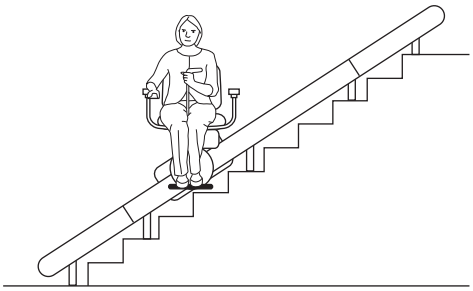
Do not write outside the box

Turn over for the next question

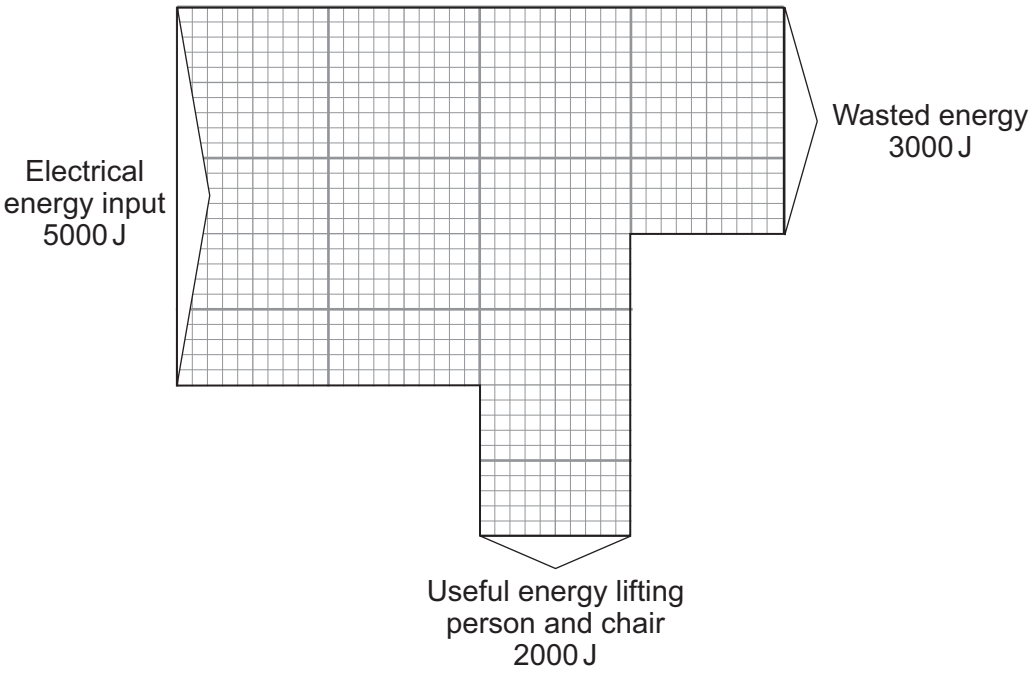
DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

6 A person uses a stairlift to go upstairs. The stairlift is powered by an electric motor.



The Sankey diagram shows the energy transfers for the electric motor.



6 (a) Complete the following sentence.

The electric motor wastes energy as ..... energy.
(1 mark)

Do not write outside the box

6 (b) Use the equation in the box to calculate the efficiency of the electric motor.

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

Show clearly how you work out your answer.

.....

.....

Efficiency = ...

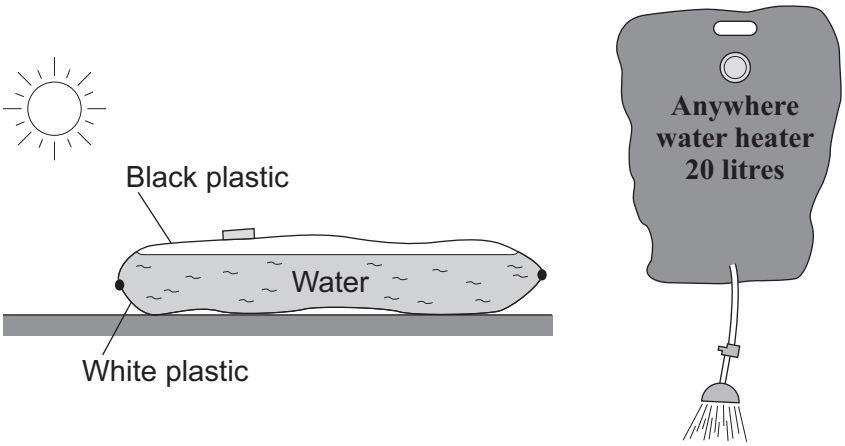
(2 marks)

3

Turn over for the next question

Do not write outside the box

7 The diagram shows a simple type of portable shower. The water container is a strong plastic bag that is black on one side and white on the other. To warm the water, the bag is placed on the ground in direct sunlight, with the black side facing the Sun.



7 (a) (i) Name the process by which heat is transferred from the Sun to the outside of the bag.

.....

(1 mark)

7 (a) (ii) Explain why the black side of the bag and not the white side should face the Sun.

.....

.....

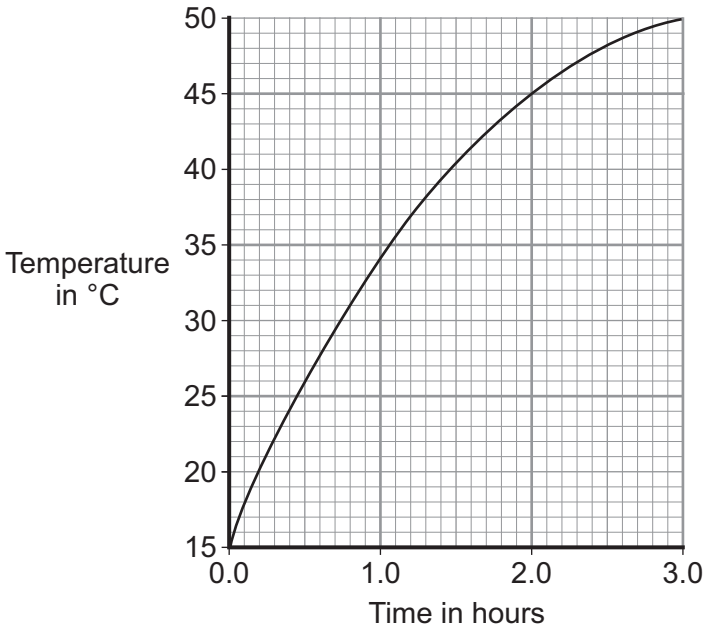
.....

.....

(2 marks)

Do not write outside the box

7 (b) The graph shows how the temperature of the water inside a full bag increases after the bag is placed outside on a sunny day.



7 (b) (i) How long does it take for the water to reach 37 °C?

.....

(1 mark)

7 (b) (ii) Describe how the temperature of the water changes during the three hours.

.....

.....

(1 mark)

7 (c) A different manufacturer makes the same type of portable shower but uses a bag with a larger surface area. The bag is made from the same coloured plastics and holds the same amount of water.

7 (c) (i) To compare the efficiency of the two bags at heating water, several variables need to be controlled.

Name **two** variables that need to be controlled.

1 .....

2 .....

(2 marks)

7 (c) (ii) The second bag has a larger surface area.
Draw a line on the graph to show how the temperature of the water inside the second bag would change over the first hour.
Assume that the two bags are tested in exactly the same way.

(1 mark)

8

Turn over ▶

Do not write outside the box

8 (a) By 2023, nearly all of the existing nuclear power stations in the UK will be closed down.

8 (a) (i) Before a nuclear power station can be demolished, the remaining nuclear fuel, radioactive waste materials and reactor must be carefully removed.

What is this process called?

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

decommissioning ☐

decontaminating ☐

dismantling ☐

(1 mark)

8 (a) (ii) The workers are exposed to radiation as they remove the reactor. One of the biggest risks is from the isotope cobalt-60, which has a half-life of 5.3 years.

Explain the advantage of waiting 11 years after a nuclear power station has closed down before starting to remove the reactor.

.....

.....

.....

.....

(2 marks)

Do not write outside the box

8 (b) It is almost certain that new nuclear power stations will be built in the UK.

The table shows the results of surveys asking people in the UK whether they were in favour of, or against, the building of new nuclear power stations.

	2001	**2005**	**2007**
Percentage (%) in favour	20	41	65
Percentage (%) against	60	28	20
Percentage (%) not sure	20	31	15

8 (b) (i) From these surveys, how did public opinion on the building of new nuclear power stations change between 2001 and 2007?

.....

.....

(1 mark)

8 (b) (ii) Suggest a reason why some people may think that the results from these surveys are unreliable.

.....

.....

(1 mark)

8 (b) (iii) Give **one** reason in favour of building new nuclear power stations.

.....

.....

(1 mark)

Question 8 continues on the next page

Do not write outside the box

8 (c) The government of one Middle Eastern country has decided to build its first nuclear power station. The oil that would have been used to generate electricity can then be sold to other countries.

On what is this decision based?

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

economic issues ☐

ethical issues ☐

social issues ☐

(1 mark)

7

END OF QUESTIONS

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Version1.0: 29/07/2011

General Certificate of Secondary Education

Science B 4462 / Physics 4451

PHY1F Unit Physics 1

Mark Scheme

2011 Examination – June Series

STEMUP.CO.UK

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Marking Guidance for Examiners

GCSE Science Papers

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:

where consequential marking needs to be considered in a calculation;

or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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PHY1F

Question 1

question	answers	extra information	mark
1(a)(i)	**L**		1
1(a)(ii)	**M**		1
1(b)	To make a smoke detector work.		1
1(c)	40	no tolerance	1
Total			**4**

PHY1F

Question 2

question	answers	extra information	mark
2(a)(i)	microwave		1
2(a)(ii)	**C**		1
2(a)(iii)	Digital signals are less affected by interference.		1
2(b)(i)	infra red		1
2(b)(ii)	2 or 3 reflections shown	lines are straight and most angles look correct by eye four or more reflections gains **1** mark only ray must touch side of the fibre to qualify as a reflection ray must reach end of the fibre	2
Total			**6**

PHY1F

Question 3

question	answers	extra information	mark
3(a)	high		1
3(b)(i)	reduce		1
3(b)(ii)	increases (it) less / no vitamin D produced	points may score written in either answer space do **not** accept less sunlight / UV	1 1
Total			**4**

PHY1F

Question 4

question	answers	extra information	mark
4(a)	any **two** from: • light pollution • cloud cover • atmospheric pollution • telescope not powerful enough • distant stars are not bright enough	 accept street lights the weather is insufficient do **not** accept very general statements eg 'the weather' or 'the atmosphere' accept a description of atmospheric pollution accept sensible comment regarding zoom of telescope accept lens is not strong enough accept diameter of lens is too small do **not** accept lens is not big enough	2
4(b)	any **one** from: • difficult / expensive / to maintain / repair • expensive to put into space	 accept have to go into space to fix it ignore answers in terms of collision with other objects in space	1

Question 4 continues on the next page

PHY1F

Question 4 continued

question	answers	extra information	mark
4(c)(i)	The atmosphere absorbs gamma rays.		1
4(c)(ii)	support the theories that predict WIMPs exist		1
Total			**5**

PHY1F

Question 5

question	answers	extra information	mark
5(a)	radio gives out sound **or** others give out heat / thermal energy	radio must be chosen for reason to score inclusion of other forms of energy negates mark	1 1
5(b)	Kettle	accept 2.5 (kW)	1
5(c)	60 (p)	accept £0.6(0) allow **1** mark for correct substitution ie 4 × 15 substitution only scores if no subsequent step shown £60 scores **1** mark	2
5(d)	(bigger volume) takes more time (to boil) (so) more energy transferred (and) this costs more money	accept explanation using data from graph do **not** accept electricity for energy ignore references to cost of water	1 1 1
Total			**8**

PHY1F

Question 6

question	answers	extra information	mark
6(a)	heat / thermal **or / and** sound	do **not** accept noise other forms of energy eg light negates answer	1
6(b)	0.4 **or** 40 %	allow **1** mark for $\frac{2000}{5000}$ **or** equivalent fraction an answer 0.4 % gains **1** mark answers 0.4 or 40 given with any unit gains **1** mark 40 without % gains **1** mark	2
Total			**3**

PHY1F

Question 7

question	answers	extra information	mark
7(a)(i)	radiation	ignore thermal / infrared	1
7(a)(ii)	black is a better / good absorber (of heat / radiation)	ignore reference to black being a good emitter black absorbs heat is insufficient do **not** accept black attracts / absorbs the Sun do **not** accept black attracts heat	1
	(so) temperature rises faster **or** white is a worse / poor absorber (of heat / radiation) (1) (so if white faces) temperature would rise slower (1)	must be an indication of heating up quicker accept white is a better / good reflector (of heat / radiation) ignore any reference to light	1
7(b)(i)	1.2 (hours) **or** 1 hour 12 minutes	no tolerance	1
7(b)(ii)	increases (rapidly at first then increases at a slower rate)	do **not** accept increases at a steady rate	1

Question 7 continues on the next page

PHY1F

Question 7 continued

question	answers	extra information	mark
7(c)(i)	any **two** from: • (fill with) same mass / volume / amount of water • same level of (sun)light / sunshine • outside for the same (length of) time • outside at same time (of day / year) • initial water temperature • the side of the bag facing the Sun	accept same heat / light source accept same place do **not** accept any factors to do with the construction of plastic bags eg thickness	2
7(c)(ii)	curved line drawn above given line	both lines must start from the same point ignore if continues beyond one hour or levels off after 1 hour do **not** accept a straight line	1
Total			**8**

PHY1F

Question 8

question	answers	extra information	mark
8(a)(i)	decommissioning		1
8(a)(ii)	level of radiation **or** radiation dose (to workers) decreased	accept the isotope / cobalt(-60) has decayed (a lot) accept the isotope / cobalt(-60) has decayed in 2 half lives accept exposed to less radiation do **not** accept no radiation left	1
	less hazardous / dangerous (to workers health)	accept safer do **not** accept there is no hazard accept allows reactor to cool (down) an answer of radiation levels decrease by 75 % or drops to 25 % gains **2** marks	1
8(b)(i)	more in favour **or** fewer against	quoting figures alone is insufficient do **not** accept it increases ignore any reasons given	1

Question 8 continues on the next page

PHY1F

Question 8 continued

question	answers	extra information	mark
8(b)(ii)	any **one** from: • sample too small • do not know how many (people) were asked • different people asked (in different years) • sample not representative (of population) • people did not understand the questions • do not know who carried out the surveys • do not know if surveys asked same questions	do **not** accept they are biased unless acceptable reason for bias given	1

Question 8 continues on the next page

PHY1F

Question 8 continued

question	answers	extra information	mark
8(b)(iii)	any **one** from: • no / less pollutant gases produced • reliable source (of energy / electricity) • running out of fossil fuels • conserve fossil fuels • meet increasing demand • less reliance on imported fossil fuels / electricity • concentrated energy source(s) • lower transportation costs for fuel • to replace old <u>nuclear</u> power stations	accept a named gas accept does not contribute to global warming accept a named fossil fuel accept fossil fuels won't have to be used accept named fossil fuel ignore references to efficiency / job creation / local economy / selling electricity	1
8(c)	economic issues		1
Total			**7**

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
January 2011

Science B
Unit Physics P1

PHY1F

F

Physics
Unit Physics P1

Wednesday 19 January 2011 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. 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.

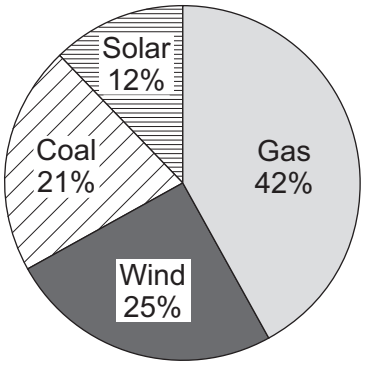
Advice
- In all calculations, show clearly how you work out your answer.

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Do not write outside the box

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

1 (a) The pie chart shows the energy sources used by one company to generate electricity.



1 (a) (i) Which two energy sources used by the company do **not** produce any polluting gases?

..... and .....

(1 mark)

1 (a) (ii) Calculate the percentage (%) of electricity that is generated using energy sources that do **not** produce any polluting gases.

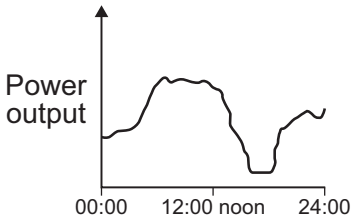
.....

Percentage = ...

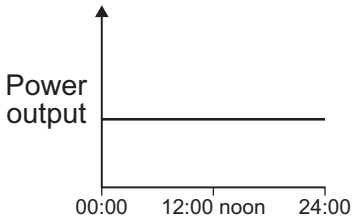
(1 mark)

1 (b) Which graph, **A**, **B** or **C**, is most likely to show the electrical power output from a wind turbine over one day?

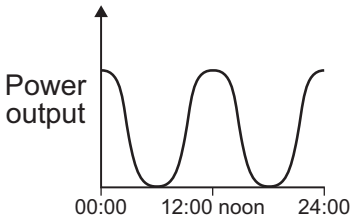
Write your answer, **A**, **B** or **C**, in the box.



Graph **A**



Graph **B**



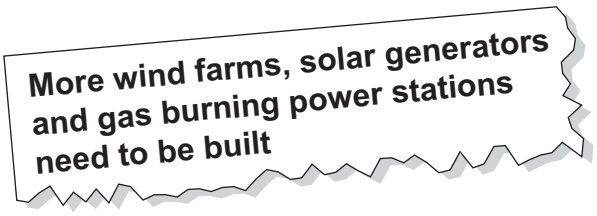
Graph **C**

Graph ☐

(1 mark)

Do not write outside the box

1 (c) The government has said that more electricity must be generated from renewable energy sources. A newspaper reported that:



Why is the statement in the newspaper incorrect?

.....

.....

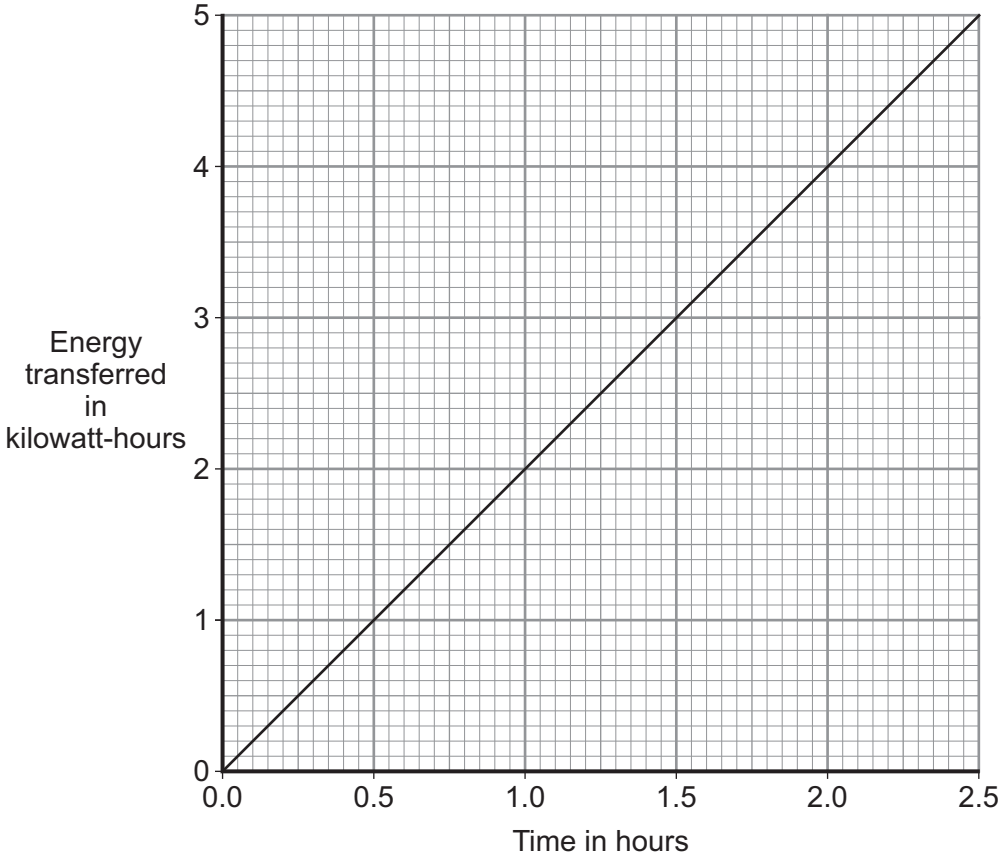
(1 mark)

4

Turn over for the next question

Do not write outside the box

2 The graph shows how the energy transferred by a 2 kW electric kettle varies with the time, in hours, that the kettle is switched on.



