AQA GCSE PHYSICS (4403)

PHYSICS



EXAM QUESTION PACK

UNIT P1 FOUNDATION TIER PH1FP PAPERS

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AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

GCSE

SCIENCE A
PHYSICS

F

Foundation Tier Unit Physics P1

Wednesday 25 May 2016 Afternoon Time allowed: 1 hour

Materials

For this paper you must have:
- a ruler
- a calculator
- the Physics Equations Sheet (enclosed).

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 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 7(b) should be answered in continuous prose.
  In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

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

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

1 Different energy sources are used to generate electricity.

1 (a) Use words from the box to match the correct energy source to each of the descriptions given in **Table 1**.

[3 marks]

biofuel	**coal**	**geothermal**	**nuclear**	**waves**

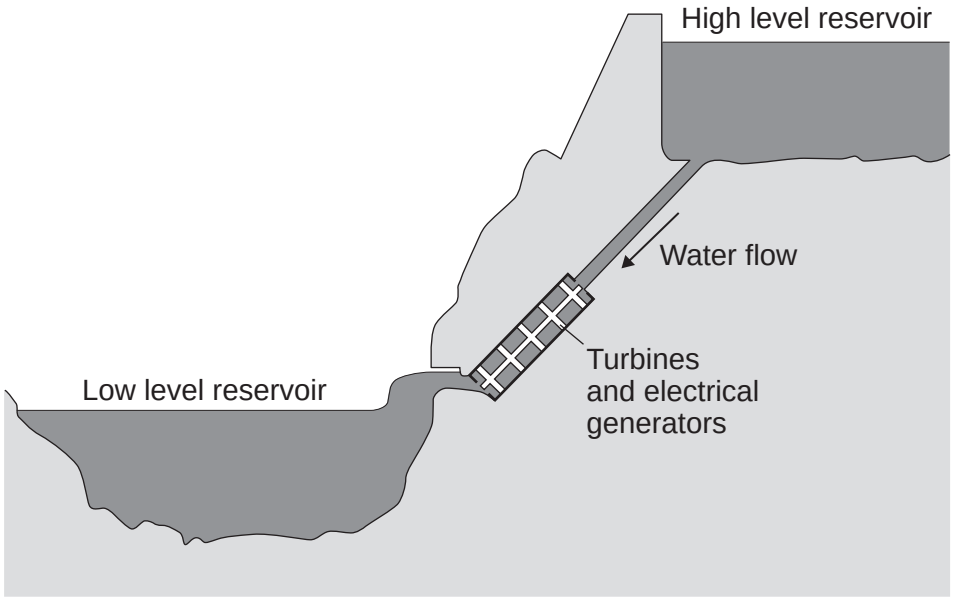
Table 1

Description	**Energy source**
Energy from the Earth's core is used to heat water.	
Fission of uranium nuclei is used to heat water.	
Gases from rotting plant material are burned to heat water.	

1 (b) Energy can be stored in a pumped storage power station.

Figure 1 shows a pumped storage power station.

Figure 1



Do not write outside the box

When electricity is needed, the water in the high level reservoir is allowed to flow to the low level reservoir. The flowing water generates electricity.

Use the correct answer from the box to complete each sentence.

[3 marks]

electrical	**gravitational potential**	**kinetic**	**nuclear**	**sound**

The water in the high level reservoir stores _____ energy.

The flowing water has _____ energy.

The water turns the turbine which is connected to the generator.

The generator produces some _____, this is wasted energy.

1 (c) The total power input to a pumped storage power station is 600 MW.

The useful power output is 540 MW.

1 (c) (i) Calculate the efficiency of this pumped storage power station.
Use the correct equation from the Physics Equations Sheet.

[2 marks]

_____

_____

_____

Efficiency = _____

1 (c) (ii) Calculate how much power is wasted by the pumped storage power station.

[1 mark]

_____

Power = _____ MW

1 (c) (iii) How is the temperature of the surroundings affected by the energy wasted by the pumped storage power station?

[1 mark]

_____

10

Turn over ▶

Do not write outside the box

2 The electric kettle shown in **Figure 2** is used to boil water.

Figure 2



2 (a) After the water has boiled, the temperature of the water decreases by 22 °C.
The mass of water in the kettle is 0.50 kg.
The specific heat capacity of water is 4200 J/kg °C.

Calculate the energy transferred to the surroundings from the water.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

Energy = _____ joules

2 (b) Why is the total energy input to the kettle higher than the energy used to heat the water?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
Energy is absorbed from the surroundings.	
Energy is used to heat the kettle.	
The kettle is more than 100% efficient.	

Do not write outside the box

2 (c) In one day, 0.6 kWh of energy is transferred from the mains electricity supply to the kettle.

The energy costs 15 pence per kWh.

Calculate the cost of using the kettle for one day.

[2 marks]

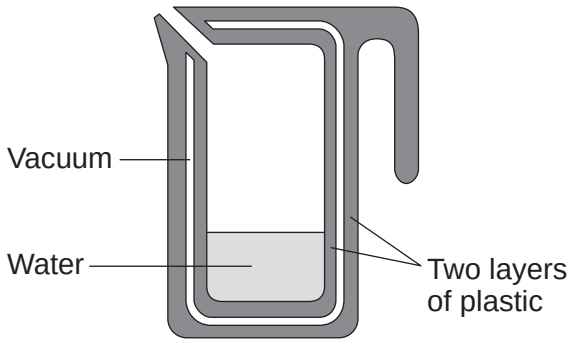
_____

_____

Cost = _____ pence

2 (d) A new type of electric kettle is made from two layers of plastic separated by a vacuum. After the water in the kettle has boiled, the water stays hot for at least 2 hours. The new kettle is shown in **Figure 3**.

Figure 3



2 (d) (i) Which energy transfers does a vacuum reduce?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
conduction and radiation	
conduction and convection	
convection and radiation	

2 (d) (ii) Using the new kettle may reduce the householder's energy bill. Suggest **one** reason why.

[1 mark]

_____

_____

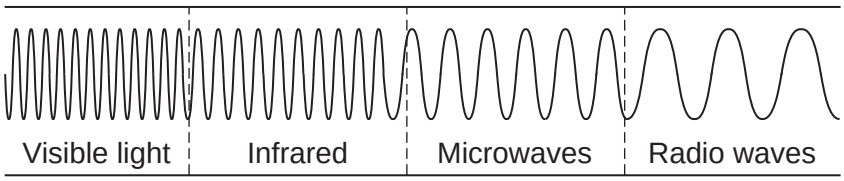
7

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3 Infrared and microwaves are two types of electromagnetic radiation.

Figure 4 shows the positions of the two types of radiation within part of the electromagnetic spectrum.

Figure 4



3 (a) (i) Name **one** type of electromagnetic radiation which has more energy than infrared.

[1 mark]

_____

3 (a) (ii) Use the correct answer from the box to complete each sentence.

Each answer may be used once, more than once or not at all.

[3 marks]

greater than	**less than**	**the same as**

The wavelength of infrared is _____ the wavelength of microwaves.

The frequency of microwaves is _____ the frequency of infrared.

The speed of microwaves in a vacuum is _____ the speed of infrared in a vacuum.

Do not write outside the box

3 (b) Cosmic Microwave Background Radiation (CMBR) is electromagnetic radiation that fills the universe.

Only one theory about the origin of the universe can explain the presence of CMBR.

3 (b) (i) Give the name of this theory.

[1 mark]

_____

3 (b) (ii) Which other piece of evidence supports this theory?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
the diffraction of sound waves	
the electromagnetic spectrum	
the red-shift of light from distant galaxies	

6

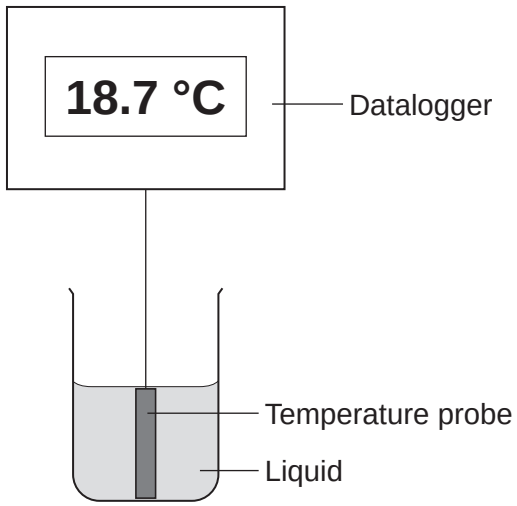
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4 A student investigated the cooling effect of evaporation.

She used the equipment (datalogger and probe) in **Figure 5** to measure how the temperature of a liquid changed as the liquid evaporated.

Figure 5



4 (a) Which type of variable was the temperature in this investigation?

[1 mark]

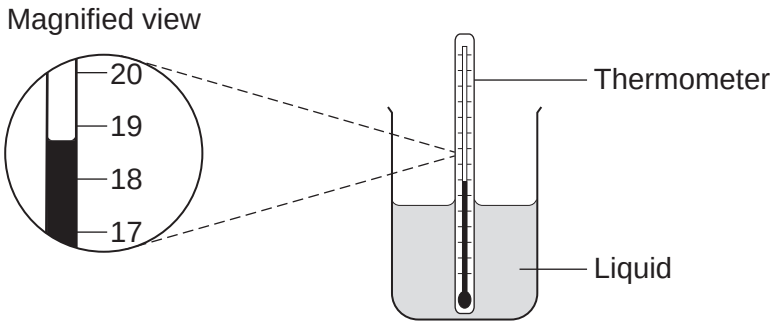
Tick (✓) **one** box.

	Tick (✓)
control	
dependent	
independent	

Do not write outside the box

4 (b) The student could have used the thermometer shown in **Figure 6**.

Figure 6



How does the resolution of the equipment in **Figure 5** compare with the resolution of the thermometer?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
The equipment has a better resolution.	
The equipment has a worse resolution.	
The equipment has the same resolution.	

4 (c) Before the investigation started, the student checked the accuracy of three different temperature probes. The student put the probes in a beaker of boiling water that had a temperature of 100.0 °C.
Figure 7 shows the readings from the three temperature probes.

Figure 7

Probe A	**Probe B**	**Probe C**
99.8	**100.1**	**103.2**

Which **one** of the temperature probes, **A**, **B** or **C**, was **least** accurate?

[2 marks]

Write the correct answer in the box.

Give a reason for your answer.

_____

_____

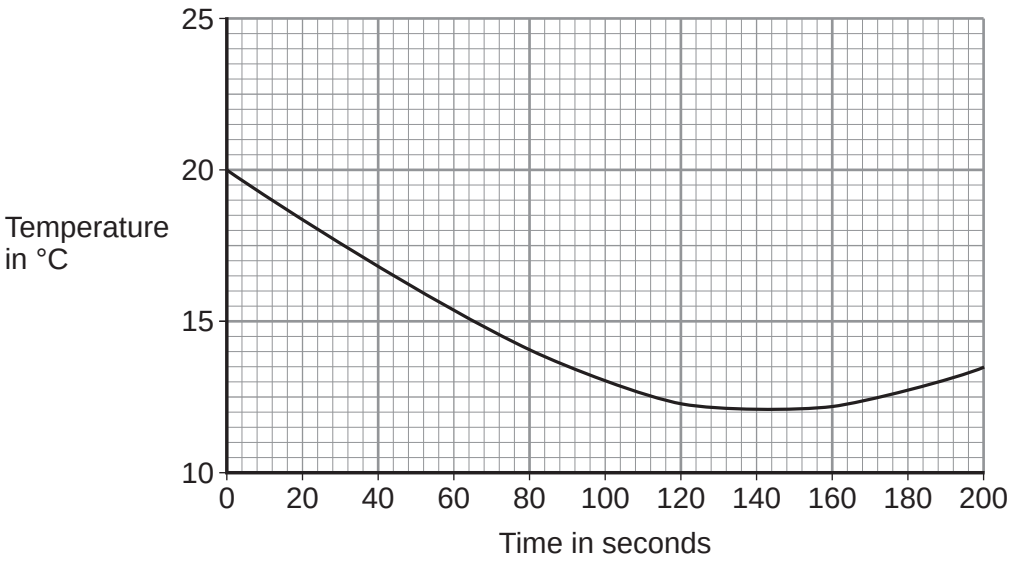
Question 4 continues on the next page

Turn over ▶

Do not write outside the box

4 (d) **Figure 8** shows how the temperature recorded changed during the investigation.

Figure 8



4 (d) (i) Use **Figure 8** to determine the lowest temperature recorded as the liquid evaporated.

[1 mark]

Temperature = _____ °C

4 (d) (ii) Use **Figure 8** to determine how long it took for all the liquid to evaporate.
Give a reason for your answer.

[2 marks]

Time = _____ seconds

Reason: _____

_____

4 (d) (iii) How would increasing the starting temperature of the liquid above 20 °C affect the rate of evaporation of the liquid?

[1 mark]

_____

_____

8

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Turn over for the next question

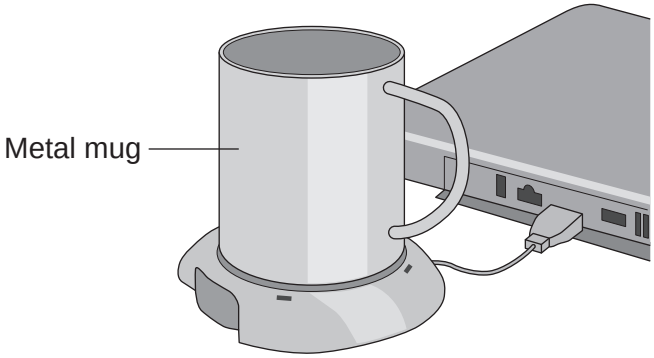
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ANSWER IN THE SPACES PROVIDED

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5 A heater uses energy from a laptop computer to keep a drink hot.

Figure 9 shows a metal mug on the heater.

Figure 9



5 (a) The laptop computer is operating on battery power.
How would connecting the heater affect the amount of time the laptop computer would operate for, before needing to be recharged?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
it would decrease the time	
it would not affect the time	
it would increase the time	

5 (b) The power output from the heater is 12 W.

Calculate the energy transferred to the metal mug in 60 seconds.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

Energy = _____ joules

Do not write outside the box

5 (c) The heater causes a convection current in the liquid inside the mug.

Complete the sentences to explain how.

[3 marks]

The liquid at the bottom of the mug heats up and becomes less _____ .

The hot liquid _____ and the cooler liquid at the top of the mug _____ .

5 (d) **Table 2** lists changes that may affect the energy transfer per second from the heater to the liquid.

Tick (✓) **one** box to show the effect of **each** change.

[3 marks]

Table 2

Change	Energy transfer per second to the liquid		
	increases	**decreases**	**does not change**
use a mug with a smaller base			
use a lower power heater			
use a plastic mug instead of a metal mug			

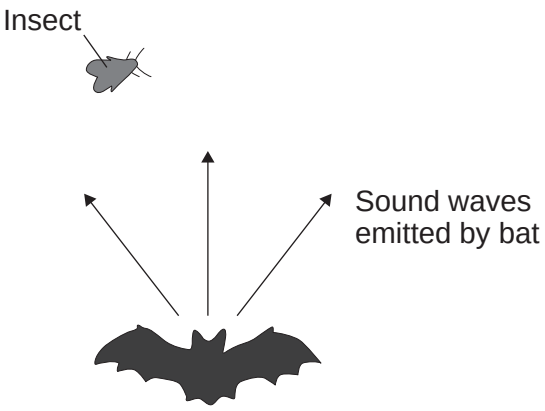
9

Turn over for the next question

Do not write outside the box

6 Bats use the reflection of high pitched sound waves to determine the position of objects. **Figure 10** shows a bat and an insect flying in front of the bat.

Figure 10



6 (a) What determines the pitch of a sound wave?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
amplitude	
frequency	
speed	

6 (b) State the name given to reflected sound waves.

[1 mark]

_____

Do not write outside the box

6 (c) The bat emits sound waves with a range of wavelengths.

Some of the sound waves will be diffracted by the insect.

Complete the following sentences to explain why.

[2 marks]

Diffraction is caused by the sound waves _____ as they pass the insect.

The most diffraction happens when the wavelength of the sound wave is

_____ the size of the insect.

6 (d) The bat emits a sound wave with a frequency of 25.0 kHz and a wavelength of 0.0136 metres.

Calculate the speed of this sound wave.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

_____

_____

_____

Speed = _____ m/s

6 (e) Sound waves are longitudinal. Describe a longitudinal sound wave.

[2 marks]

_____

_____

_____

_____

8

Do not write outside the box

7 A small community of people live in an area in the mountains.
The houses are not connected to the National Grid.

The people plan to buy an electricity generating system that uses either the wind or the flowing water in a nearby river.

Figure 11 shows where these people live.

Figure 11



7 (a) It would not be economical to connect the houses to the National Grid.
Give **one** reason why.

[1 mark]

7 (b) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Information about the two electricity generation systems is given in **Figure 12**.

Figure 12

The wind turbine costs £50 000 to buy and install.
The hydroelectric generator costs £20 000 to buy and install.
The average power output from the wind turbine is 10 kW.
The hydroelectric generator will produce a constant power output of 8 kW.

Do not write outside the box

Compare the advantages and disadvantages of the two methods of generating electricity.

Use your knowledge of energy sources as well as information from **Figure 12**.

[6 marks]

Extra space

7

Turn over for the next question

Do not write outside the box

8 (a) Heating food in a saucepan over a gas flame is inefficient.
Suggest why.

[2 marks]

_____

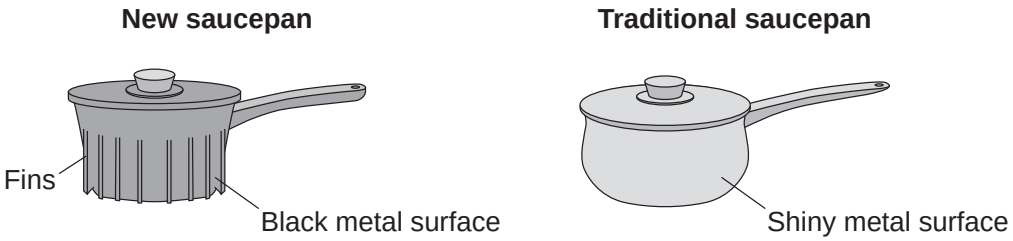
_____

_____

_____

8 (b) A new saucepan has been designed that heats up food much faster than a traditional saucepan. **Figure 13** shows the two saucepans.

Figure 13



Describe how the features of the new saucepan cause the food to heat up faster than when the food is heated in the traditional saucepan.

[2 marks]

Fins _____

_____

Black metal surface _____

_____

8 (c) State the relationship between the temperature of the saucepan and the rate at which the saucepan emits infrared radiation.

[1 mark]

_____

_____

5

END OF QUESTIONS

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GCSE

Science A / Physics

PH1FP

Mark scheme

4405/4403
June 2016

Version 1.0: Final Mark Scheme

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

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.

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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 Assessment Objectives and specification content that each question is intended to cover.

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 bullet points 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.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

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 errors / 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)

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	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, 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 or by each stage of a longer calculation.

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 is 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 Accept / allow

Accept is used to indicate an equivalent answer to that given on the left-hand side of the mark scheme. Allow is used to denote lower-level responses that just gain credit.

3.9 Ignore / Insufficient / Do <u>not</u> allow

Ignore of insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

4. Quality of Communication and levels marking

In Question **7(b)** students are required to produce extended written material in English, and will be assessed on the quality of their 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.

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)	geothermal nuclear biofuel		1 1 1	AO1 1.4.1a 1.4.1d
1(b)	gravitational (potential) kinetic sound		1 1 1	AO1 1.3.1a 1.4.1b
1(c)(i)	90% or 0.9(0)	an answer of 0.9(0) with a unit gains **1** mark an answer of 90 with no unit or an incorrect unit gains **1** mark	2	AO2 1.2.1d
1(c)(ii)	60 (MW)	allow 10%	1	AO2 1.2.1b
1(c)(iii)	increased		1	AO1 1.2.1c
Total			**10**	

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	46 200	accept 46 000 allow **1** mark for correct substitution ie 0.5 x 4200 x 22 provided no subsequent step	2	AO2 1.1.4d
2(b)	Energy is used to heat the kettle.		1	AO2 1.2.1b
2(c)	9 (pence)	allow **1** mark for correct substitution ie 0.6 x 15 provided no subsequent step	2	AO2 1.3.1d
2(d)(i)	conduction and convection		1	AO1 1.1.3a
2(d)(ii)	any **one** from: • water stays hotter for longer (than a 'conventional' kettle) • water boiled less often • less energy transferred to the surroundings • (new design is) more efficient		1	AO2 1.2
Total			**7**	

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)(i)	any **one** from: • (visible) light • UV / ultra violet • X-ray • gamma / γ-ray		1	AO1 1.5.1e
3(a)(ii)	less than less than the same as		1 1 1	AO1 1.5.1d 1.5.1e
3(b)(i)	(the) Big Bang (theory)		1	AO1 1.5.4e
3(b)(ii)	the red-shift of light from distant galaxies		1	AO1 1.5.4c
Total			**6**	

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)	dependent		1	AO3 1.1.3b
4(b)	The equipment has a better resolution.		1	AO3 1.1.3
4(c)	(probe) C largest difference between reading and actual temperature	allow 103.2 reason only scores if C chosen accept larger it is 3.2 greater is insufficient comparing C with only one other probe is insufficient	1 1	AO3 1.1.3
4(d)(i)	12(°C)	accept a value between 12.0 and 12.2 inclusive	1	AO2 1.1.3d
4(d)(ii)	140 (seconds) <u>temperature</u> starts to rise	accept an answer between 130 and 150 inclusive only scores if time mark awarded accept the <u>temperature</u> was lowest (at this time)	1 1	AO2 AO3 1.1.3b
4(d)(iii)	increase	accept faster (rate)	1	AO1 1.1.3b
Total			**8**	

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	it would decrease the time		1	AO3 1.2.1a
5(b)	720 (J)	allow **1** mark for correct substitution ie 12 x 60 provided no subsequent step	2	AO2 1.3.1c
5(c)	<u>dense</u> rises falls	 accept equivalent words accept equivalent words	1 1 1	AO1 1.1.3a
5(d)	 decreases decreases decreases	more than one tick in any row negates the mark	 1 1 1	AO3 1.1.3c 1.1.3d
Total			**9**	

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)	frequency		1	AO1 1.5.3b
6(b)	echo(es)		1	AO1 1.5.3c
6(c)	spreading (out) equal to	changing direction is insufficient moving apart is insufficient bending is insufficient accept: similar to same (order of magnitude) as slightly smaller than slightly larger than	1 1	AO1 1.5.1g
6(d)	340 (m/s)	allow **1** mark for correct substitution ie 25 000 x 0.0136 provided no subsequent step or allow 1 mark for a correct calculation showing an incorrect value from conversion to hertz x 0.0136 an answer of 0.34 gains **1** mark	2	AO2 1.5.1j
6(e)	(a wave where the) oscillations are parallel to the direction of energy transfer causing (areas of) compression and rarefaction	both marking points may appear as labels on a diagram accept vibrations for oscillations accept in same direction as for parallel to allow direction of wave (motion) for direction of energy transfer accept correct description in terms of particles mechanical wave is insufficient needs a medium to travel through is insufficient	1 1	AO1 1.5.1b
Total			**8**	

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(a)	any **one** from: • high cost of installing overhead power lines or underground cables or pylons • high cost as (very) long cables needed • amount of electricity required is too low	allow not enough (surplus) electricity would be generated	1	AO1 1.4.1e

Question 7 continues on the next page . . .

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
7 (b)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.		6	3 AO1 2 AO2 1 AO3 1.4.1b

0 marks	**Level 1 (1-2 marks)**	**Level 2 (3-4 marks)**	**Level 3 (5-6 marks)**
No relevant information	at least **one** advantage **or one** disadvantage of either method	at least **one** advantage **and one** disadvantage is stated for **one** method **and** a different advantage **or** disadvantage is stated for the other method	clear comparison of advantages **and** disadvantages of **each** method

examples of physics points made in the response	**extra information**
Advantages of both methods:	
• both renewable sources of energy	
• both have no fuel (cost)	accept carbon neutral
• both have very small (allow 'no') running costs	accept no greenhouse gases
• no carbon dioxide produced	accept doesn't contribute to global warming
Advantages of wind:	
• higher average power output	produces more energy is insufficient
Advantages of hydroelectric:	
• constant / reliable power (output)	
• lower (installation) cost	
Disadvantages of wind:	
• higher (installation) cost	
• variable / unreliable power output	
• (may) kill birds / bats	
Disadvantages of hydroelectric:	
• lower power output	
• (may) kill fish or (may) damage habitats	
• more difficult to set up (within river)	
Disadvantages of both methods	
• (may be) noisy	
• visual pollution	ignore payback time unless no other relevant points made ignore time to build for both

Total			**7**

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
8(a)	a proportion / percentage of the energy is wasted	allow heat for energy allow some energy is wasted	1	AO2 1.2.1b 1.2.1c
	(wasted) energy is transferred to surroundings **or** energy is needed to heat pan (before food is heated)		1	
8(b)	(fins have a) large(r) surface area	accept fins increase the surface area	1	AO1 1.1.1c 1.1.1e 1.1.3c
	(black metal surface is a) good / better absorber of infrared radiation	allow 'heat' or 'energy' for infrared radiation ignore good emitter of infrared radiation not a good reflector is insufficient	1	
8(c)	the higher the temperature (of the saucepan) the greater the rate at which infrared radiation is emitted	accept converse answer allow the higher the temperature the more infrared radiation is emitted allow there is a positive correlation	1	AO2 1.1.1b
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	
8	
TOTAL	

General Certificate of Secondary Education
Foundation Tier
June 2015

Science A
Unit Physics P1

PH1FP

F

Physics
Unit Physics P1

Friday 12 June 2015 1.30 pm to 2.30 pm

For this paper you must have:
- a ruler
- a calculator
- the Physics Equations Sheet (enclosed).

A

Time allowed
- 1 hour

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 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 7(a) should be answered in continuous prose.
  In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

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

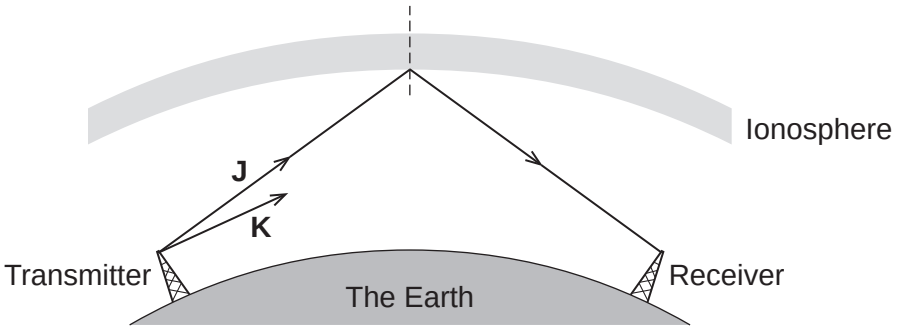
Do not write outside the box

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

1 Different parts of the electromagnetic spectrum are useful for different methods of communication.

1 (a) **Figure 1** shows a transmitter emitting two electromagnetic waves, **J** and **K**.

Figure 1



Wave **J** is reflected by a layer in the atmosphere called the ionosphere.

1 (a) (i) Wave **K** will also be reflected by the ionosphere.
On **Figure 1**, draw the path of wave **K** to show that it **does not** reach the receiver.

[2 marks]

1 (a) (ii) What is the name given to the dashed line in **Figure 1**?

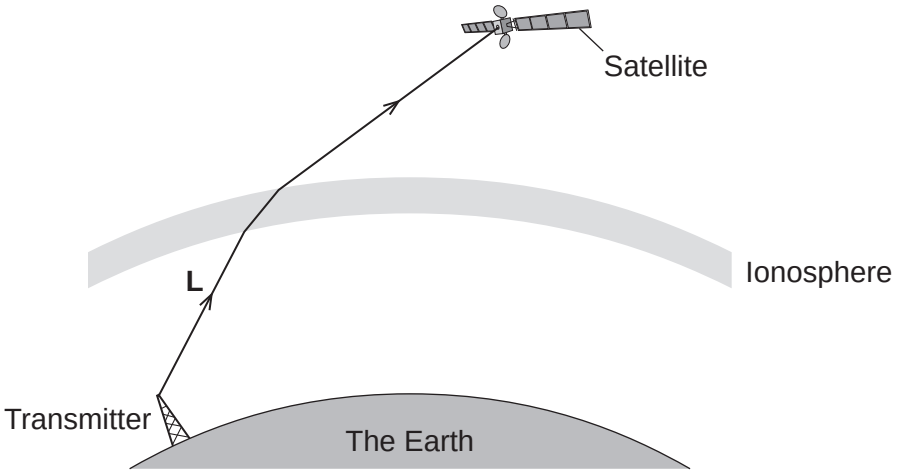
[1 mark]

.....