2 (a) In one week, the kettle is used for a total of 1.5 hours.
Electricity costs 15 p per kilowatt-hour.

Use the equation in the box to calculate the cost of using the kettle for the week.

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

Show clearly how you work out your answer.

.....

.....

Cost = ... p

(2 marks)

2 (b) Draw a new line on the graph to show how the energy transferred by a 1 kW kettle varies with time.

(1 mark)

3

Do not write outside the box

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

3 (a) The names of the three types of nuclear radiation are given in **List A**.
Some properties of these types of radiation are given in **List B**.

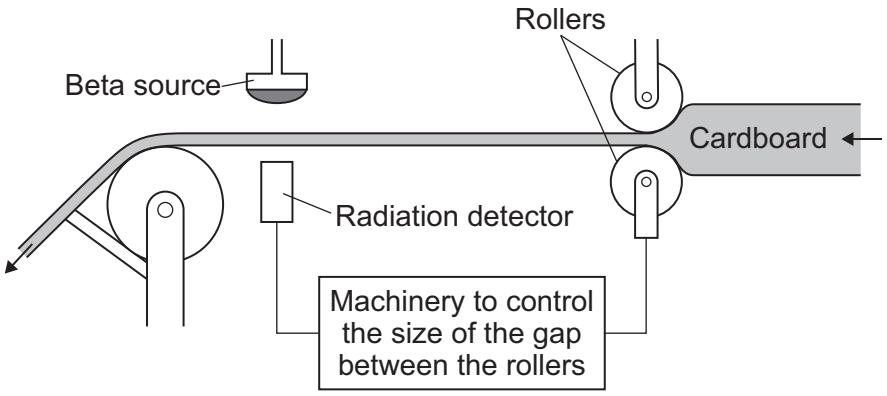
Draw a straight line to link each type of radiation in **List A** to its correct property in **List B**.

Draw only **three** lines.

List A **Type of nuclear radiation**	**List B** **Property of radiation**
Alpha	Has the same mass as an electron
Beta	Very strongly ionising
Gamma	Passes through 10 cm of aluminium
	Deflected by a magnetic field but not deflected by an electric field

(3 marks)

3 (b) The diagram shows a system used to control the thickness of cardboard as it is made.



Do not write outside the box

The cardboard passes through a narrow gap between a beta radiation source and a radiation detector.

The table gives the detector readings over 1 hour.

Time	Detector reading
08:00	150
08:15	148
08:30	151
08:45	101
09:00	149

3 (b) (i) Between 08:00 and 08:30, the cardboard is produced at the usual, correct thickness.

Explain how you can tell from the detector readings that the cardboard produced at 08:45 is thicker than usual.

.....

.....

.....

.....

(2 marks)

3 (b) (ii) Which would be the most suitable half-life for the beta source?

Draw a ring around your answer.

six days **six months** **six years**

(1 mark)

3 (b) (iii) This control system would **not** work if the beta radiation source was replaced by an alpha radiation source.

Why not?

.....

.....

(1 mark)

7

Do not write outside the box

4 (a) Use the words from the box to complete the following sentences.

conduction	**convection**	**radiation**

4 (a) (i) The transfer of thermal energy (heat) by the movement of hot liquids

is called ..... .

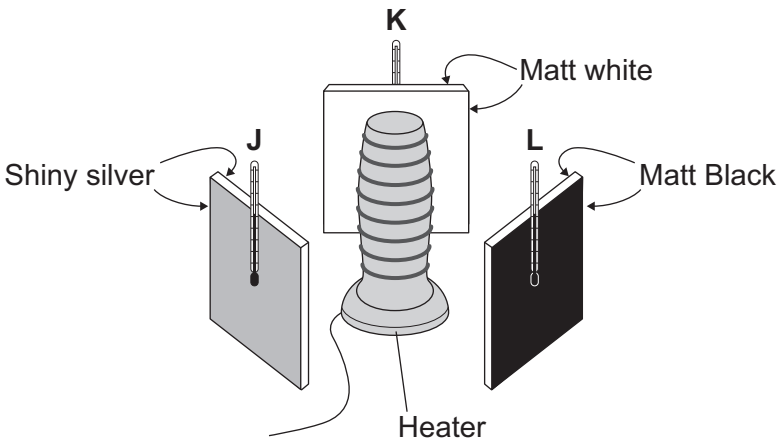
(1 mark)

4 (a) (ii) The transfer of thermal energy (heat) from one particle to another

is called ..... .

(1 mark)

4 (b) A student set up the following equipment. The 3 metal plates are the same distance from the heater. The surfaces of each of the 3 metal plates are different colours.



The student switched the heater on for 10 minutes. The thermometers were read before the heater was switched on. The thermometers were read again just after the heaters were switched off.
The readings are shown in the table.

	Temperature before switching on in °C	**Temperature after switching on in °C**
1	19	21
2	19	29
3	19	23

Do not write outside the box

4 (b) (i) Which set of readings, **1**, **2** or **3**, is most likely to have been taken from the thermometer labelled **L**?

.....

Give a reason for your answer.

.....

.....

(2 marks)

4 (b) (ii) Which **one** of the following was **not** a control variable in this experiment?

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

the distance between the heater and the metal plates ☐

the power of the heater ☐

the temperature before the heater was switched on ☐

the colour of the metal plates ☐

(1 mark)

4 (b) (iii) Suggest **one** advantage of using a temperature sensor, data logger and computer, rather than a thermometer to carry out this experiment.

.....

.....

(1 mark)

Question 4 continues on the next page

Do not write outside the box

4 (c) The picture shows a fire fighter putting out a forest fire. The fire fighter's clothing has thick thermal padding inside and a light coloured, fire proof, shiny layer outside.



4 (c) (i) What is the main way that heat is transferred through the air from the fire to the fire fighter?

.....

.....

(1 mark)

4 (c) (ii) Why is the outside layer of the clothing shiny?

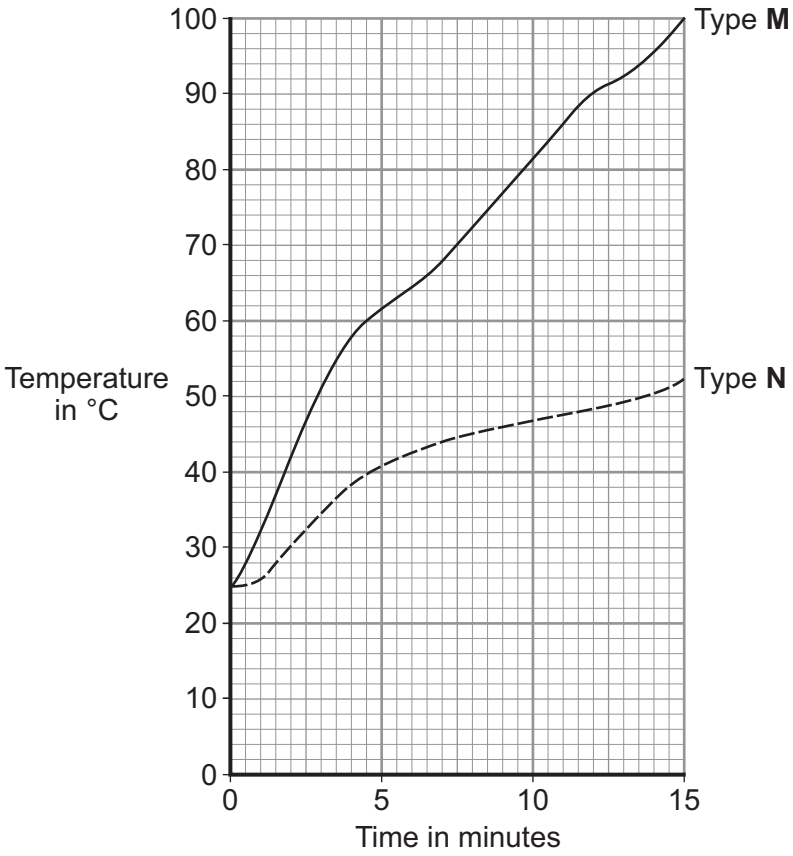
.....

.....

(1 mark)

Do not write outside the box

4 (d) The graph shows the result of a laboratory test on two types of thermal padding. Each type of padding was put onto a very hot metal surface and the temperature inside the padding was taken every minute.



Which type of padding, **M** or **N**, would it be best to use inside the fire fighter's clothing?

.....

Give a reason for your answer.

.....

.....

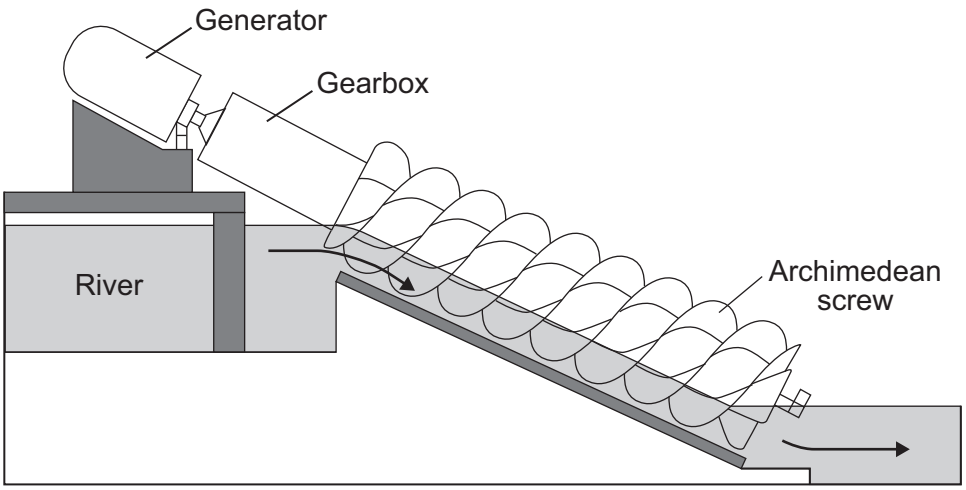
(1 mark)

9

Turn over ▶

Do not write outside the box

5 The diagram shows a small-scale, *micro-hydroelectricity* generator which uses the energy of falling river water to generate electricity. The water causes a device, called an Archimedean screw, to rotate.
The Archimedean screw is linked to the generator by a gearbox.



5 (a) Complete the following sentence by drawing a ring around the correct word in the box.

The gravitational potential energy of the falling water is transformed

into the | chemical / electrical / kinetic | energy of the Archimedean screw.

(1 mark)

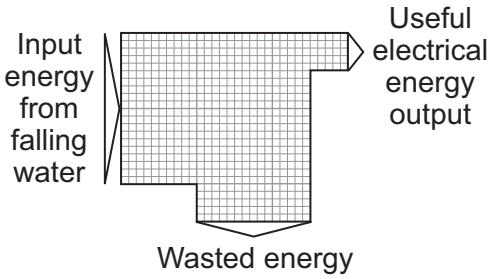
Do not write outside the box

5 (b) A micro-hydroelectric generator is very efficient. Most of the input energy from the falling water is transformed into useful electrical energy.

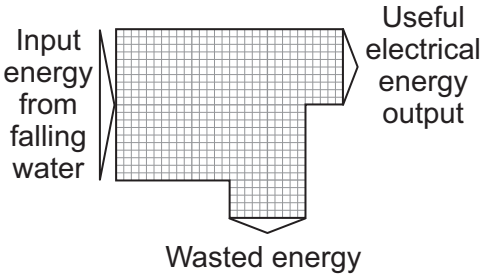
Which **one** of the following Sankey diagrams, **X**, **Y** or **Z**, shows the energy transformations produced by this generator?

Write your answer, **X**, **Y**, or **Z**, in the box.

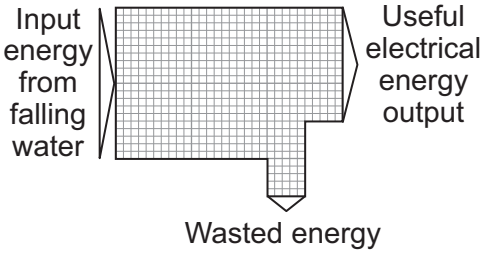
Sankey diagram **X**



Sankey diagram **Y**



Sankey diagram **Z**



Sankey diagram ☐

(1 mark)

Question 5 continues on the next page

Turn over ▶

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Do not write outside the box

5 (c) A micro-hydroelectric system generates about 60 kW of electricity, enough for 50 homes. A conventional large-scale hydroelectric power station may generate more than 5 000 000 kW of electricity.

5 (c) (i) Give **one** advantage of a conventional large-scale hydroelectric power station compared to a micro-hydroelectric system.

.....

.....

(1 mark)

5 (c) (ii) Which **one** of the following statements gives a **disadvantage** of a conventional large-scale hydroelectric power station compared to a micro-hydroelectric system?

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

Energy is wasted as heat and sound. ☐

Large areas of land are flooded. ☐

A constant flow of water is needed. ☐

(1 mark)

5 (d) The electricity generated by the micro-hydroelectric system is transferred directly to local homes. The electricity generated by a conventional large-scale hydroelectric power station is transferred to homes anywhere in the country through a system of cables and transformers.

5 (d) (i) What name is given to the system of cables and transformers used to transfer electricity to homes anywhere in the country?

.....

(1 mark)

5 (d) (ii) Using short cables to transfer electricity to local homes is much more efficient than using very long cables to transfer electricity to homes anywhere in the country.

Why?

.....

.....

(1 mark)

Do not write outside the box

5 (e) Nepal is a mountainous country with over 6000 rivers. In Nepal, 9000 kW of electricity are generated using micro-hydroelectric generators.

Suggest **one** reason why in the UK much less electricity is generated using micro-hydroelectric generators, than in Nepal.

.....

.....

(1 mark)

7

Turn over for the next question

Do not write outside the box

6 Small sailing boats can be fitted with a passive radar device. The device increases the chance that the small boat will be seen on the radar screen of a large ship.
The radar transmitter on the large ship emits microwaves.

6 (a) Microwaves and radio waves are both part of the electromagnetic spectrum.

How are microwaves different from radio waves?

.....

.....

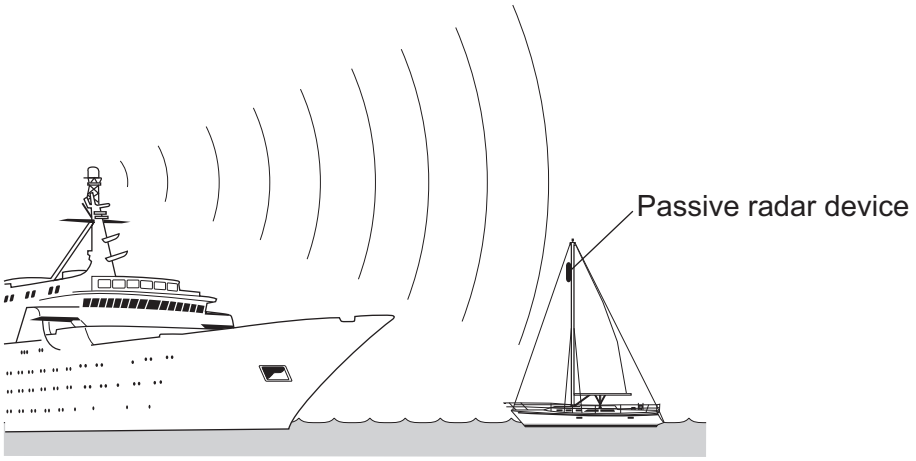
(1 mark)

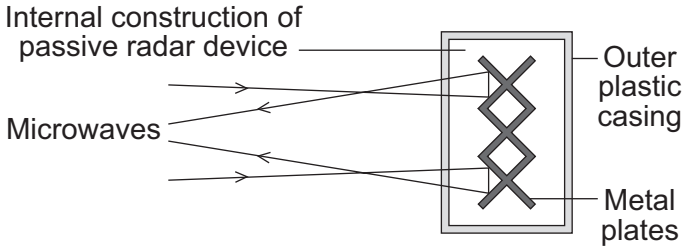
6 (b) How fast do microwaves travel through the air or a vacuum compared to radio waves?

.....

(1 mark)

6 (c) The diagrams show the position of a passive radar device on a small boat and the internal construction of one type of passive radar device.





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Do not write outside the box

Microwaves can be absorbed, reflected or transmitted by different materials and types of surface.

Explain what happens to the microwaves from the ship's transmitter when they reach the passive radar device.

.....

.....

.....

.....

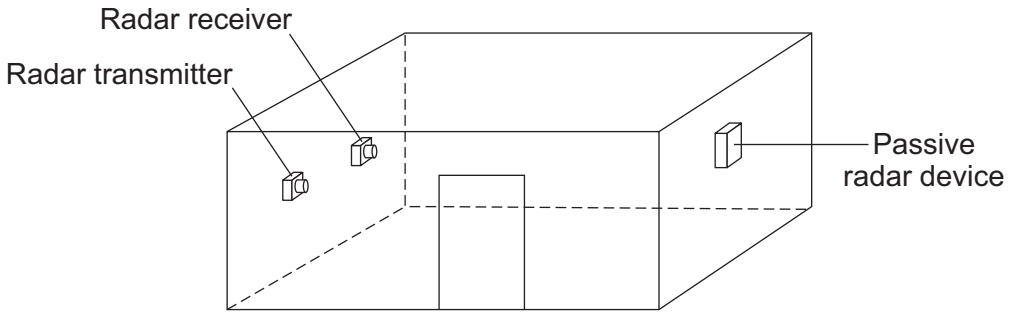
(2 marks)

Question 6 continues on the next page

Do not write outside the box

6 (d) Each type of passive radar device has an RCS value. The larger the RCS value, the easier it is for a small boat fitted with the device to be detected.

An independent group of scientists measured the RCS values of 4 different types of device. The RCS value for each device was measured in the same room using the same equipment.



6 (d) (i) Why are the walls of the room covered in a material that absorbs the waves emitted by the radar transmitter?

.....

.....

(1 mark)

6 (d) (ii) Why is it important to use the same room and the same equipment?

.....

.....

(1 mark)

6 (d) (iii) Why is it important that the measurements are made by an independent group of scientists?

.....

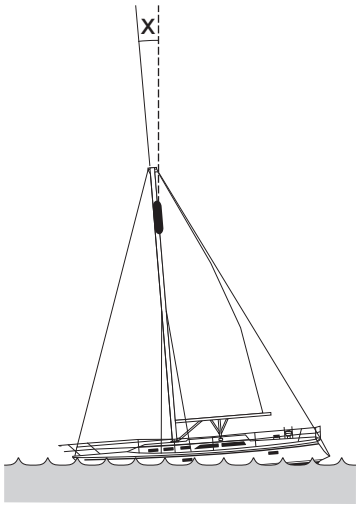
.....

(1 mark)

Do not write outside the box

6 (e) The movement of a small boat causes the mast and device to lean over, therefore the RCS values were measured at different angles.

The table gives the RCS values obtained by the scientists.



Device	Angle X			
	0°	5°	10°	15°
A	1.4	1.6	1.7	1.8
B	4.7	2.6	2.3	1.9
C	9.3	3.3	1.9	1.1
D	4.5	4.8	5.0	4.6

6 (e) (i) Describe how the RCS values for **device A** are different to the RCS values for **device B**.

.....

.....

.....

.....

(2 marks)

6 (e) (ii) The scientists recommended that a passive radar device fitted to a small boat should have:

- the largest possible RCS value
- an RCS value consistently above 2.0

Which **one** of the devices, **A**, **B**, **C** or **D**, would you recommend that someone fits to their boat?

.....

Give a reason for your answer.

.....

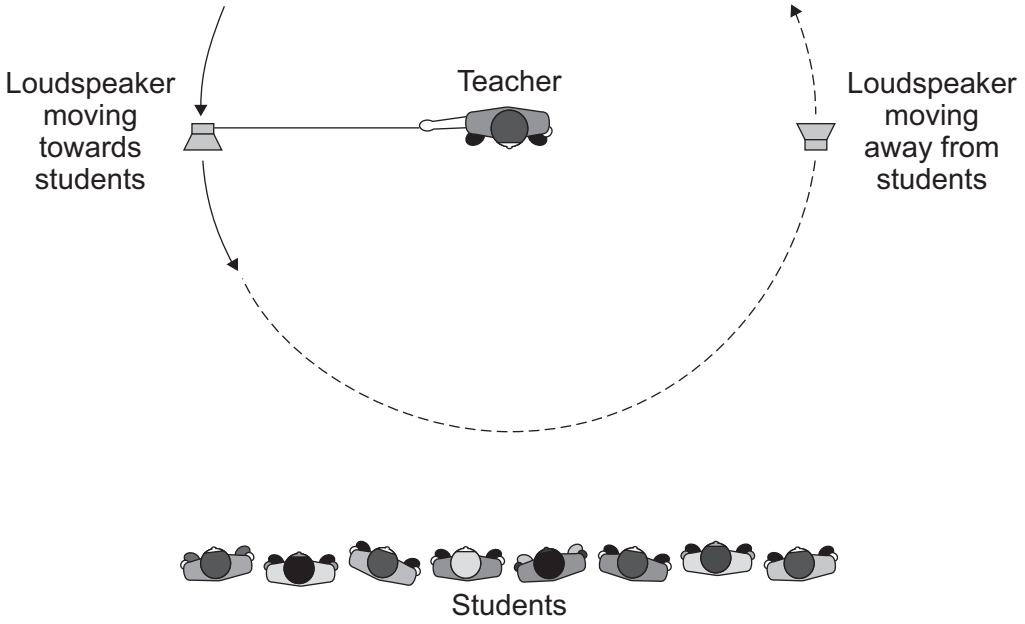
.....

(1 mark)

10

Do not write outside the box

7 The diagram shows a teacher using a loudspeaker to demonstrate an important effect. The loudspeaker, which produces a note of constant frequency, is swung around in a circle.



7 (a) As the loudspeaker moves towards the students, the frequency of the note heard by the students increases.

What happens to the note heard by the students as the loudspeaker moves away from them?

.....

.....

(1 mark)

Do not write outside the box

7 (b) The teacher is using the demonstration to model the red-shift in light that is observed from most distant galaxies.

7 (b) (i) Which **one** of the following statements gives the main reason why models are used in science?

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

Models can help to explain an effect or theory. ☐

Models can prove that a theory is correct. ☐

Models can help to generate new ideas. ☐

(1 mark)

7 (b) (ii) Explain how this demonstration can be used as a model for red-shift.

.....

.....

.....

.....

(2 marks)

7 (c) Red-shift provides evidence to support the theory that the Universe began from a very small initial point.

What name is given to this theory?

.....

(1 mark)

5

END OF QUESTIONS

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Version1.0: 24/02/2011

General Certificate of Secondary Education

Science B 4462 / Physics 4451

PHY1F Unit Physics 1

Mark Scheme

2011 Examination – January Series

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Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Marking Guidance for Examiners

GCSE Science Papers

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:

where consequential marking needs to be considered in a calculation;

or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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PHY1F

Question 1

question	answers	extra information	mark
1(a)(i)	solar and wind	both required for mark either order	1
1(a)(ii)	37(%)	accept their **two** sources in a(i) correctly added as an error carried forward (ecf)	1
1(b)	**A**		1
1(c)	gas is non-renewable	do **not** accept they are not all renewable statements such as gas produces CO_2 is neutral	1
Total			**4**

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PHY1F

Question 2

question	answers	extra information	mark
2(a)	45(p)	accept £0.45 for both marks allow **1** mark for correct substitution ie 3 × 15 do **not** award any marks if 45 is used in a subsequent calculation to obtain a final answer	2
2(b)	straight line drawn from origin passing through (1,1)	line must reach 1,1 but does not need to continue beyond	1
Total			**3**

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PHY1F

Question 3

question	answers	extra information	mark
3(a)	**1** mark for each correct line **List A** Type of nuclear radiation Alpha Beta Gamma **List B** Property of radiation Has the same mass as an electron Very strongly ionising Passes through 10 cm of aluminium Deflected by a magnetic field but not deflected by an electric field	if more than 1 line is drawn from any box in List **A**, none of those lines gain any credit	3
3(b)(i)	(the detector) reading had gone down	'it' equals detector reading accept the reading in the table is the smallest accept 101 is (much) lower than other readings / a specific value eg 150 do **not** accept this answer if it indicates the readings are the thickness	1
	more beta (particles / radiation) is being absorbed / stopped	accept radiation for beta particles / radiation accept fewer particles being detected	1
3(b)(ii)	six years		1

Question 3 continues on the next page . . .

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PHY1F

Question 3 continued . . .

question	answers	extra information	mark
3(b)(iii)	alpha would not penetrate the cardboard	accept the basic property- alpha (particles) cannot pass through paper / card accept alpha (particles) are less penetrating (than beta) range in air is neutral	1
Total			**7**

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PHY1F

Question 4

question	answers	extra information	mark
4(a)(i)	convection		1
4(a)(ii)	conduction		1
4(b)(i)	2 black is the best <u>absorber</u> (of thermal energy / heat)	 accept black is the best emitter (of thermal energy / heat) note that a comparative is needed (eg better or best)	1 1
4(b)(ii)	the colour of the metal plates		1
4(b)(iii)	any **one** from: • more precise / accurate / reliable • can measure continuously • take many readings in a small time • removes (human) reading error • can compare / draw graphs automatically • records data automatically	 do **not** accept better reading do **not** accept thermometer is unreliable accept easier to read	1
4(c)(i)	radiation	accept radiates accept infra red (IR) waves do **not** accept heat waves	1

Question 4 continues on the next page . . .

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PHY1F

Question 4 continued . . .

question	answers	extra information	mark
4(c)(ii)	to reflect (heat away from the fire fighter)	accept it reflects accept it is a poor absorber (of thermal radiation / heat) do **not** accept deflect / bounce for reflect	1
4(d)	**N** transfers / absorbs less heat **or** gives smallest increase in temperature	the mark is for the reason which does not score if **M** is chosen accept will keep fire fighters cooler accept **N** is cooler (after 15 minutes) an answer **N** goes up to 52°C and **M** goes up to 100°C is insufficient	1
Total			**9**

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PHY1F

Question 5

question	answers	extra information	mark
5(a)	kinetic		1
5(b)	**Z**		1
5(c)(i)	generates a lot more energy / electricity / power **or** can supply (energy / electricity / power) to more homes	need fewer conventional large-scale hydroelectric power stations is neutral	1
5(c)(ii)	Large areas of land are flooded.		1
5(d)(i)	National Grid	this answer only	1
5(d)(ii)	less energy / heat loss (from the cables)	accept wasted for loss accept answers in terms of fewer transformers needed do **not** accept less electricity lost / wasted do **not** accept no energy lost	1

Question 5 continues on the next page . . .

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PHY1F

Question 5 continued . . .

question	answers	extra information	mark
5(e)	any **one** from: • fewer rivers (suitable for generators) • less mountainous (so rivers fall smaller distances)	accept answers in terms of difficulty linking villages and towns to grid (in Nepal) accept answers in terms of more isolated communities accept answers in terms of UK having more resources for large-scale power stations	1
Total			**7**

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PHY1F

Question 6

question	answers	extra information	mark
6(a)	higher frequency **or** shorter wavelength **or** greater energy	general properties / uses are neutral do **not** accept different frequency / wavelength / energy	1
6(b)	the same (speed)	accept they travel at the speed of light	1
6(c)	pass through / transmitted by the plastic / casing <u>reflected</u> by the metal / plates	 do **not** accept bounce / deflected etc for reflected if neither marking point scores an answer reflected (back to boat / from the device) scores **1** mark	1 1
6(d)(i)	waves are not <u>reflected</u> from the walls **or** only waves (reflected) from the device are detected	accept microwaves / radar for waves do **not** accept bounce / deflected etc for reflected accept to stop reflected waves affecting results	1

Question 6 continues on the next page . . .

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PHY1F

Question 6 continued . . .

question	answers	extra information	mark
6(d)(ii)	different types (of device) can be compared	fair test is insufficient accept idea that only one variable is then changed	1
6(d)(iii)	so (measurements / results / scientists) are not biased towards one type / manufacturer of device/s	accept to avoid bias accept so they are not biased	1
6(e)(i)	any **two** from: • (for any angle) **A** values < **B** values • **A** values increase with (increasing) angle • **B** values decrease with (increasing) angle • **A** values do not vary as much (as **B** values)	if temperature is mentioned rather than angle a maximum of **1** mark can be scored **or** converse eg **B** values are higher / better / stronger accept weakest at 0^o strongest at 15^o values go up is insufficient accept strongest at 0^o weakest at 15^o values go down is insufficient	2
6(e)(ii)	**D** values are always over 2(.0)	mark is for the reason reason cannot score if **D** is not chosen	1
Total			**10**

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PHY1F

Question 7

question	answers	extra information	mark
7(a)	frequency / pitch decreases	accept wavelength increases accept it / the note becomes deeper / lower it / the note decreases is insufficient quieter is neutral	1
7(b)(i)	Models can help to explain an effect or theory.		1
7(b)(ii)	(moving) loudspeaker represents the (moving) galaxy the decrease in frequency of the sound is like red-shift	accept sound waves represent light waves accept increase in frequency is like blue-shift accept answers in terms of wavelength change accept sound going away from you is like red-shift accept red-shift happens when galaxies / stars move away (from Earth) this accept only scores if first marking point scores	1 1
7(c)	big bang		1
Total			**5**

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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.

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Do not write outside the box

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	**List B** Energy source
Where I live is the sunniest part of the country.	Wind
Where I live, the land is very flat and it always seems to be windy.	Waves
Where I live, it is not safe to swim. The sea is always too rough.	Solar
Where I live, you can see steam coming out of the ground.	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)

Do not write outside the box

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

Do not write outside the box

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)

Do not write outside the box

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.

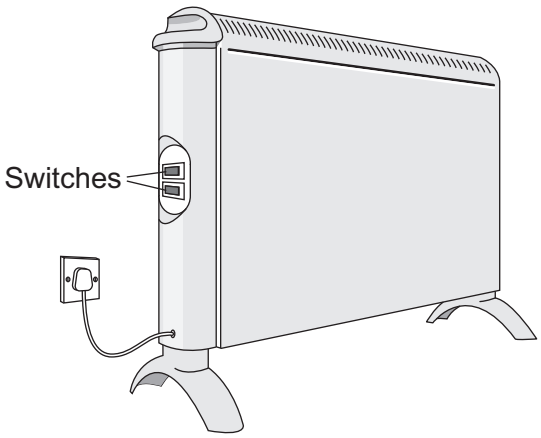
(1 mark)

5

Turn over for the next question

Do not write outside the box

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

Show clearly how you work out your answer.

.....

.....

Energy transferred = ... kWh

(2 marks)

Do not write outside the box

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.

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

Show clearly how you work out your answer.

.....

.....

Total cost = ... pence

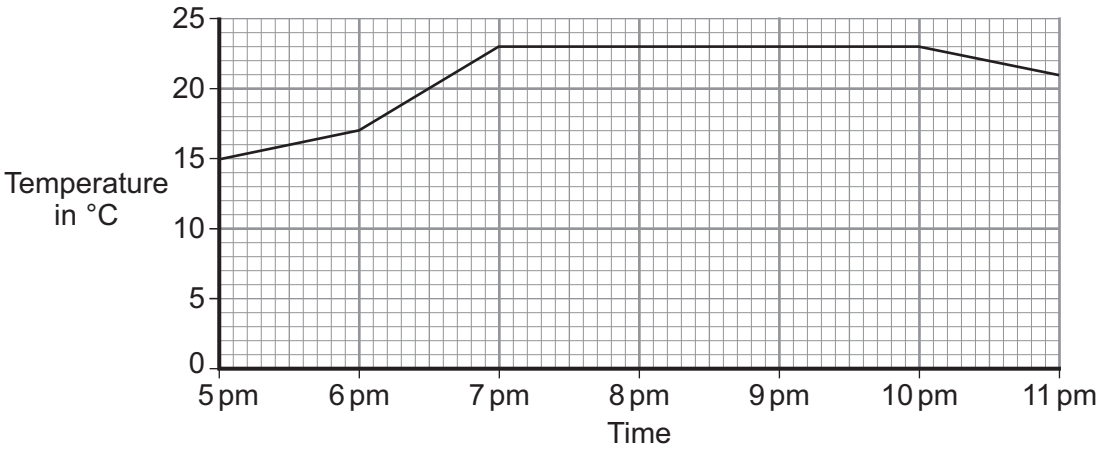
(2 marks)

Question 3 continues on the next page

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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

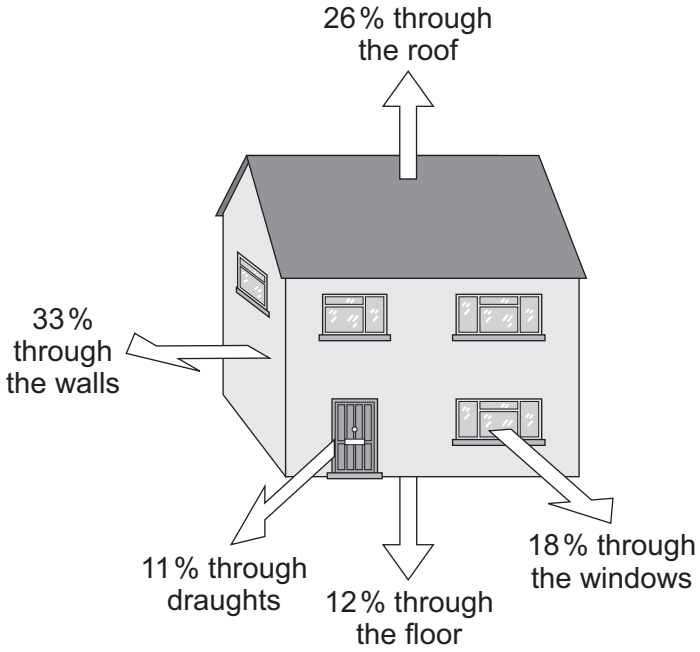
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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

Do not write outside the box

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)

Do not write outside the box

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.

	Cost	Money saved each year
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 ▶

Do not write outside the box

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.

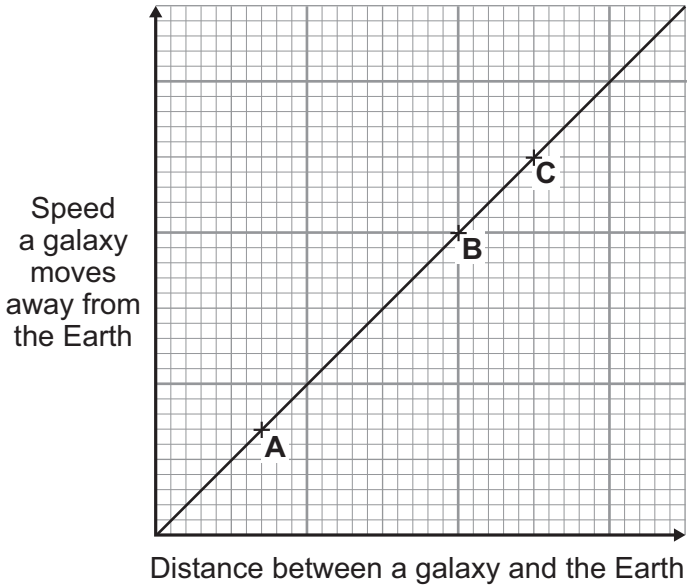
This observation gives evidence for the idea that the universe is

shrinking.
not changing.
expanding.

(1 mark)

Do not write outside the box

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.

.....

.....

.....

.....

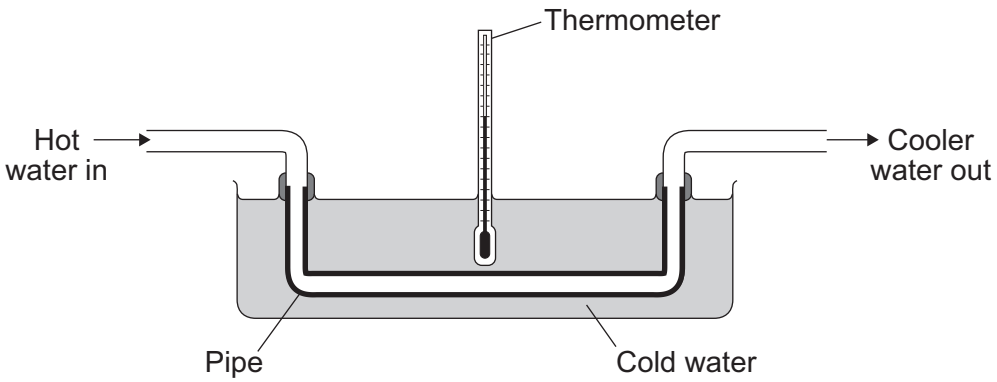
(2 marks)

6

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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?

.....

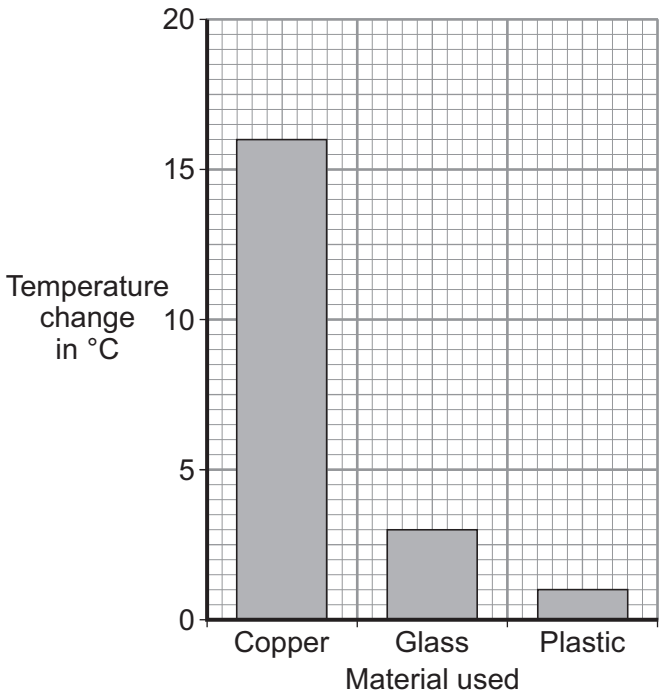
(1 mark)

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

Do not write outside the box



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.

.....

.....