Do not write outside the box

1 (b) **Figure 2** shows a transmitter sending a signal to a satellite orbiting the Earth.

Figure 2



1 (b) (i) Which type of electromagnetic wave is used to send a signal to a satellite?

[1 mark]

Draw a ring around the correct answer.

gamma **microwave** **ultraviolet**

1 (b) (ii) What name is given to the process that occurs as wave **L** passes into the ionosphere?

[1 mark]

Draw a ring around the correct answer.

diffraction **reflection** **refraction**

Question 1 continues on the next page

Do not write outside the box

1 (c) Waves **J**, **K** and **L** are electromagnetic waves.

What are **two** properties of **all** electromagnetic waves?

[2 marks]

Tick (✓) **two** boxes.

Property	**Tick (✓)**
All electromagnetic waves are longitudinal.	
All electromagnetic waves are transverse.	
All electromagnetic waves are mechanical.	
All electromagnetic waves have the same speed in a vacuum.	
All electromagnetic waves have the same frequency.	

7

Do not write outside the box

2 **Figure 3** shows a man using a leaf blower to move some leaves.

Figure 3



The leaf blower is powered by an electric motor connected to a battery.

2 (a) Energy transfers take place when the leaf blower is being used.

Use the correct answer from the box to complete each sentence.

[3 marks]

chemical	**electrical**	**kinetic**	**nuclear**	**sound**

The battery stores ..... energy which is transferred into electrical energy.

The electric motor transfers electrical energy usefully into ..... energy.

The motor wastes energy as ..... energy and as energy that heats the surroundings.

Question 2 continues on the next page

Do not write outside the box

2 (b) The total power input to the leaf blower is 750 W.
The useful power output of the leaf blower is 360 W.

Calculate the efficiency of the leaf blower.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

.....

Efficiency = ...

5

Do not write outside the box

3 **Figure 4** shows a black metal casserole dish that is put inside a hot oven. Food is cooked inside the casserole dish.

Figure 4



3 (a) Energy is transferred quickly from the inside of the hot oven, through the metal casserole dish to the food.

3 (a) (i) Why are metals good conductors of energy?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
because they contain free atoms	
because they contain free electrons	
because they contain free ions	

Question 3 continues on the next page

Do not write outside the box

3 (a) (ii) Why do black surfaces become hot quickly?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
Because they are good absorbers of infrared radiation.	
Because they are good absorbers of ultraviolet radiation.	
Because they are good absorbers of visible light.	

3 (b) **Figure 5** shows a person removing a hot casserole dish from an oven, using oven gloves.

Figure 5



3 (b) (i) Use the correct answer from the box to complete the sentence.

[1 mark]

conductors	**insulators**	**radiators**

The oven gloves are good ..... .

Do not write outside the box

3 (b) (ii) How would wearing oven gloves affect the rate of energy transfer to a person's hands compared with not wearing oven gloves?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
The rate of energy transfer would be higher.	
The rate of energy transfer would be lower.	
The rate of energy transfer would stay the same.	

3 (c) What **two** factors determine the amount of energy transferred by an electric oven?

[2 marks]

1 .....

2 .....

3 (d) A company has invented an 'app' that allows householders to control the electric oven in their home using their mobile phone.
The mobile phone can be used to switch the electric oven on and off.

Suggest **one** benefit of using a mobile phone to switch an electric oven on and off.

[1 mark]

.....

.....

7

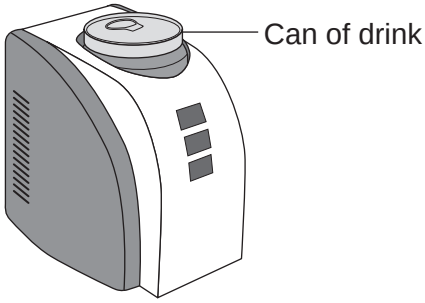
Turn over for the next question

Do not write outside the box

4 A 'can-chiller' is used to make a can of drink colder.

Figure 6 shows a can-chiller.

Figure 6



4 (a) The can-chiller decreases the temperature of the liquid in the can by 15 °C.
The mass of liquid is 0.33 kg.
The specific heat capacity of the liquid is 4200 J/kg °C.

Calculate the energy transferred from the liquid as it cools.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Energy = ... J

4 (b) Complete the following sentence.

[1 mark]

The specific heat capacity of a substance is the amount of energy required to change the ..... of one kilogram of the substance by one degree Celsius.

Do not write outside the box

4 (c) To calculate the specific heat capacity of a material, the mass of the material needs to be measured.

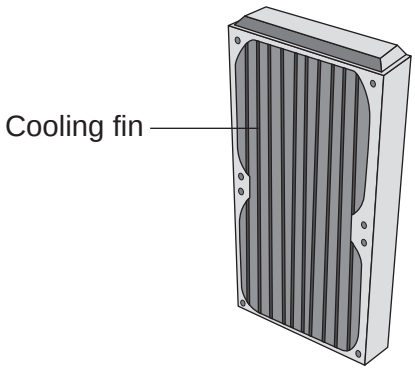
State the name of a measuring instrument used to measure mass.

[1 mark]

.....

4 (d) The back of the can-chiller has cooling fins, as shown in **Figure 7**.

Figure 7



The cooling fins increase the rate of energy transfer from the can-chiller to the surroundings.

Complete the following sentences.

[2 marks]

The cooling fins are a ..... colour because that makes them good emitters of infrared radiation.

The large surface area of the cooling fins allows the air around the can-chiller to gain energy quickly and rise, transferring energy by ..... .

Question 4 continues on the next page

Do not write outside the box

4 (e) (i) The energy input to the can-chiller is the same as the energy output. This shows that energy is conserved.

Complete the following sentence.

[1 mark]

Energy can be transferred usefully, stored or dissipated, but cannot be

..... or destroyed.

4 (e) (ii) The temperature of the can of drink decreases while it is in the can-chiller.

What happens to the temperature of the air around the cooling fins?

[1 mark]

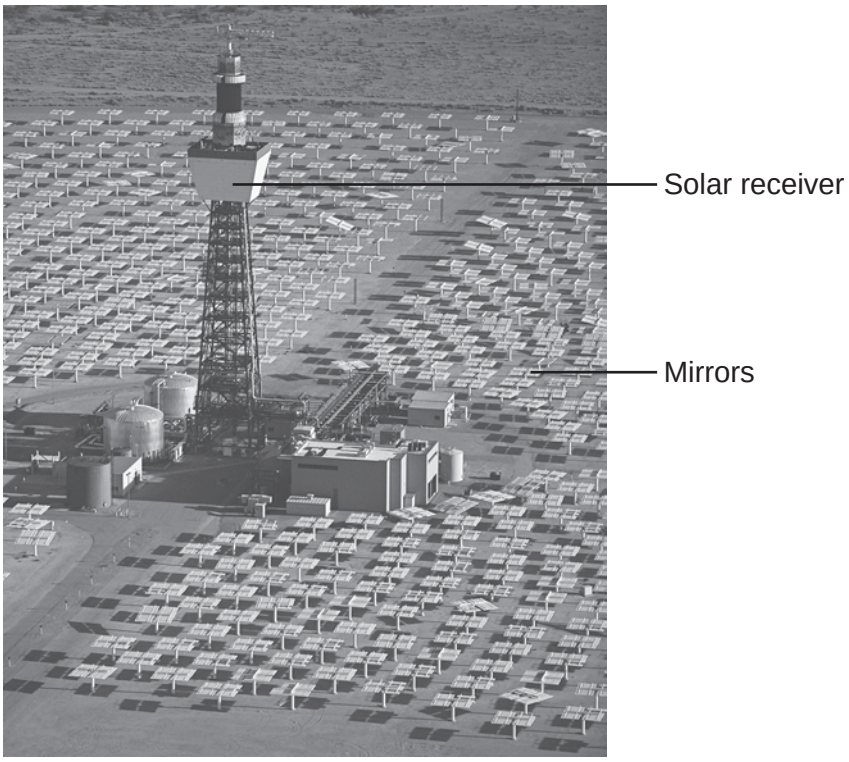
.....

8

Do not write outside the box

5 **Figure 8** shows a solar thermal power station.

Figure 8



Energy from the Sun is directed at the solar receiver by many mirrors.

5 (a) (i) Suggest **one** reason why a solar thermal power station is built in a hot desert.

[1 mark]

.....

.....

5 (a) (ii) Complete the following sentence to describe how the mirrors direct energy from the Sun towards the solar receiver.

[1 mark]

Energy from the Sun is ..... by the mirrors towards the solar receiver.

Question 5 continues on the next page

Do not write outside the box

5 (a) (iii) Heated water is used to generate electricity in the solar thermal power station.
Choose the correct answer from the box to complete each sentence.

[3 marks]

boiler	**motor**	**transformer**	**turbine**

At the solar receiver, water is heated in a ..... which turns the water into steam. The steam turns a ..... which is connected to a generator. The generator produces electricity. A ..... is used to change the voltage for transmission along power lines.

5 (b) A solar storage power station is a new type of solar power station.
It is able to store energy from the Sun to generate electricity at night.

The solar storage power station can supply a town with a maximum electrical power of 140 000 kW for 15 hours.

Calculate the maximum energy, in kWh, stored by the solar storage power station.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Energy = ... kWh

Do not write outside the box

5 (c) A different method of generating electricity uses wind turbines.
A student researching a wind farm wrote the following.

> Top Hill Wind Farm has 25 wind turbines.
> Last week, one of the wind turbines generated electricity for only 42 hours out of a possible 168 hours.
> My conclusion is that all wind turbines operate for only 25% of the time.

5 (c) (i) Give **two** reasons why the student is **not** correct in reaching his conclusion.

[2 marks]

1 .....

.....

2 .....

.....

5 (c) (ii) Give **one** reason why wind turbines do not generate electricity all the time.

[1 mark]

.....

.....

5 (c) (iii) Give **one** advantage of using wind turbines to generate electricity compared with using fossil fuel power stations.

[1 mark]

.....

.....

11

Turn over for the next question

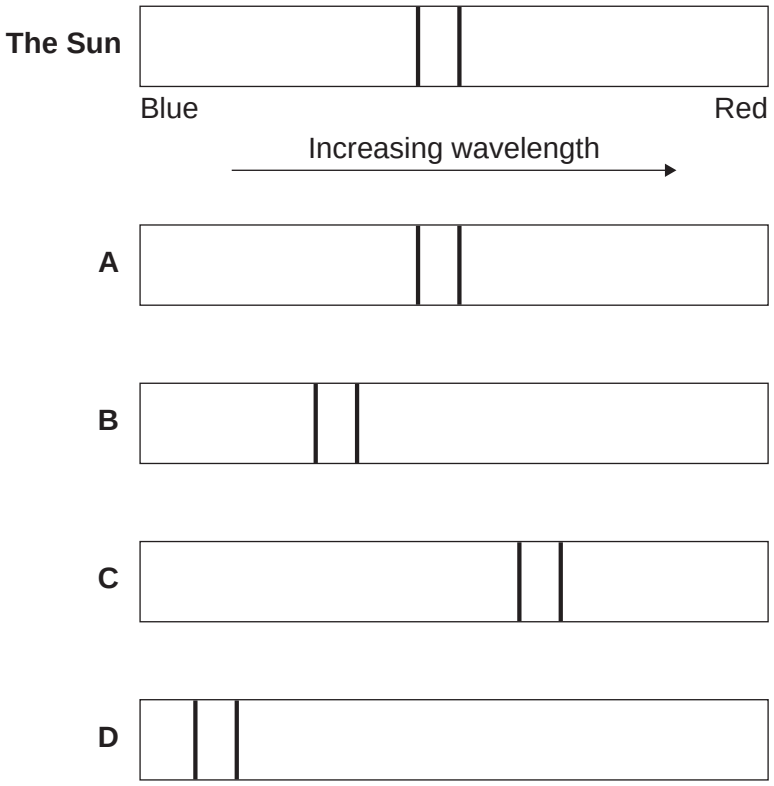
Do not write outside the box

6 Scientists can use the visible light spectrum from distant stars to determine whether the stars are moving.

The visible light spectrum from stars includes dark lines at specific wavelengths.

6 (a) **Figure 9** shows the visible light spectrum from the Sun and from four other stars, **A**, **B**, **C** and **D**.

Figure 9



6 (a) (i) Which star, **A**, **B**, **C** or **D**, is moving away from the Earth?

[1 mark]

Do not write outside the box

6 (a) (ii) How does the speed of star **B** compare with the speed of star **D**?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
The speed of star **B** is greater than the speed of star **D**.	
The speed of star **B** is less than the speed of star **D**.	
The speed of star **B** is the same as the speed of star **D**.	

6 (b) A radio wave is emitted by a star.
The radio wave has a wavelength of 1500 m and a frequency of 200 000 Hz.

Calculate the speed of this radio wave.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

Choose the correct unit from the list below.

m **m/s** **m/s^2**

.....

.....

.....

Speed = ... unit .....

5

Turn over for the next question

Do not write outside the box

7 (a) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

A householder wants to reduce her energy bills. She collected information about a number of ways of reducing energy used. The information is shown in **Table 1**.

Table 1

Ways of reducing energy used	Cost to buy and install in £	Money saved per year in £
Install an energy-efficient boiler	2 000	320
Insulate the loft	400	200
Install double-glazed windows	12 000	120
Install cavity wall insulation	415	145

Use the information in **Table 1** to compare the different ways of reducing the energy used. Your answer should include some calculations.

[6 marks]

.....

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Do not write outside the box

Extra space .....

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7 (b) Increasing the amount of insulation in a house affects the total U-value of the house.

7 (b) (i) What is meant by the term 'U-value'?

[1 mark]

.....

.....

.....

7 (b) (ii) How is the U-value affected by increasing the amount of insulation?

[1 mark]

.....

8

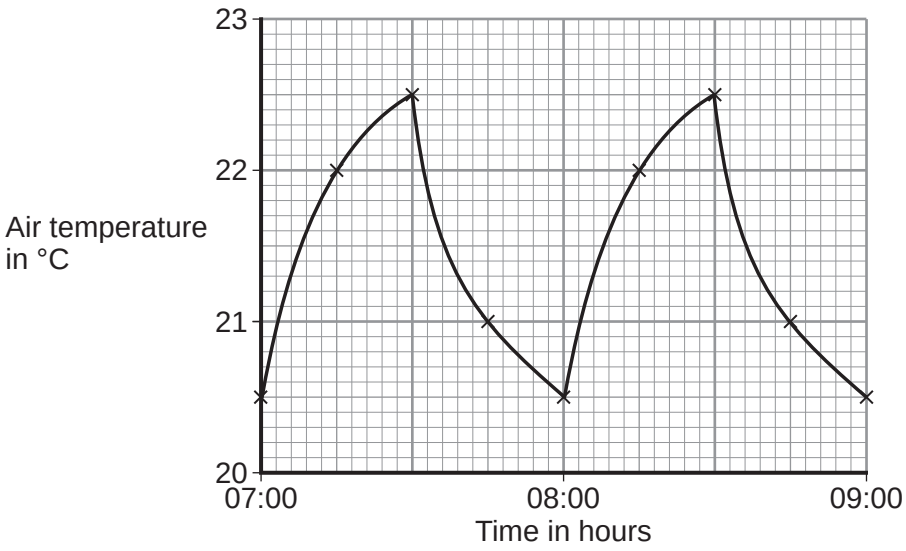
Turn over for the next question

Do not write outside the box

8 A householder monitored how the air temperature inside his house changed over a 2-hour period. The householder measured the temperature every 15 minutes.

Figure 10 shows how the temperature changed with time.

Figure 10



8 (a) (i) The householder used a digital thermometer to measure the temperature.

What would be an appropriate resolution for the digital thermometer?

[1 mark]

Draw a ring around your answer.

0.5 °C **1 °C** **5 °C**

8 (a) (ii) The householder's results are shown on a line graph in **Figure 10**.

Why would it **not** be appropriate to use the results to plot a bar chart?

[1 mark]

.....

.....

Do not write outside the box

8 (b) The householder's heating is controlled by a thermostat. The thermostat switches the heating on when the temperature decreases below a certain temperature.

8 (b) (i) At what temperature does the thermostat switch the heating on?

[1 mark]

..... °C

8 (b) (ii) Use **Figure 10** to determine the number of minutes that the householder's heating was switched on between 07:00 and 09:00.

[1 mark]

.....

.....

Time = ... minutes

Question 8 continues on the next page

Do not write outside the box

8 (c) The householder read the following extract from a newspaper article about reducing energy use in the home.

> . . . decreasing the temperature setting on your thermostat by 1 °C will reduce your heating bill by 10% . . .

On Monday, the householder set his thermostat at 20.0 °C and recorded the energy, in kWh, used to heat his house.

On Tuesday, the householder set his thermostat at 19.0 °C and recorded the energy, in kWh, used to heat his house.

Table 2 shows the results of the householder's investigation.

Table 2

Thermostat setting in °C	Energy in kWh
20.0	8.0
19.0	7.2

8 (c) (i) The outside temperature was the same on both days.

Give **one** reason why this was important.

[1 mark]

.....

.....

8 (c) (ii) Explain how the results shown in **Table 2** support the extract from the newspaper article.

Justify your answer with a calculation.

[2 marks]

.....

.....

.....

.....

Do not write outside the box

8 (c) (iii) The statement in the extract is **not** valid for all situations.
Suggest why.

[2 marks]

.....

.....

.....

.....

9

END OF QUESTIONS

Do not write outside the box

There are no questions printed on this page

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AQA

GCSE

Science A / Physics

PH1FP

Mark scheme

4405/4403
June 2015

Version/Stage: 1.0 Final

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

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 from 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 Assessment Objectives and specification content that each question is intended to cover.

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 bullet points 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.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

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 errors / 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	green, 5	0
2	red*, 5	1
3	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

3.1 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.

3.2 Marking procedure for calculations

Full marks can be given for a correct numerical answer, 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 or by each stage of a longer calculation.

3.3 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.

3.4 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 is 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.

3.5 Phonetic spelling

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

3.6 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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3.2 Ignore / Insufficient / Do not allow

Ignore of insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

4. Quality of Communication and levels marking

In Question **7a** students are required to produce extended written material in English, and will be assessed on the quality of their 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.

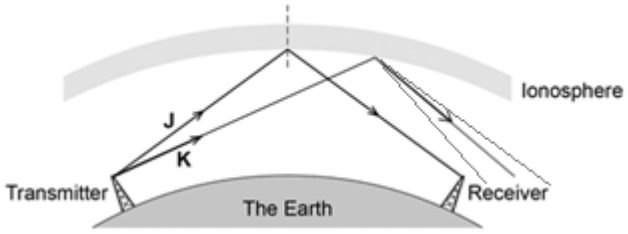
The following general criteria should be used to assign marks to a level:

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

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Question	Answers	Extra information	Mark	AO / Spec. ref.
1(a)(i)	reflection of wave **K** at or within the ionosphere angle i = angle r  	allow dashed lines 'judge by eye' tolerance for the reflected ray is between the first e and last r ignore arrows a reflected ray to the receiver doesn't score 2nd mark additional rays shown doesn't score 2nd mark	1 1	AO2 P1.5.2b
1(a)(ii)	normal		1	AO1 P1.5.2a
1(b)(i)	microwave		1	AO1 P1.5.1k
1(b)(ii)	refraction		1	AO1 P1.5.1g
1(c)	All electromagnetic waves are transverse. All electromagnetic waves have the same speed in a vacuum.		1 1	AO1 P1.5.1b, c, d
Total			**7**	

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Question	Answers	Extra information	Mark	AO / Spec. ref.
2(a)	chemical kinetic sound	correct order only	1 1 1	AO1 P1.2.1a
2(b)	48% or 0.48	an answer of 0.48 with a unit gains **1** mark an answer of 0.48% gains **1** mark an answer of 48 with or without a unit gains **1** mark	2	AO2 P1.2.1d
Total			**5**	

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Question	Answers	Extra information	Mark	AO / Spec. ref.
3(a)(i)	because they contain free electrons		1	AO1 P1.1.3a
3(a)(ii)	because they are good absorbers of infrared radiation		1	AO1 P1.1.1c
3(b)(i)	insulators		1	AO1 P1.1.3a
3(b)(ii)	the rate of energy transfer would be lower.		1	AO1 P1.1.3c
3(c)	power time	allow the temperature (of the oven) watts or wattage is insufficient	1 1	AO1 P1.3.1b
3(d)	it can be switched on / off remotely	accept sensible suggestions about remote operation eg can be turned on / off from work **or** food can be cooked before you get home	1	AO3 P1.1
Total			**7**	

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Question	Answers	Extra information	Mark	AO / Spec. ref.
4(a)	20 790 (J)	an answer of 21 000 (J) (2 s.f.) gains **2** marks allow **1** mark for correct substitution: ie E = 0.33 x 4200 x 15 provided no subsequent step shown	2	AO2 P1.1.4d
4(b)	temperature		1	AO1 P1.1.4d
4(c)	(top pan) balance	accept scales do **not** accept a scale do **not** accept weighing scales do **not** accept newtonmeter do **not** accept spring balance	1	AO1 P1.1.4d
4(d)	dark / black / (dark) grey convection	 correct order only	1 1	AO1 P1.1.1c P1.1.3c
4(e)(i)	created	accept made	1	AO1 P1.2.1a
4(e)(ii)	increases		1	AO1 P1.2.1c
Total			**8**	

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Question	Answers	Extra information	Mark	AO/Spec. ref.
5(a)(i)	high levels of infrared radiation (from the Sun)	allow lots of (solar) energy (available) do **not** accept 'heat' for infrared 'it is hot' is insufficient 'lots of sunlight' is insufficient	1	AO2 P1.4.1a
5(a)(ii)	reflected		1	AO1 P1.5.1g
5(a)(iii)	boiler turbine transformer	correct order only	1 1 1	AO1 P1.4.1a
5(b)	2 100 000 (kWh)	allow **1** mark for correct substitution i.e. 140 000 x 15 provided no subsequent step	2	AO2 P1.3.1c
5(c)(i)	only 1 wind turbine was considered **or** other wind turbines may have generated more electricity only 1 week's weather was reported on **or** wind speed varies from one week to another	accept only one location is considered accept insufficient sample size 'wind speed varies' is insufficient	1 1	AO3 P1.4
5(c)(ii)	any **one** from: • wind speed is too high / low • wind is unreliable	allow no wind allow too windy allow wind is variable	1	AO1 P1.4

Question 5 continues on the next page . . .

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Question 5 continued . . .

Question	Answers	Extra information	Mark	AO/Spec. ref.
5(c)(iii)	any **one** from: • wind is a renewable energy source • do not use fuel • energy source is free • do not release carbon dioxide • do not release greenhouse gases • do not release sulfur dioxide • do not cause acid rain • do not cause climate change • do not cause global warming • do not cause global dimming	answer must be an advantage of wind, converse answers in terms of fossil fuels are insufficient accept do not release pollutant gases 'no pollution' is insufficient	1	AO1 P1.4.1f
Total			**11**	

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Question	Answers	Extra information	Mark	AO / Spec. ref.
6(a)(i)	C		1	AO2 P1.5.4a
6(a)(ii)	The speed of star **B** is less than the speed of star **D**.		1	AO3 P1.5.4b
6(b)	300 000 000 m/s	allow **1** mark for correct substitution ie 200 000 x 1500 provided no subsequent step shown allow unit correctly indicated in list if not written in answer space	2 1	AO2 AO1 P1.5.1j
Total			**5**	

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<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td>7 (a)</td><td colspan="2">Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 4 and apply a ‘best-fit’ approach to the marking.</td><td>6</td><td>AO2
AO3
P1.2
HSW</td></tr>
<tr><td colspan="5">
<table>
<tr><th>0 marks</th><th>Level 1 (1-2 marks)</th><th>Level 2 (3-4 marks)</th><th>Level 3 (5-6 marks)</th></tr>
<tr><td>No relevant information</td><td>There is a relevant statement about an energy saving method</td><td>There is at least one clear comparison of energy saving methods and their cost effectiveness with an appropriate calculation</td><td>There is a comparison of energy saving methods and their cost effectiveness with appropriate calculations. Comparison to include further detail.</td></tr>
</table>
</td></tr>
<tr><td colspan="2">examples of physics points made in the response

examples of relevant statements
• energy efficient boiler saves the most (energy / money) per year
• loft insulation costs the least to install
• double-glazing costs the most to install
examples of statements that include cost effectiveness
• loft insulation is the most cost effective in the long term
• double-glazing is the least cost effective
• loft insulation has the shortest payback time
• double-glazing has the longest payback time
• payback time calculated for any method
examples of further detail
• for cost effectiveness install in the following order: loft, cavity wall, boiler, double-glazing
• for reducing energy use install in the following order: boiler, loft, cavity wall, double glazing
• don’t install double-glazing for insulation purposes
• double-glazing won’t pay for itself in your lifetime
• justified choice of best / worst method</td><td colspan="2">extra information

payback times:
energy efficient boiler: 6.25 years
loft insulation: 2 years
double glazing: 100 years
cavity wall insulation: 2.86 years</td><td></td></tr>
</table>

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Question 7 continued . . .

Question	Answers	Extra information	Mark	AO / Spec. ref.
7(b)(i)	how effective a material is as an insulator	accept 'heat' for energy accept how effective a material is at keeping energy in accept the lower the U-value the better the insulator accept the lower the U-value the lower the rate of energy transfer	1	AO1 P1.1.4a
7(b)(ii)	(the U-value) decreases		1	AO1 P1.1.4b
Total			**8**	

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Question	Answers	Extra information	Mark	AO / Spec. ref.
8(a)(i)	0.5 °C		1	AO3 P1.1
8(a)(ii)	data is continuous **or** both variables are continuous **or** independent variable is continuous **or** time is continuous	accept results / measurements for data accept data is not categoric one variable is continuous is insufficient air temperature is continuous is insufficient	1	AO3 P1.1
8(b)(i)	20.5 (°C)		1	AO2 P1.1
8(b)(ii)	60 (minutes)	accept 1 hour	1	AO2 P1.1
8(c)(i)	so a comparison can be made **or** outside temperature is a control variable	accept: (outside) temperature would affect energy required (to maintain temperature of the house) **or** (outside) temperature would affect internal temperature (of the house) **or** heat loss will be faster on a cold day outside temperature will affect the results is insufficient fair test is insufficient	1	AO3 P1.1

Question 8 continues on the next page . . .

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Question	Answers	Extra information	Mark	AO / Spec. ref.
8(c)(ii)	the cost is equal to the number of kWh x the cost per kWh calculation 0.8 / 8.0 = 0.1 or 10%	accept (heating) bill depends on (number of) kWh used accept energy for kWh allow 7.2 / 8.0 = 0.9 or 90%	1 1	AO3 AO2 P1.1
8(c)(iii)	heating is on for more / less time (than anticipated) because some days it is cooler / warmer (than anticipated)	 accept other sensible suggestions an answer giving two sensible situations gains **2** marks possible examples: • some houses have different amounts of insulation • there are different styles of house temperature (inside / outside) is always changing is insufficient	1 1	AO3 P1.1
Total			**9**	

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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	
9	
TOTAL	

AQA

General Certificate of Secondary Education
Foundation Tier
June 2014

Science A
Unit Physics P1

PH1FP

F

Physics
Unit Physics P1

Thursday 12 June 2014 9.00 am to 10.00 am

For this paper you must have:
- a ruler
- a calculator
- the Physics Equations Sheet (enclosed).

A

Time allowed
- 1 hour

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 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 9 should be answered in continuous prose.
  In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

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

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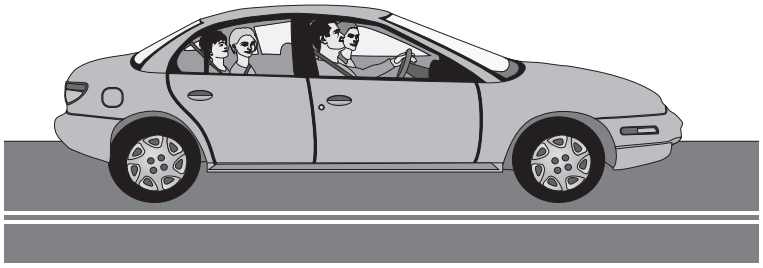
Do not write outside the box

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

1 **Figure 1** shows a car with an electric motor.

The car is moving along a flat road.

Figure 1



1 (a) (i) Use the correct answers from the box to complete each sentence.

[3 marks]

light	**electrical**	**kinetic**	**potential**	**sound**

The car's motor transfers ..... energy

into useful ..... energy as the car moves.