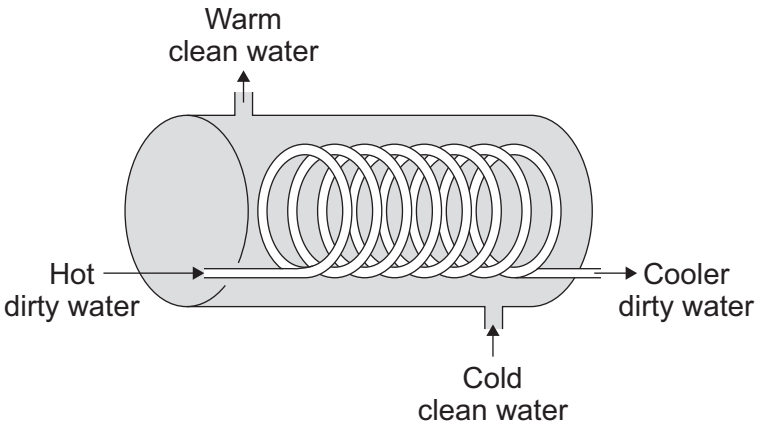
.....

(2 marks)

Question 6 continues on the next page

Do not write outside the box

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

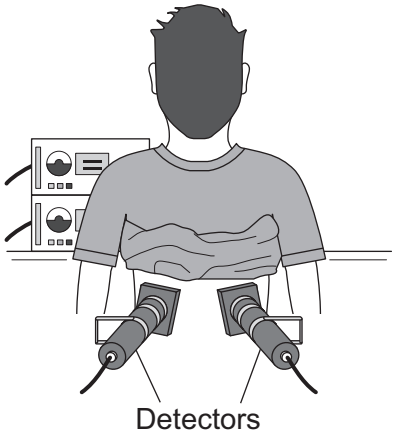
Do not write outside the box

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

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 .....

.....

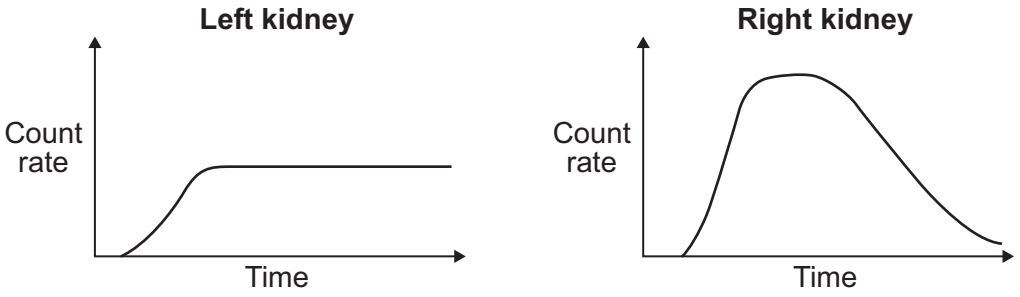
(2 marks)

Do not write outside the box

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 ▶

Do not write outside the box

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

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Version : 02/08/2010

General Certificate of Secondary Education

Science B 4462 / Physics 4451

PHY1F Unit Physics 1

Mark Scheme

2010 Examination – June Series

STEMUP.CO.UK

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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Marking Guidance for Examiners

GCSE Science Papers

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:

where consequential marking needs to be considered in a calculation;

or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct

substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

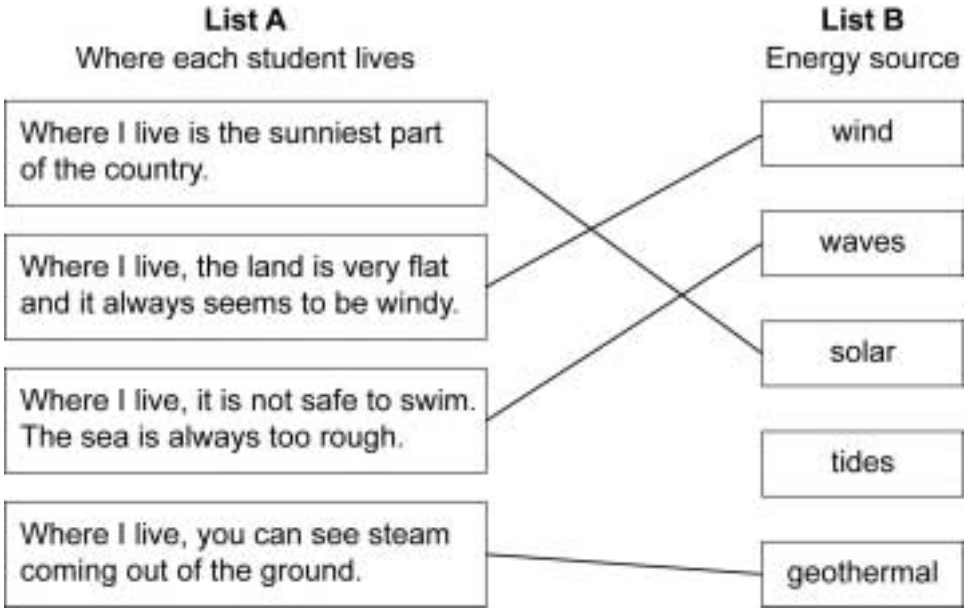
(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use the **?** area in the CMI+ software to forward such answers to a Senior Examiner.

PHY1F

Question 1

question	answers	extra information	mark
1(a)	all 4 lines correct  	allow **1** mark for each correct line if more than 1 line goes from a box in **List A** then all those lines are incorrec	4
1(b)	all renewable	accept a correct description of renewable eg replaced faster than used **or** never run out do **not** accept can be used again accept any other common feature eg do not produce pollution / polluting (gases) no fuel is burnt (energy input) is free eco-friendly / environmentally friendly / natural resources / sustainable sources are insufficient	1
1(c)	large areas of land are flooded		1
Total			**6**

PHY1F

Question 2

question	answers	extra information	mark
2(a)(i)	infra red (rays) **or** radio (waves)	accept IR do **not** accept heat waves do **not** accept TV waves	1
2(a)(ii)	<u>radio</u> (waves)	this answer only	1
2(b)	frequency		1
2(c)(i)	need to know if it is harmful / makes you ill	answer should be in terms of establishing if harmful or not harmful ie trying to clear up any uncertainty do **not** accept answers that assume it is harmful eg Wi-Fi systems will make you ill accept idea that safety issue may worry people accept idea that (more) research may reassure people accept idea of finding out (the truth)	1
2(c)(ii)	an opinion		1
Total			**5**

PHY1F

Question 3

question	answers	extra information	mark
3(a)(i)	2(.0)	accept 2000 W or 2000 watt(s) accept answer given in table do **not** accept 2000	1
3(a)(ii)	4.5	allow **1** mark for correct substitution ie 1.5 × 3 allow **1** mark for the answers 1.5 or 6(.0)	2
3(a)(iii)	54 **or** their (a)(ii) × 12 correctly calculated	allow **1** mark for correct substitution ie 4.5 × 12 **or** their (a)(ii) × 12 allow **1** mark if correct answer is given in pounds eg £54	2

Question 3 continues on the next page . . .

PHY1F

Question 3 continued . . .

question	answers	extra information	mark
3(b)(i)	6 pm temperature starts to rise faster **or** graph (line) is steeper / steepest	 only scores if 6 pm given it refers to graph gradient or temperature accept answers in terms of relative temperature rise eg 5 to 6 pm 2 °C rise, 6 to 7 pm 6 °C rise accept temperature rises sharply / rapidly / quickly do **not** accept temperature starts to rise	1 1
3(b)(ii)	middle box ticked		1
Total			**8**

PHY1F

Question 4

question	answers	extra information	mark
4(a)(i)	walls	accept sides (of house)	1
4(a)(ii)	fit double glazing **or** close / fit curtains / fit shutters	accept close windows accept keep house at a lower temperature accept fit (foam) draft excluders around the windows / in the jams accept put plastic (film) across the windows do **not** accept fit thicker glass	1
4(b)(i)	cavity (wall insulation)	accept the middle one	1
4(b)(ii)	fit hot water jacket **and** draught-proofing (together) saves most money	both required only scores if first mark scores accept saves more than fitting (energy efficient) light bulbs accept saves £40 accept gives the shortest payback time an answer fit energy efficient light bulbs (on its own) gains **1** mark only	1 1
Total			**5**

PHY1F

Question 5

question	answers	extra information	mark
5(a)	any **one** from: • above the atmosphere • no clouds in the way • no light pollution	 accept no atmospheric pollution answers in terms of being closer to space negate answers in terms of looking at the Earth negate	1
5(b)(i)	red-shift		1
5(b)(ii)	expanding		1
5(c)(i)	as one gets bigger the other gets bigger	accept (directly) proportional accept positive correlation	1
5(c)(ii)	**C** it is furthest from the Earth **or** it is furthest away **or** has the largest red-shift **or** it is moving (away) the fastest	 only scores if **C** is chosen	1 1
Total			**6**

PHY1F

Question 6

question	answers	extra information	mark
6(a)	conduction		1
6(b)(i)	any **one** from: • starting temperature (of cold water) • pipe length • pipe diameter • pipe (wall) thickness • volume of cold water • temperature of hot water (in) • time	 temperature is insufficient accept size of pipe accept amount for volume	1
6(b)(ii)	(type of) material is categoric	accept one variable is categoric accept variable(s) are categoric accept it is categoric accept variable(s) are not continuous descriptions of variables ie names and numbers is insufficient	1
6(b)(iii)	copper greatest temperature change	 only scores if copper chosen accept heat for temperature accept heated water the fastest accept it was hottest (after 10 minutes) accept it is the best / a good conductor	1 1

Question 6 continues on the next page . . .

PHY1F

Question 6 continued . . .

question	answers	extra information	mark
6(c)	larger (surface) area	accept the pipe is longer accept hot (dirty) water (inside pipe) is in contact with the cold water (outside pipe) for a longer time the pipe is a spiral is insufficient	1
Total			**6**

PHY1F

Question 7

question	answers	extra information	mark
7(a)	gamma will pass through the body **or** alpha will not pass through the body	it refers to gamma answers must relate to the body accept skin for body	1
	gamma is only slightly ionising **or** alpha is heavily ionising	accept gamma causes less damage to cells / tissue do **not** accept gamma causes no damage to cells less harmful is insufficient	1
7(b)(i)	(both graphs show an initial) increase in count-rate	accept both show an increase	1
7(b)(ii)	only the right kidney is working correctly		1
	any **two** from: • count-rate / level / line for right kidney decreases (rapidly) • count-rate / level / line for <u>left</u> kidney does not change • radiation is being passed out / into urine - if referring to right kidney • radiation is not being passed out - if referring to the left kidney	if incorrect box chosen maximum of **1** mark can be awarded reference to named kidney can be inferred from the tick box it decreases is insufficient it does not change is insufficient	2

Question 7 continues on the next page . . .

PHY1F

Question 7 continued . . .

question	answers	extra information	mark
7(c)(i)	time taken for number of nuclei to halve **or** time taken for the count-rate to halve		1
7(c)(ii)	short half-life - the level of radiation (in the body) decreases rapidly to a safe / very small level **or** a long half-life - the radiation remains in the body / for a long time level of radiation remains high	it refers to short life isotope answers in terms of damage eg cancer are insufficient	1 1
Total			**9**

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
January 2010

Science B
Unit Physics P1

PHY1F

F

Physics
Unit Physics P1

Written Paper

Wednesday 20 January 2010 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 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.

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Areas outside the box will not be scanned for marking

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

1 (a) The diagram shows the electromagnetic spectrum.
The pictures show four devices that use electromagnetic waves. Each device uses a different type of electromagnetic wave.

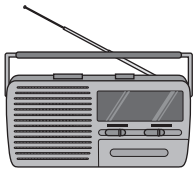
Draw a line from each device to the type of electromagnetic wave that it uses.
One has been done for you.

Gamma rays	X-rays	Ultraviolet rays	Visible light	Infra red rays	Microwaves	Radio waves

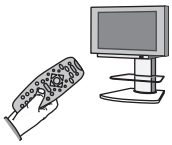
Sunbed



Radio



TV remote control



Filament lamp



(3 marks)

1 (b) A headline from a recent newspaper article is shown below.



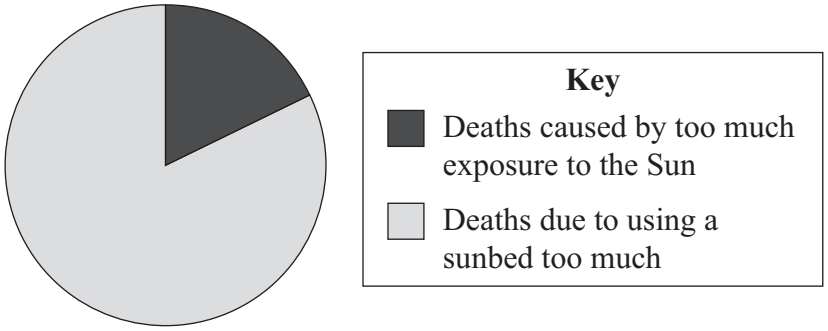
1 (b) (i) What serious health problem may be caused by using a sunbed too much?

.....

(1 mark)

Areas outside the box will not be scanned for marking

1 (b) (ii) The pie chart compares the number of deaths in Britain each year, which may have been caused by using sunbeds too much, with those which may have been caused by too much exposure to the Sun.



It is difficult for a doctor to be certain that a person has died because of using a sunbed too much.

Suggest why.

.....

.....

(1 mark)

1 (b) (iii) A spokesperson for a leading cancer charity said:

> 'We want people, especially young people, to know the possible dangers of using a sunbed.'

Why is it important that you know the possible dangers of using a sunbed?

.....

.....

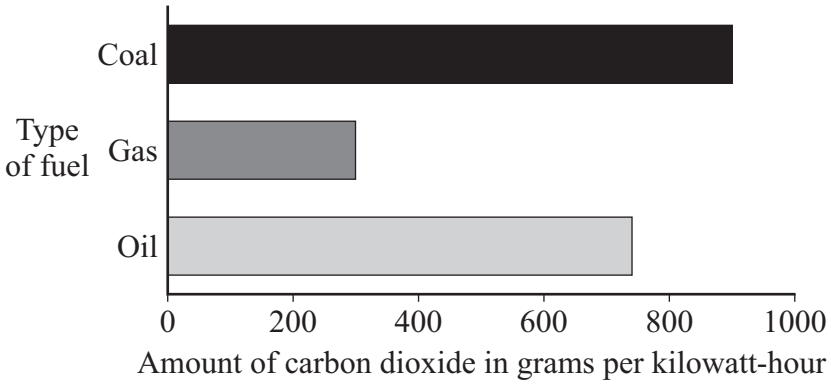
(1 mark)

6

Areas outside the box will not be scanned for marking

2 (a) Most electricity in the UK is generated in power stations that burn fossil fuels.

The bar chart shows how much carbon dioxide is produced for each kilowatt-hour of electricity generated using a fossil fuel.



2 (a) (i) Which fossil fuel produces the smallest amount of carbon dioxide for each kilowatt-hour of electricity generated?

.....

(1 mark)

2 (a) (ii) Which **one** of the following statements gives the reason why the data has been shown as a bar chart and not as a line graph?

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

Both variables are categoric. ☐

Both variables are continuous. ☐

One variable is categoric, the other is continuous. ☐

(1 mark)

2 (a) (iii) Why does a nuclear power station **not** produce any carbon dioxide?

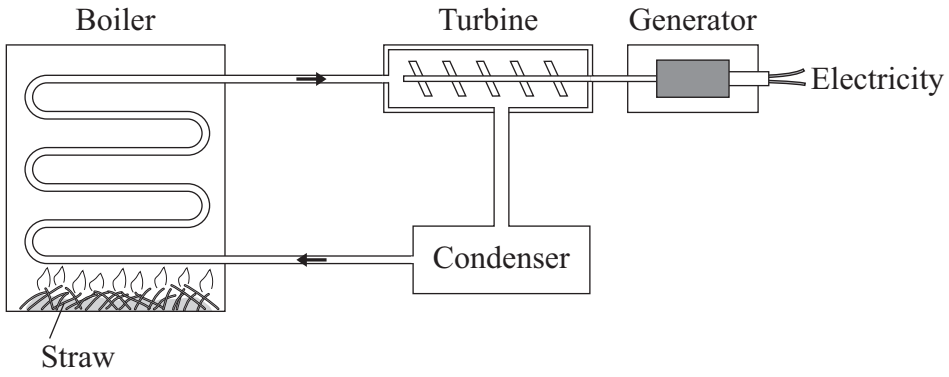
.....

.....

(1 mark)

Areas outside the box will not be scanned for marking

2 (b) Some types of power station generate electricity by burning straw.



2 (b) (i) Use words from the box to complete the following sentences.

boiler	**gas**	**generator**	**steam**	**turbine**	**water**

Straw is burned in a ..... . Water is heated to make

..... which is used to drive a ..... .

This turns a ..... to produce electricity.

(4 marks)

2 (b) (ii) Straw is a type of renewable energy source known as a biofuel.

Name **one** other type of renewable energy source used to produce electricity.

.....

(1 mark)

2 (b) (iii) A power station generates 36 000 000 watts (36 MW) of electrical power by burning straw. The average power used in each home in the UK over one year is 2000 watts.

Calculate the number of homes that the power station could supply electricity to.

Show clearly how you work out your answer.

.....

.....

Number of homes = ...

(2 marks)

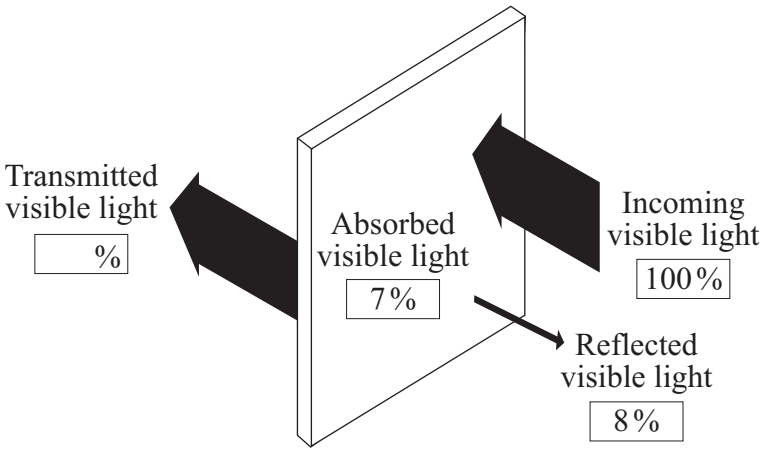
10

Turn over ▶

Areas outside the box will not be scanned for marking

3 Glass reflects, absorbs and transmits both infra red radiation and visible light.

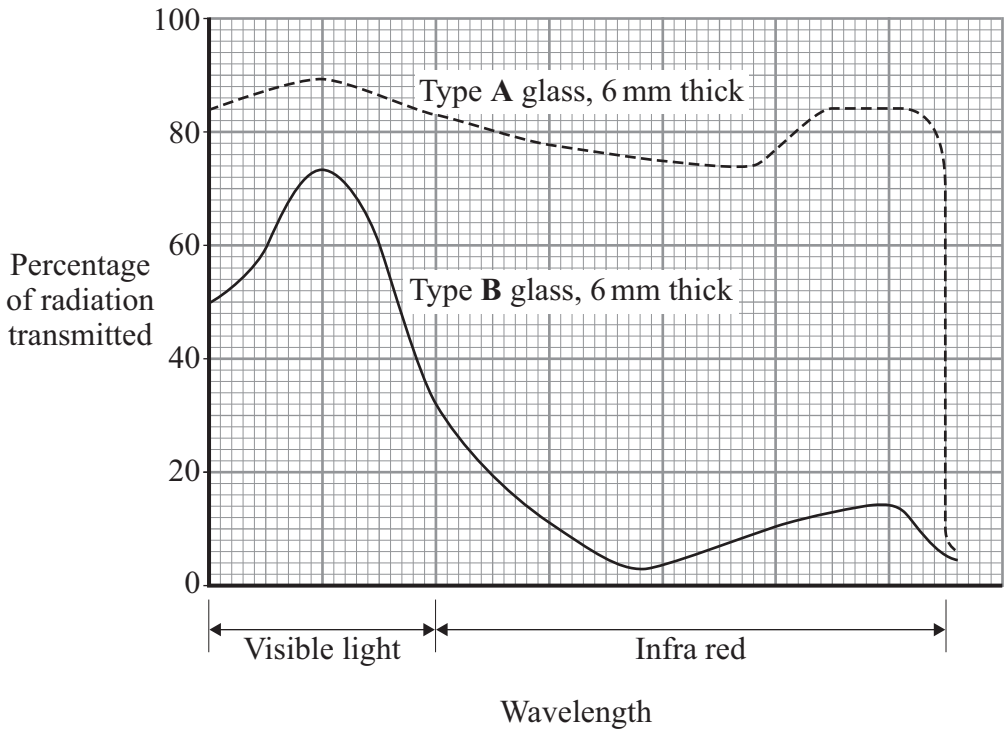
3 (a) The diagram shows the percentages of visible light that are reflected and absorbed by one type of glass.