Some energy is wasted as ..... energy.

1 (a) (ii) What happens to the wasted energy?

[1 mark]

.....

.....

Do not write outside the box

1 (b) The electric motor has an input energy of 50 000 joules each second.

The motor transfers 35 000 joules of useful energy each second.

Calculate the efficiency of the electric motor.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Efficiency = ...

6

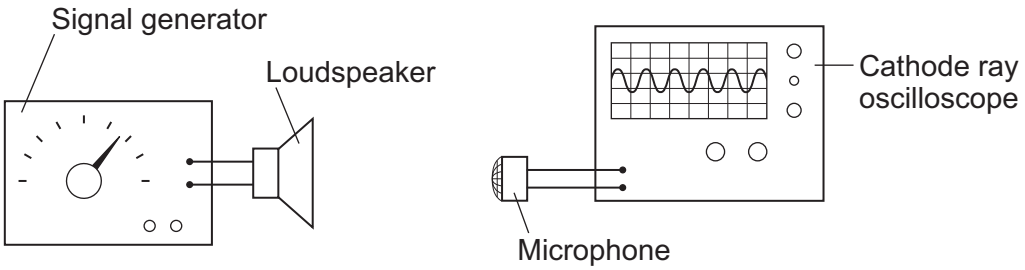
Turn over for the next question

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2 (a) **Figure 2** shows a signal generator connected to a loudspeaker.

The signal generator is adjusted to change the sound wave produced by the loudspeaker.

Figure 2

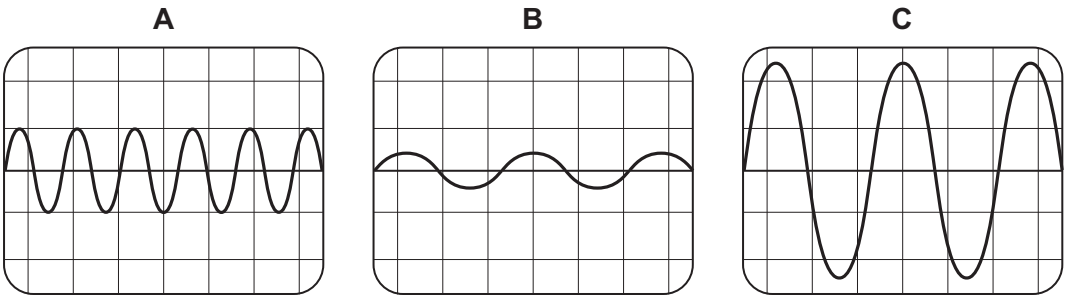


A microphone connected to a cathode ray oscilloscope (CRO) is used to detect the sound waves from the loudspeaker.

Figure 3 shows the CRO traces, **A**, **B** and **C**, produced by three different sound waves.

The settings on the CRO were the same for each trace.

Figure 3



Use the correct letter, **A**, **B** or **C**, to complete each sentence.

2 (a) (i) The sound wave with the highest frequency is shown by trace ☐.

[1 mark]

2 (a) (ii) The sound wave with the smallest amplitude is shown by trace ☐.

[1 mark]

Do not write outside the box

2 (b) The loudspeaker produces a sound wave with a frequency of 850 hertz and a wavelength of 0.4 metres.

Calculate the speed of this sound wave. Give the unit.

Use the correct equation from the Physics Equations Sheet.

Choose the unit from the list below.

joules **metres / second** **watts**

[3 marks]

.....

.....

.....

Speed = ...

2 (c) A motorbike is driven towards a microphone and CRO which are placed by the side of the road.

The motorbike emits a sound wave of constant frequency.

Draw a ring around the correct answer to complete each sentence.

[2 marks]

As the motorbike moves towards the microphone, the frequency of the sound wave detected by the microphone will be

higher than / the same as / lower than

the frequency of the sound wave produced by the motorbike.

The wavelength of the sound wave detected by the microphone will be

longer than / the same as / shorter than

the wavelength of the sound wave from the motorbike.

7

Do not write outside the box

3 Energy can be transferred through some materials by convection.

3 (a) Use the correct answer from the box to complete the sentence.

[1 mark]

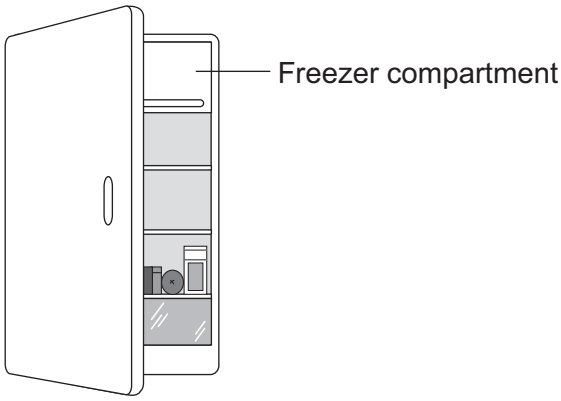
gas	liquid	solid

Energy **cannot** be transferred by convection through a ..... .

3 (b) **Figure 4** shows a fridge with a freezer compartment.

The temperature of the air inside the freezer compartment is –5 °C.

Figure 4



Use the correct answer from the box to complete each sentence.

Each answer may be used once, more than once or not at all.

[3 marks]

decreased	unchanged	increased

When the air near the freezer compartment is cooled, the energy of the air particles is ..... .

The spaces between the air particles are ..... .

The density of the air is ..... .

Do not write outside the box

3 (c) **Table 1** shows some information about three fridges, **A**, **B** and **C**.

The efficiency of each fridge is the same.

Table 1

Fridge	Volume in litres	Energy used in one year in kWh
A	232	292
B	382	409
C	622	524

3 (c) (i) Which fridge, **A**, **B** or **C**, would cost the least to use for 1 year?

[2 marks]

Give **one** reason for your answer.

.....

.....

3 (c) (ii) A householder looks at the data in **Table 1**.

What should she conclude about the pattern linking the volume of the fridge and the energy it uses in one year?

[1 mark]

.....

.....

3 (c) (iii) The householder could not be certain that her conclusion is correct for all fridges.

Suggest **one** reason why not.

[1 mark]

.....

.....

8

Do not write outside the box

4 Iceland is a country that generates most of its electricity using geothermal power stations and hydroelectric power stations.

4 (a) (i) Complete the following sentences to describe how some geothermal power stations work.

[3 marks]

In regions where volcanoes are active, the ground is hot.

Cold ..... is pumped down into the ground

and is ..... by hot rocks.

It returns to the surface as steam. The steam is used to turn a turbine.

The turbine drives a ..... to produce electricity.

4 (a) (ii) Which **one** of the following statements about geothermal power stations is true?

Tick (✓) **one** box.

[1 mark]

Geothermal power stations use fossil fuels. ☐

Geothermal power stations produce carbon dioxide. ☐

Geothermal power stations provide a reliable source of electricity. ☐

Do not write outside the box

4 (b) What is needed for a hydroelectric power station to be able to generate electricity?

Tick (✓) **one** box.

[1 mark]

Falling water ☐

A long coastline ☐

Lots of sunny days ☐

5

Turn over for the next question

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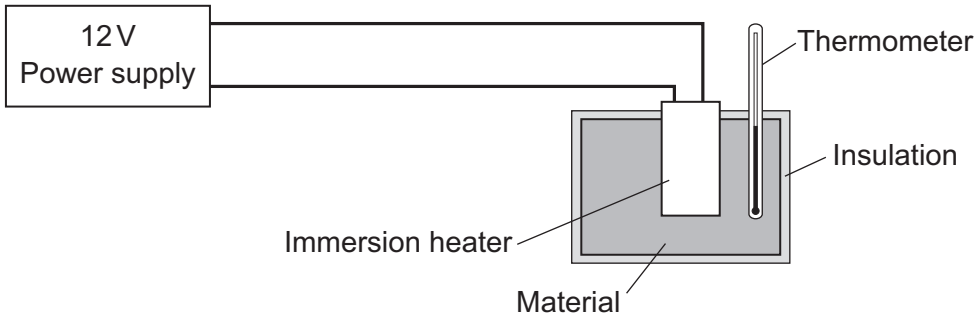
5 A student used the apparatus in **Figure 5** to compare the energy needed to heat blocks of different materials.

Each block had the same mass.

Each block had holes for the thermometer and the immersion heater.

Each block had a starting temperature of 20 °C.

Figure 5



The student measured the time taken to increase the temperature of each material by 5 °C.

5 (a) (i) State **two** variables the student controlled.

[2 marks]

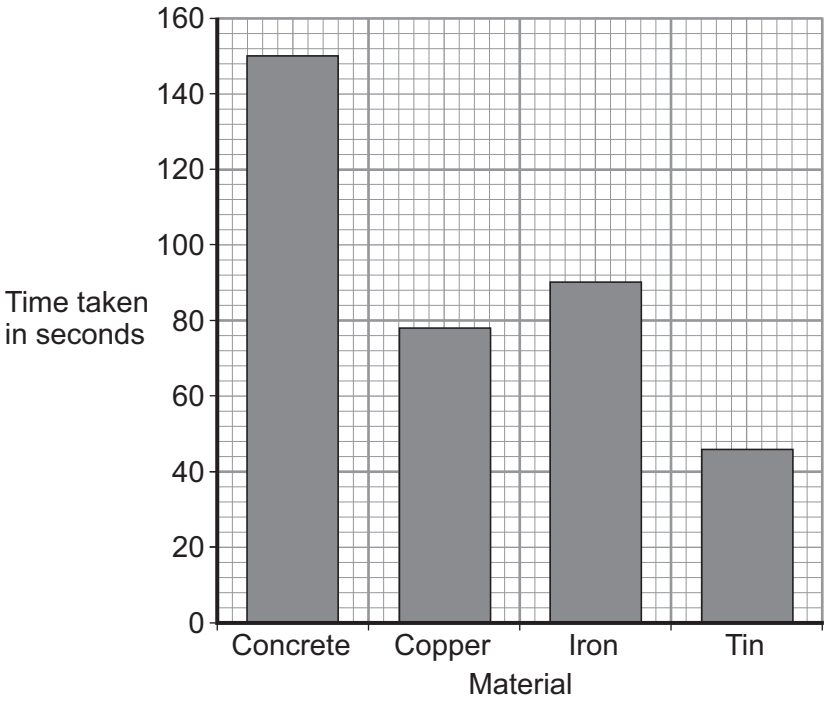
1 .....

2 .....

Do not write outside the box

Figure 6 shows the student's results.

Figure 6



5 (a) (ii) Why was a bar chart drawn rather than a line graph?

[1 mark]

.....

.....

5 (a) (iii) Which material was supplied with the most energy?

.....

Give the reason for your answer.

[2 marks]

.....

.....

Question 5 continues on the next page

Do not write outside the box

5 (a) (iv) The iron block had a mass of 2 kg.

Calculate the energy transferred by the heater to increase the temperature of the iron block by 5 °C.

Use the correct equation from the Physics Equations Sheet.

The specific heat capacity of iron is 450 J/kg °C.

[2 marks]

.....

.....

.....

Energy transferred = ... J

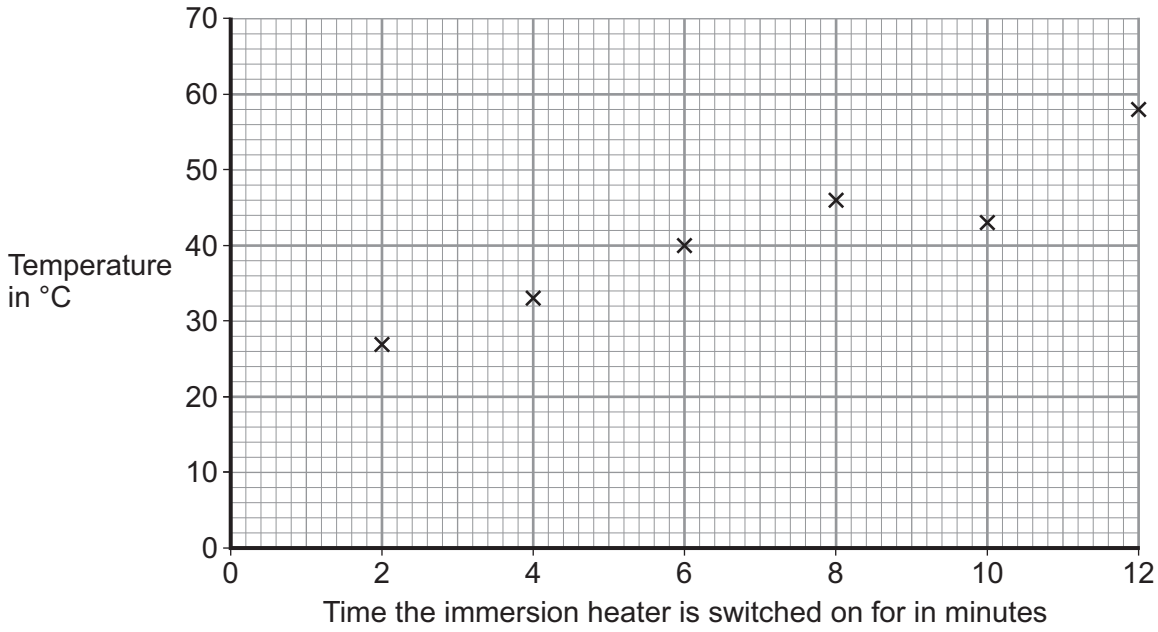
Do not write outside the box

5 (b) The student used the same apparatus to heat a 1 kg block of aluminium.

He recorded the temperature of the block as it was heated from room temperature.

The results are shown in **Figure 7.**

Figure 7



5 (b) (i) One of the student's results is anomalous.

Draw a ring around the anomalous result.

[1 mark]

5 (b) (ii) Draw the line of best fit for the points plotted in **Figure 7**.

[1 mark]

5 (b) (iii) What was the temperature of the room?

[1 mark]

Temperature = ... °C

5 (b) (iv) What was the interval of the time values used by the student?

[1 mark]

Interval = ... minutes

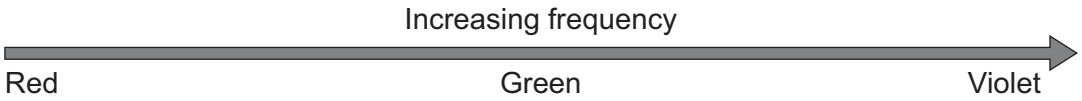
11

Do not write outside the box

6 (a) The visible light spectrum has a range of frequencies.

Figure 8 shows that the frequency increases from red light to violet light.

Figure 8



Use the correct answers from the box to complete the sentence.

decreases	**stays the same**	**increases**

[2 marks]

As the frequency of the light waves increases, the wavelength

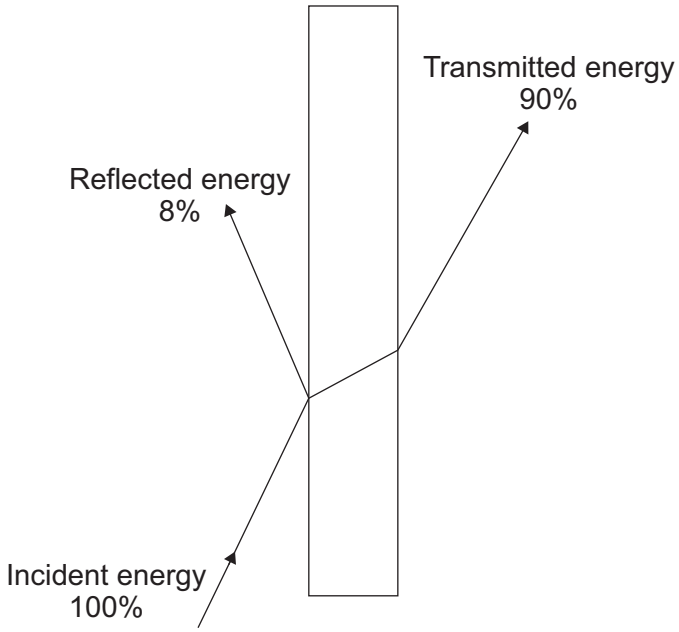
of the light waves ..... and

the energy of the light waves ..... .

Do not write outside the box

6 (b) **Figure 9** shows what happens to the light energy when a ray of light hits a glass block.

Figure 9



98% of the incident energy is either reflected or transmitted by the glass block.

What happens to the other 2% of the incident energy?

[1 mark]

.....

.....

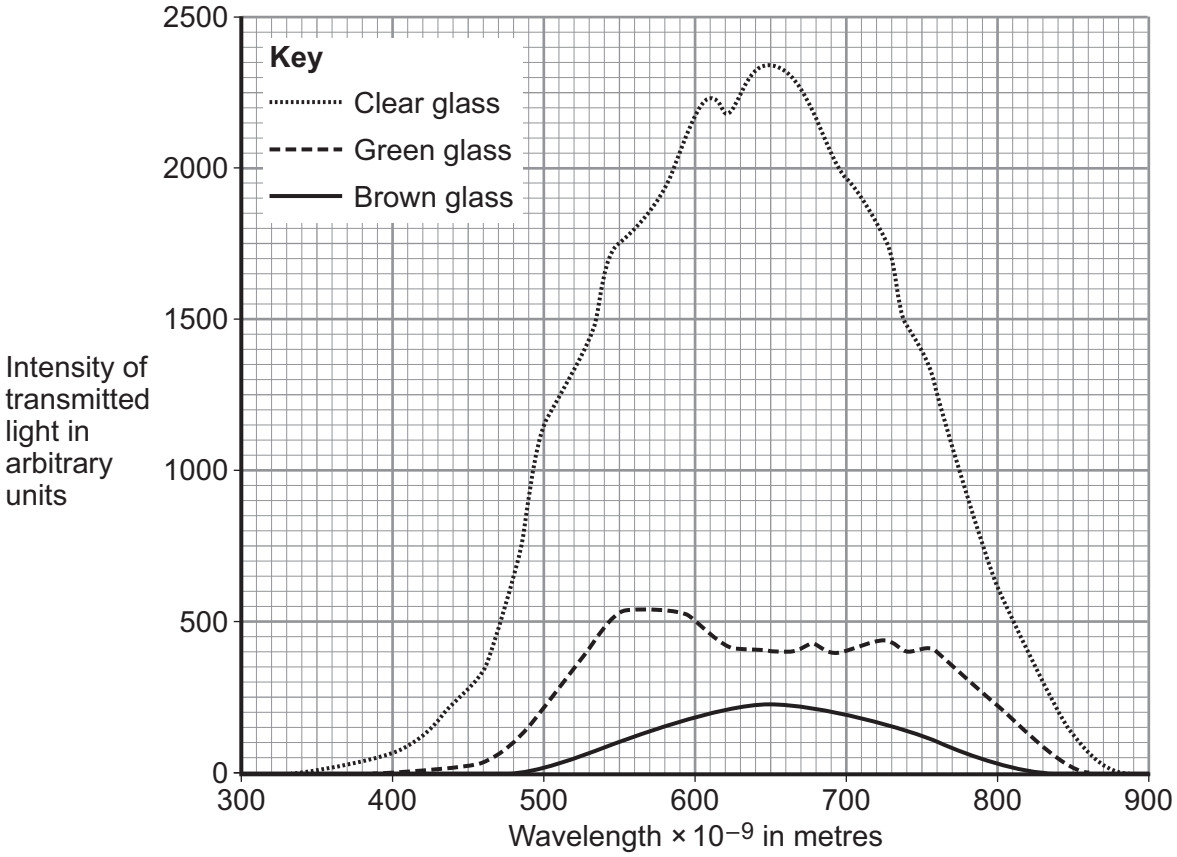
Question 6 continues on the next page

Do not write outside the box

6 (c) Bottled beer will spoil if the intensity of the light passing through the glass bottle into the beer is too high.

Figure 10 shows the intensity of the light that is transmitted through three different pieces of glass.

Figure 10



6 (c) (i) The pieces of glass all had the same thickness.

Suggest why.

[1 mark]

.....

.....

6 (c) (ii) Bottles made of brown glass are suitable for storing beer.

Suggest why.

[1 mark]

.....

.....

5

Do not write outside the box

7 Electricity can be generated using various energy sources.

7 (a) Give **one** advantage and **one** disadvantage of using nuclear power stations rather than gas-fired power stations to generate electricity.

[2 marks]

Advantage .....

.....

Disadvantage .....

.....

7 (b) (i) A single wind turbine has a maximum power output of 2 000 000 W.

The wind turbine operated continuously at maximum power for 6 hours.

Calculate the energy output in kilowatt-hours of the wind turbine.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Energy output = ... kWh

7 (b) (ii) Why, on average, do wind turbines operate at maximum power output for only 30% of the time?

[1 mark]

.....

.....

7 (c) An on-shore wind farm is made up of many individual wind turbines.

They are connected to the National Grid using underground power cables.

Give **one** advantage of using underground power cables rather than overhead power cables.

[1 mark]

.....

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6

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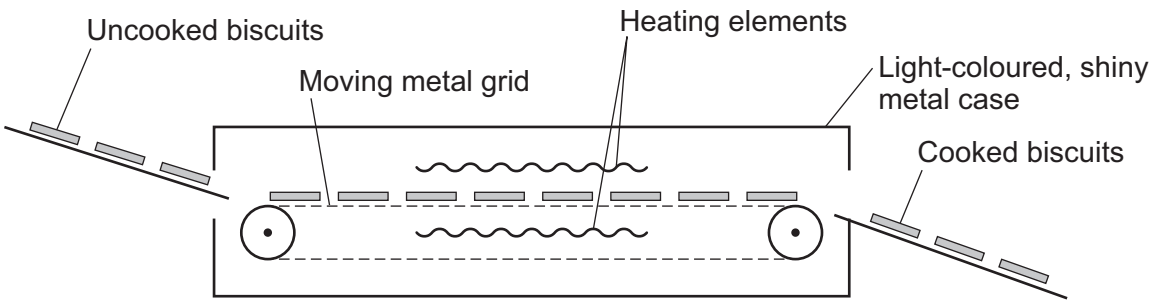
8 **Figure 11** shows one way that biscuit manufacturers cook large quantities of biscuits.

The uncooked biscuits are placed on a moving metal grid.

The biscuits pass between two hot electrical heating elements inside an oven.

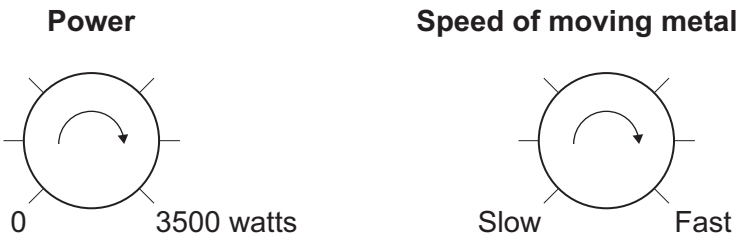
The biscuits turn brown as they cook.

Figure 11



The oven has two control knobs, as shown in **Figure 12**.

Figure 12



8 (a) Which type of electromagnetic radiation makes the biscuits turn brown?

[1 mark]

.....

8 (b) Suggest **two** ways of cooking the biscuits in this oven, to make them turn browner.

[2 marks]

1 .....

.....

2 .....

.....

Do not write outside the box

8 (c) The inside and outside surfaces of the oven are light-coloured and shiny.

Explain why.

[3 marks]

.....

.....

.....

.....

.....

.....

6

Turn over for the next question

Do not write outside the box

9 **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

The information in the box is about the properties of solids and gases.

Solids:
- have a fixed shape
- are difficult to compress (to squash).

Gases:
- will spread and fill the entire container
- are easy to compress (to squash).

Use your knowledge of kinetic theory to explain the information given in the box.

You should consider:
- the spacing between the particles
- the movement of individual particles
- the forces between the particles.

[6 marks]

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6

END OF QUESTIONS

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GCSE

SCIENCE A / PHYSICS

PH1FP

Mark scheme

4405/4403
June 2014

Version: 1.0 Final

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

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.

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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 Assessment Objectives and specification content that each question is intended to cover.

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 bullet points 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 / ; e.g. 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	green, 5	0
2	red*, 5	1
3	red*, 8	0

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

Candidate	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, 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, 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 or by each stage of a longer calculation.

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 Ignore / Insufficient / Do <u>not</u> allow

Ignore or insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

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Quality of Written Communication and levels marking

In Question 9 candidates 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.

Candidates 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.

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Question	Answers	Extra information	Mark	AO spec ref
1(a)(i)	electrical kinetic sound	correct order only	1 1 1	AO1 1.2
1(a)(ii)	transferred into surroundings / atmosphere	accept warms the surroundings allow released into the environment becomes heat or sound is insufficient	1	AO1 1.2.1c
1(b)	0.7 / 70 %	an answer of 70 without % or with the wrong unit **or** 0.7 with a unit gains **1** mark	2	AO2 1.2.1d
Total			**6**	

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Question	Answers	Extra information	Mark	AO spec ref
2(a)(i)	A		1	AO2 1.5.3b
2(a)(ii)	B		1	AO2 1.5.3b
2(b)	340 metres/second	 allow **1** mark for correct substitution ie 850 × 0.4 provided no subsequent step shown accept m/s	2 1	AO1 AO2 1.5.1j
2(c)	higher than shorter than		1 1	AO1 1.5.4a
Total			**7**	

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Question	Answers	Extra information	Mark	AO spec ref
3(a)	solid		1	AO1 1.1.3a
3(b)	decreased decreased increased	correct order only	1 1 1	AO1 1.1.3a
3(c)(i)	A uses least / less energy (in 1 year)	reason only scores if A chosen a comparison is required accept uses least power accept uses least kWh	1 1	AO2 AO3 1.3.1b
3(c)(ii)	greater the volume the greater the energy it uses (in 1 year)		1	AO3 1.1.3
3(c)(iii)	a very small number sampled	accept only tested 3 accept insufficient evidence / data allow not all fridges have the same efficiency **or** a correct description implying different efficiencies only tested each fridge once is insufficient there are lots of different makes is insufficient	1	AO3 1.1.3
Total			**8**	

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Question	Answers	Extra information	Mark	AO spec ref
4(a)(i)	<u>water</u> heated <u>generator</u>	 accept boiled or turned to steam do **not** accept evaporated 	1 1 1	AO1 1.4.1d
4(a)(ii)	geothermal power stations provide a reliable source of electricity		1	AO1 1.4.1d
4(b)	falling water		1	AO1 1.4.1b
Total			**5**	

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Question	Answers	Extra information	Mark	AO spec ref
5(a)(i)	any **two** from: • mass (of block) • starting temperature • final / increase in temperature • voltage / p.d. • power (supplied to each block) • type / thickness of insulation	accept weight for mass temperature is insufficient same power supply insufficient same insulation insufficient	2	AO2 4.3.2a
5(a)(ii)	one of variables is categoric **or** (type of) material is categoric	accept the data is categoric accept a description of categoric do **not** accept temp rise is categoric	1	AO3 4.4.2c
5(a)(iii)	concrete (heater on for) longest / longer time	reason only scores if concrete chosen a long time or quoting a time is insufficient do **not** accept it is the highest bar	1 1	AO2 AO3 1.3.1c
5(a)(iv)	4500 (J)	allow **1** mark for correct substitution ie 2 × 450 × 5 provided no subsequent step shown	2	AO2 1.1.4d

Question 5 continues on the next page . . .

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Question 5 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
5(b)(i)	point at 10 minutes identified		1	AO3 1.1.4
5(b)(ii)	line through all points except anomalous	line must go from at least first to last point	1	AO2 1.1.4
5(b)(iii)	20 (°C)	if 20^0C is given, award the mark. If an answer other than 20^0C is given, look at the graph. If the graph shows a correct extrapolation of the candidate's best-fit line and the intercept value has been correctly stated, allow 1 mark.	1	AO3 1.1.4
5(b)(iv)	2 (minutes)		1	AO3 1.1.4
Total			**11**	

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Question	Answers	Extra information	Mark	AO spec ref
6(a)	decreases increases	correct order only	1 1	AO1 1.5.1e
6(b)	absorbed	makes the glass warmer is insufficient (energy) is wasted is insufficient	1	AO3 1.5.1
6(c)(i)	intensity (of transmitted light) depends on thickness **or** to enable a valid comparison **or** it is a control variable	accept absorption depends on thickness it would affect the results is insufficient fair test is insufficient	1	AO3 1.5.1
6(c)(ii)	transmits the least light **or** absorbs the most light	accept very little light is transmitted do **not** accept transmits none of the light do **not** accept absorbs all of the light any reference to heat negates this mark	1	AO3 1.5.1
Total			**5**	

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Question	Answers	Extra information	Mark	AO spec ref
7(a)	advantage any **one** from: • produce no / little greenhouse gases / carbon dioxide	allow produces no / little polluting gases allow doesn't contribute to global warming / climate change allow produce no acid rain / sulphur dioxide reference to atmospheric pollution is insufficient produce no harmful gases is insufficient	1	AO1 1.4.1a
	• high(er) energy density in fuel	accept one nuclear power station produces as much power as several gas power stations nuclear power stations can supply a lot of or more energy is insufficient		
	• long(er) operating life	allow saves using reserves of fossil fuels or gas		
	disadvantage any **one** from: • produce (long term) radioactive waste	accept waste is toxic accept nuclear for radioactive	1	
	• accidents at nuclear power stations may have far reaching or long term consequences			
	• high(er) decommissioning costs	accept high(er) building costs		
	• long(er) start up time			

Question 7 continues on the next page . . .

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Question 7 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
7(b)(i)	12 000 (kWh)	allow **1** mark for correct substitution eg 2000 × 6 **or** 2 000 000 × 6 **or** $\frac{12\,000\,000}{1000}$ an answer of 12 000 000 scores **1** mark	2	AO2 1.3.1c
7(b)(ii)	any idea of unreliability, eg • wind is unreliable • shut down if wind too strong/weak • wind is variable	reference to weather alone is insufficient	1	AO1 1.4
7(c)	any **one** from: • cannot be seen • no hazard to (low flying) aircraft / helicopters • unlikely to be or not damaged / affected by (severe) weather • (normally) no / reduced shock hazard	unlikely to be damaged is insufficient safer is insufficient less maintenance is insufficient installed in urban areas is insufficient	1	AO1 1.4
Total			**6**	

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Question	Answers	Extra information	Mark	AO spec ref
8(a)	infrared / IR	correct answer only	1	AO1 1.1.1a
8(b)	any **two** from: • increase the power / watts • decrease the speed • put biscuits through again	 allow increase the temperature of the oven or make the oven hotter allow leave the biscuits in for longer increase radiation is insufficient ignore changes to the design of the oven	2	AO2 1.3.1c
8(c)	(inside) surface is a (good) reflector or poor absorber (of IR) (and) <u>outside</u> surface is poor emitter (of IR) (so) increases the energy reaching the biscuits	Ignore bounce for reflect surface is a (good) reflector of light does not score surface is a (good) reflector of light and infrared / heat does score allow reduces energy loss or makes oven more efficient do **not** accept no energy losses keeps oven hotter is insufficient	1 1 1	AO1 1.1.1c, d
Total			**6**	

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Question	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.	Mark	AO spec ref
9		6	AO1 1.1.2a

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant content.	Considers either solid or gas and describes at least one aspect of the particles. **or** Considers both solids and gases and describes an aspect of each.	Considers both solids and gases and describes aspects of the particles. **or** Considers one state and describes aspects of the particles and explains at least one of the properties. **or** Considers both states and describes an aspect of the particles for both and explains a property for solids or gases.	Considers both states of matter and describes the spacing and movement / forces between the particles. Explains a property of both solids and gases.

examples of the points made in the response	extra information
Solids • (particles) close together • (so) no room for particles to move closer (so hard to compress) • vibrate about fixed point • strong forces of attraction (at a distance) • the forces become repulsive if the particles get closer • particles strongly held together/not free to move around (shape is fixed) **Gases** • (particles) far apart • space between particles (so easy to compress) • move randomly • negligible/no forces of attraction • spread out in all directions (to fill the container)	any explanation of a property must match with the given aspect(s) of the particles.

Total		6

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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	
9	
TOTAL	

General Certificate of Secondary Education
Foundation Tier
June 2013

Science A
Unit Physics P1

PH1FP

F

Physics
Unit Physics P1

Thursday 13 June 2013 9.00 am to 10.00 am

For this paper you must have:
- a ruler
- a calculator
- the Physics Equations Sheet (enclosed).

Time allowed
- 1 hour

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 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 9(a) should be answered in continuous prose. In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

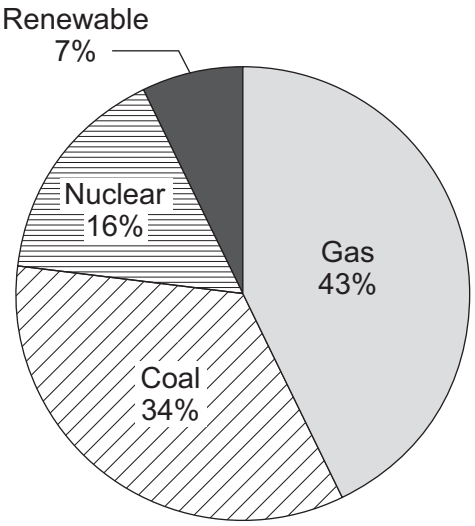
Advice
- In all calculations, show clearly how you work out your answer.

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Do not write outside the box

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

1 (a) The pie chart shows the proportions of electricity generated in the UK from different energy sources in 2010.



1 (a) (i) Calculate the percentage of electricity generated using fossil fuels.

.....

Percentage = ... %

(1 mark)

1 (a) (ii) The pie chart shows that 7% of electricity was generated using renewable energy sources.

Which **one** of the following is **not** a renewable energy source?

Tick (✓) **one** box.

Oil ☐

Solar ☐

Wind ☐

(1 mark)

Do not write outside the box

1 (b) Complete the following sentence.

In some types of power station, fossil fuels are burned to heat ..... to produce steam.

(1 mark)

1 (c) Burning fossil fuels releases carbon dioxide into the atmosphere.

Why do many scientists think adding carbon dioxide to the atmosphere is harmful to the environment?

Tick (✓) **one** box.

Carbon dioxide is the main cause of acid rain. ☐

Carbon dioxide causes global warming. ☐

Carbon dioxide causes visual pollution. ☐

(1 mark)

4

Turn over for the next question

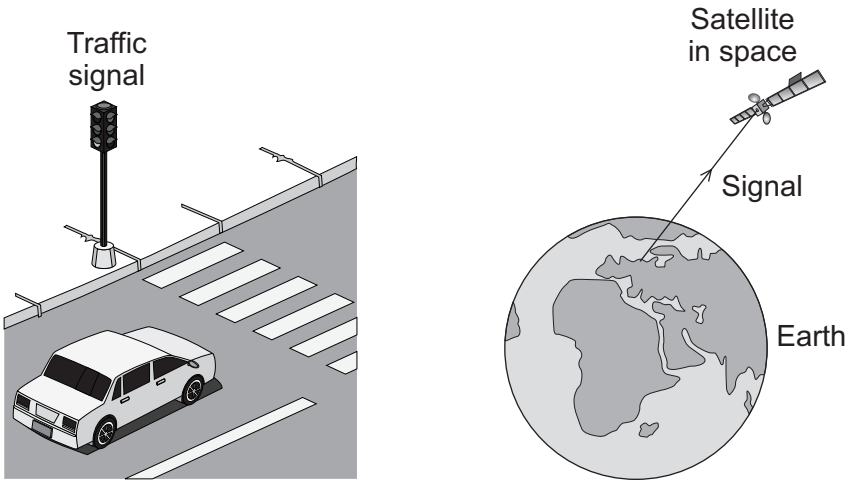
Do not write outside the box

2 **Diagram 1** shows four of the seven types of wave in the electromagnetic spectrum.

Diagram 1

J	**K**	**L**	Visible light	Infrared	Microwaves	Radio waves

2 (a) The **four** types of electromagnetic wave named in **Diagram 1** above are used for communication.



2 (a) (i) Which type of electromagnetic wave is used when a traffic signal communicates with a car driver?

.....

(1 mark)

2 (a) (ii) Which type of electromagnetic wave is used to communicate with a satellite in space?

.....

(1 mark)

2 (b) Gamma rays are part of the electromagnetic spectrum.

Which letter, **J**, **K** or **L**, shows the position of gamma rays in the electromagnetic spectrum?

Draw a ring around the correct answer.

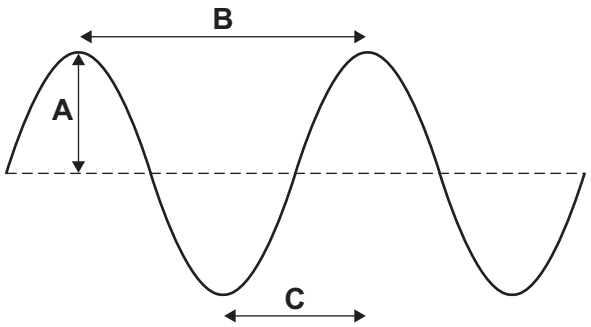
J **K** **L**

(1 mark)

Do not write outside the box

2 (c) **Diagram 2** shows an infrared wave.

Diagram 2



2 (c) (i) Which **one** of the arrows, labelled **A**, **B** or **C**, shows the wavelength of the wave?

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

(1 mark)

2 (c) (ii) Draw a ring around the correct answer to complete the sentence.

The wavelength of infrared waves is [shorter than / the same as / longer than] the wavelength of radio waves.

(1 mark)

Question 2 continues on the next page

Do not write outside the box

2 (d) Mobile phone networks send signals using microwaves. Some people think the energy a person's head absorbs when using a mobile phone may be harmful to health.

2 (d) (i) Scientists have compared the health of people who use mobile phones with the health of people who do not use mobile phones.

Which **one** of the following statements gives a reason why scientists have done this?

Tick (✓) **one** box.

To find out if using a mobile phone is harmful to health. ☐

To find out if mobile phones give out radiation. ☐

To find out why some people are healthy. ☐

(1 mark)

2 (d) (ii) The table gives the specific absorption rate (SAR) value for two different mobile phones.

The SAR value is a measure of the maximum energy a person's head absorbs when a mobile phone is used.

Mobile Phone	SAR value in W/kg
X	0.28
Y	1.35

A parent buys mobile phone **X** for her daughter.

Using the information in the table, suggest why buying mobile phone **X** was the best choice.

.....

.....

.....

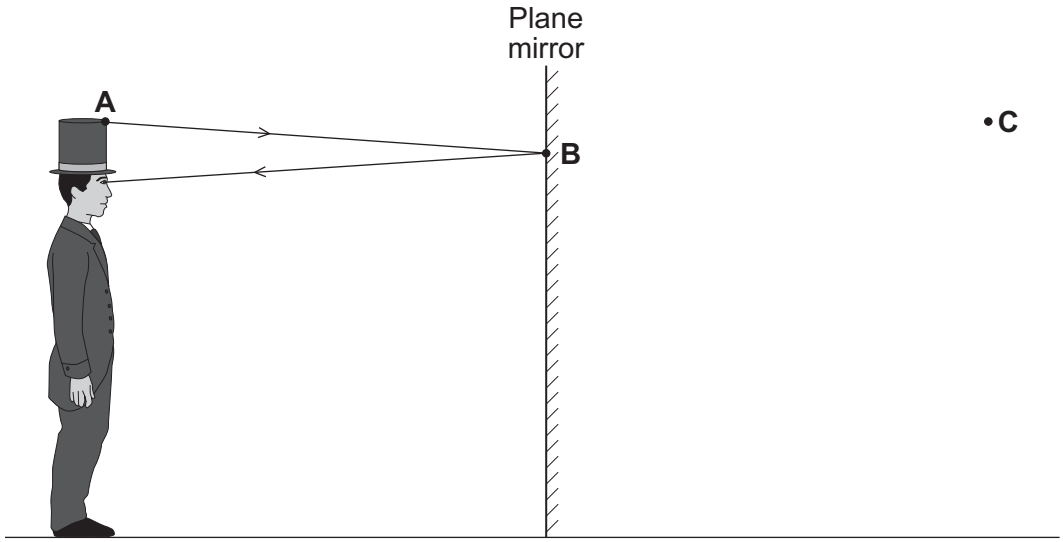
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(2 marks)

8

Do not write outside the box

3 A person can see an image of himself in a tall plane mirror.



The diagram shows how the person can see his hat.

3 (a) Which point, **A**, **B** or **C**, shows the position of the image of his hat?

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

(1 mark)

3 (b) On the diagram, use a ruler to draw a light ray to show how the person can see his shoe.

(3 marks)

3 (c) Which **one** of the words in the box is used to describe the image formed by a plane mirror?

Draw a ring around the correct answer.

imaginary	**real**	**virtual**

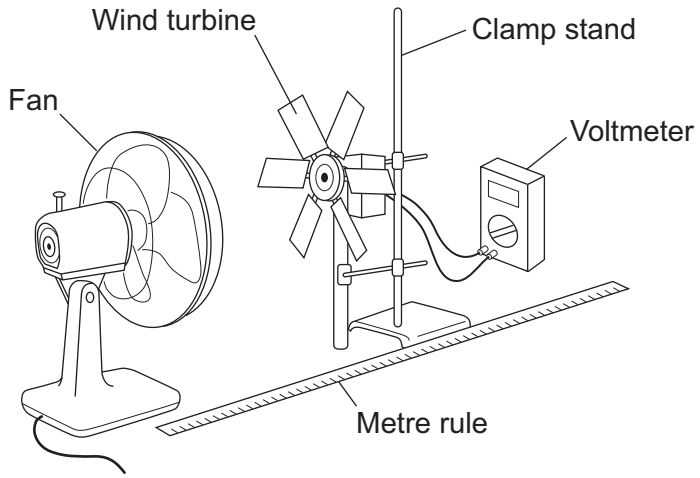
(1 mark)

5

Do not write outside the box

4 (a) A student investigated how the number of blades on a wind turbine affects the output voltage of the turbine.

The student used the apparatus shown in the diagram.



The fan was used to turn the wind turbine.

4 (a) (i) The fan was always the same distance from the wind turbine.

Why?

.....

.....

(1 mark)

4 (a) (ii) After switching the fan on, the student waited 20 seconds before taking the voltmeter reading.

Suggest why.

.....

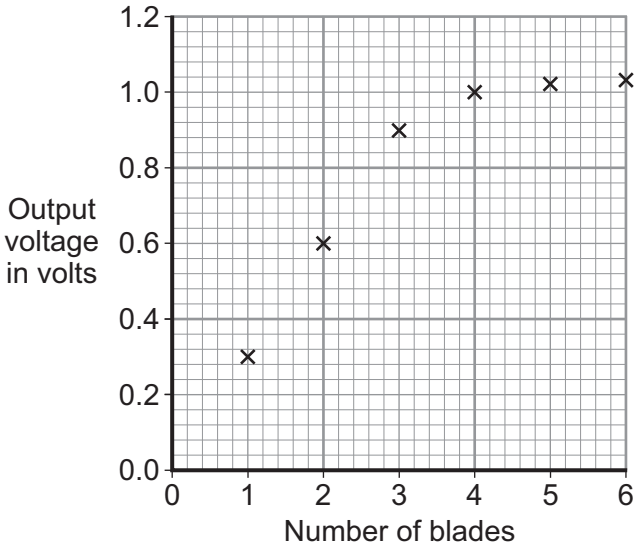
.....

(1 mark)

Do not write outside the box

4 (a) (iii) The student changed the number of blades on the wind turbine.

The student's results are shown in the scatter graph.



What conclusion can be made from the results in the scatter graph?

.....

.....

.....

.....

(2 marks)

Question 4 continues on the next page

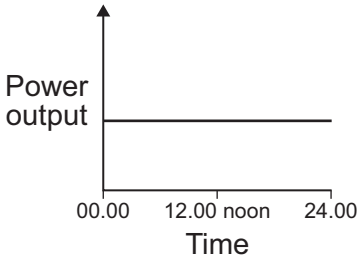
Turn over ▶

Do not write outside the box

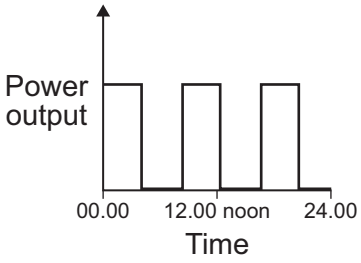
4 (b) The amount of electricity generated using wind turbines is increasing.

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

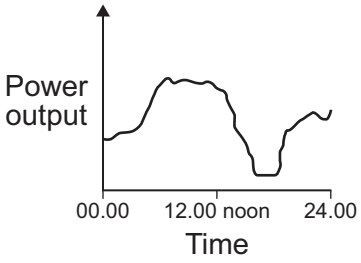
Graph **A**



Graph **B**



Graph **C**



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

Give a reason for your answer.

.....

.....

.....

(2 marks)

6

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

5 (a) A lorry has an air horn. The air horn produces sound waves in the air.

5 (a) (i) Use **one** word to complete the following sentence.

Sound waves cause air particles to ..... .

(1 mark)

5 (a) (ii) The air horn produces sound waves at a constant frequency of 420 Hz.
The wavelength of the sound waves is 0.80 m.

Calculate the speed of the sound waves.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Speed = ... m/s

(2 marks)

5 (b) A person standing at the side of the road, as the lorry goes past, hears the sound from the air horn change pitch.

5 (b) (i) What determines the pitch of a sound?

Draw a ring around the correct answer.

amplitude **frequency** **loudness**

(1 mark)

5 (b) (ii) As the lorry moves away from the person, the air horn continues to produce sound waves with a wavelength of 0.80 m.

What is the wavelength of the sound waves the person heard?

Draw a ring around the correct answer.

shorter than 0.8 m **equal to 0.8 m** **longer than 0.8 m**

(1 mark)

Do not write outside the box

5 (b) (iii) The sound waves the person heard from the moving air horn are different to the sound waves the air horn produced.

What name is given to this effect?

Draw a ring around the correct answer.

diffraction **Doppler** **refraction**

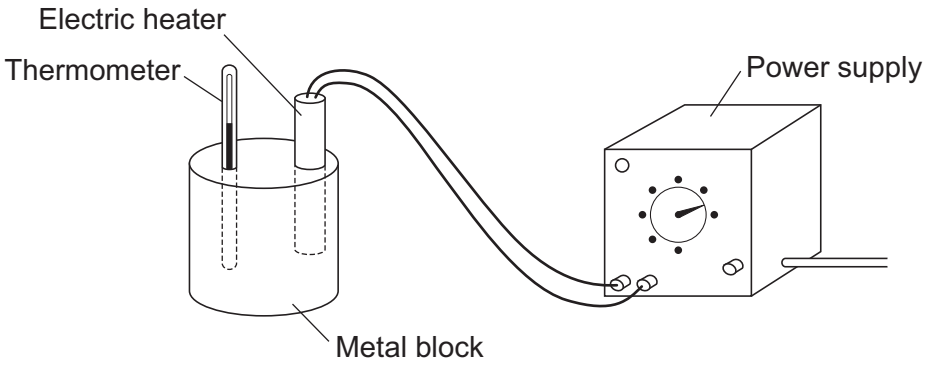
(1 mark)

6

Turn over for the next question

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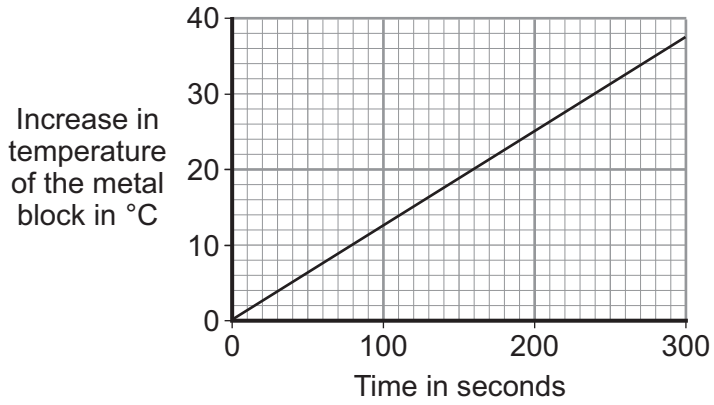
6 (a) A student used the apparatus drawn below to investigate the heating effect of an electric heater.



6 (a) (i) Before starting the experiment, the student drew **Graph A**.

Graph A shows how the student expected the temperature of the metal block to change after the heater was switched on.

Graph A



Describe the pattern shown in **Graph A**.

.....

.....

.....

.....

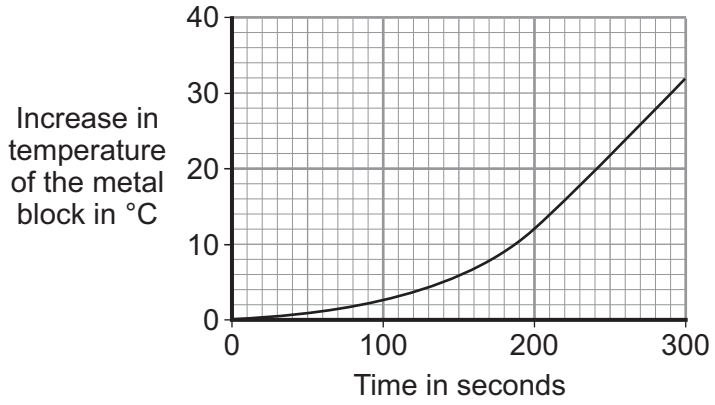
(2 marks)

Do not write outside the box

6 (a) (ii) The student measured the room temperature. He then switched the heater on and measured the temperature of the metal block every 50 seconds.

The student calculated the increase in temperature of the metal block and plotted **Graph B**.

Graph B



After 300 seconds, **Graph B** shows the increase in temperature of the metal block is lower than the increase in temperature expected from **Graph A**.

Suggest **one** reason why.

.....

.....

(1 mark)

6 (a) (iii) The power of the electric heater is 50 watts.

Calculate the energy transferred to the heater from the electricity supply in 300 seconds.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Energy transferred = ... J

(2 marks)

Question 6 continues on the next page

Do not write outside the box

6 (b) The student uses the same heater to heat blocks of different metals. Each time the heater is switched on for 300 seconds.

Each block of metal has the same mass but a different specific heat capacity.

Metal	Specific heat capacity in J/kg°C
Aluminium	900
Iron	450
Lead	130

Which **one** of the metals will heat up the most?

Draw a ring around the correct answer.

aluminium **iron** **lead**

Give, in terms of the amount of energy needed to heat the metal blocks, a reason for your answer.

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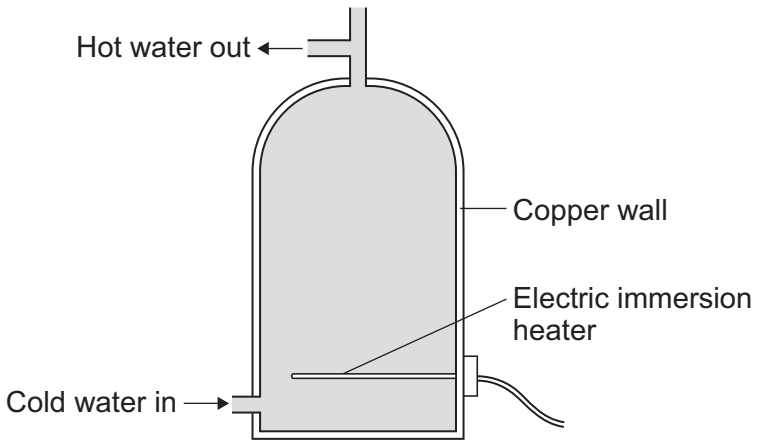
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(2 marks)

6 (c) A homeowner uses an electric immersion heater to heat the water in his hot water tank. The hot water tank has no insulation.



Do not write outside the box

6 (c) (i) Draw a ring around the correct answer to complete each sentence.

Energy is transferred through the water by

conduction.
convection.
evaporation.

Energy is transferred through the copper wall of the hot water tank by

conduction.
convection.
evaporation.

(2 marks)

6 (c) (ii) To keep the water in the tank hot for longer, the homeowner fits an insulating jacket around the tank. The insulating jacket costs £12 to buy.

The homeowner expects to save £16 each year from reduced energy bills.

Calculate the pay-back time for the insulating jacket.

.....

.....

Pay-back time = ... years

(2 marks)

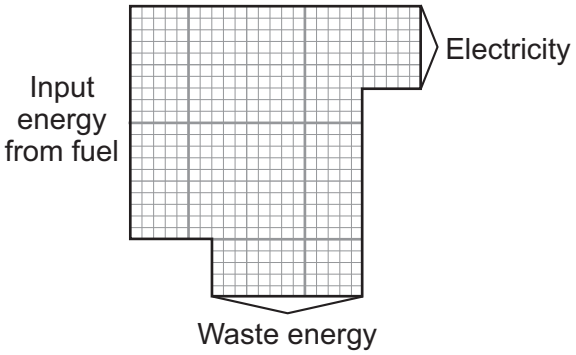
11

Turn over for the next question

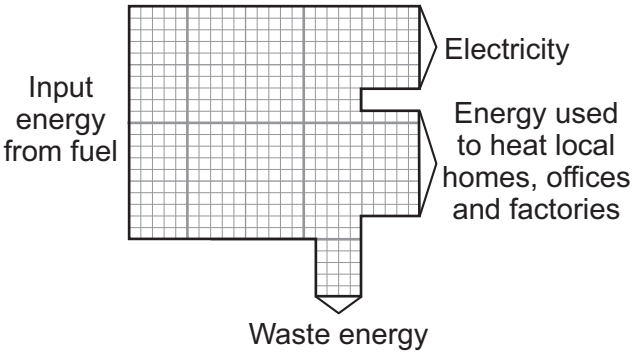
Do not write outside the box

7 The Sankey diagrams show the energy transfers in a traditional coal-burning power station and a combined heat and power (CHP) station.

Traditional coal-burning power station



CHP station



7 (a) What effect does the waste energy from a power station have on the surroundings?

.....

.....

(1 mark)

7 (b) Calculate the efficiency of the CHP station.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Efficiency = ...

(2 marks)

Do not write outside the box

7 (c) Why is a CHP station more efficient than a traditional coal-burning power station?

.....

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.....

.....

(2 marks)

7 (d) A CHP station is usually used to meet the demand for electricity within the local area. The electricity is not transmitted and distributed through the National Grid.

7 (d) (i) What is the National Grid?

Tick (✓) **one** box.

A system of cables and pylons. ☐

A system of cables and transformers. ☐

A system of cables, transformers and power stations. ☐

(1 mark)

7 (d) (ii) Using the electricity locally and not transmitting it through the National Grid increases the overall efficiency of a CHP station by 7%.

Give **one** reason why.

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.....

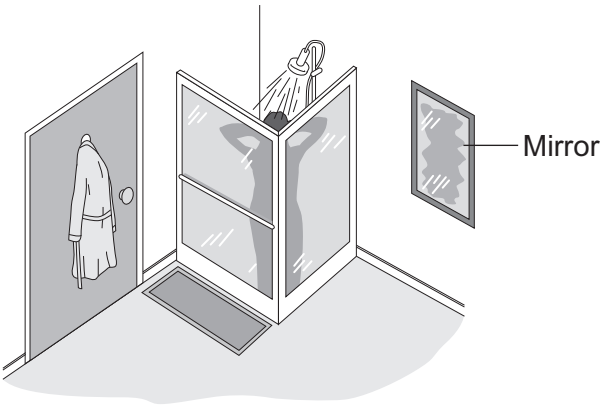
(1 mark)

7

Turn over for the next question

Do not write outside the box

8 The picture shows a person taking a hot shower.



8 (a) When a person uses the shower the mirror gets misty.

Why?

.....

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(3 marks)

Do not write outside the box

8 (b) The homeowner installs an electrically heated mirror into the shower room.

When a person has a shower, the heated mirror does **not** become misty but stays clear.

Why does the mirror stay clear?

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(2 marks)

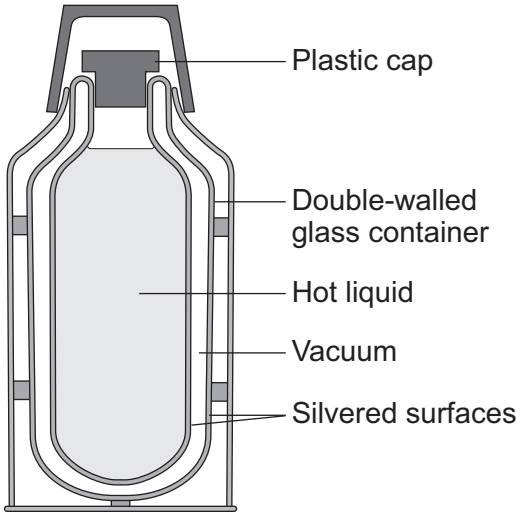
5

Turn over for the next question

Do not write outside the box

9 (a) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The diagram shows the structure of a vacuum flask.



A vacuum flask is designed to reduce the rate of energy transfer by heating processes.

Describe how the design of a vacuum flask keeps the liquid inside hot.

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Do not write outside the box

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(6 marks)

9 (b) Arctic foxes live in a very cold environment.



Arctic foxes have small ears.

How does the size of the ears help to keep the fox warm in a cold environment?

.....

.....

.....

.....

.....