What percentage of visible light is transmitted by this type of glass?

..... %
(1 mark)

3 (b) The amounts of infra red radiation and visible light transmitted by glass depend on the type and thickness of glass. The data obtained from tests on two different types of glass is displayed in the graph below.



Areas outside the box will not be scanned for marking

3 (b) (i) To be able to compare the two types of glass, it was important to control one variable.

What variable was controlled in the tests?

.....

(1 mark)

3 (b) (ii) A homeowner has a glass conservatory built on the back of the house. The homeowner tells the builder that the inside of the conservatory should stay as cool as possible throughout the summer.

Explain why the builder uses 'type **B**' glass for the conservatory.

.....

.....

.....

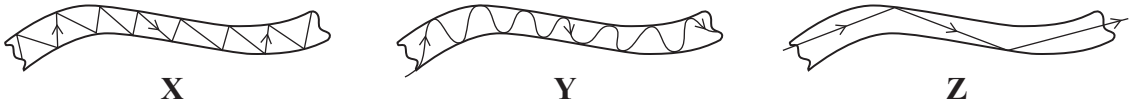
.....

(2 marks)

3 (c) Infra red and visible light can be used to send signals along an optical fibre.

Which **one** of the following diagrams, **X**, **Y** or **Z**, shows the path taken by a signal as it travels along an optical fibre?

Draw a ring around the correct diagram.



X **Y** **Z**

(1 mark)

5

Areas outside the box will not be scanned for marking

4 Some rocks inside the Earth contain a radioactive element, uranium-238. When an atom of uranium-238 decays, it gives out an alpha particle.

4 (a) The following statement about alpha particles was written by a student.
The statement is **not** correct.

Alpha particles can pass through a very thin sheet of lead.

Change **one** word in the statement to make it correct.

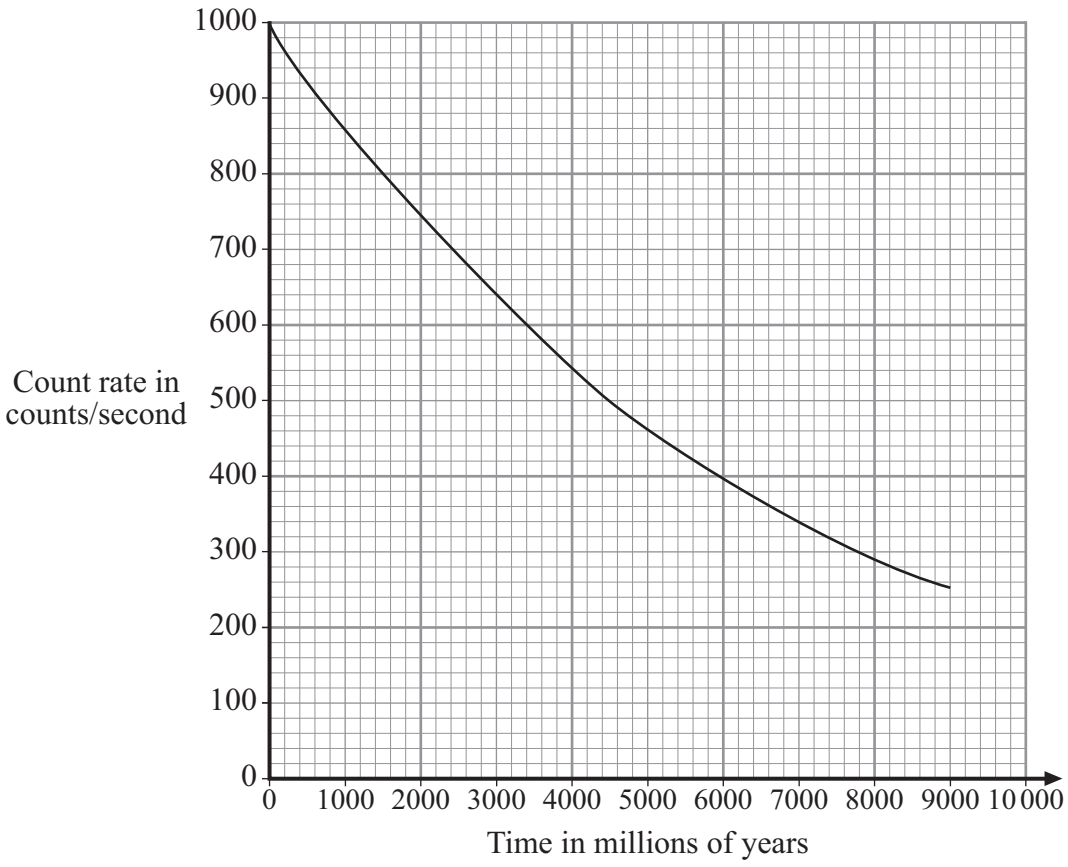
Write down your **new** statement.

.....

.....

(1 mark)

4 (b) The graph shows how the count rate from a sample of uranium-238 changes with time.



The graph can be used to find the half-life of uranium-238. The half-life is 4500 million years.

4 (b) (i) Draw on the graph to show how it can be used to find the half-life of uranium-238.

(1 mark)

Areas outside the box will not be scanned for marking

4 (b) (ii) There is now half as much uranium-238 in the rocks as there was when the Earth was formed.

How old is the Earth?

Draw a ring around your answer.

2250 million years **4500 million years** **9000 million years**

(1 mark)

4 (b) (iii) If a sample of uranium-238 were available, it would not be possible to measure the half-life in a school experiment.

Explain why.

.....

.....

.....

.....

(2 marks)

5

Turn over for the next question

Areas outside the box will not be scanned for marking

5 (a) An optical telescope, used to observe stars, is to be built either at the bottom or at the top of a high mountain.

5 (a) (i) What type of electromagnetic radiation is detected by an optical telescope?

.....

(1 mark)

5 (a) (ii) Give **one** advantage of having the telescope at the top of the high mountain rather than at the bottom.

.....

.....

(1 mark)

5 (b) Gamma radiation from the Sun is absorbed by the atmosphere.

Where should a telescope designed to detect gamma radiation be positioned?

.....

.....

(1 mark)

5 (c) By observing distant galaxies, scientists have found evidence to support the 'Big Bang' theory.

Which statement about the 'Big Bang' theory is correct?

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

Scientists have proved beyond doubt that it happened. ☐

It is the only way of explaining the origin of the Universe. ☐

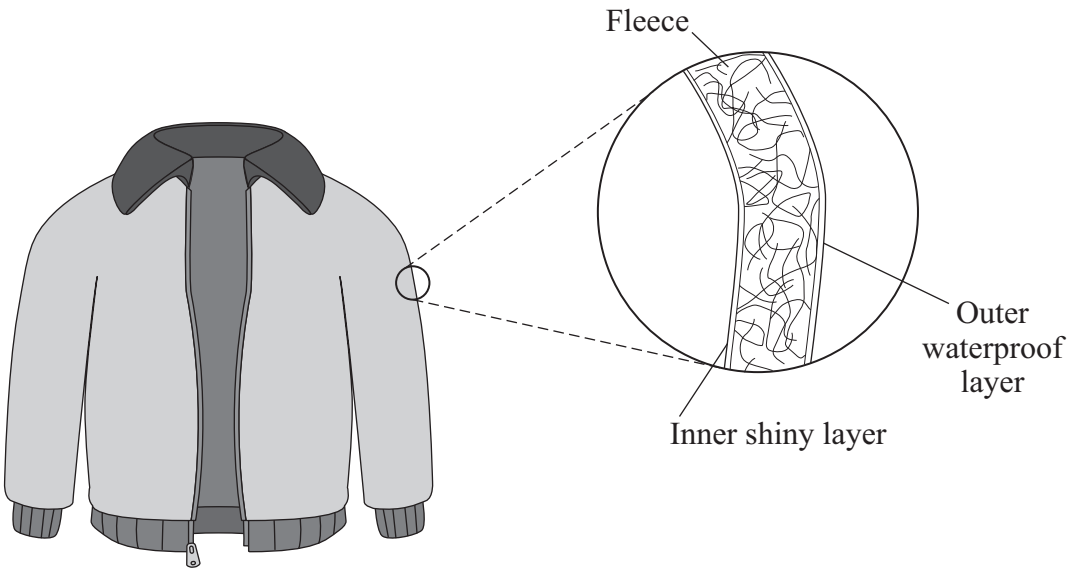
The Universe began from a very small point. ☐

(1 mark)

4

Areas outside the box will not be scanned for marking

6 (a) The diagram shows a ski jacket that has been designed to keep a skier warm. The jacket is made from layers of different materials.



6 (a) (i) The inner layer is shiny to reduce heat transfer.

Which process of heat transfer will it reduce?

.....

(1 mark)

6 (a) (ii) Why is the layer of fleece good at reducing the transfer of heat from a skier's body?

.....

.....

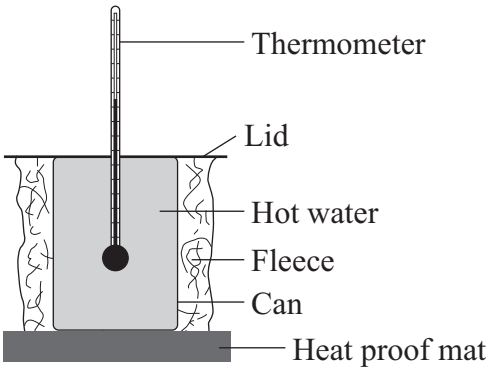
(1 mark)

Question 6 continues on the next page

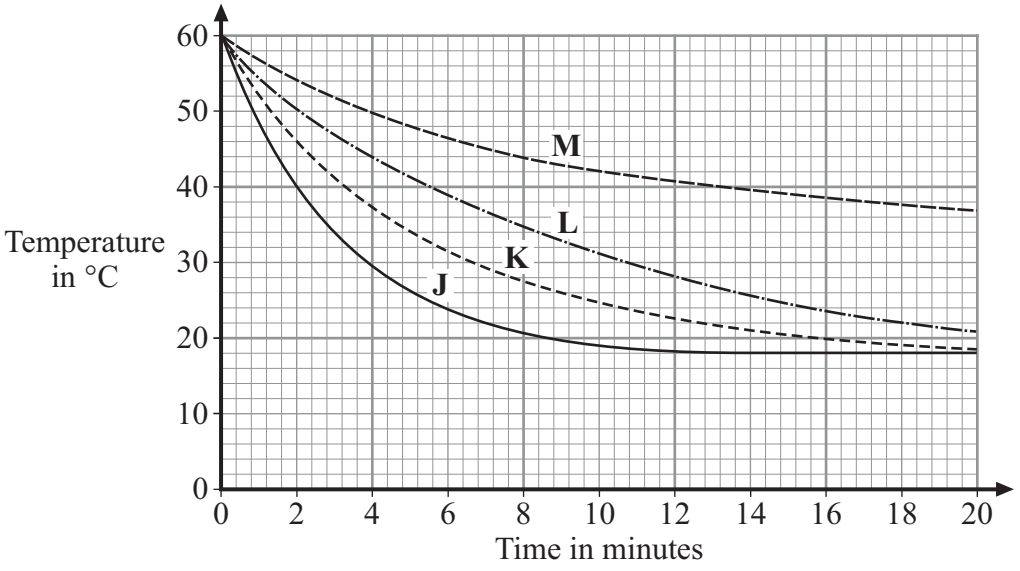
Turn over ▶

Areas outside the box will not be scanned for marking

6 (b) A student tested four different types of fleece, **J**, **K**, **L** and **M**, to find which would make the warmest jacket. Each type of fleece was wrapped around a can which was then filled with hot water.
The temperature of the water was taken every two minutes for 20 minutes.



The graph shows the student's results.



6 (b) (i) In each test, the water cooled faster during the first five minutes than during the last five minutes. Why?

.....

.....

(1 mark)

Areas outside the box will not be scanned for marking

6 (b) (ii) To be able to compare the results, it was important to use the same volume of water in each test.

Give **one** other quantity that was the same in each test.

.....

.....

(1 mark)

6 (b) (iii) Look at the graph line for fleece **K**.

Estimate what the temperature of the water in the can wrapped in fleece **K** would be after 40 minutes.

.....

(1 mark)

6 (b) (iv) Which type of fleece, **J**, **K**, **L** or **M**, should the student recommend to be used in the ski jacket?

.....

Give a reason for your answer.

.....

.....

.....

.....

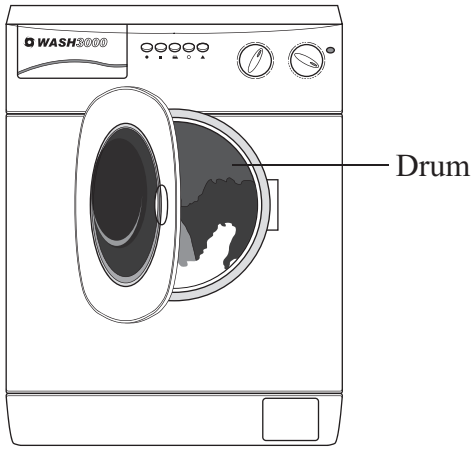
(2 marks)

7

Turn over for the next question

Areas outside the box will not be scanned for marking

7 The picture shows a new washing machine. When the door is closed and the machine switched on, an electric motor rotates the drum and washing.



7 (a) Complete the following sentences.

7 (a) (i) An electric motor is designed to transform electrical energy into

..... energy.

(1 mark)

7 (a) (ii) Some of the electrical energy supplied to the motor is wasted as

..... energy and ..... energy.

(1 mark)

7 (b) What happens to the energy wasted by the electric motor?

.....

.....

(1 mark)

Areas outside the box will not be scanned for marking

7 (c) The diagram shows the label from the new washing machine.

Model – Wash 3000 **Energy A**	
More efficient A B C D E Less efficient	A
Energy consumption kWh/wash cycle (based on 40 °C wash)	1.1

An 'A' rated washing machine is *more energy efficient* than a 'C' rated washing machine.

Explain what being *more energy efficient* means.

.....

.....

.....

.....

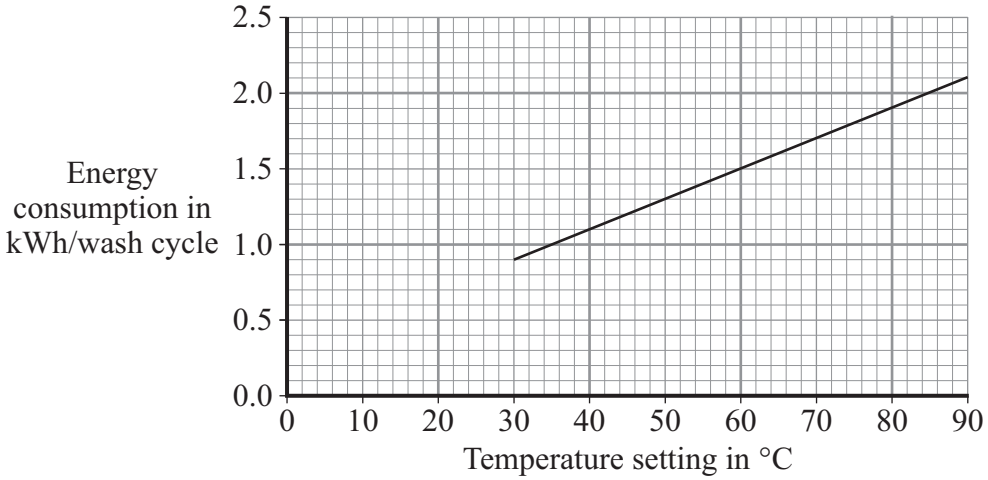
(2 marks)

Question 7 continues on the next page

Turn over ▶

Areas outside the box will not be scanned for marking

7 (d) The graph shows that washing clothes at a lower temperature uses less energy than washing them at a higher temperature. Using less energy will save money.



7 (d) (i) Electricity costs 12 p per kilowatt-hour (kWh).
The temperature setting is turned down from 40 °C to 30 °C.

Use the graph and equation in the box to calculate the money saved each wash cycle.

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

Show clearly how you work out your answer.

.....

.....

Money saved = ... p

(2 marks)

7 (d) (ii) Suggest why reducing the amount of energy used by washing machines could reduce the amount of carbon dioxide emitted into the atmosphere.

.....

.....