(2 marks)

8

END OF QUESTIONS

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There are no questions printed on this page

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Version 1.0



General Certificate of Secondary Education
June 2013

Science A / Physics PH1FP

(Specification 4405 / 4403)

Unit: Physics 1

Final

Mark Scheme

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 events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process 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 standardisation each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised 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 from: aqa.org.uk

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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 bullet points 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 / ; e.g. 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	green, 5	0
2	red*, 5	1
3	red*, 8	0

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

Candidate	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, 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, 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 or by each stage of a longer calculation.

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 Ignore / Insufficient / Do <u>not</u> allow

Ignore or insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

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Quality of Written Communication and levels marking

In Question 9(a) candidates 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.

Candidates 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.

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Question 1

question	answers	extra information	mark
1(a)(i)	77		1
1(a)(ii)	Oil		1
1(b)	water	accept H_2O	1
1(c)	Carbon dioxide causes global warming		1
Total			**4**

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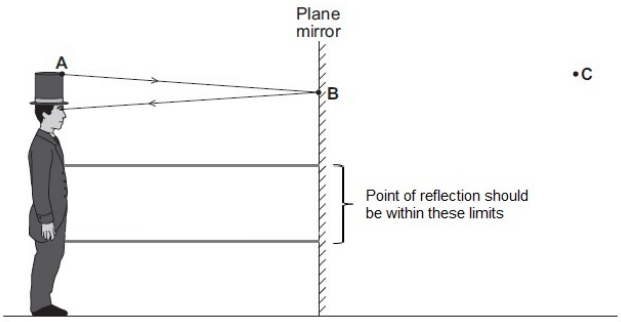
Question 2

question	answers	extra information	mark
2(a)(i)	(visible) light	accept visible	1
2(a)(ii)	microwaves		1
2(b)	J		1
2(c)(i)	B		1
2(c)(ii)	shorter than		1
2(d)(i)	To find out if using a mobile phone is harmful to health		1
2(d)(ii)	any **two** from: • (X has a) low(er) SAR value • (maximum) energy absorbed (by the head) is less • (if mobiles are harmful) less likely to cause harm	"it" refers to mobile phone accept has a low(er) rate accept energy emitted (by phone) is less accept radiation for energy accept will not cause harm accept it is safer	2
Total			**8**

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Question 3

question	answers	extra information	mark
3(a)	C		1
3(b)	reflection at the mirror of ray from shoe to person's eye	may be drawn freehand	1
	angle of incidence = angle of reflection	judged by eye a ruler must have been used	1
	arrow to show correct direction on either incident or reflected ray	only one arrow needed but if more drawn must be no contradiction both incident and reflected ray must be shown	1
			
3(c)	virtual		1
Total			**5**

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Question 4

question	answers	extra information	mark
4(a)(i)	changing the distance may / will affect / change the voltmeter reading	accept so only one independent variable accept distance affects speed of wind (turbine) accept it is a control variable accept to give valid results fair test is insufficient to make the results accurate is insufficient	1
4(a)(ii)	any sensible practical suggestions, eg • so fan reaches a steady / full speed • so wind (turbine) reaches a steady / full speed • so voltmeter reaches / gives a steady reading	accept power for speed accept accurate or valid reading a correct reading is insufficient do **not** accept precise reading	1
4(a)(iii)	as the number of blades increases so does the (voltmeter) reading / output / voltage further relevant detail, eg • voltmeter increase is greatest up to 3 blades • voltmeter reading hardly changes with 4, 5 or 6 blades • increase is directly proportional up to 3 blades • it reaches a limit • a numerical example giving two pairs of numbers, eg 2 blades = 0.6V, 4 blades = 1V	number of blades affects the reading / output is insufficient accept does not change between 4 and 6 blades accept does not change after 4 / 5 blades	1 1
4(b)	C wind speed / strength varies	reason scores only if C is chosen accept wind is **not** constant / reliable	1 1
Total			**6**

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Question 5

question	answers	extra information	mark
5(a)(i)	vibrate / oscillate	accept a correct description move is insufficient	1
5(a)(ii)	336	allow **1** mark for correct substitution, ie 420 × 0.8(0) provided no subsequent step shown	2
5(b)(i)	frequency		1
5(b)(ii)	longer than 0.8 m		1
5(b)(iii)	Doppler		1
Total			**6**

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Question 6

question	answers	extra information	mark
6(a)(i)	temperature (increase) and time switched on are <u>directly proportional</u>	accept the idea of equal increases in time giving equal increases in temperature answers such as: • as time increases, temperature increases • positive correlation • linear relationship • temperature and time are proportional score **1** mark	2
6(a)(ii)	any **one** from: • energy transfer (from the block) to the surroundings • (some) energy used to warm the heater / thermometer (itself) • (metal) block is not insulated	"it" refers to the metal block accept lost for transfer accept air for surroundings accept takes time for heater to warm up	1
6(a)(iii)	15 000	allow **1** mark for correct substitution, ie 50 × 300 provided no subsequent step shown	2
6(b)	lead needs least energy to raise temperature by 1°C	reason only scores if lead is chosen accept needs less energy to heat it (by the same amount) lowest specific heat capacity is insufficient	1 1

Question 6 continues on the next page . . .

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Question 6 continued . . .

question	answers	extra information	mark
6(c)(i)	convection conduction	correct order only	1 1
6(c)(ii)	¾ (year) **or** 0.75 **or** 9 months **or** 274 days	allow **1** mark for correct method, ie $\frac{12}{16}$ shown	2
Total			**11**

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Question 7

question	answers	extra information	mark
7(a)	warms it	do **not** accept answers in terms of waste gases **or** pollution	1
7(b)	80% **or** 0.8	answers of 80 **or** 0.8 plus a unit gain **1** mark **only** **or** allow **1** mark for a correct substitution, ie $\frac{16}{20}$ an answer of 35% **or** 0.35 gains **1** mark answers of 85%, 75%, 0.85 **or** 0.75 gain **1** mark	2
7(c)	some of the energy that would be wasted (by a coal-burning power station) is usefully used (to heat homes etc)	accept less waste energy accept energy used to heat homes etc	1 1
7(d)(i)	A system of cables and transformers		1
7(d)(ii)	less energy / power loss / wasted (in shorter cables)	accept no energy / power loss / wasted (in shorter cables) accept energy is lost when transmitted through cables do **not** accept electricity for energy	1
Total			**7**

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Question 8

question	answers	extra information	mark
8(a)	any **two** from: • water evaporates • water molecules / particles go into the air • mirror (surface) is cooler than (damp) air • water molecules / particles that hit the mirror lose energy • cooler air cannot hold as many water molecules / particles	accept steam / water vapour for water molecules accept water turns to steam accept the mirror / surface / glass is cold accept water molecules / particles that hit the mirror cool down	2
	(causes) condensation (on the mirror) **or** particles move closer together	accept steam changes back to water (on the mirror)	1
8(b)	mirror (surface) is warm	mirror is heated is insufficient	1
	(rate of) condensation reduced	accept no condensation (happens)	1
Total			**5**

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Question 9

question	answers	extra information	mark
9(a)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5.		6

0 marks	**Level 1 (1–2 marks)**	**Level 2 (3–4 marks)**	**Level 3 (5–6 marks)**
No relevant content.	There is a basic explanation of **one** feature **or** a simple statement relating reduction in energy transfer to **one** feature.	There is a clear explanation of **one** feature **or** a simple statement relating reduction in energy transfer to **two** features.	There is a detailed explanation of at least **two** features **or** a simple statement relating reduction in energy transfer to all **four** features.

examples of the points made in response	**extra information**
plastic cap: • plastic is a poor conductor • stops convection currents forming at the top of the flask so stopping energy transfer by convection • molecules / particles evaporating from the (hot) liquid cannot move into the (surrounding) air so stops energy transfer by evaporation • plastic cap reduces / stops energy transfer by conduction / convection / evaporation glass container: • glass is a poor conductor so reducing energy transfer by conduction • glass reduces / stops energy transfer by conduction	accept throughout: heat for energy loss for transfer accept insulator for poor conductor

Question 9 continues on the next page . . .

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Question 9 continued . . .

question	answers	extra information	mark
	vacuum: • both conduction and convection require a medium / particles • so stops energy transfer between the two walls by conduction and convection • vacuum stops energy transfer by conduction / convection silvered surfaces: • silvered surfaces reflect infrared radiation • silvered surfaces are poor emitters of infrared radiation • infrared radiation (partly) reflected back (towards hot liquid) • silvered surfaces reduce / stop energy transfer by radiation	accept heat for infrared	
9(b)	(the ears have a) small <u>surface area</u>	ears are small is insufficient	1
	so reducing energy radiated / transferred (from the fox)	accept heat lost for energy radiated do **not** accept stops heat loss	1
Total			**8**

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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	
9	
TOTAL	

General Certificate of Secondary Education
Foundation Tier
January 2013

Science A
Unit Physics P1

PH1FP

F

Physics
Unit Physics P1

Thursday 17 January 2013 1.30 pm to 2.30 pm

For this paper you must have:
- a ruler
- a calculator
- the Physics Equations Sheet (enclosed).

Time allowed
- 1 hour

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 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 8(b) should be answered in continuous prose. In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

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 Three energy sources used to generate electricity are given in **List A**.
Statements about the energy sources used to generate electricity are given in **List B**.

Draw **one** line from each energy source in **List A** to the statement about the energy source in **List B**.

List A **Energy source**	**List B** **Statement about energy source**
Geothermal	Uses energy from falling water
Hydroelectric	Uses energy from inside the Earth
Nuclear	Is unpredictable
	Produces dangerous waste

(3 marks)

3

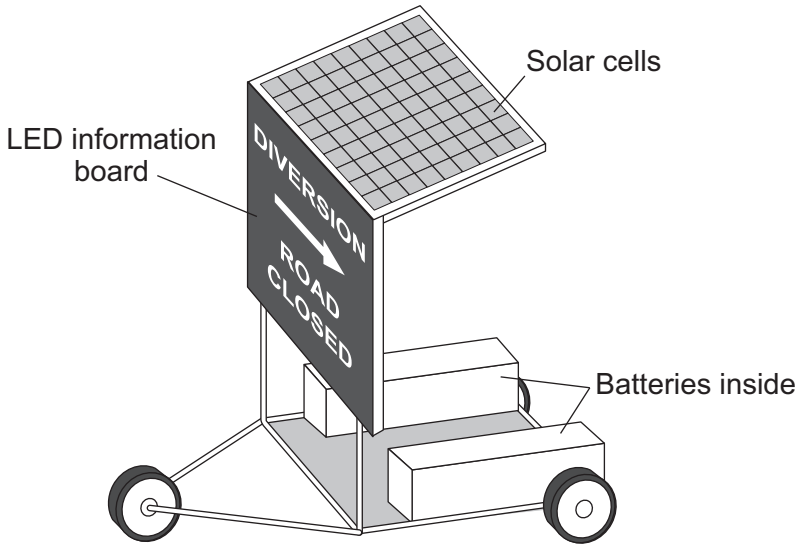
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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

Do not write outside the box

2 The picture shows a temporary road traffic information board.



The batteries power the LEDs used in the information board.
The solar cells keep the batteries charged.

2 (a) Use words from the box to complete each of the following sentences.

chemical	**electrical**	**light**	**sound**

The solar cells transfer light energy to ..... energy.

The batteries transfer ..... energy to electrical energy.

The LEDs transfer electrical energy to ..... energy.
(3 marks)

Do not write outside the box

2 (b) When the total energy input to the solar cells is 200 joules, the useful energy output from the solar cells to the batteries is 50 joules.

Calculate the efficiency of the solar cells.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Efficiency = ...

(2 marks)

2 (c) Which **one** of the following statements gives the reason for using solar cells to charge the batteries?

Tick (✓) **one** box.

Solar cells will charge the batteries day and night. ☐

The information board can be used anywhere it is needed. ☐

A small number of solar cells produce a lot of electricity. ☐

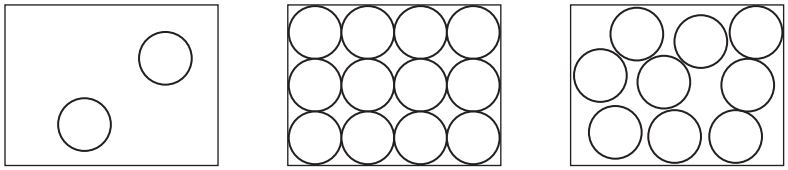
(1 mark)

6

Turn over for the next question

Do not write outside the box

3 (a) The diagrams, **X**, **Y** and **Z**, show how the particles are arranged in the three states of matter.



X **Y** **Z**

3 (a) (i) Which **one** of the diagrams, **X**, **Y** or **Z**, shows the arrangement of particles in a liquid?

Write the correct answer in the box. ☐

(1 mark)

3 (a) (ii) Which **one** of the diagrams, **X**, **Y** or **Z**, shows the arrangement of particles in a gas?

Write the correct answer in the box. ☐

(1 mark)

3 (b) Draw a ring around the correct answer in each box to complete each sentence.

3 (b) (i) In a gas, the particles are

vibrating in fixed positions.

moving randomly.

not moving.

(1 mark)

3 (b) (ii) In a solid, the forces between the particles are

stronger than

equal to

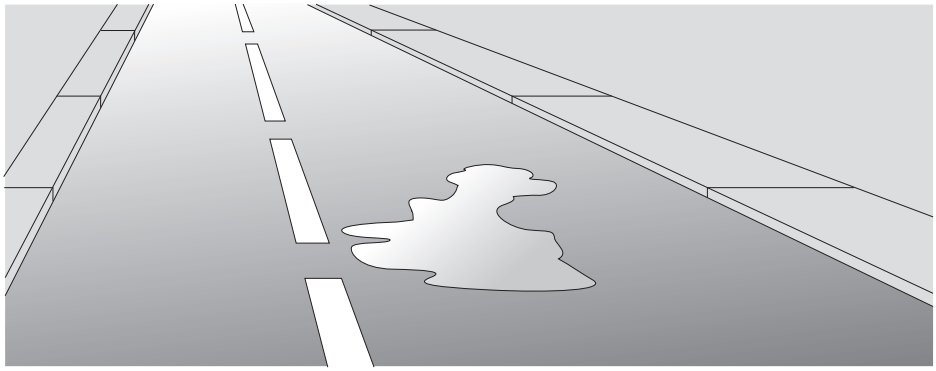
weaker than

the forces between the particles in a liquid.

(1 mark)

Do not write outside the box

3 (c) The picture shows a puddle of water in a road, after a rain shower.



3 (c) (i) During the day, the puddle of water dries up and disappears. This happens because the water particles move from the puddle into the air.

What process causes water particles to move from the puddle into the air?

Draw a ring around the correct answer.

condensation **evaporation** **radiation**

(1 mark)

3 (c) (ii) Describe **one** change in the weather which would cause the puddle of water to dry up faster.

.....

.....

(1 mark)

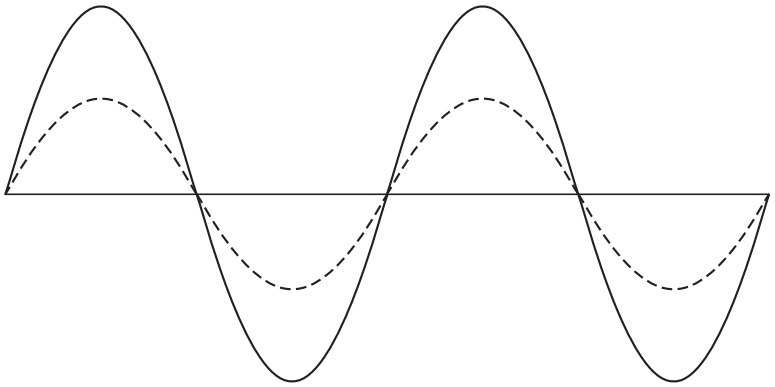
6

Turn over for the next question

Do not write outside the box

4 (a) **Diagram 1** shows two waves.

Diagram 1



4 (a) (i) Name **one** wave quantity that is the same for the two waves.

.....

(1 mark)

4 (a) (ii) Name **one** wave quantity that is different for the two waves.

.....

(1 mark)

4 (a) (iii) The waves in **Diagram 1** are transverse.

Which **one** of the following types of wave is **not** a transverse wave?

Draw a ring around the correct answer.

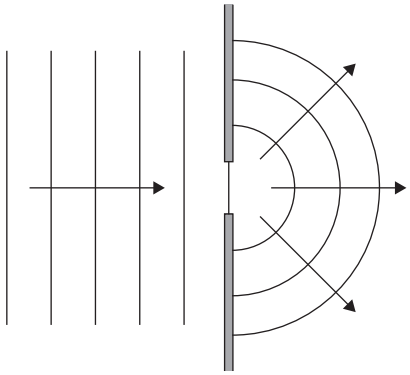
gamma rays **sound** **visible light**

(1 mark)

Do not write outside the box

4 (b) **Diagram 2** shows water waves in a ripple tank moving towards and passing through a gap in a barrier.

Diagram 2



4 (b) (i) The water waves spread out after passing through the gap in the barrier.

What name is given to the process causing the waves to spread out?

.....

(1 mark)

4 (b) (ii) Every second, 8 waves pass through the gap in the barrier. The waves have a wavelength of 0.015 metres.

Calculate the speed of the water waves and give the unit.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Speed = ...

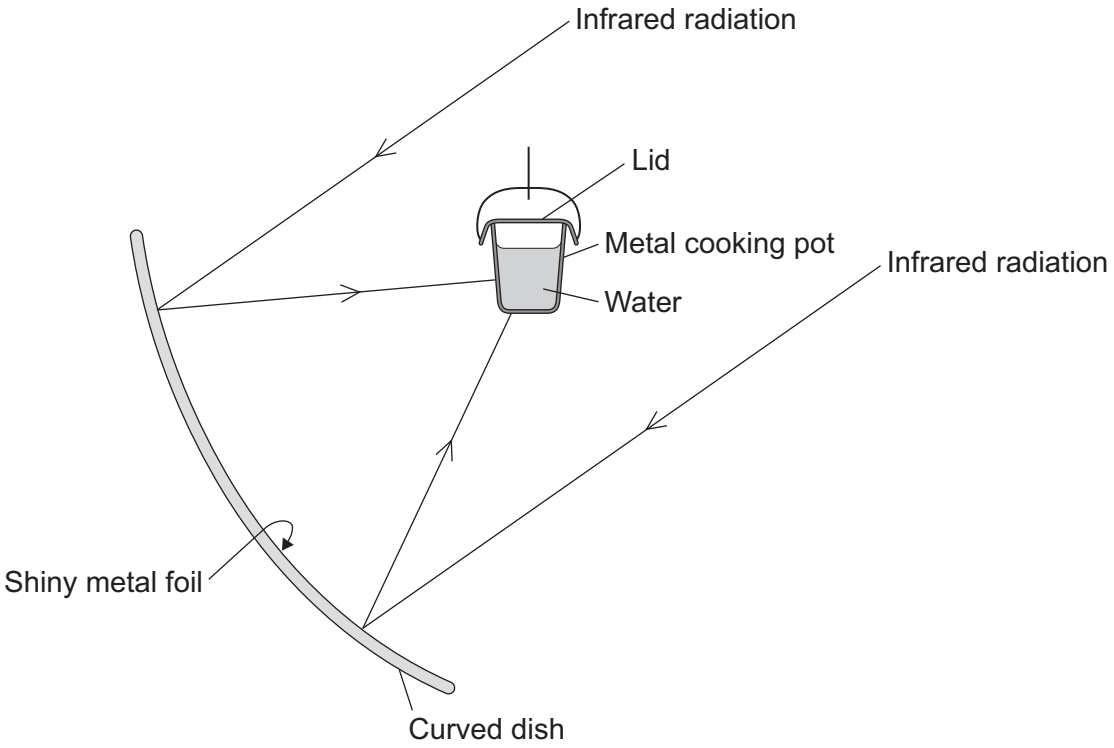
(3 marks)

7

Turn over for the next question

Do not write outside the box

5 The diagram shows the design of a solar cooker. The cooker heats water using infrared radiation from the Sun.



5 (a) Why is the inside of the large curved dish covered with shiny metal foil?

.....

.....

(1 mark)

5 (b) Which would be the best colour to paint the outside of the metal cooking pot?

Draw a ring around the correct answer.

black **silver** **white**

Give a reason for your answer.

.....

.....

.....

(2 marks)

Do not write outside the box

5 (c) Why does the cooking pot have a lid?

.....

.....

(1 mark)

5 (d) Calculate how much energy is needed to increase the temperature of 2 kg of water by 80 °C.

The specific heat capacity of water = 4200 J/kg °C.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Energy = ... J

(2 marks)

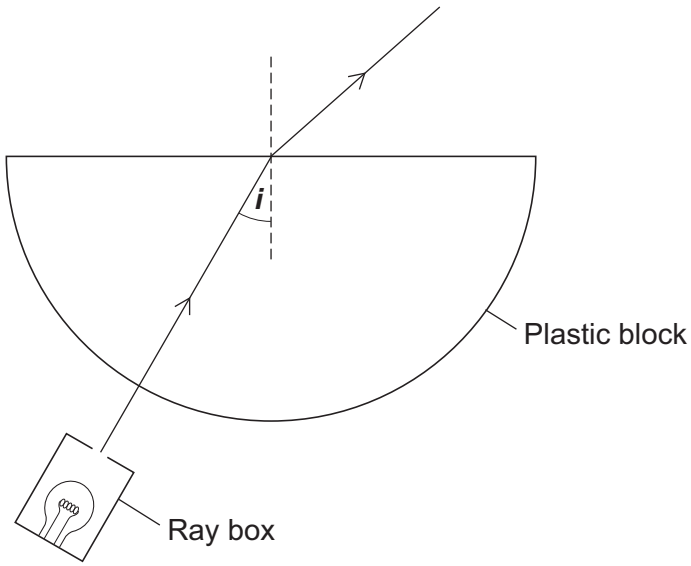
6

Turn over for the next question

Do not write outside the box

6 A student investigated the refraction of light as it passed out of a clear plastic block into the air.
Diagram 1 shows the apparatus the student used.

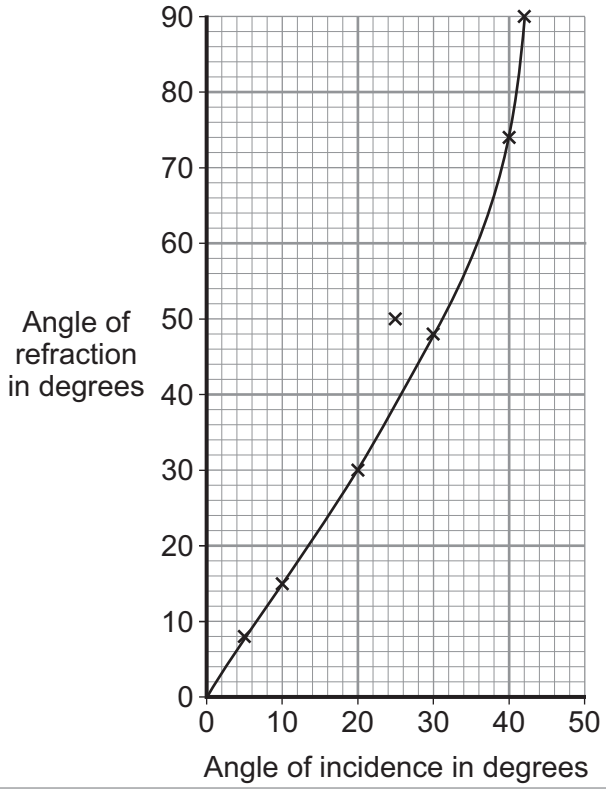
Diagram 1



6 (a) The angle ***i*** is the angle of incidence.

Use the letter ***r*** to mark the angle of refraction on **Diagram 1**. *(1 mark)*

6 (b) The student measured the angle of refraction for different angles of incidence.
The results are shown in the graph.



Do not write outside the box

6 (b) (i) One of the results seems to be anomalous.

Draw a ring around the anomalous data point on the graph.

(1 mark)

6 (b) (ii) The student did measure the angles of incidence accurately.

What is likely to have caused the anomalous result?

.....

.....

(1 mark)

6 (b) (iii) What conclusion can the student make from the results shown in the graph.

Draw a ring around the correct answer in the box to complete the sentence.

The angle of refraction is

less than
equal to
greater than

the angle of incidence.

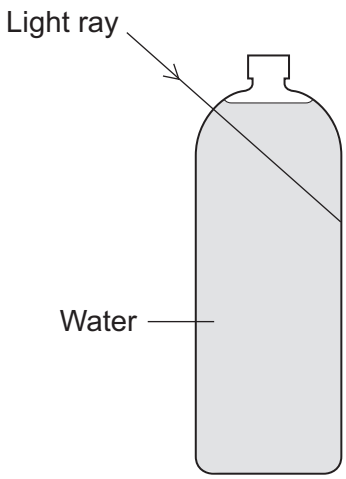
(1 mark)

6 (c) Light travelling from water into air is refracted in the same way as when light travels from plastic into air.

Diagram 2 shows a large bottle, filled with water. The bottle is made from clear plastic.

Draw on **Diagram 2** the path of the light ray as it passes out of the bottle into the air.

Diagram 2



(2 marks)

Question 6 continues on the next page

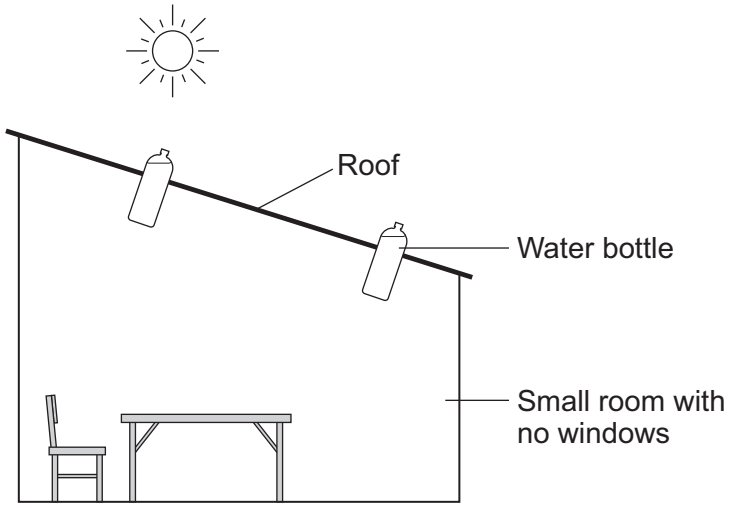
Turn over ▶

Do not write outside the box

6 (d) In some countries, people are too poor to pay for electricity. Some people living in small houses with no natural light use bottles filled with water as a sort of light bulb.

The bottles are fitted into small holes in the roof of the house. Sunlight goes into the bottle of water. When the light leaves the bottle, the light is refracted, causing sunlight to spread into the room.

Diagram 3



6 (d) (i) What is likely to be the most important outcome of using this simple device to provide light?

Tick (✓) **one** box.

People will have enough light to work inside their homes. ☐

Fewer plastic bottles will be thrown into rubbish tips. ☐

Plastic bottles will increase in value. ☐

(1 mark)

6 (d) (ii) Suggest **one** disadvantage of using this device compared with using a light bulb.

.....

.....

.....

(1 mark)

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

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

7 (a) (i) What name is given to this observation?

.....

(1 mark)

7 (a) (ii) Draw a ring around the correct answer in the box to complete the sentence.

This observation gives scientists evidence that

light can be stretched.
galaxies are changing colour.
the Universe is expanding.

(1 mark)

7 (a) (iii) There is a pattern linking the size of the observed increase in the wavelengths of light from a galaxy and the distance the galaxy is from the Earth.



Which **one** of the graphs, **L**, **M** or **N**, shows the correct pattern?

Write the correct answer in the box. ☐

(1 mark)

Do not write outside the box

7 (b) Observations help scientists answer questions about the Universe.

Scientists **cannot** answer every question.

Which **one** of the following questions **cannot** be answered by scientists?

Tick (✓) **one** box.

How old is the Universe? ☐

Why was the Universe created? ☐

How fast does light travel through the Universe? ☐

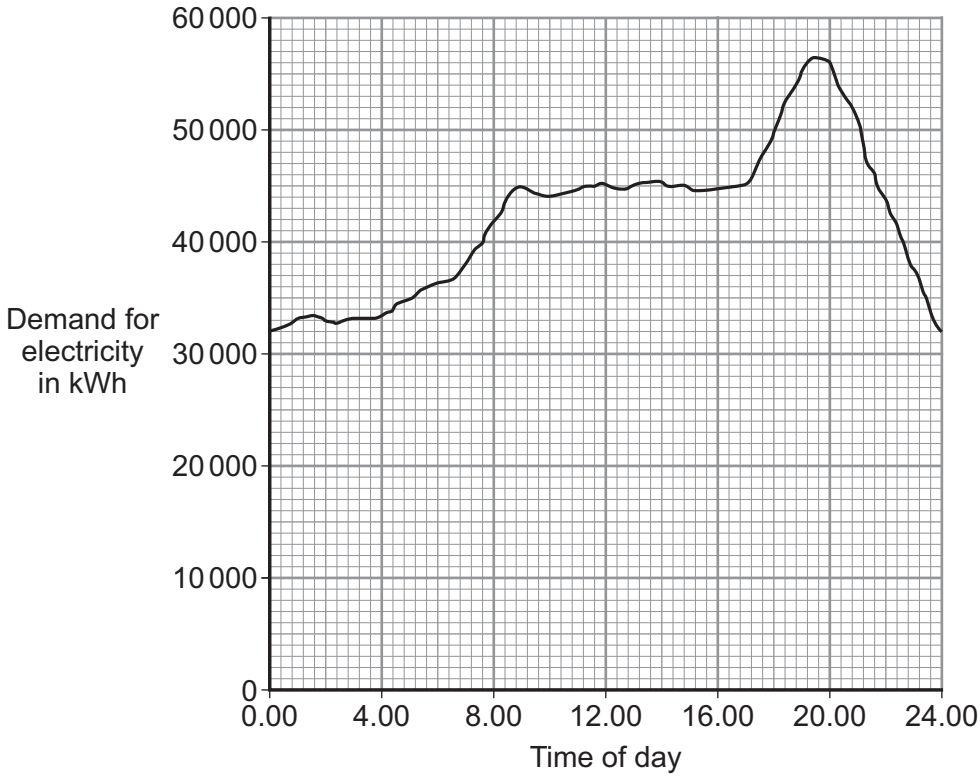
(1 mark)

4

Turn over for the next question

Do not write outside the box

8 (a) The graph shows how the demand for electricity in the UK changes during one 24-hour period.



The table gives the start-up times for two types of power station.

Type of power station	Start-up time
Gas	A few minutes
Nuclear	Several days

How would these two types of power station be used to meet the demand for electricity during this 24-hour period?

.....

.....

.....

.....

.....

.....

(3 marks)

Do not write outside the box

8 (b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

A farmer plans to generate all the electricity needed on her farm, using either a biogas generator or a small wind turbine.

The biogas generator would burn methane gas. The methane gas would come from rotting the animal waste produced on the farm. When burnt, methane produces carbon dioxide.

The biogas generator would cost £18 000 to buy and install. The wind turbine would cost £25 000 to buy and install.

The average power output from the wind turbine would be the same as the continuous output from the biogas generator.

Evaluate the advantages and disadvantages of the two methods of generating electricity.

Conclude, with a reason, which system would be better for the farmer to buy and install.

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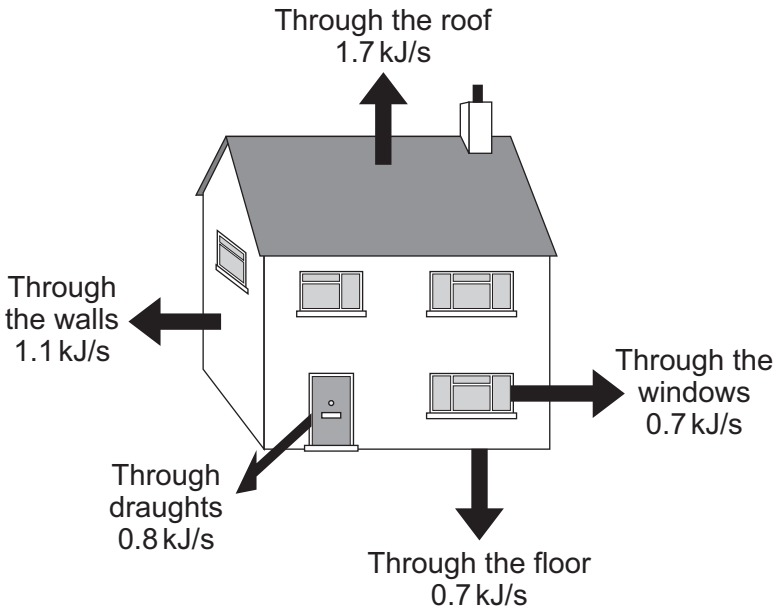
(6 marks)

9

Do not write outside the box

9 **Diagram 1** shows the energy transferred per second from a badly insulated house on a cold day in winter.

Diagram 1



9 (a) (i) When the inside of the house is at a constant temperature, the energy transferred from the heating system to the inside of the house equals the energy transferred from the house to the outside.

Calculate, in kilowatts, the power of the heating system used to keep the inside of the house in **Diagram 1** at a constant temperature.

1 kilowatt (kW) = 1 kilojoule per second (kJ/s)

.....

Power of the heating system = ... kW

(1 mark)

Do not write outside the box

9 (a) (ii) In the winter, the heating system is switched on for a total of 7 hours each day.

Calculate, in kilowatt-hours, the energy transferred each day from the heating system to the inside of the house.

Use the correct equation from the Physics Equations Sheet.

.....

.....

Energy transferred each day = ... kWh

(2 marks)

9 (a) (iii) Energy costs 15 p per kilowatt-hour.

Calculate the cost of heating the house for one day.

.....

Cost = ...

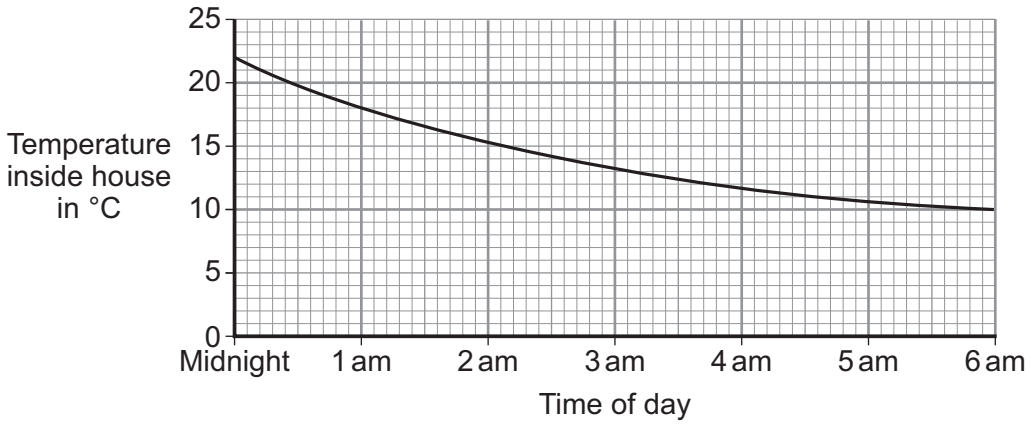
(1 mark)

Question 9 continues on the next page

Do not write outside the box

9 (a) (iv) The heating system is switched off at midnight.

The graph shows how the temperature inside the house changes after the heating system has been switched off.



Draw a ring around the correct answer in the box to complete the sentence.

Between midnight and 6 am the rate of energy transfer from

the house

decreases.
decreases then stays constant.
increases.

Give the reason for your answer.

.....

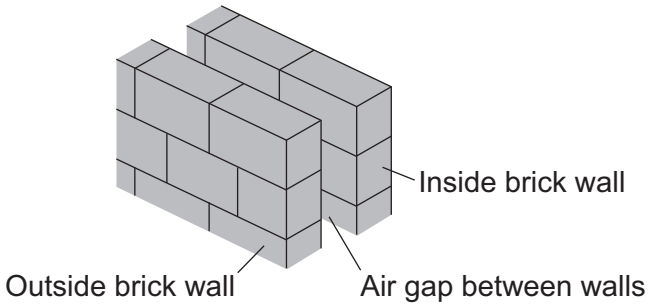
.....

(2 marks)

Do not write outside the box

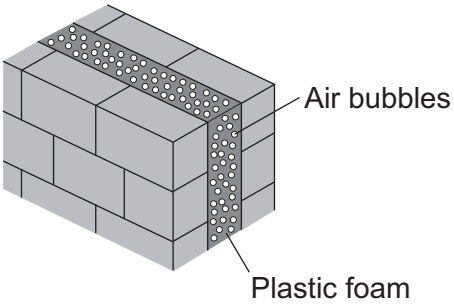
9 (b) **Diagram 2** shows how the walls of the house are constructed.
Diagram 3 shows how the insulation of the house could be improved by filling the air gap between the two brick walls with plastic foam.

Diagram 2



U-value of the wall = 0.7

Diagram 3



U-value of the wall = 0.3

9 (b) (i) The plastic foam reduces energy transfer by convection.

Explain why.

.....

.....

.....

.....

(2 marks)

9 (b) (ii) Filling the air gap with plastic foam reduces the U-value of the wall.

What is meant by the term *U-value*?

.....

.....

(1 mark)

Question 9 continues on the next page

Turn over ▶

Do not write outside the box

9 (c) A homeowner has part of the outside wall of her house removed and replaced with double-glazed glass doors.

U-value of the wall = 0.3
U-value of glass doors = 1.8

Explain the effect of replacing part of the outside wall with glass doors on the rate of energy transfer from the house.

.....

.....

.....

.....

.....

(2 marks)

11

END OF QUESTIONS

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Version 1.0



General Certificate of Secondary Education
January 2013

Science A / Physics (Specification 4405 / 4403) PH1FP

Unit: Physics 1

Final

Mark Scheme

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 events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process 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 standardisation each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised 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.

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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 bullet points 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	green, 5	0
2	red*, 5	1
3	red*, 8	0

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

Candidate	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, 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, 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 or by each stage of a longer calculation.

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 Ignore / Insufficient / Do not allow

Ignore or insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

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Quality of Written Communication and levels marking

In Question 8(b) candidates 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.

Candidates 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.

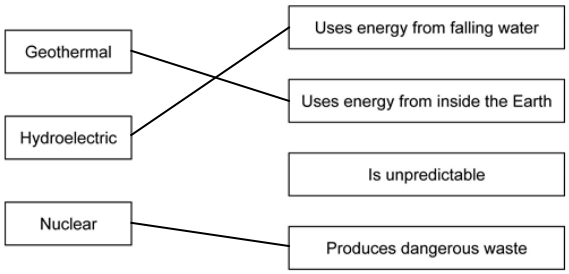
Level 3: detailed

- 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.

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Question 1

question	answers	extra information	mark
1		allow **1** mark for each correct line if more than one line goes from an energy source then all lines from that energy source are wrong	3
Total			**3**

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Question 2

question	answers	extra information	mark
2(a)	electrical chemical light		1 1 1
2(b)	25 % **or** 0.25	allow **1** mark for correct substitution, ie 50 ÷ 200 provided no subsequent step shown **or** answers of 25 with a unit **or** 0.25 with a unit gain **1** mark answers of 25 without a unit **or** 0.25% gain **1** mark	2
2(c)	the information board can be used anywhere it is needed		1
Total			**6**

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Question 3

question	answers	extra information	mark
3(a)(i)	Z		1
3(a)(ii)	X		1
3(b)(i)	moving randomly		1
3(b)(ii)	stronger than		1
3(c)(i)	evaporation		1
3(c)(ii)	any **one** from: • becomes windy • temperature increases • less humid	accept (becomes) sunny “the sun’’ alone is insufficient	1
Total			**6**

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Question 4

question	answers	extra information	mark
4(a)(i)	wavelength	accept frequency accept speed	1
4(a)(ii)	amplitude	accept energy height is insufficient	1
4(a)(iii)	sound		1
4(b)(i)	diffraction	accept diffract a description is insufficient	1
4(b)(ii)	0.12 metre per second **or** m/s **or** metre/second	allow **1** mark for correct substitution, ie 8 × 0.015 provided no subsequent step shown do **not** accept mps units must be consistent with numerical answers	2 1
Total			**7**

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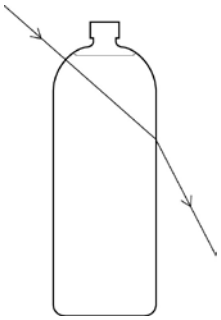
Question 5

question	answers	extra information	mark
5(a)	to reflect (the infrared)	accept (shiny surfaces) are good reflectors ignore reference to incorrect type of wave	1
5(b)	black best absorber (of infrared)	 answer should be comparative black absorbs (infrared) is insufficient accept good absorber (of infrared) ignore reference to emitter ignore attracts heat ignore reference to conduction	1 1
5(c)	to reduce energy loss **or** so temperature of water increases faster **or** reduces loss of water (by evaporation)	accept to stop energy loss accept heat for energy accept to stop / reduce convection accept to heat water faster accept cooks food faster	1
5(d)	672 000	 allow **1** mark for correct substitution, ie 2 × 4200 × 80 provided no subsequent step shown	2
Total			**6**

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Question 6

question	answers	extra information	mark
6(a)	angle of refraction correctly identified	accept any correct indication	1
6(b)(i)	result at i = 25° identified		1
6(b)(ii)	measuring angle of refraction incorrectly	accept any practical suggestion that would lead to the angle r being incorrect eg placing the protractor in the wrong place not marking the refracted ray correctly / accurately / ray box has been moved do **not** accept measured angle i and angle r incorrectly do **not** accept plotted incorrectly	1
6(b)(iii)	greater than		1
6(c)	shown refracting out of the bottle with angle of refraction larger than angle of incidence 	allow **1** mark for refraction shown on correct side of normal with angle of refraction smaller than angle of incidence	2
6(d)(i)	People will have enough light to work inside their homes		1

Question 6 continues on the next page . . .

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Question 6 continued . . .

question	answers	extra information	mark
6(d)(ii)	accept any sensible suggestion eg does not work at night no control over light cannot switch on and off	do **not** accept roof leaks eg cannot control brightness	1
Total			**8**

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Question 7

question	answers	extra information	mark
7(a)(i)	red-shift	accept Doppler (effect)	1
7(a)(ii)	the Universe is expanding		1
7(a)(iii)	N		1
7(b)	Why was the Universe created?		1
Total			**4**

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Question 8

question	answers	extra information	mark
8(a)	any **three** from: • gas can be switched on (and off) quickly but nuclear cannot • gas can be used to meet surges in demand • gas can contribute to / meet the base load • nuclear provides base load **or** nuclear is used to generate all of the time	gas has a short start-up time alone is insufficient accept specific times from graph, anything from 1700 to 2200	3

8(b)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.			6
0 marks	**Level 1 (1-2 marks)**	**Level 2 (3-4 marks)**	**Level 3 (5-6 marks)**	
No relevant content.	There is a brief description of one advantage **or** disadvantage of using either biogas or wind **or** makes a conclusion with a reason.	There is a description of some advantages **and / or** disadvantages for biogas **and / or** wind **or** there is a direct comparison between the two systems **and** at least one advantage / disadvantage **or** a detailed evaluation of one system only with a conclusion.	There is a clear and detailed comparison of the two systems. There must be a clear conclusion of which system would be best with at least one comparative reason given for the choice made.	

Question 8 continues on the next page . . .

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Question 8 continued . . .

examples of the points made in the response	extra information
Biogas	
• renewable	
• energy resource is free	
• reliable energy source	accept works all of the time
• does not depend on the weather	
• uses up (animal) waste products	
• concentrated energy source	
• cheaper (to buy and install)	accept once only
• shorter payback-time (than wind)	
• adds carbon dioxide to the atmosphere	when waste burns it produces carbon dioxide is insufficient
• contributes to the greenhouse effect **or** contributes to global warming	
• no transport cost for fuels	
Wind turbine	
• renewable	
• energy resource is free	
• not reliable	
• depends on the weather / wind	
• will be times when not enough electricity generated for the farm's needs	
• dilute energy source	
• longer payback-time (than biogas)	
• more expensive (to buy and install)	accept once only
• does not produce any carbon dioxide	accept pollutant gases for carbon dioxide accept does not pollute air
	produces visual or noise pollution is insufficient harmful gases is insufficient

Total			**9**

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Question 9

question	answers	extra information	mark
9(a)(i)	5(.0)		1
9(a)(ii)	35 **or** their (a)(i) × 7 correctly calculated	allow **1** mark for correct substitution, ie 5 **or** their (a)(i) × 7 provided no subsequent step shown	2
9(a)(iii)	525(p) **or** (£) 5.25 **or** their (a)(ii) × 15 correctly calculated	if unit p or £ given they must be consistent with the numerical answer	1
9(a)(iv)	decreases temperature difference (between inside and outside) decreases	 accept gradient (of line) decreases do **not** accept temperature (inside) decreases do **not** accept graph goes down	1 1
9(b)(i)	air (bubbles are) trapped (in the foam) (and so the) air cannot circulate / move / form convection current	do **not** accept air traps heat foam has air pockets is insufficient air is a good insulator is insufficient no convection current is insufficient answers in term of warm air from the room being trapped are incorrect and score no marks	1 1

Question 9 continues on the next page . . .

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Question 9 continued . . .

question	answers	extra information	mark
9(b)(ii)	how effective / good a material is as an insulator / at keeping energy in	accept heat for energy accept the lower the U-value the better the insulator accept the lower the U-value the lower the rate of energy / heat transfer	1
9(c)	it will increase because the glass is not (such) a good insulator (as the wall)	room will be cooler is insufficient the U-value has increased is insufficient	1 1
Total			**11**

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	
7	
8	
TOTAL	

AQA

General Certificate of Secondary Education
Foundation Tier
June 2012

Science A
Unit Physics P1

PH1FP

F

Physics
Unit Physics P1

Wednesday 20 June 2012 9.00 am to 10.00 am

For this paper you must have:
- a ruler
- the Physics Equations Sheet (enclosed).

You may use a calculator.

Time allowed
- 1 hour

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 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 8(b) should be answered in continuous prose. In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

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

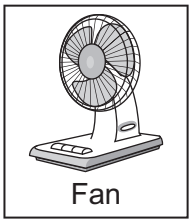
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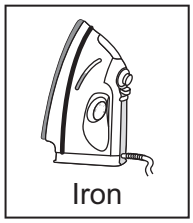
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Answer **all** questions in the spaces provided.

1 The appliances shown below transfer electrical energy to other types of energy.

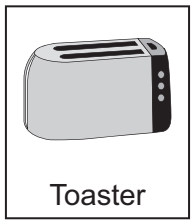

Vacuum cleaner


Fan


Iron


Drill


Washing machine


Toaster


Television

1 (a) The vacuum cleaner is designed to transfer electrical energy to kinetic energy.

Three more of the appliances are also designed to transfer electrical energy to kinetic energy. Which **three**?

Draw a ring around each correct appliance.

(3 marks)

Do not write outside the box

1 (b) Which **two** of the following statements are true?

Tick (✓) **two** boxes.

Appliances only transfer part of the energy usefully. ☐

The energy transferred by appliances will be destroyed. ☐

The energy transferred by appliances makes the surroundings warmer. ☐

The energy output from an appliance is bigger than the energy input. ☐

(2 marks)

5

Turn over for the next question

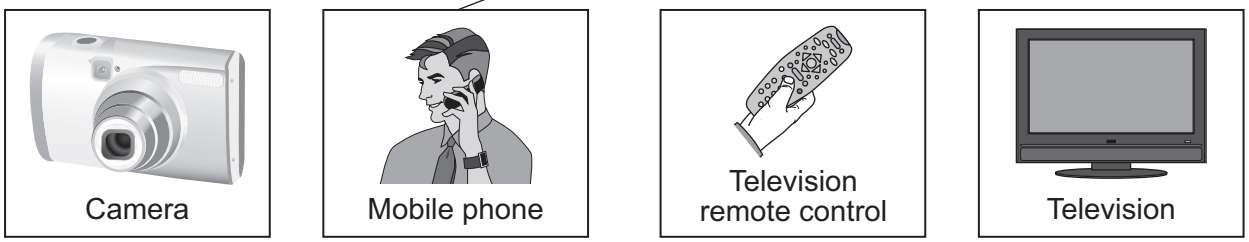
Do not write outside the box

2 (a) The diagram shows the electromagnetic spectrum.

The pictures show four devices. Each device uses a different type of electromagnetic wave.

Draw **one** line from each device to the type of electromagnetic wave the device uses. One line has been drawn for you.

Gamma rays	X-rays	Ultraviolet waves	Visible light waves	Infrared waves	Microwaves	Radio waves



(3 marks)

2 (b) Visible light waves travel through space at a speed of 300 000 km/s.

How fast do infrared waves travel through space?

.....

(1 mark)

2 (c) Draw a ring around the correct answer in the box to complete the sentence.

Infrared waves have | a longer wavelength than / the same wavelength as / a shorter wavelength than | visible light waves.

(1 mark)

Do not write outside the box

2 (d) The two diagrams, **A** and **B**, show a light ray travelling into a glass block.

Diagram A

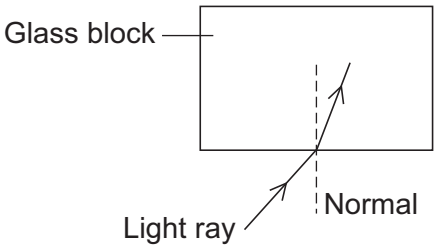
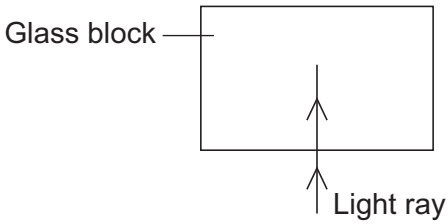


Diagram B



2 (d) (i) Look at **Diagram A**.

What name is given to the process that happens as the light enters the glass block?

.....

(1 mark)

2 (d) (ii) Look at **Diagram B**.

The light enters the glass block without changing direction.

Why?

.....

.....

(1 mark)

7

Turn over for the next question

Do not write outside the box

3 A school is near a busy road. A car travels past the school at high speed.



The students notice that the sound of the car engine seems to change as the car travels past the school. A teacher says that this is an example of the Doppler effect. The students decide to study the sound they hear from passing cars.

3 (a) (i) Give **one** risk the students should consider when doing their study.

.....

(1 mark)

3 (a) (ii) As a car travels towards the students, the frequency of the sound the students hear is different to the frequency of the sound they would hear if the car was stationary.

Draw a ring around the correct answer in the box to complete the sentence.

Compared to the sound from the stationary car, the frequency has

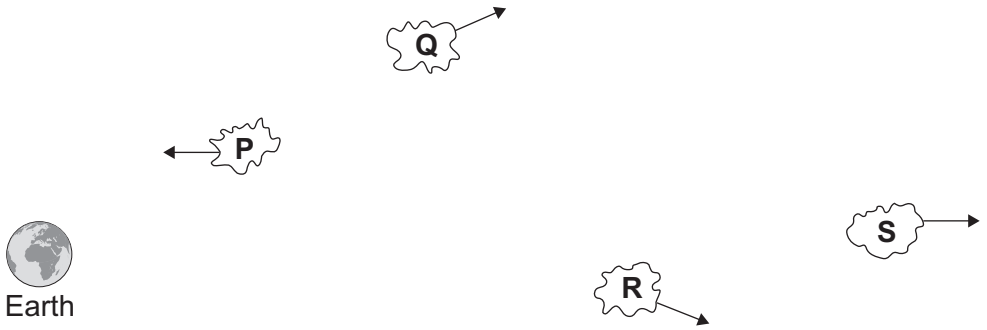
decreased.
increased.
become quieter.

(1 mark)

Do not write outside the box

3 (b) In the same way as the sound from the car engine changes, the light from most galaxies also seems to have a change in observed frequency. This is called red-shift.

3 (b) (i) The diagram shows four galaxies, **P**, **Q**, **R** and **S**. The arrows show the direction the galaxies are moving relative to the Earth.



Which **one** of the galaxies is moving the fastest?

Write the correct answer in the box.

Which **one** of the galaxies will produce the biggest red-shift?

Write the correct answer in the box.

(2 marks)

Question 3 continues on the next page

Do not write outside the box

3 (b) (ii) Most scientists support a theory that the Universe began from a very small initial point. Red-shift can be used as evidence for this theory.

What name is given to the theory that the Universe began from a very small initial point?

.....

(1 mark)

3 (b) (iii) Cosmic microwave background radiation (CMBR) provides more evidence for this theory. CMBR is detected coming from space.

Where does CMBR come from?

Tick (✓) **one** box.

CMBR only comes from near the Sun. ☐

CMBR comes from all parts of the Universe. ☐

CMBR only comes from the Moon. ☐

(1 mark)

3 (b) (iv) Which statement gives the reason why most scientists support the theory that the Universe began from a very small initial point?

Tick (✓) **one** box.

The evidence proves it happened. ☐

There is no other way of explaining how the Universe began. ☐

At the moment it is the best way of explaining our scientific knowledge. ☐

(1 mark)

7

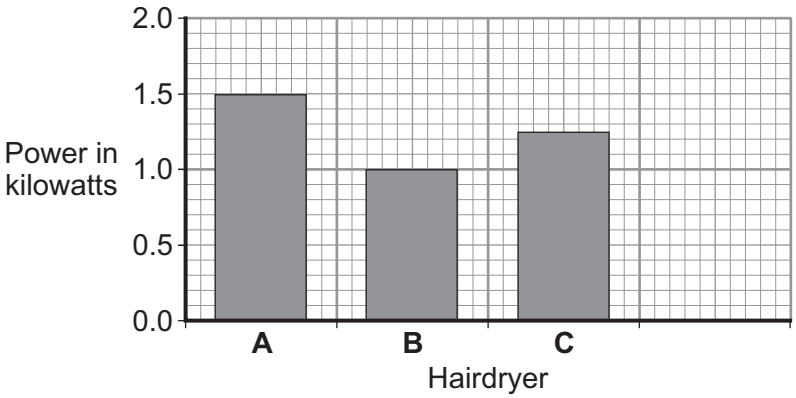
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Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

4 (a) The bar chart shows the power of three different electric hairdryers.



4 (a) (i) Which **one** of the hairdryers, **A**, **B** or **C**, would transfer the most energy in 5 minutes?

Write the correct answer in the box. ☐

(1 mark)

4 (a) (ii) A small 'travel' hairdryer has a power of 500 watts.

Draw a fourth bar on the bar chart to show the power of the 'travel' hairdryer.

(1 mark)

4 (b) A family shares the same hairdryer.
The hairdryer has a power of 1.2 kW. The hairdryer is used for a total of 2 hours each week.

4 (b) (i) Calculate how many kilowatt-hours (kWh) of energy the hairdryer transfers in 2 hours.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

.....

.....

Energy transferred = ... kWh

(2 marks)

Do not write outside the box

4 (b) (ii) Electricity costs 15 pence per kWh.

Calculate the cost of using the hairdryer for 2 hours.

Show clearly how you work out your answer.

.....

.....

Cost = ... pence
(2 marks)

6

Turn over for the next question

Do not write outside the box

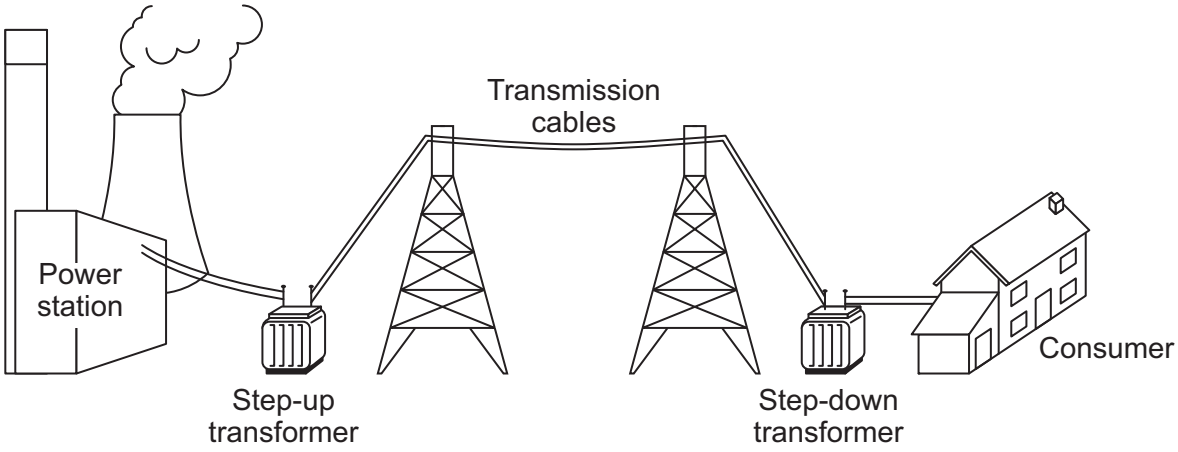
5 In the UK, most electricity is generated in power stations that burn fossil fuels.

5 (a) Which type of fossil fuel power station has the shortest start-up time?

.....