(1 mark)

8

END OF QUESTIONS

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Version : 24/02/2010



General Certificate of Secondary Education

Science B 4462/ Physics 4451

PHY1F Unit Physics 1

Mark Scheme

2010 examination - January series

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Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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Dr Michael Cresswell Director General

MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

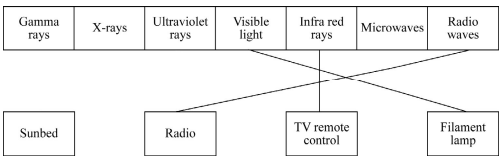
3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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PHY1F

Question 1

question	answers	extra information	mark
1(a)	all three lines correct  	allow **1** mark for each correct line if more than one line goes from a device then all lines from that device are wrong	3
1(b)(i)	<u>skin</u> cancer	do **not** accept cancer do **not** accept sunburn correct answer only	1
1(b)(ii)	other factors may be involved	accept may have been in the Sun too long accept (over)-use of sunbeds and (over)-exposure to the Sun (both) give the same symptoms accept any other sensible factor that could lead to doubt do **not** accept irrelevant answers eg may be run over by a car do **not** accept large numbers killed by exposure to the Sun	1
1(b)(iii)	can assess risk **or** make your own decision	answers should be in terms of assessing your own health risk accept so you limit its use / don't use one do **not** accept so you don't get skin cancer do **not** accept so you don't get sunburn	1
Total			**6**

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PHY1F

Question 2

question	answers	extra information	mark
2(a)(i)	gas		1
2(a)(ii)	one variable is categoric, the other is continuous		1
2(a)(iii)	fuel is **not** burned	accept nothing is burned do **not** accept they don't use fossil fuels	1
2(b)(i)	boiler steam turbine generator		1 1 1 1
2(b)(ii)	any **one** from: • wind • waves • tidal • geothermal • solar • falling water	 accept wind turbines accept tide accept the Sun / sunlight accept solar panels / cells do **not** accept light accept hydroelectric do **not** accept water do **not** accept any named biofuel	1
2(b)(iii)	18 000	allow **1** mark for showing a correct method ie 36 000 000 ÷ 2 000 an answer of 0.018 gains **1** mark	2
Total			**10**

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PHY1F

Question 3

question	answers	extra information	mark
3(a)	85		1
3(b)(i)	thickness (of glass)	accept how thick the glass is do **not** accept light intensity	1
3(b)(ii)	transmits less infra red	accept radiation / or heat for infra red accept transmits less energy (at all wavelengths) accept (glass **B**) absorbs more infra red accept infra red is the same as heat ignore reference to visible light	1
	infra red has a heating effect **or** infra red warms the room	ignore references to conservatory keeping cool	1
3(c)	**Z**		1
Total			**5**

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PHY1F

Question 4

question	answers	extra information	mark
4(a)	alpha particles **cannot** pass through... **or** alpha particles can pass through a very thin sheet of **paper / card**	do **not** accept gamma particles . . . credit answers where correct amendments are made to boxed statement	1
4(b)(i)	horizontal and vertical line drawn at correct positions on the graph	accept a cross drawn at 4500 / 500 on the curve **or** two pairs of lines drawn, for example, at 600 and 300 accept a horizontal line drawn at 500 on its own do **not** accept vertical lines only	1
4(b)(ii)	4500 million years		1
4(b)(iii)	half-life too long no (measurable) change in count rate	do **not** accept simply its half-life is 4500 million years do **not** accept have not got the equipment do **not** accept it's harmful (to children) if neither of the above points scored, accept not enough time to measure it for **1** mark	1 1
Total			**5**

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PHY1F

Question 5

question	answers	extra information	mark
5(a)(i)	(visible) light		1
5(a)(ii)	any **one** from: • less / no light pollution • less atmospheric distortion / interference • less / no cloud cover • **image / picture** is clearer	 accept no street lights accept less / thinner atmosphere do **not** accept no atmosphere accept less atmospheric pollution do **not** accept less pollution accept above the clouds do **not** accept gives a clearer view / signal	1
5(b)	on a satellite	accept in orbit / space accept in a high altitude balloon accept above the atmosphere do **not** accept on top of a mountain do **not** accept on a plane ignore any reason given correct or otherwise	1
5(c)	The Universe began from a very small point.		1
Total			**4**

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PHY1F

Question 6

question	answers	extra information	mark
6(a)(i)	radiation		1
6(a)(ii)	traps (small pockets of) air	do **not** accept it's an insulator do **not** accept reduces conduction and / or convection do **not** allow it doesn't allow heat to escape	1
6(b)(i)	bigger temperature difference (between the water and surroundings) at the start (than at the end)	do **not** accept water is hotter	1
6(b)(ii)	starting temperature (of the water)	accept thickness of fleece do **not** accept same amount of fleece do **not** accept thermometer / can do **not** accept time is the same	1
6(b)(iii)	18 (°C)	correct answer only	1
6(b)(iv)	**M** smallest temperature drop (after 20 mins)	 cannot score if **M** is not chosen accept it's the best insulator accept smallest loss in heat accept keeps heat / warmth in for longer	1 1
Total			**7**

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PHY1F

Question 7

question	answers	extra information	mark
7(a)(i)	kinetic	do **not** accept movement	1
7(a)(ii)	thermal sound	accept heat for thermal do **not** accept noise for sound both answers required in either order	1
7(b)	transferred to surroundings / surrounding molecules / atmosphere **or** becomes dissipated / spread out	'it escapes' is insufficient accept warms the surroundings accept degraded / diluted accept a correct description for surroundings eg to the washing machine do **not** accept transformed into heat on its own	1
7(c)	a smaller proportion / percentage of the energy supplied is wasted	owtte accept a statement such as 'less energy is wasted' for **1** mark do **not** accept costs less to run ignore references to uses less energy	2
7(d)(i)	2.4 (p)	accept 2 p if it is clear from the working out this is rounded from 2.4 p allow **1** mark for correct substitution of correct values ie 0.2 × 12 allow **1** mark for calculating cost at 40 °C (13.2 p) **or** cost at 30 °C (10.8 p)	2

Question 7 continues on the next page . . .

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PHY1F

Question 7 continued . . .

question	answers	extra information	mark
7(d)(ii)	any **one** from: • less electricity needed • fewer power stations needed • less fuel is burned	ignore answers in terms of the washing machine releasing less energy an answer in terms of the washing machine releasing CO_2 negates the mark do **not** accept less energy is produced accept a correctly named fuel do **not** accept less fuel is needed	1
Total			**8**

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Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature								

For Examiner's Use

General Certificate of Secondary Education
June 2009

SCIENCE B
Unit Physics P1

PHY1F
F

PHYSICS
Unit Physics P1

Foundation 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.

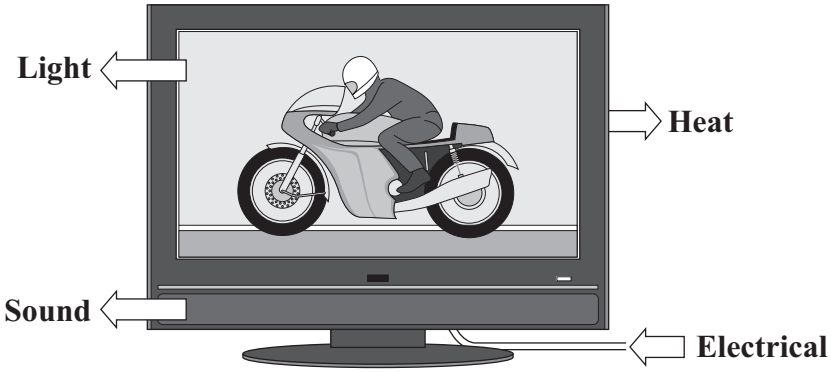
For Examiner's Use			
Question	Mark	Question	Mark
1		6	
2		7	
3			
4			
5			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

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Areas outside the box will not be scanned for marking

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

1 The diagram shows the energy transformations produced by a TV.



1 (a) Use words from the diagram to complete the following sentence.

The TV is designed to transform ..... energy into light and ..... energy.

(2 marks)

1 (b) Which **one** of the following statements is **false**?

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

The energy transformed by the TV makes the surroundings warmer. ☐

The energy transformed by the TV becomes spread out. ☐

The energy transformed by the TV will be destroyed. ☐

(1 mark)

Areas outside the box will not be scanned for marking

1 (c) Two different makes of television, **A** and **B**, transform energy at the same rate. Television **A** wastes less energy than television **B**.

Complete the following sentence by drawing a ring around the correct line in the box.

Television **A** has

a higher efficiency than
the same efficiency as
a lower efficiency than

television **B**.

(1 mark)

4

Turn over for the next question

Areas outside the box will not be scanned for marking

2 Wind and tides are renewable energy sources that are used to generate electricity.

2 (a) Complete each sentence by putting a tick (✓) in the box next to the correct answer.

2 (a) (i) The wind is:

a predictable energy source. ☐

a constant energy source. ☐

an unreliable energy source. ☐

(1 mark)

2 (a) (ii) The tides are:

a predictable energy source. ☐

a constant energy source. ☐

an unreliable energy source. ☐

(1 mark)

2 (b) If wood is to be used as a renewable energy source, what must be done each time a tree is chopped down?

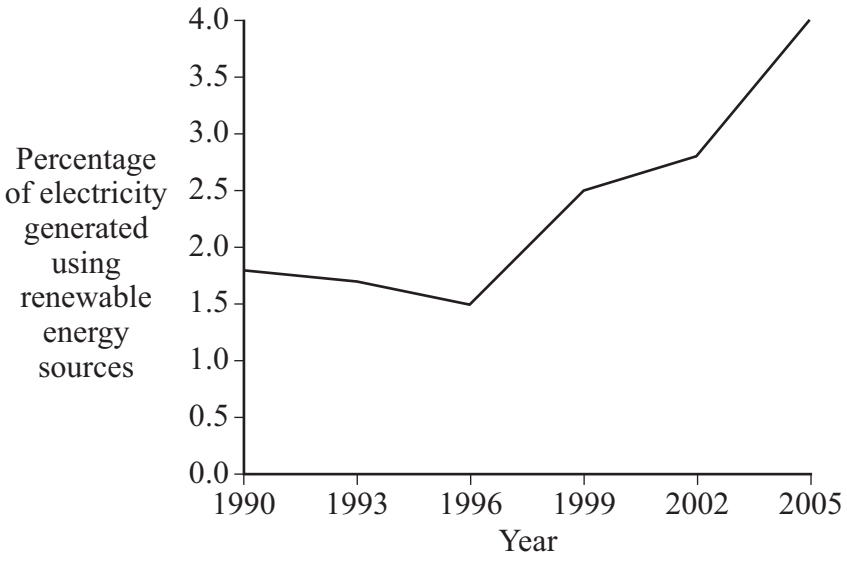
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.....

(1 mark)

Areas outside the box will not be scanned for marking

2 (c) In the UK, electricity is generated using renewable and non-renewable energy sources. The graph shows the percentage of electricity generated using renewable energy sources between 1990 and 2005.



Complete the following sentence by drawing a ring around the correct line in the box.

In 2015, the percentage of electricity generated using renewable energy sources is most likely to be

greater than 4%
equal to 4%
less than 4%

.

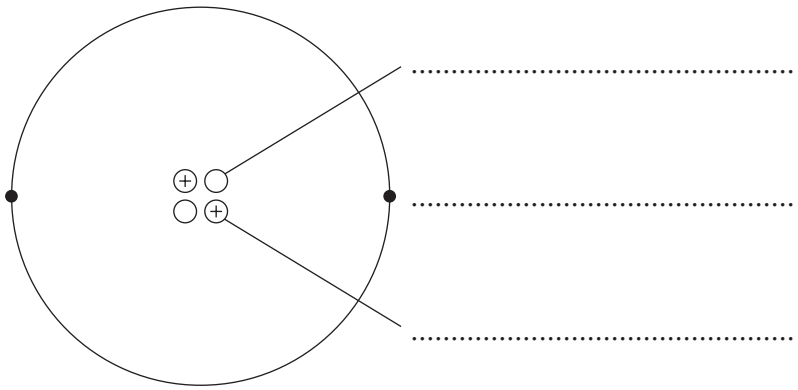
(1 mark)

4

Turn over for the next question

Areas outside the box will not be scanned for marking

3 The diagram shows a helium atom.



3 (a) (i) Use the words in the box to label the diagram.

electron	**neutron**	**proton**

(2 marks)

3 (a) (ii) An alpha particle is the same as the nucleus of a helium atom.

How is an alpha particle different from a helium atom?

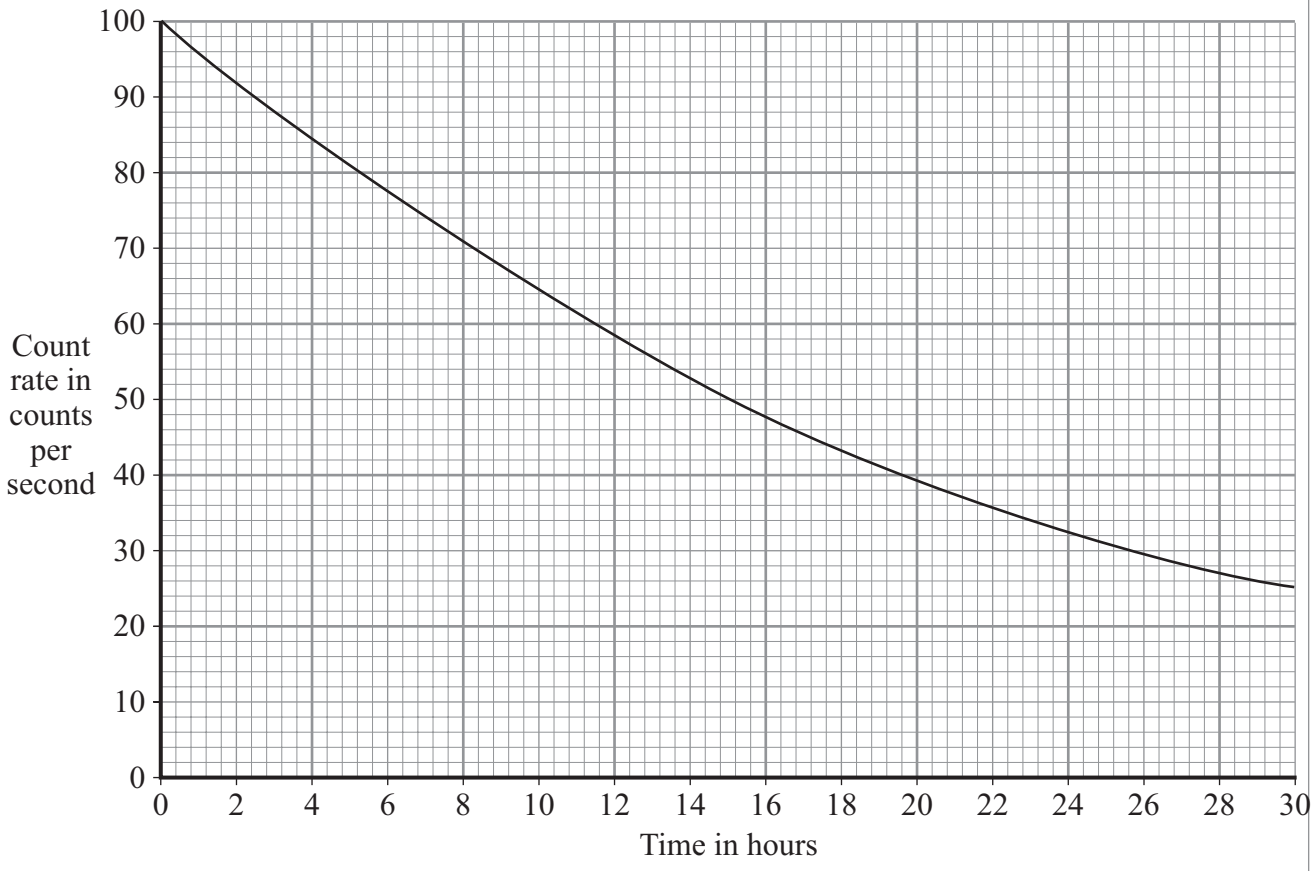
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(1 mark)

Areas outside the box will not be scanned for marking

3 (b) The graph shows how the count rate from a sample of radioactive sodium-24 changes with time.



3 (b) (i) How many hours does it take for the count rate to fall from 100 counts per second to 50 counts per second?

Time = ... hours
(1 mark)

3 (b) (ii) What is the half-life of sodium-24?

Half-life = ... hours
(1 mark)

Question 3 continues on the next page

Turn over ▶

Areas outside the box will not be scanned for marking

3 (c) A smoke detector contains a small amount of americium-241.

Americium-241 is a radioactive substance which emits alpha particles. It has a half-life of 432 years.

3 (c) (i) Which **one** of the following statements gives a reason why the americium-241 inside the smoke detector will **not** need replacing?

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

The alpha particles have a low energy. ☐

People replace smoke detectors every few years. ☐

Americium-241 has a long half-life. ☐

(1 mark)

3 (c) (ii) The diagram shows the label on the back of the smoke detector.



Why do people need to know that the smoke detector contains a radioactive material?

.....

.....

(1 mark)

7

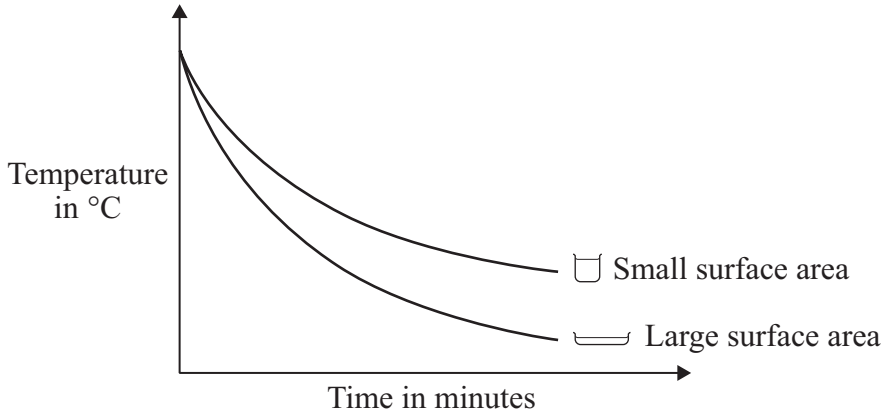
Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Areas outside the box will not be scanned for marking

4 (a) The graph compares how quickly hot water cooled down in two glass beakers with different surface areas.

The volume of water in each beaker was the same.



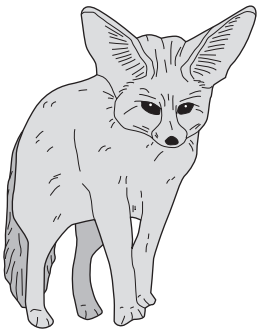
Describe how the surface area of the water affected how fast the water cooled down.

.....

.....

(1 mark)

4 (b) Some foxes live in a hot desert environment.



This type of fox has very large ears.

Explain how the size of the fox's ears help it to keep cool in a hot desert.

.....

.....

.....

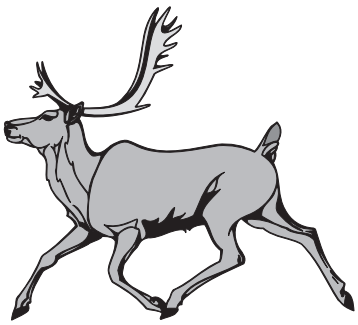
.....

(2 marks)

Areas outside the box will not be scanned for marking

4 (c) Polar bears and reindeer are adapted to live in cold environments.





Use the words in the box to complete the following sentences.

conduction	**convection**	**radiation**

4 (c) (i) The white colour of a polar bear's fur helps to keep the polar bear warm by reducing the heat lost by ..... .

(1 mark)

4 (c) (ii) The hairs of a reindeer are hollow. The air trapped inside the hairs reduces the heat lost by ..... .

(1 mark)

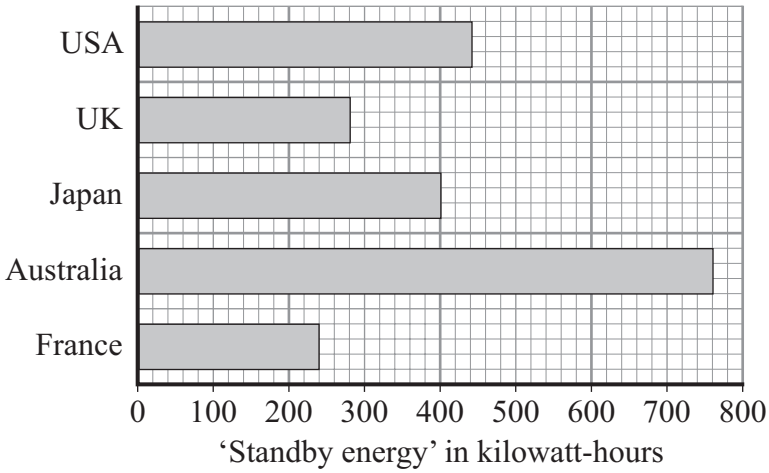
5

Turn over for the next question

Areas outside the box will not be scanned for marking

5 Electrical appliances that are left on standby still use energy.

The bar chart compares the *average* amount of 'standby energy' wasted each year in every home in five countries.



5 (a) (i) In which country are the homes that waste, on average, the smallest amount of 'standby energy'?

Draw a ring around your answer.

Australia **France** **Japan** **UK** **USA**

(1 mark)

5 (a) (ii) Suggest a reason why an *average* value is used for the 'standby energy' wasted in the homes.

.....

.....

(1 mark)

5 (b) (i) Australia has one of the lowest electricity prices in the world.

How does this low price seem to affect the amount of 'standby energy' wasted?

.....

.....

(1 mark)

Areas outside the box will not be scanned for marking

5 (b) (ii) In Australia, most electricity is generated in coal-burning power stations. The Australian government wants less electricity to be wasted.

Wasting less electricity would be good for the Australian environment.

Explain why.

.....

.....

.....

.....

(2 marks)

5 (c) Energy is not usually measured in kilowatt-hours.

Which **one** of the following units is usually used to measure energy?

Draw a ring around your answer.

hertz **joule** **watt**

(1 mark)

5 (d) (i) Electricity in Japan costs the equivalent of 17 pence per kilowatt-hour.

Use the information in the bar chart and the equation in the box to calculate how much the 'standby energy' used in an average Japanese home costs each year.

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

Show clearly how you work out your answer.

Give your answer in pence.

.....

.....

Cost = ... pence

(3 marks)

Question 5 continues on the next page

Areas outside the box will not be scanned for marking

5 (d) (ii) In Japan, the largest proportion of electricity is generated using nuclear fuels.

Which **one** of the following statements gives a good reason for using nuclear fuels to generate electricity?

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

A nuclear power station is very expensive to build. ☐

A small amount of nuclear fuel generates a large amount of electricity. ☐

It is easy to store nuclear waste safely. ☐

(1 mark)

10

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Areas outside the box will not be scanned for marking

6 (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

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

.....

(1 mark)

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

.....

(1 mark)

6 (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)

Areas outside the box will not be scanned for marking

6 (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.

.....

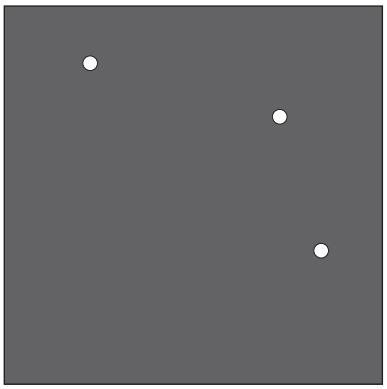
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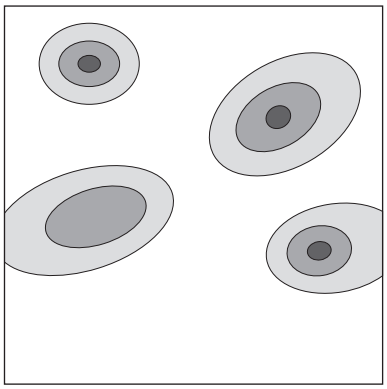
.....

(2 marks)

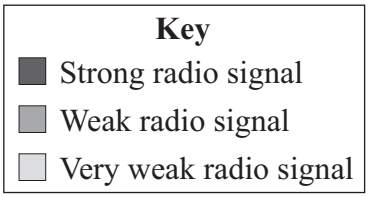
6 (d) The pictures represent the images produced using a visible light telescope and a radio telescope. Both images are of the same part of the sky. The shading on the radio telescope image represents the strength of the radio signals.



Visible light image



Radio telescope image



Suggest what extra information can be gained from the radio telescope image compared with the visible light image.

.....

.....

(1 mark)

7

Areas outside the box will not be scanned for marking

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

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

.....

.....

(1 mark)

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

.....

.....

(1 mark)

7 (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.

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

.....

.....

(1 mark)

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

.....

.....

(1 mark)

Areas outside the box will not be scanned for marking

7 (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)

7 (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

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

Why is using the same test important?

.....

.....

(1 mark)

Question 7 continues on the next page

Areas outside the box will not be scanned for marking

7 (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)

7 (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

END OF QUESTIONS

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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Science B 4462 / Physics 4451

PHY1F Unit 1 Physics

Mark Scheme

2009 examination – June series

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Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Dr Michael Cresswell Director General

MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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PHY1F

Question 1

question	answers	extra information	mark
1(a)	electrical sound	correct order only	1 1
1(b)	the energy transformed by the TV will be destroyed		1
1(c)	a higher efficiency than		1
Total			**4**

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PHY1F

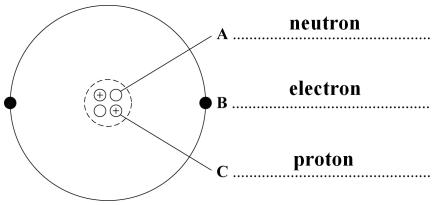
Question 2

question	answers	extra information	mark
2(a)(i)	an unreliable energy source		1
2(a)(ii)	a predictable energy source		1
2(b)	plant / grow (at least) one new tree		1
2(c)	greater than 4%		1
Total			**4**

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PHY1F

Question 3

question	answers	extra information	mark
3(a)(i)		all 3 labels correct allow **1** mark for 1 correct label	2
3(a)(ii)	has no electrons	it = alpha allow alpha has a positive(charge) allow a helium (atom) has no (charge) do **not** accept general properties of alpha do **not** accept general answers in terms of size / density / mass etc	1
3(b)(i)	15 (hours)	accept any answer between 14.8 and 15.2 inclusive	1
3(b)(ii)	15 (hours) or their (b)(i)		1
3(c)(i)	americium-241 has a long half life		1

Question 3 continues on the next page . . .

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PHY1F

Question 3 continued . . .

question	answers	extra information	mark
3(c)(ii)	any **one** from: • alpha (particles) are harmful to … • so they dispose of it safely / appropriately • so they don't break it open / open it • so they can make a choice about having a radioactive source (in the house)	it = radioactive material accept radiation / radioactive material is harmful to … accept specific example of harm eg can cause cancer accept radiation is poisonous if ingested / inhaled do **not** accept it is poisonous / in case of leakage accept do **not** touch the radioactive source	1
Total			**7**

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PHY1F

Question 4

question	answers	extra information	mark
4(a)	the bigger the surface area, the faster the water cools down / temperature falls	answers must imply rate accept heat for temperature provided rate is implied do **not** accept cools down more unless qualified	1
4(b)	any **two** from: the ears: • have large surface / area • radiate heat • keep blood cooler	 not just has large ears accept loses heat, but does not score if the reason given for heat loss is wrong	2
4(c)(i)	radiation		1
4(c)(ii)	conduction		1
Total			**5**

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PHY1F

Question 5

question	answers	extra information	mark
5(a)(i)	France		1
5(a)(ii)	any **one** from: • different homes have different appliances • different homes have different numbers of appliances • standby power not the same for all appliances • some people will switch appliances off • homes have different numbers of residents • can't measure every (individual) home	accept all homes are different accept named appliances accept people waste different amounts of energy accept any sensible suggestions do **not** accept answers in terms of accurate / precise etc	1
5(b)(i)	increases amount of energy wasted	accept (encourages) people to leave appliances on (standby) accept increases it	1

Question 5 continues on the next page . . .

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PHY1F

Question 5 continued . . .

question	answers	extra information	mark
5(b)(ii)	any **two** from: • less electricity needed / generated • fewer power stations needed • less coal is burned • less pollutant gases produced	do **not** accept coal is non-renewable / running out answers in terms of fuel stocks neutral accept named gases accept harmful for pollutant accept greenhouse gases accept reduce / slow / stop global warming accept reduces acid rain	2
5(c)	joule		1
5(d)(i)	6800	accept £68 for **3** marks an answer of 68 gains **2** marks allow **2** marks for correct substitution ie 400 × 17 allow **1** mark for obtaining 400 answers of 7480, 4760, 12920, 4080 gain **2** marks	3
5(d)(ii)	a small . . . . . electricity		1
Total			**10**

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PHY1F

Question 6

question	answers	extra information	mark
6(a)(i)	HESS	accept gamma	1
6(a)(ii)	infra red	accept IR accept answers written in table do **not** accept heat	1
6(b)	clearer / more detailed / sharper / less distorted image any **one** from: • no light pollution • light is not scattered by the atmosphere	do **not** accept image is bigger accept no clouds to prevent observations accept light is scattered by the atmosphere (implies William Herschel) accept light does (not have to) pass through the atmosphere accept air for atmosphere do **not** accept answers in terms of distance	1 1

Question 6 continues on the next page . . .

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PHY1F

Question 6 continued . . .

question	answers	extra information	mark
6(c)	any **two** from: • microwaves absorbed by water (molecules) • signal strength greater (in dry environment) • more sensitive (in dry environment) • detect weaker signals (in dry environment) • more detailed / clearer image (in dry environment)	accept more microwaves reach telescope accept harder to detect signals in a humid environment accept image contains more information do **not** accept better image	2
6(d)	a fourth / extra galaxy / star	accept a planet / another object / source	1
Total			**7**

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PHY1F

Question 7

question	answers	extra information	mark
7(a)(i)	any **one** from: • less (prone to) interference • can be (easily) processed by computers • better (quality) signal • signal can be restored	 accept interference causes less / no permanent damage accept no interference accept noise / distortion for interference accept can be processed without an analogue to digital converter accept clearer signal do **not** accept faster / sends more information	1
7(a)(ii)	cooking **or** satellite communication	do **not** accept microwave (oven) accept radar accept (microwave) telescopes accept Wi-Fi do **not** accept radio	1
7(b)(i)	compare (the health of) mobile phone users with non-mobile phone users	must be an implied comparison between users and non-users any idea of doing an experiment negates the mark	1
7(b)(ii)	increase the sample size	accept use more people accept have a large sample size repeat the research / test is neutral	1

Question 7 continues on the next page . . .

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PHY1F

Question 7 continued . . .

question	answers	extra information	mark
7(b)(iii)	ethical		1
7(c)(i)	so the phones can be compared (fairly)	a fair test is insufficient accept different tests (may) give different results do **not** accept to make the results reliable, unless qualified eg all variables are controlled do **not** accept bias unless qualified	1
7(c)(ii)	yes all are below the legal limit / 2 (W/kg) **or** no and any **one** from: • even absorbing a small amount of energy may be harmful • no proof that small amounts of energy are not harmful	 accept microwaves for energy accept emits energy absorbed by head / other parts of body accept because the SAR value is not 0 (W/kg)	1
7(d)	any **one** from: • to get an independent opinion • company scientists may be biased	 accept company scientists may manipulate results	1
Total			**8**

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Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

For Examiner's Use

General Certificate of Secondary Education
January 2009

SCIENCE B
Unit Physics P1

PHY1F
F

PHYSICS
Unit Physics P1

Foundation Tier

Monday 19 January 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.

For Examiner's Use			
Question	Mark	Question	Mark
1		6	
2		7	
3			
4			
5			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

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There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Areas outside the box will not be scanned for marking

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

1 The table shows the electromagnetic spectrum.
Three types of wave have been missed out.

Gamma rays		Ultraviolet rays	Visible light		Micro-waves	

Shortest wavelength ⟷ Longest wavelength

1 (a) (i) Use words from the box to complete the table.

infra red rays	**radio waves**	**X-rays**

(2 marks)

1 (a) (ii) Which **one** of the following gives a use of gamma rays?

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

to communicate with satellites ☐

to see objects ☐

to kill cancer cells ☐

(1 mark)

1 (a) (iii) Complete the following sentence by drawing a ring around the correct word in the box.

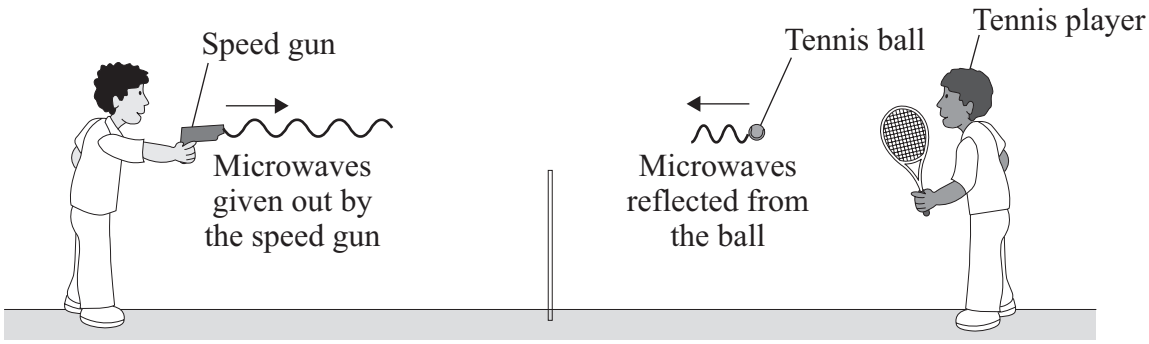
All electromagnetic waves move [energy / gases / particles] from one place to another.

(1 mark)

4

Areas outside the box will not be scanned for marking

2 (a) The picture shows a speed gun being used to measure how fast a tennis player hits the ball.



Some of the microwaves from the speed gun are absorbed by the ball and some are reflected by the ball.

2 (a) (i) Complete the following sentence by choosing **one** of the phrases from the box.

longer than	**the same as**	**shorter than**

The wavelength of the microwaves reflected from the ball are

..... the wavelength of the microwaves from the speed gun.

(1 mark)

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

When the ball absorbs microwaves, its temperature will

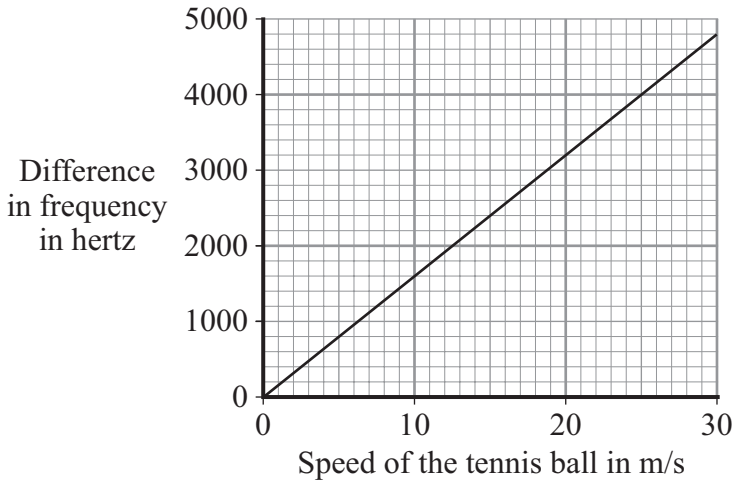
decrease slightly
not change
increase slightly

.

(1 mark)

Areas outside the box will not be scanned for marking

2 (b) The microwaves reflected from the ball have a higher frequency than the microwaves from the speed gun.
The graph shows how the difference between the two frequencies depends on the speed of the ball.



2 (b) (i) Describe the pattern that links the difference between the two frequencies and the speed of the ball.

.....

.....

(1 mark)

2 (b) (ii) The speed gun measures the difference between the two frequencies as 3200 Hz.

Use the graph to find the speed of the tennis ball.
Show clearly on the graph how you obtain your answer.

Speed of the tennis ball = ... m/s

(2 marks)

2 (b) (iii) Which **one** of the following gives the reason why the data has been shown as a line graph and **not** as a bar chart?

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

Frequency and speed are both categoric variables. ☐

Frequency and speed are both continuous variables. ☐

Speed is a continuous variable and frequency is a categoric variable. ☐

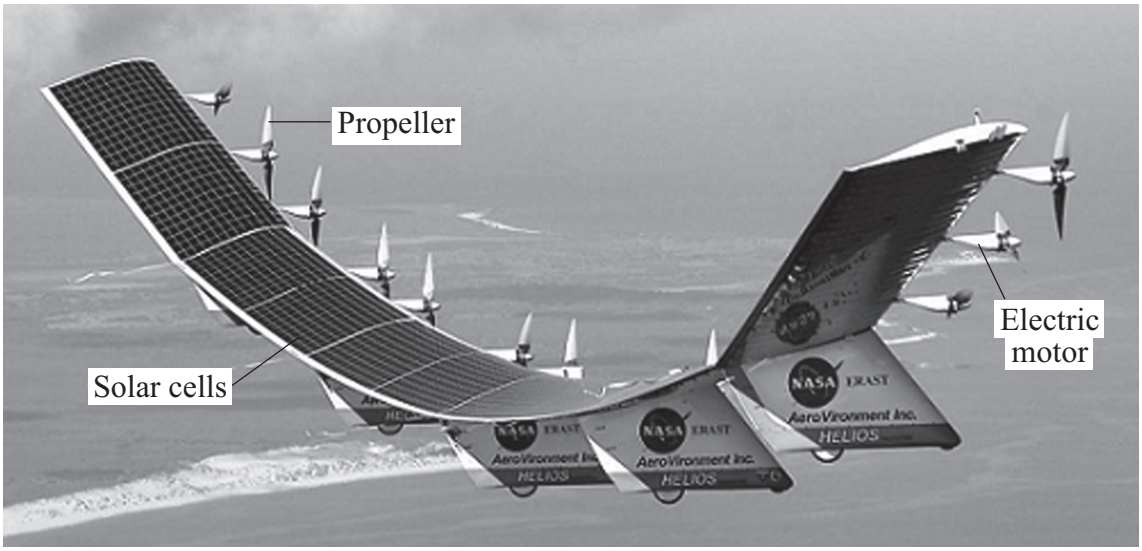
(1 mark)

6

Turn over ▶

Areas outside the box will not be scanned for marking

3 The picture shows a solar-powered aircraft. The aircraft has no pilot.



3 (a) Use words from the box to complete the following sentence.

electrical	**heat**	**light**	**sound**

Solar cells are designed to transform ..... energy into

..... energy.

(2 marks)

3 (b) On a summer day, 175 000 joules of energy are supplied to the aircraft's solar cells every second. The useful energy transferred by the solar cells is 35 000 joules every second.

3 (b) (i) Use the equation in the box to calculate the efficiency of the solar cells.

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

Show clearly how you work out your answer.

.....

.....

Efficiency = ...

(2 marks)

Areas outside the box will not be scanned for marking

3 (b) (ii) What happens to the energy that is **not** usefully transferred by the solar cells?

.....

(1 mark)

3 (c) The aircraft propellers are driven by electric motors. As well as the solar cells, there are fuel cells that provide additional power to the electric motors.

3 (c) (i) Suggest **one** advantage of the aircraft having fuel cells as well as the solar cells.

.....

.....

(1 mark)

3 (c) (ii) Give **one** environmental advantage of using electric motors to drive the aircraft propellers rather than motors that burn a fuel.

.....

.....

(1 mark)

3 (c) (iii) Eventually, the designers want to produce an unmanned aircraft that can fly at twice the height of a passenger jet for up to six months.

Suggest **one** possible use for an aircraft such as this.

.....

.....

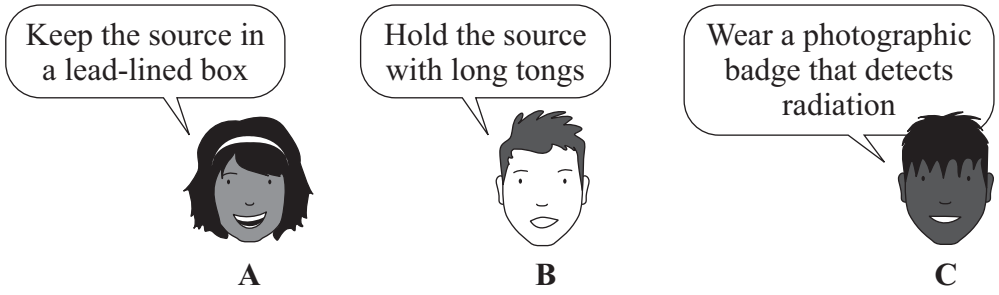
(1 mark)

8

Turn over for the next question

Areas outside the box will not be scanned for marking

4 Before using a radioactive source, a teacher asked her students to suggest safety procedures that would reduce her exposure to the radiation. The students made the following suggestions.