(1 mark)

5 (b) The diagram shows how electricity is distributed around the UK.



5 (b) (i) Which of the parts labelled in the diagram form the National Grid?

.....

(1 mark)

5 (b) (ii) A step-up transformer is used near the power station.

Draw a ring around the correct answer in each box to complete each sentence.

A step-up transformer increases the

current.
power.
voltage.

Using a step-up transformer makes the distribution of electricity

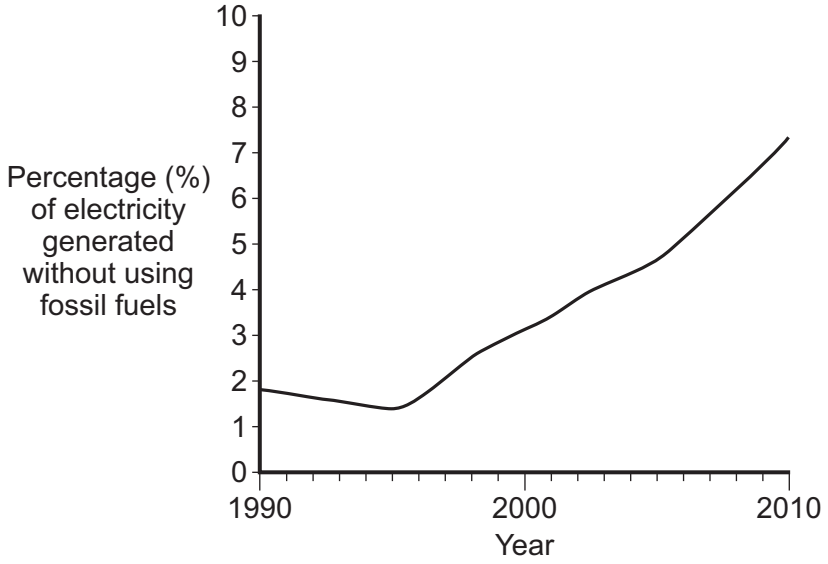
less dangerous.
more efficient.
work faster.

(2 marks)

Do not write outside the box

5 (c) Electricity in the UK is also generated without using fossil fuels.

The graph shows how the percentage of electricity generated in the UK without using fossil fuels changed between 1990 and 2010.



What does the data in the graph suggest will probably happen to the percentage of electricity generated in the UK without using fossil fuels over the next 10 years?

.....

.....

(1 mark)

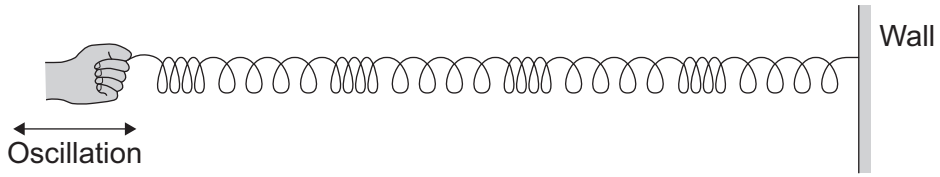
5

Turn over for the next question

Do not write outside the box

6 **Diagram 1** shows a longitudinal wave being produced in a stretched spring.

Diagram 1



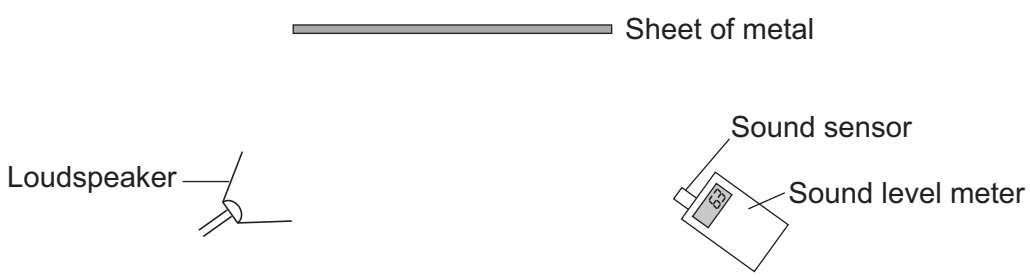
6 (a) A longitudinal wave has areas of compression and areas of rarefaction.

Mark with the letter **C**, **one** area of compression shown in **Diagram 1**.

(1 mark)

6 (b) **Diagram 2** shows the apparatus a teacher uses to demonstrate that sound can be reflected.

Diagram 2



6 (b) (i) Using a ruler, draw on **Diagram 2** to show how sound from the loudspeaker is reflected by the sheet of metal to the sound sensor.

(2 marks)

6 (b) (ii) The teacher replaced the sheet of metal with a sheet of glass.

When he did this, the reading on the sound level meter went down.

Suggest why.

.....

.....

(1 mark)

Do not write outside the box

6 (b) (iii) The teacher changed the output from the loudspeaker to increase the amplitude of the sound wave produced.

What effect, if any, does this increase of amplitude have on the loudness of the sound?

Draw a ring around the correct answer.

makes the sound quieter	**does not change the loudness of the sound**	**makes the sound louder**

(1 mark)

6 (b) (iv) The loudspeaker produces a sound wave at a frequency of 850 Hz. The wavelength of the sound wave is 0.4 m.

Calculate the speed of the sound wave.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

.....

.....

.....

Speed = ... m/s

(2 marks)

6 (c) Music concerts are sometimes performed in sports halls. The concerts can be spoilt because of the sound reflected from the floor and walls.

What word is used to describe a reflected sound?

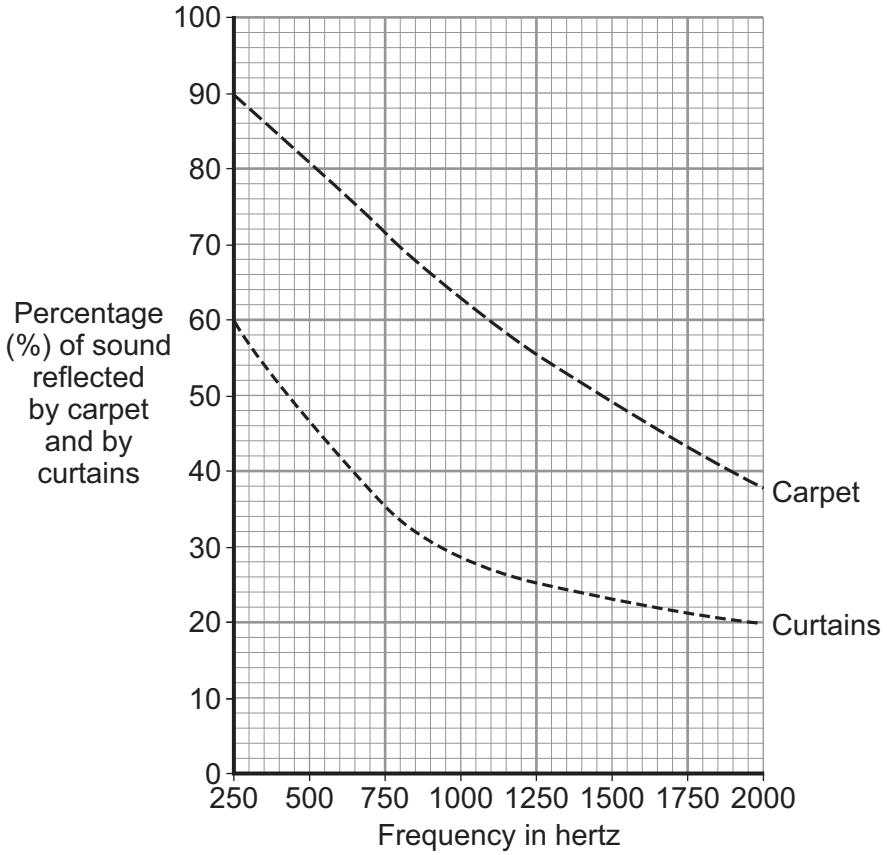
.....

(1 mark)

Question 6 continues on the next page

Do not write outside the box

6 (d) The graph shows how the percentage of sound reflected from the floor and from the walls of a large room can be reduced by carpets and by curtains.



6 (d) (i) Over which range of frequencies do curtains reduce the percentage of sound reflected the most?

Tick (✓) **one** box.

from 250 Hz to 750 Hz ☐

from 750 Hz to 1250 Hz ☐

from 1250 Hz to 1750 Hz ☐

(1 mark)

Do not write outside the box

6 (d) (ii) The manager of a sports hall plans to use the hall for regular music concerts. He has enough money to buy either carpet or curtains, but not both.

To improve the sound an audience hears, it would be better to hang curtains on the walls rather than laying a carpet over the floor.

Use the data in the graph to explain why.

.....

.....

.....

.....

(2 marks)

11

Turn over for the next question

Do not write outside the box

7 A wood burning stove is used to heat a room.



The fire in the stove uses wood as a fuel. The fire heats the matt black metal case of the stove.

7 (a) The air next to the stove is warmed by infrared radiation.

How does the design of the stove help to improve the rate of energy transfer by infrared radiation?

.....

.....

.....

.....

(2 marks)

Do not write outside the box

7 (b) Burning 1 kg of wood transfers 15 MJ of energy to the stove. The stove then transfers 13.5 MJ of energy to the room.

Calculate the efficiency of the stove.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

.....

.....

.....

Efficiency = ...

(2 marks)

7 (c) Some of the energy from the burning wood is wasted as the hot gases leave the chimney and warm the air outside the house.

Name **one** other way energy is wasted by the stove.

.....

(1 mark)

7 (d) Some people heat their homes using electric heaters. Other people heat their homes using a wood burning stove.

Give **two** environmental advantages of using a wood burning stove to heat a home rather than heaters that use electricity generated from fossil fuels.

1 .....

.....

2 .....

.....

(2 marks)

Question 7 continues on the next page

Do not write outside the box

7 (e) The metal case of the stove gets hot when the fire is lit.

Here is some information about the stove.

Mass of metal case	100 kg
Starting temperature of metal case	20 °C
Final temperature of metal case	70 °C
Specific heat capacity of metal case	510 J/kg °C

Calculate the energy required to raise the temperature of the metal case to 70 °C.

Use the correct equation from the Physics Equations Sheet.

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

.....

.....

.....

.....

Energy required = ...

(3 marks)

10

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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8 (a) Geothermal energy and the energy of falling water are two resources used to generate electricity.

8 (a) (i) What is geothermal energy?

.....

.....

(1 mark)

8 (a) (ii) Hydroelectric systems generate electricity using the energy of falling water.

A pumped storage hydroelectric system can also be used as a way of storing energy for future use.

Explain how.

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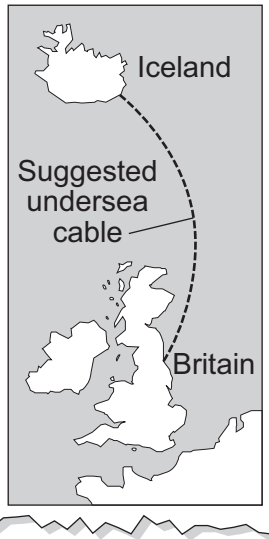
(2 marks)

8 (b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate*.

Read the following extract from a newspaper.

Britain may be switched on by Iceland

Iceland is the only country in the world generating all of its electricity from a combination of geothermal and hydroelectric power stations. However, Iceland is using only a small fraction of its energy resources. It is estimated that using only these resources, the amount of electricity generated could be increased by up to four times.



To help supply the future demand for electricity in Britain, there are plans to build thousands of new offshore wind turbines. It has also been suggested that the National Grid in Britain could be linked to the electricity generating systems in Iceland. This would involve laying a 700 mile undersea electricity cable between Iceland and Britain.

Do not write outside the box

Discuss the advantages and disadvantages of the plan to build thousands of offshore wind turbines around Britain **and** the suggested electricity power link between Britain and Iceland.

.....

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.....

(6 marks)

9

END OF QUESTIONS

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ANSWER IN THE SPACES PROVIDED

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Question 7: Wood burning stove photo © Thinkstock

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General Certificate of Secondary Education

Science A 4405 / Physics 4403

PH1FP **Unit Physics 1**

Mark Scheme

2012 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 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.

PH1FP

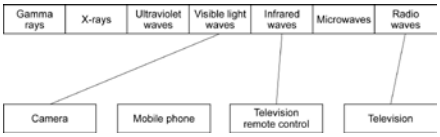
Question 1

question	answers	extra information	mark
1(a)	fan drill washing machine	 four circled including correct three scores **1** mark five circled scores zero	1 1 1
1(b)	Appliances only transfer part of the energy usefully The energy transferred by appliances makes the surroundings warmer		1 1
Total			**5**

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Question 2

question	answers	extra information	mark
2(a)	3 lines drawn linking: camera to visible light television to radio waves remote control to infrared 	 if more than one line is drawn from any device all those lines are incorrect	 1 1 1
2(b)	300 000 km/s **or** 300 000 000 m/s	unit required accept the same (as light) accept the speed of light	1
2(c)	a longer wavelength than		1
2(d)(i)	refraction	 do **not** allow a misspelling that might be reflection	1
2(d)(ii)	travelling along the normal	accept light is at 90° to the surface / block light is not entering at an angle is insufficient	1
Total			**7**

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Question 3

question	answers	extra information	mark
3(a)(i)	any suitable risk eg being injured by a car	accept a measure to reduce the risk eg stand well away from edge of pavement stay on school grounds / don't go onto the street be aware of the dangers of traffic car travelling at high speed is insufficient	1
3(a)(ii)	increased		1
3(b)(i)	S S		1 1
3(b)(ii)	big bang (theory)		1
3(b)(iii)	CMBR comes from all parts of the Universe		1
3(b)(iv)	At the moment it is the best way of explaining our scientific knowledge		1
Total			**7**

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Question 4

question	answers	extra information	mark
4(a)(i)	A		1
4(a)(ii)	bar drawn with correct height	ignore width of bar	1
4(b)(i)	2.4	$E = P \times t$ allow **1** mark for correct substitution ie 1.2×2 provided no subsequent step shown	2
4(b)(ii)	36 or their (b)(i) $\times$ 15 correctly calculated **or** their (b)(i) $\times$ 0.15 correctly calculated with an answer given in £	allow **1** mark for correct substitution ie 2.4×15 **or** their (b)(i) $\times$ 15 allow **1** mark for correct substitution provided no subsequent step shown an answer £0.36 gains both marks	2
Total			**6**

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Question 5

question	answers	extra information	mark
5(a)	gas (burning)		1
5(b)(i)	(transmission) cables and (step-up and step-down) transformers	if transformers are named ie step-up transformer then both step-up and step-down must be given mention of power station or consumer negates mark	1
5(b)(ii)	voltage more efficient		1 1
5(c)	increase		1
Total			**5**

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Question 6

question	answers	extra information	mark
6(a)	letter C clearly marking a compression	accept C at any point in a compression if more than one letter C marked all must be correct	1
6(b)(i)	straight continuous line drawn from loudspeaker to metal to sound sensor angle I = angle R	judge by eye judge by eye ignore any arrows on lines	1 1
6(b)(ii)	less sound reflected **or** (some) sound passes through the glass	accept energy for sound accept (some) sound absorbed by the glass	1
6(b)(iii)	makes the sound louder		1
6(b)(iv)	340	$v = f \times \lambda$ allow **1** mark for correct substitution ie 850×0.4 provided no subsequent step shown	2
6(c)	echo		1
6(d)(i)	from 250 Hz to 750 Hz		1

Question 6 continues on the next page

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Question 6 continued

question	answers	extra information	mark
6(d)(ii)	curtains reduce (percentage of) sound reflected more(than carpet) for all frequencies (shown)	accept curtains absorb more sound (than carpet) accept for both marks an answer in terms of walls having a larger (surface) area to reflect sound and curtains reducing the amount of reflected sound more (than carpet) answers less noisy or walls / curtains have a larger area gain **1** mark only do **not** accept curtains are cheaper	1 1
Total			**11**

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Question 7

question	answers	extra information	mark
7(a)	any **two** from: • black is a good emitter of (infrared radiation) • large surface (area) • matt surfaces are better emitters (than shiny surfaces)	accept heat for radiation ignore reference to absorbing radiation accept matt surfaces are good emitters ignore reference to good conductor	2
7(b)	90 % or 0.9(0)	efficiency = useful energy out (×100%) / total energy in allow **1** mark for correct substitution ie 13.5 / 15 provided no subsequent step shown an answer of 90 scores **1** mark an answer of 90 / 0.90 with a unit scores **1** mark	2
7(c)	(producing) light	allow (producing) sound	1

Question 7 continues on the next page

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Question 7 continued

question	answers	extra information	mark
7(d)	any **two** from: • wood is renewable • (using wood) conserves fossil fuels • wood is carbon neutral	 accept wood grows again / quickly accept wood can be replanted accept doesn't use fossil fuels accept a description cheaper / saves money is insufficient	2
7(e)	 2 550 000 joules /J	E = m × c × θ allow **1** mark for correct substitution ie 100 × 510 x 50 provided no subsequent step shown answers of 1 020 000, 3 570 000 gain **1** mark accept kJ / MJ do **not** accept j for full credit the unit and numerical answer must be consistent	 2 1
Total			**10**

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Question 8

question	answers	extra information	mark
8(a)(i)	energy from hot rocks in the Earth	accept heat that occurs naturally in the Earth accept steam / hot water rising to the Earth's surface accept an answer in terms of the energy released by radioactive decay in the Earth heat energy is insufficient	1
8(a)(ii)	water is pumped / moved up (to a higher reservoir)	 this mark point only scores if first mark point is awarded	1 1
8(b)			6

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 4 and apply a 'best-fit' approach to the marking.

0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content	There is a brief description of at least one advantage or disadvantage for either the planned wind turbines or the suggested electricity power link.	There is a description of advantages and disadvantages for either the planned wind turbines or the suggested electricity power link. **or** A description of the advantages or disadvantages for both the planned wind turbines and the suggested electricity power link.	There is a clear and detailed description of at least one advantage and one disadvantage for both the planned wind turbines and suggested electricity power link.

Question 8 continues on the next page

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Question 8 continued

examples of the points made in the response	extra information
Offshore wind turbines	
advantages	
• renewable (energy resource)	
• low running costs	
• energy is free	
• no gas emissions (when in use)	accept a named gas eg CO_2 accept no fuel is burned accept less dependent on fossil fuels
• land is not used (up)	
disadvantages	
• unreliable – accept wind does not always blow	ignore references to destroying or harming habitats
• hazard to birds / bats	
• visual pollution – do not accept noise pollution	do **not** allow if clearly referring to onshore wind turbines
	do **not** accept spoils landscape
• difficulty of linking turbines to the National Grid	
• large initial cost	
• difficult to erect / maintain	accept a lot of maintenance needed
• CO_2 emissions in manufacture (of large number of turbines)	

Question 8 continues on the next page

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Question 8 continued

examples of the points made in the response	extra information
Suggested Link	
advantages	
• income for Iceland	
• using Iceland's (available) energy (resources)	accept using (Iceland's) renewable energy (resources) do **not** accept reduce the amount of Iceland's wasted energy
• provide electricity when wind does not blow / reliable	
• provide electricity at times of peak demand	
• even out fluctuations in supply	
• excess electricity from Britain (windy days) to Iceland and used to pump water up to store energy	
• Britain less dependent on fossil fuels	accept Britain needs fewer (new) power stations accept conserves fossil fuels
disadvantages	
• large initial cost	accept expensive (to lay cables)
• power loss along a long cable	
• (engineering) difficulties in laying / maintaining the cable	accept difficult to repair (if damaged)

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	
7	
8	
TOTAL	

General Certificate of Secondary Education
Foundation Tier
January 2012

Science A
Unit Physics P1

PH1FP

F

Physics
Unit Physics P1

Friday 20 January 2012 9.00 am to 10.00 am

For this paper you must have:
- a ruler
- the Physics Equations Sheet (enclosed).

You may use a calculator.

Time allowed
- 1 hour

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 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 8(b) should be answered in continuous prose. In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

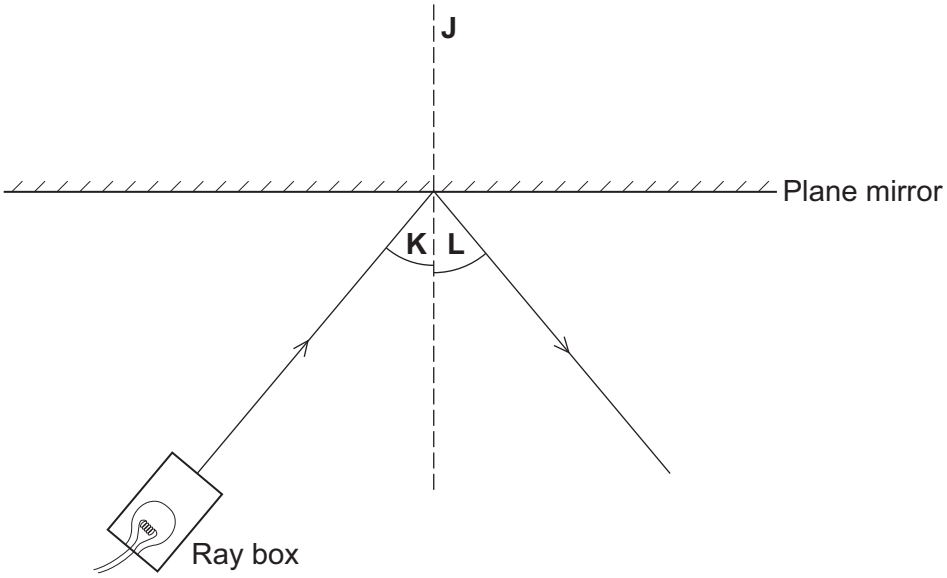
Advice
- In all calculations, show clearly how you work out your answer.

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Do not write outside the box

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

1 The diagram shows a ray of light from a ray box that is reflected by a plane mirror.



1 (a) What name is given to the dashed line labelled **J**?

Draw a ring around the correct answer.

incident **normal** **reflection**

(1 mark)

1 (b) Draw a ring around the correct answer in the box to complete the sentence.

If the angle marked **K** is halved, then the angle marked **L** will

be doubled.

not change.

be halved.

(1 mark)

1 (c) A student looking into the mirror can see an image of the ray box.

Which **two** words can be used to describe the image that the student sees?

Draw a ring around the **two** correct answers.

inverted **magnified** **real** **upright** **virtual**

(2 marks)

4

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

2 (a) The diagram below shows six of the seven types of wave that make up the electromagnetic spectrum.

Gamma rays		Ultraviolet	Visible light	Infrared	Microwaves	Radio waves

2 (a) (i) What type of electromagnetic wave is missing from the diagram?

.....

(1 mark)

2 (a) (ii) Which of the following electromagnetic waves has the most energy?

Draw a ring around the correct answer.

gamma rays **radio waves** **visible light**

(1 mark)

2 (a) (iii) Which of the following electromagnetic waves is given out by a TV remote control?

Draw a ring around the correct answer.

infrared **microwaves** **ultraviolet**

(1 mark)

2 (b) Draw a ring around the correct answer in the box to complete the sentence.

Microwaves travel through a vacuum at

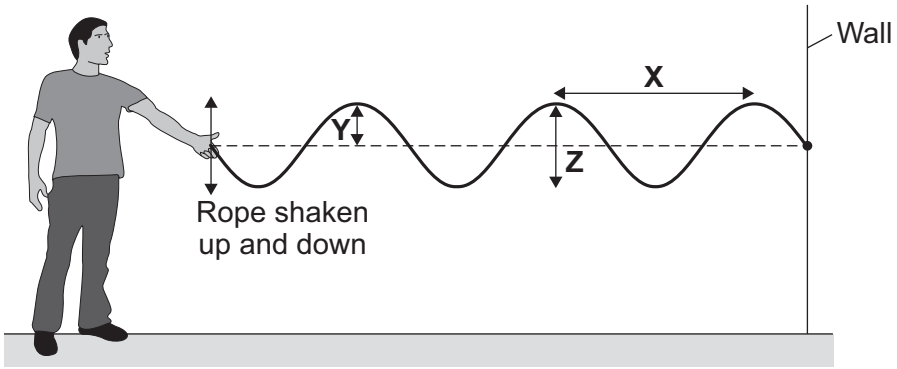
a slower speed than
the same speed as
a faster speed than

radio waves.

(1 mark)

Do not write outside the box

2 (c) The diagram shows waves being produced on a rope.
The waves are **not** reflected by the wall.



2 (c) (i) Draw an arrow on the diagram to show the direction in which the waves transfer energy.
(1 mark)

2 (c) (ii) Which **one** of the arrows, labelled, **X**, **Y** or **Z**, shows the amplitude of a wave?

Write the correct answer in the box. ☐

(1 mark)

2 (c) (iii) The waves produced on the rope are transverse.

Name **one** other type of transverse wave.

.....
(1 mark)

2 (d) The rope is shaken up and down, producing 3 waves every second.
The waves have a wavelength of 1.2 metres.

2 (d) (i) State the frequency of the waves.

..... Hz
(1 mark)

2 (d) (ii) Calculate the speed of the waves.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

.....

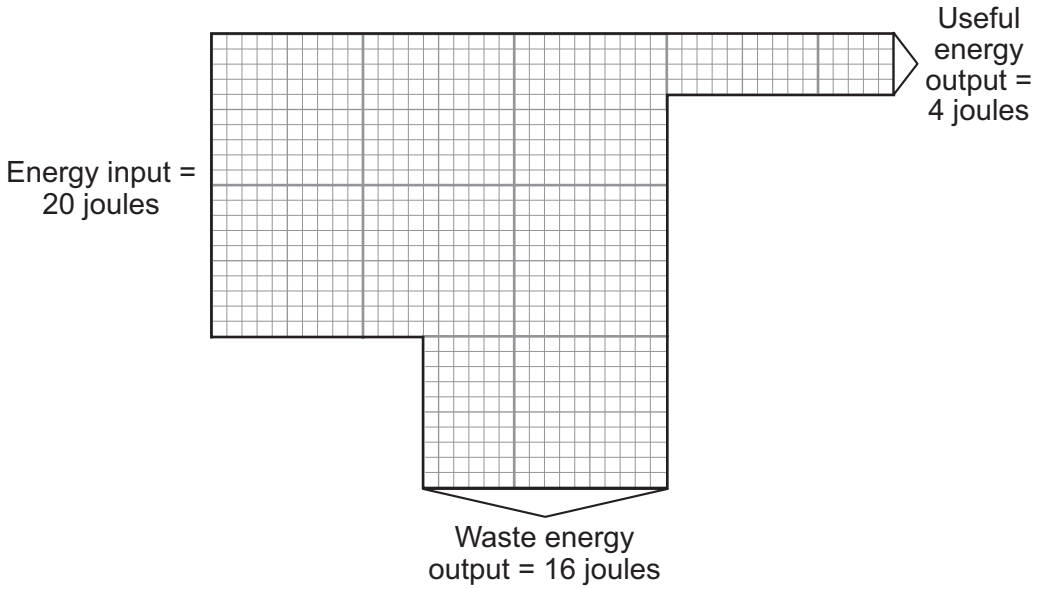
.....

Wave speed = ... m/s
(2 marks)

10

Do not write outside the box

3 (a) The Sankey diagram for a low energy light bulb, known as a CFL, is shown below.



3 (a) (i) What is the useful energy output that the CFL is designed to produce?

.....

(1 mark)

3 (a) (ii) What effect does the waste energy output have on the surrounding air?

.....

.....

(1 mark)

3 (a) (iii) Use the information in the diagram to calculate the efficiency of the CFL.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

.....

.....

.....

.....

Efficiency = ...

(2 marks)

Do not write outside the box

3 (a) (iv) CFLs contain mercury. Mercury is a poisonous substance.

It is important that old CFLs are sent for recycling and not thrown into a rubbish bin.

Suggest **one** reason why.

.....

.....

(1 mark)

3 (b) A new type of low energy bulb uses light emitting diodes (LEDs).

Draw a ring around the correct answer in the box to complete the sentence.