A **B** **C**

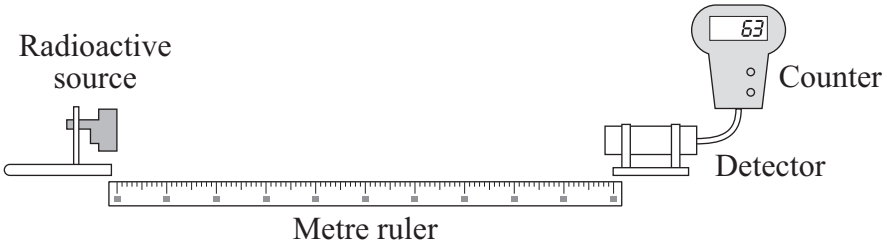
4 (a) Which suggestion, **A**, **B** or **C**, would **not** reduce the exposure of the teacher to radiation?

.....

(1 mark)

Areas outside the box will not be scanned for marking

4 (b) The diagram shows how the teacher measured the distance that the radiation travelled from the source. The count-rate at different distances from the source was measured and recorded in the table.



Distance from source to detector in cm	Count-rate in counts per minute
20	85
40	81
60	58
80	53
100	23

What type of radiation was the source emitting, alpha, beta or gamma?

.....

Explain the reasons for your choice.

.....

.....

.....

.....

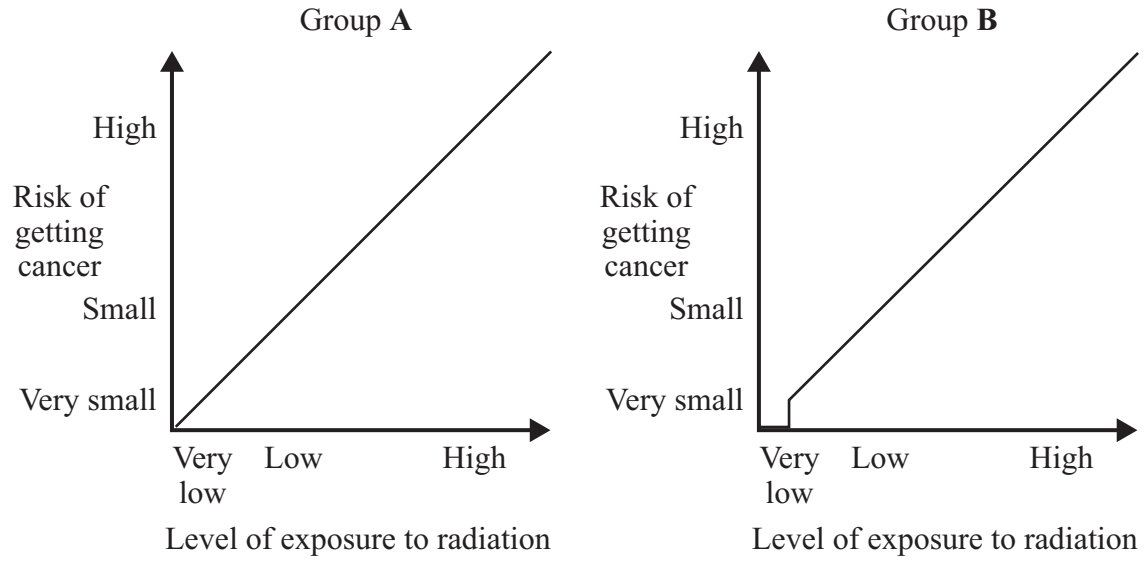
(3 marks)

Question 4 continues on the next page

Turn over ▶

Areas outside the box will not be scanned for marking

4 (c) The graphs show how two groups of scientists, **A** and **B**, link exposure to radiation and the risk of getting cancer.



4 (c) (i) Complete the following sentence using a word or phrase from the box.

decreases	**has no effect on**	**increases**

Both groups of scientists agree that a high level of exposure to radiation

..... the risk of getting cancer.

(1 mark)

4 (c) (ii) Use the graphs to describe carefully how the two groups of scientists disagree when the level of exposure to radiation is very low.

.....

.....

.....

.....

(2 marks)

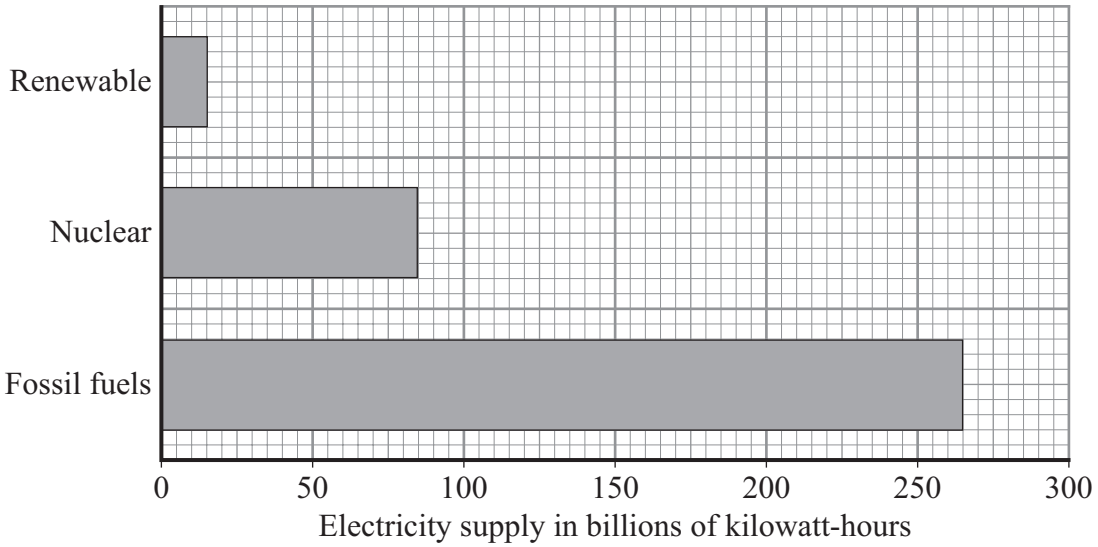
7

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Areas outside the box will not be scanned for marking

5 The bar chart shows the different energy sources used to generate the UK's electricity in 2007.



5 (a) (i) The wind is a renewable energy source.

Name **one** more renewable energy source used to generate electricity.

.....

(1 mark)

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

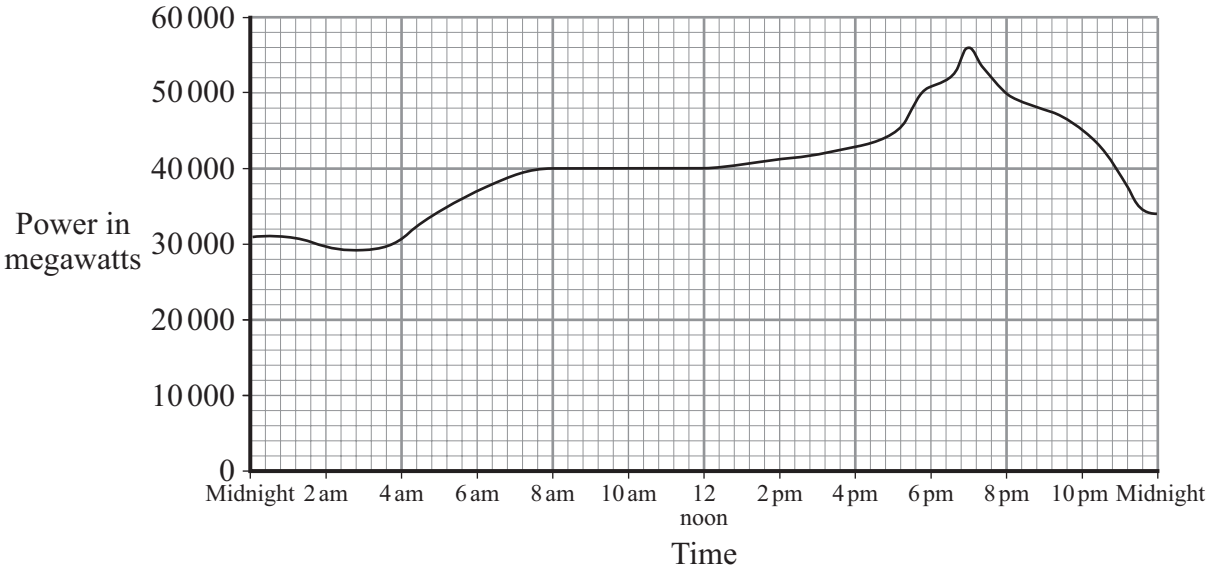
Using less fossil fuels to generate electricity will | decrease / not change / increase | the

amount of carbon dioxide emitted into the atmosphere.

(1 mark)

Areas outside the box will not be scanned for marking

5 (b) The graph shows how the demand for electricity in the UK varied over one day in the winter.



5 (b) (i) Describe how the demand for electricity varied between 4.00 am and 10.00 am.

.....

.....

.....

.....

(2 marks)

5 (b) (ii) Which type of power station has the fastest start-up time?

Draw a ring around your answer.

coal **natural gas** **nuclear** **oil**

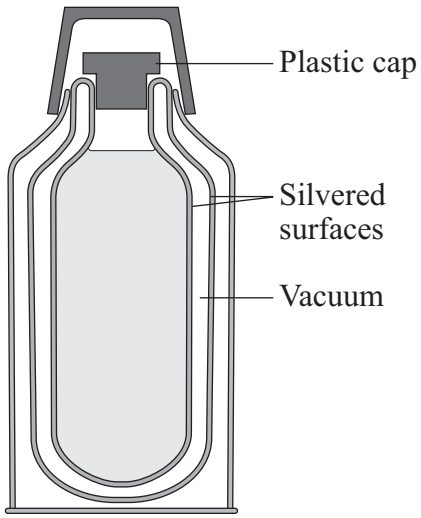
(1 mark)

5

Turn over ▶

Areas outside the box will not be scanned for marking

6 A vacuum flask is designed to reduce the rate of heat transfer.



6 (a) (i) Complete the table to show which methods of heat transfer are reduced by each of the features labelled in the diagram.

The first row has been done for you.

Feature	**Conduction**	**Convection**	**Radiation**
vacuum	✓	✓	
silvered surfaces			
plastic cap			

(2 marks)

6 (a) (ii) Explain why the vacuum between the glass walls of the flask reduces heat transfer by conduction and convection.

.....

.....

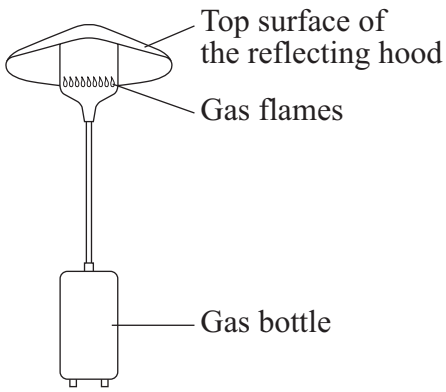
.....

.....

(2 marks)

Areas outside the box will not be scanned for marking

6 (b) The diagram shows a gas flame patio heater.



6 (b) (i) Explain why the top surface of the reflecting hood should be a light, shiny surface rather than a dark, matt surface.

.....

.....

.....

(2 marks)

6 (b) (ii) Most of the chemical energy in the gas is transformed into heat. A **small** amount of chemical energy is transformed into light.

Draw and label a Sankey diagram for the patio heater.

(2 marks)

6 (b) (iii) State why the total energy supplied to the patio heater must always equal the total energy transferred by the patio heater.

.....

.....

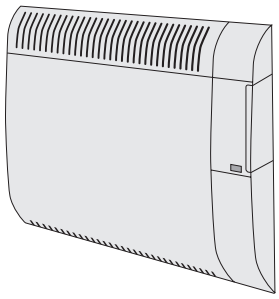
(1 mark)

9

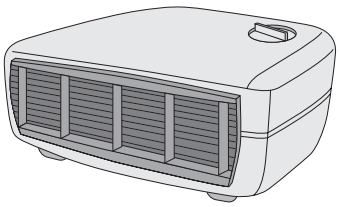
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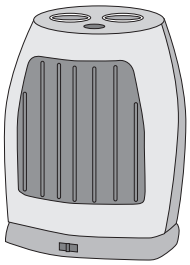
7 The pictures show three different types of electric heater.



400 W oil-filled panel heater (wall mounted)
- 3 heat settings
- Efficient background heat
- Safety overheat cut-out



3 kW fan heater
- 2 heat settings
- Power indicator light
- Cool air fan setting



1800 W ceramic heater
- 2 heat settings
- 8 hour timer
- Power indicator light
- Safety overheat cut-out

7 (a) The ceramic heater is run on full power for 5 hours.

Use the following equation to calculate, in kilowatt-hours, the amount of energy transferred from the mains to the heater.

energy transferred = power × time

Show clearly how you work out your answer.

.....

.....

Energy transferred = ... kilowatt-hours

(2 marks)

7 (b) Which heater will be the most expensive to run on its highest heat setting?

.....

(1 mark)

Areas outside the box will not be scanned for marking

7 (c) A heater is needed for a small office.

Comparing each type of heater with the other two, give **one** advantage of using each type of heater in the office.

oil-filled panel heater .....

.....

fan heater .....

.....

ceramic heater .....

.....

(3 marks)

6

END OF QUESTIONS

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ANSWER IN THE SPACES PROVIDED

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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Science B 4462/ Physics 4451

PHY1F Unit Physics 1

Mark Scheme

2009 examination – January series

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Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

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PHY1F

Question 1

question	answers	extra information	mark
1(a)(i)	X-rays infra red (rays) radio (waves)	all three in correct order allow **1** mark for **1** correct	2
1(a)(ii)	to kill cancer cells		1
1(a)(iii)	energy		1
Total			**4**

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PHY1F

Question 2

question	answers	extra information	mark
2(a)(i)	shorter than		1
2(a)(ii)	increase slightly		1
2(b)(i)	go up in the same ratio **or** (directly) proportional **or** as speed (of the tennis ball) increases so does the (difference in) frequency	accept as one goes up, so does the other accept positive correlation	1
2(b)(ii)	20 (m/s)	allow **1** mark for showing correct method on graph (ie horizontal or vertical line anywhere on graph) if indicated by a cross, must be ± half square of correct value)	2
2(b)(iii)	frequency and speed are both continuous variables		1
Total			**6**

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PHY1F

Question 3

question	answers	extra information	mark
3(a)	light electrical	correct order only	1 1
3(b)(i)	0.2 **or** 1/5	accept 20% for both marks allow **1** mark for correct substitution answer of 0.2% **or** 20 gains **1** mark ignore units	2
3(b)(ii)	wasted	accept transformed to heat / other forms accept transferred to the air / surroundings sound = neutral	1
3(c)(i)	any **one** from: • can fly at night • can stay in the air for longer • can fly in the winter • can fly faster	 accept can fly when it is cloudy accept as a back-up increases power is neutral	1

Question 3 continues on the next page

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PHY1F

Question 3 continued

question	answers	extra information	mark
3(c)(ii)	any **one** from: • produces no (pollutant) gases **or** no greenhouse gases • produces no / less noise • less demand for fuels	accept named gas accept no air pollution do **not** accept no pollution accept less global warming accept harmful for pollutant accept produces no carbon do **not** accept environmentally friendly accept any other sensible environmental advantage	1
3(c)(iii)	accept any sensible suggestion eg, map the Earth's surface / weather forecasting / spying / monitoring changes to the Earth's atmosphere, etc	do **not** accept ideas in terms of transporting accept use as a satellite	1
Total			**8**

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PHY1F

Question 4

question	answers	extra information	mark
4(a)	**C**		1
4(b)	beta	accept gamma if answer alpha can still gain marks for saying why not beta or gamma	1
	any **two** from: • range in air for beta is (at least) 50 cm • count-rate does not drop (much) in first 40 cm • count-rate does not fall much until distance is 60 cm • alphas cannot travel more than 5 cm in air / alphas could not travel 100 cm in air • alphas would not be detected • gammas not absorbed by 100 cm of air	must have at least one quantitative statement to get **2** marks accept alphas cannot travel that far accept gammas not stopped by air accept gammas travel further than alphas and betas strength of source is neutral references to penetrating power is neutral	2
4(c)(i)	increases		1

Question 4 continues on the next page

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PHY1F

Question 4 continued

question	answers	extra information	mark
4(c)(ii)	Group **A** think that (even a very small level of exposure) gives some risk	accept there is always a risk, no matter how small the level of exposure	1
	Group **B** think that there is no risk (from a very low level of exposure)	accept below a certain level of exposure there is no risk no marks for a simple graph description	1
Total			**7**

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Question 5

question	answers	extra information	mark
5(a)(i)	any **one** from: • waves • tides • falling water • biofuel / biomass • solar • geothermal	 do **not** accept water accept hydroelectric accept sun / sunlight do **not** accept light accept solar cells / panels do **not** accept heat	1
5(a)(ii)	decrease		1
5(b)(i)	 increases from 4 am (to 8 am) remains constant from 8 am (to 10 am)	accept increases from 30 000 accept stays constant from 40 000 allow **1** mark for goes up then stays the same for full credit must be some indication of time or power	 1 1
5(b)(ii)	natural gas		1
Total			**5**

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PHY1F

Question 6

<table>
<tr><th>question</th><th>answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>6(a)(i)</td><td>silvered surfaces

radiation

plastic cap

conduction

convection } both required

<table><tr><td></td><td>conduction</td><td>convection</td><td>radiation</td></tr><tr><td>vacuum</td><td>✓</td><td>✓</td><td></td></tr><tr><td>silvered surfaces</td><td></td><td></td><td>✓</td></tr><tr><td>plastic cap</td><td>✓</td><td>✓</td><td></td></tr></table></td><td>more than the correct number of ticks in a row negates the mark</td><td>1

1

(1)

(1)</td></tr>
<tr><td>6(a)(ii)</td><td>

because there are no particles in a vacuum

conduction and convection need particles / medium</td><td>any mention of air or any other substance in a vacuum scores zero

accept atoms / molecules for particles
accept vacuum is empty space
accept there is nothing in a vacuum
accept there is no air / gas in the vacuum

need reference to both conduction and convection
accept correct descriptions</td><td>1

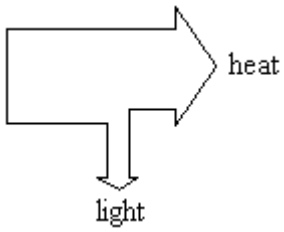
1</td></tr>
</table>

Question 6 continues on the next page

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PHY1F

Question 6 continued

question	answers	extra information	mark
6(b)(i)	less heat lost (to air above the heater) light shiny surfaces are poor emitters (of radiation) **or** dull, matt surfaces are good emitters (of radiation)	do **not** accept **no** heat lost accept radiators for emitters references to reflection are neutral do **not** credit answers which infer reflection from the underside of the hood ignore correct reference to absorption	1 1
6(b)(ii)	correct diagram drawn with one output arrow narrower than the other arrows correctly labelled with energy form eg  	flow charts score zero ignore input	1 1
6(b)(iii)	energy cannot be destroyed	accept (principle of) conservation of energy do **not** accept because energy cannot be lost without clarification	1
Total			**9**

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PHY1F

Question 7

question	answers	extra information	mark
7(a)	9	allow **1** mark for correct substitution (1.8 × 5) an answer of 9000 gains **1** mark an answer of 2 or 15 gains **1** mark	2
7(b)	(3 kW) fan heater	accept 3 kW accept the middle one	1

Question 7 continues on the next page

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Question 7 continued

7(c)		features common to more than one heater, treat as neutral	
	<u>oil-filled</u>		
	low level heat		1
	cannot be knocked over / space saving / no trailing wires **or** more control over heat output	do **not** accept just wall-mounted do **not** accept just 3 heat settings	
	<u>fan</u>		
	warms (office) rapidly **or** can be used to cool air (in summer)	 accept can be used as a fan accept cool air fan (setting) accept 'it has a cool air setting in case it gets too hot' do **not** accept a specific reference to cooling the heater	1
	<u>ceramic</u>		
	can be switched on for set periods of time **or** can be switched on before office is used / switched off automatically at night	do **not** accept just has a timer	1

Total			**6**

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