LED bulbs are more efficient than CFLs. This means that LED bulbs

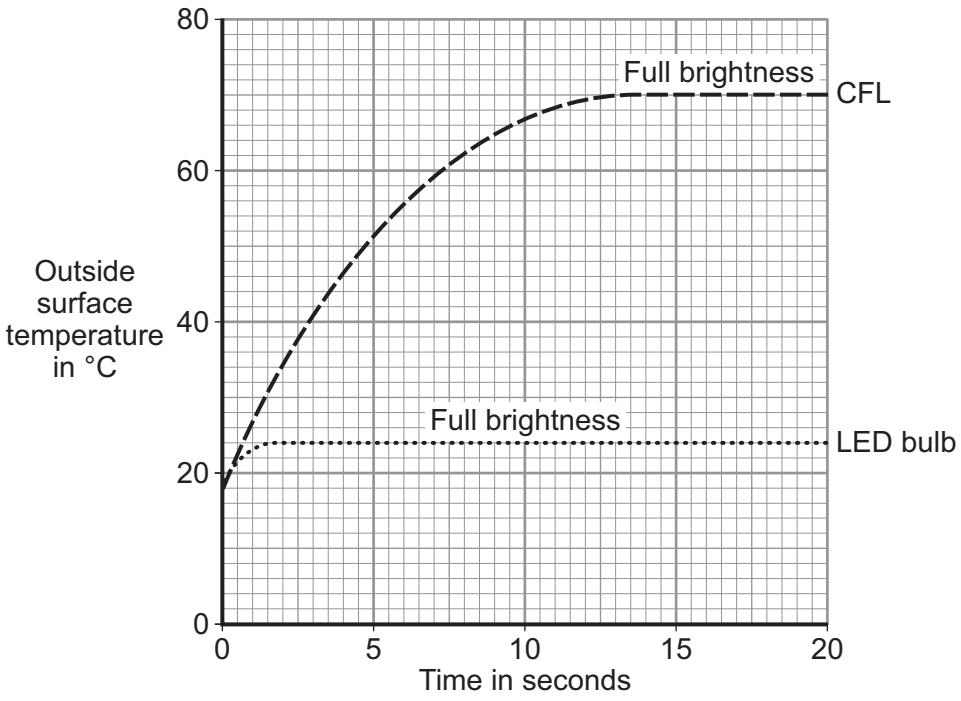
waste [a smaller / the same / a bigger] proportion of the input energy compared to CFLs.

(1 mark)

Question 3 continues on the next page

Do not write outside the box

3 (c) The graph shows how the outside surface temperatures of a CFL and an LED bulb change after they are switched on.



Apart from a higher efficiency, suggest **one** advantage of using an LED bulb rather than a CFL.

.....

.....

(1 mark)

3 (d) At the moment, LED bulbs are much more expensive to buy than CFLs.

Which **two** of the following would a homeowner need to know to decide whether it would be cost-effective to replace a CFL with an equally bright LED bulb?

Tick (✓) **two** boxes.

The number of hours each bulb lasts before needing to be replaced ☐

The power of each bulb in watts ☐

The voltage of the mains electricity supply ☐

(1 mark)

8

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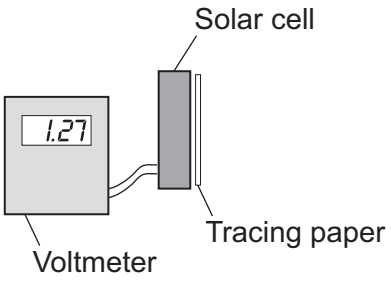
Turn over for the next question

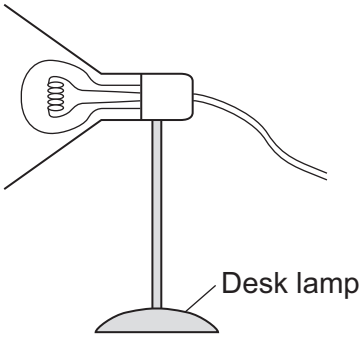
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ANSWER IN THE SPACES PROVIDED

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4 A student has read that a solar cell with a dirty surface will not work as well as a solar cell with a clean surface.

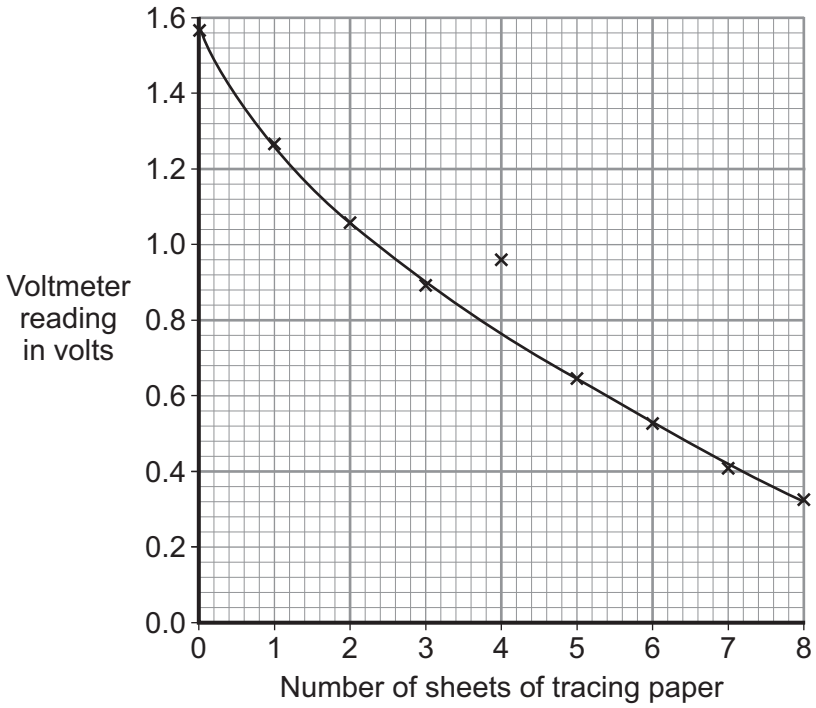
To test the effect of a dirty surface on a solar cell, the student set up the following equipment.





The student put the desk lamp a fixed distance from the solar cell. To represent the effect of a dirty surface, the student covered the surface of the solar cell with pieces of tracing paper. Each time the student added a piece of paper, she measured the output voltage of the solar cell.

4 (a) The results taken by the student have been used to draw the graph below.



4 (a) (i) One of the results seems to be anomalous.

Draw a ring around the anomalous data point on the graph.

(1 mark)

Do not write outside the box

4 (a) (ii) The larger the number of sheets of tracing paper used, the lower the intensity of the light reaching the solar cell.

Draw a ring around the correct answer in the box to complete the sentence.

A decrease in the intensity of the light reaching the solar cell causes

a decrease in
no change to
an increase in

the output voltage from the solar cell.

(1 mark)

4 (b) People can buy panels of solar cells to generate electricity for their homes.
Any surplus electricity can be sold to the electricity supply company.

4 (b) (i) Give **one** environmental advantage of generating electricity using solar cells rather than generating electricity in a coal-burning power station.

.....

.....

(1 mark)

4 (b) (ii) A homeowner pays £7600 to have solar panels fitted on the roof of their house.
The homeowner expects to save £950 each year from reduced energy bills and from selling the electricity.

Assuming these figures to be correct, calculate the pay-back time for the solar panels.

Show clearly how you work out your answer.

.....

.....

.....

Pay-back time = ... years

(2 marks)

Question 4 continues on the next page

Do not write outside the box

4 (b) (iii) Draw a ring around the correct answer in the box to complete the sentence.

Allowing the surface of the solar panels to become very dirty will

decrease
not change
increase

the pay-back time.

(1 mark)

4 (b) (iv) Explain your answer to part **(b)(iii)**.

.....

.....

.....

.....

(2 marks)

8

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Turn over for the next question

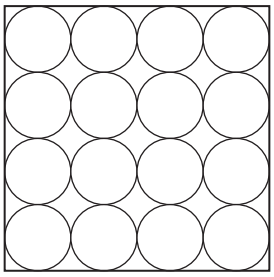
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ANSWER IN THE SPACES PROVIDED

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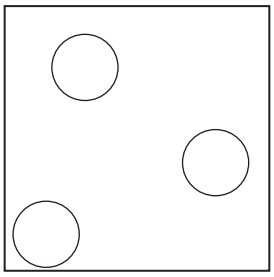
5 (a) The diagrams show the arrangement of the particles in a solid and in a gas.

Each circle represents one particle.

Solid

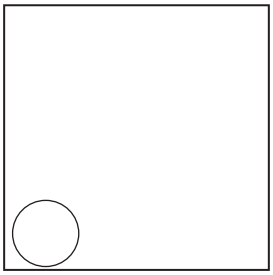


Gas



5 (a) (i) Complete the diagram below to show the arrangement of the particles in a liquid.

Liquid



(2 marks)

5 (a) (ii) Explain, in terms of the particles, why gases are easy to compress.

.....

.....

.....

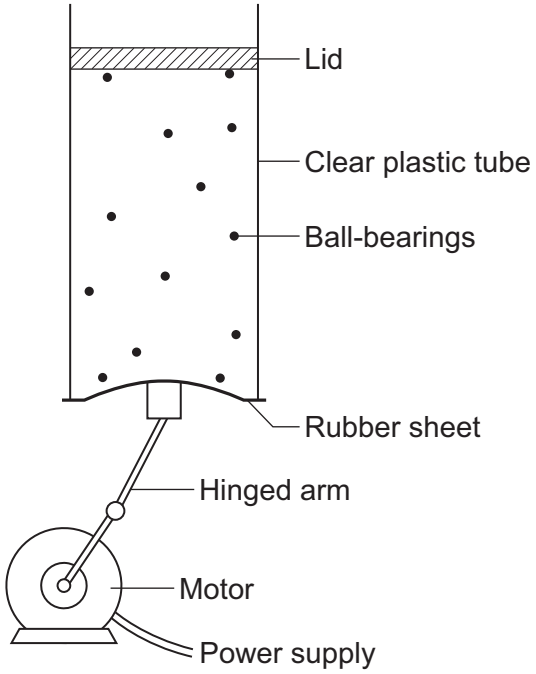
.....

(2 marks)

Do not write outside the box

5 (b) The diagram below shows the model that a science teacher used to show her students that there is a link between the temperature of a gas and the speed of the gas particles.

The ball-bearings represent the gas particles. Switching the motor on makes the ball-bearings move around in all directions.



5 (b) (i) How is the motion of the ball-bearings similar to the motion of the gas particles?

.....

.....

(1 mark)

5 (b) (ii) The faster the motor runs, the faster the ball-bearings move. Increasing the speed of the motor is like increasing the temperature of a gas.

Use the model to predict what happens to the speed of the gas particles when the temperature of a gas is increased.

.....

.....

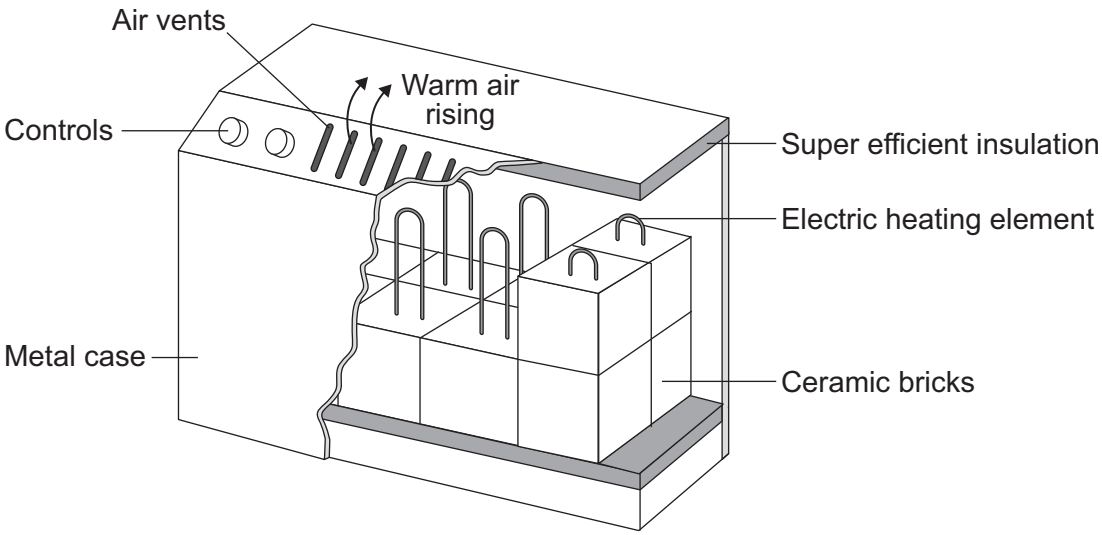
(1 mark)

6

Turn over ▶

Do not write outside the box

6 The diagram shows how one type of electric storage heater is constructed. The heater has ceramic bricks inside. The electric elements heat the ceramic bricks during the night. Later, during the daytime, the ceramic bricks transfer the stored energy to the room.



6 (a) (i) Complete the following sentences using words from the box.

conduction	**convection**	**evaporation**

Energy is transferred through the metal casing by ..... .

The warm air rising from the heater transfers energy to the

room by ..... .

(2 marks)

6 (a) (ii) The inside of the metal case is insulated.

Which **one** of the following gives the reason why?

Tick (✓) **one** box.

To transfer energy from the ceramic bricks to the room faster ☐

To stop energy from the room transferring into the heater ☐

To keep the ceramic bricks hot for a longer time ☐

(1 mark)

Do not write outside the box

6 (b) In winter, the electricity supply to a 2.6 kW storage heater is switched on for seven hours each day.

6 (b) (i) Calculate the energy transferred, in kilowatt-hours, from the electricity supply to the heater in seven hours.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

.....

.....

Energy transferred = ... kWh

(2 marks)

6 (b) (ii) The electricity supply to the heater is always switched on between midnight and 7 am. Between these hours, electricity costs 5 p per kilowatt-hour.

Calculate how much it costs to have the heater switched on between midnight and 7 am.

.....

.....

Cost = ... p

(1 mark)

6 (c) Between 7 am and 8 am, after the electricity supply is switched off, the temperature of the ceramic bricks falls by 25 °C.

Calculate the energy transferred from the ceramic bricks between 7 am and 8 am.

Total mass of ceramic bricks = 120 kg.
Specific heat capacity of the ceramic bricks = 750 J/kg °C.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

.....

.....

.....

.....

Energy transferred = ... J

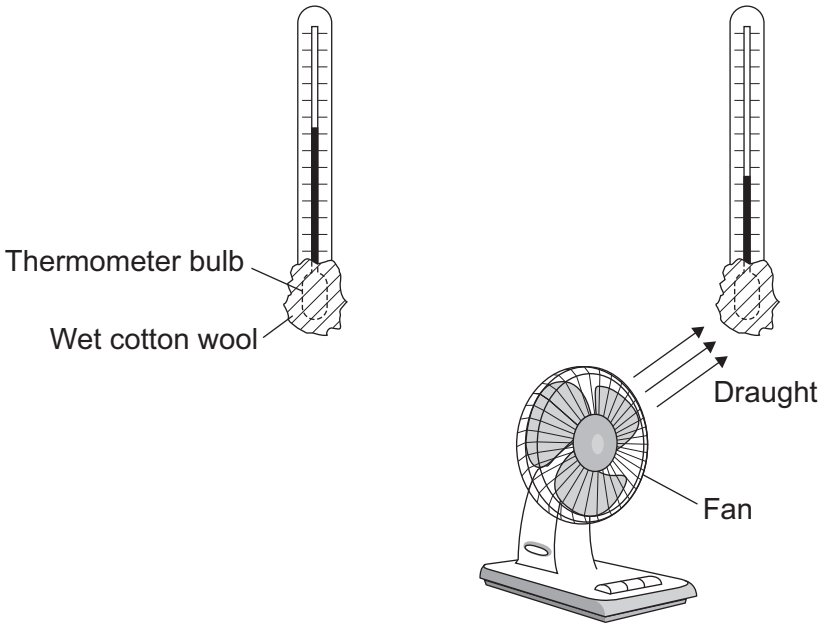
(2 marks)

8

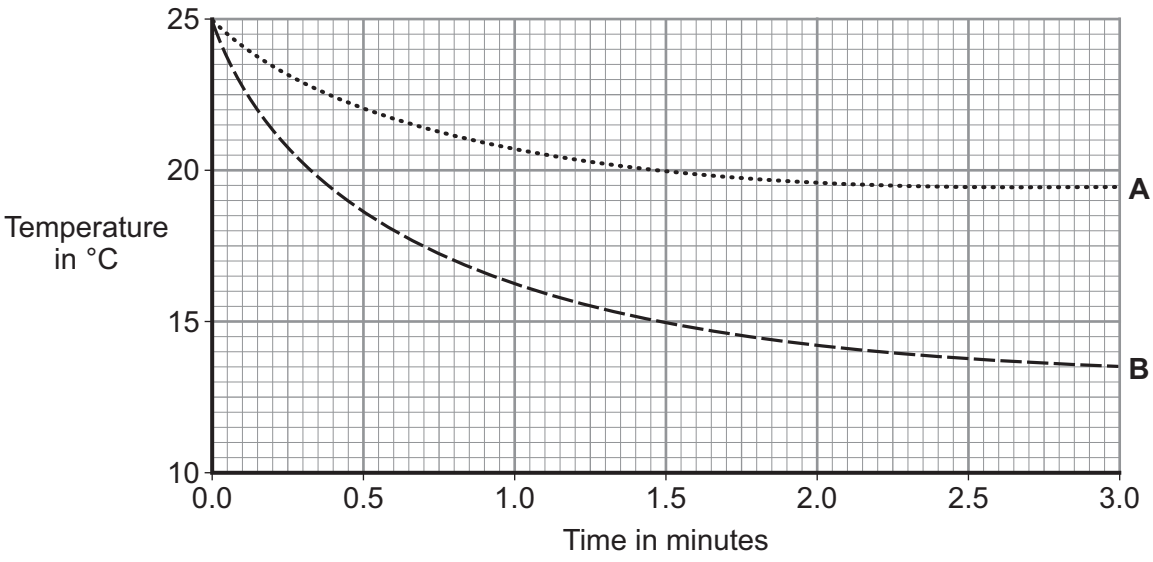
Turn over ▶

Do not write outside the box

7 The diagram shows two thermometers. The bulb of each thermometer is covered with a piece of wet cotton wool. One of the thermometers is placed in the draught from a fan.



The graph shows how the temperature of each thermometer changes with time.



Do not write outside the box

7 (a) Which of the graph lines, **A** or **B**, shows the temperature of the thermometer placed in the draught?

Write the correct answer in the box. ☐

Explain, in terms of evaporation, the reason for your answer.

.....

.....

.....

.....

.....

.....

(3 marks)

7 (b) A wet towel spread out and hung outside on a day without wind dries faster than an identical wet towel left rolled up in a plastic bag.

Explain why.

.....

.....

.....

.....

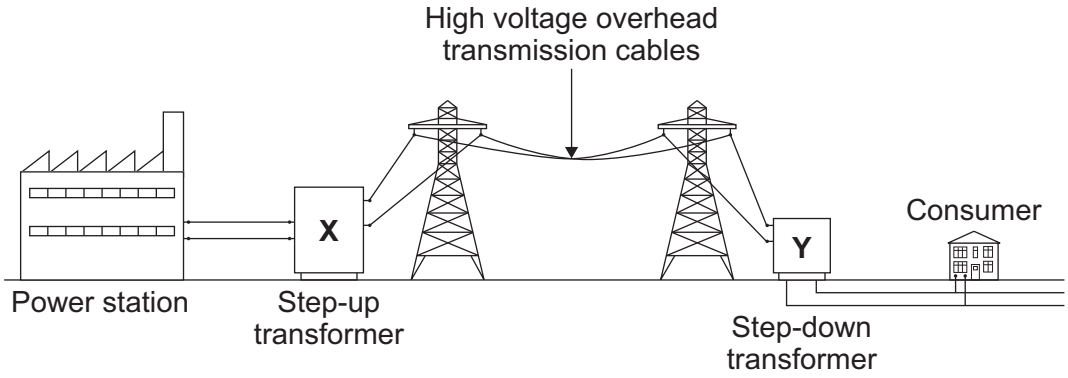
(2 marks)

5

Turn over for the next question

Do not write outside the box

8 The diagram shows the National Grid system.



8 (a) The National Grid includes step-up transformers.

Explain why.

.....

.....

.....

.....

(2 marks)

Do not write outside the box

8 (b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Over the next 10 years, more than 300 kilometres of new high voltage transmission cables are to be added to the National Grid. Most of the new cables will be suspended from pylons and run overhead while the rest will be buried underground.

Outline the advantages and disadvantages of both overhead transmission cables and underground transmission cables.

.....

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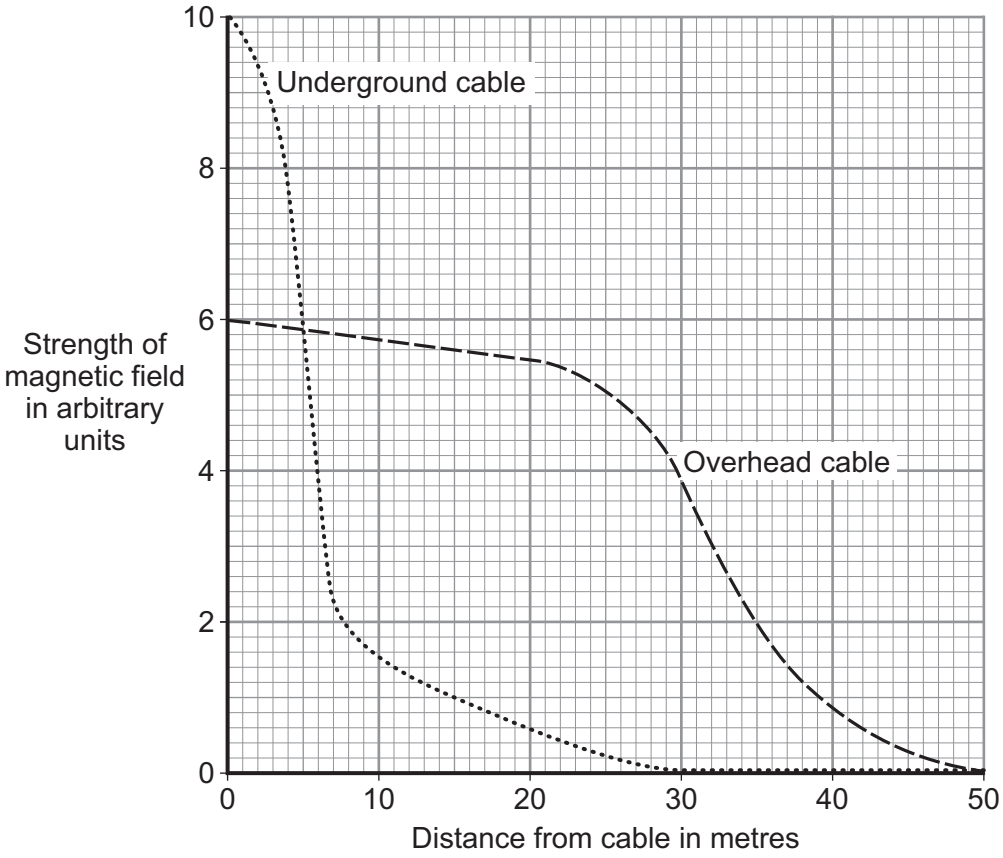
(6 marks)

Question 8 continues on the next page

Do not write outside the box

8 (c) When an electric current flows through a transmission cable, a magnetic field is produced.

The graph shows how the strength of the magnetic field varies with distance from both overhead and underground transmission cables that carry the same current.



What conclusions may be drawn from this graph?

.....

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.....

.....

(2 marks)

Do not write outside the box

8 (d) Some people think that, because of the magnetic fields, living close to transmission cables is dangerous to health. Laboratory studies on mice and rats exposed to magnetic fields for two or more years found that the magnetic fields had no effect on the animals' health.

Draw a ring around the correct answer in the box to complete the sentence.

Using animals in scientific research raises | economic / environmental / ethical | issues.

(1 mark)

11

END OF QUESTIONS

Do not write outside the box

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

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Version1.0: 29/02/2012

General Certificate of Secondary Education

Science A 4405 / Physics 4403

PH1FP Unit Physics P1

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.

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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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Quality of Written Communication and levels marking

In Question 8(b) 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.

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Question 1

question	answers	extra information	mark
1(a) A	normal		1
1(b) A	be halved		1
1(c) A	upright virtual		1 1
Total			**4**

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Question 2

question	answers	extra information	mark
2(a)(i) G	X-ray(s)		1
2(a)(ii) A	gamma rays		1
2(a)(iii) A	infrared		1
2(b) A	the same speed as		1
2(c)(i) E	horizontal arrow drawn pointing to the right	judge by eye accept drawn anywhere on diagram	1
2(c)(ii) A	**Y**		1
2(c)(iii) E	any **one** from: • any type of electromagnetic wave • water (wave) • (earthquake / seismic) S waves	accept electromagnetic wave(s) do **not** accept seismic waves do **not** accept P waves do **not** accept earthquakes	1

Question 2 continues on the next page . . .

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Question 2 continued . . .

question	answers	extra information	mark
2(d)(i) E clip with 2(d)(ii)	3		1
2(d)(ii) E clip with 2(d)(i)	3.6 **or** their (d)(i) × 1.2 correctly calculated	$v = f \times \lambda$ allow **1** mark for correct substitution ie 3 or their (d)(i) × 1.2 provided that no subsequent step is shown	2
Total			**10**

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Question 3

question	answers	extra information	mark
3(a)(i) G	light (energy)	this answer only	1
3(a)(ii) E	raises its temperature	accept warms / heats it accept air molecules / particles gain energy / move faster do **not** accept heat do **not** accept pollution	1
3(a)(iii) E	20 % or 0.2	efficiency = useful energy out (×100%) total energy in allow **1** mark for correct substitution ie $\frac{4}{20}$ provided that no subsequent step is shown 20 without % scores 1 mark, 20 **or** 0.2 with a unit scores 1 mark	2
3(a)(iv) E	mercury can be recovered / reused / recycled **or** mercury (vapour) does not get into the atmosphere / environment / air	accept to stop mercury poisoning the land / getting into the food chain / water supply accept poisonous gas for mercury (vapour) do **not** accept general poisoning cause harm to the environment is insufficient	1

Question 3 continues on the next page . . .

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Question 3 continued . . .

question	answers	extra information	mark
3(b) A	a smaller		1
3(c) E	reaches full brightness faster	accept brighter / switches on faster accept it does not get as hot accept it will not burn someone who touches it accept stays cool accept temperature does not increase as much accept temperature only goes to 24 (°C) accept contains no mercury do **not** accept wastes less energy	1
3(d) A	top two boxes both ticked The number of hours each bulb lasts before needing to be replaced. The power of each bulb in watts.		1
Total			**8**

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Question 4

question	answers	extra information	mark
4(a)(i) E	correct data point identified (4, 0.96)		1
4(a)(ii) A	a decrease in		1
4(b)(i) E	no / less atmospheric pollution	accept specific examples eg no CO_2 / greenhouse gases produced accept no harmful gases / fumes accept reduced pollution from transportation (of coal) accept does not contribute to global warming it / they refers to solar cells do **not** accept no / less pollution does not harm the environment is insufficient it is a renewable energy source is insufficient	1
4(b)(ii) E	8	allow **1** mark for showing correct method ie $\frac{7600}{950}$ provided that no subsequent step is shown	2

Question 4 continues on the next page . . .

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Question 4 continued . . .

question	answers	extra information	mark
4(b)(iii) A	increase		1
4(b)(iv) E view with 4(b)(iii)	less / no electricity generated	**these marks can score even if (b)(iii) is wrong** accept energy for electricity accept reduced power / voltage output	1
	(because) lower light intensity (hitting solar panel / cell) **or** so decreases money paid / gained (from selling electricity)	allow less light / sun (hitting solar panel / cell)	1
Total			**8**

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Question 5

question	answers	extra information	mark
5(a)(i) E	random distribution of circles in the box with at least 50 % of circles touching		1
	random distribution of circles occupies more than 50 % of the space	judged by eye	1
5(a)(ii) E	(large) gaps between particles	accept particles do not touch accept particles are spread out	1
	(so) easy to push particles closer (together) **or** forces between particles are negligible / none	an answer in terms of number of particles is insufficient	1
5(b)(i) E	(both are) random	accept a correct description of random eg unpredictable or move around freely or in all directions they take up all the space is insufficient they are spread out is insufficient they move in straight lines is insufficient	1
5(b)(ii) E	(speed also) increases		1
Total			**6**

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Question 6

question	answers	extra information	mark
6(a)(i) G	conduction convection	correct order only	1 1
6(a)(ii) A	to keep the ceramic bricks hot for a longer time		1
6(b)(i) E clip with 6(b)(ii)	18.2	$E = P \times t$ allow **1** mark for correct substitution ie 2.6×7 provided that no subsequent step is shown	2
6(b)(ii) E clip with 6(b)(i)	91 (p) **or** their (b)(i) $\times$ 5 correctly calculated	accept £0.91 do **not** accept 0.91 without £ sign	1
6(c) E	2 250 000	$E = m \times c \times \theta$ allow **1** mark for correct substitution ie $120 \times 750 \times 25$ provided that no subsequent step is shown answers 2250 kJ or 2.25 MJ gain both marks	2
Total			**8**

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Question 7

question	answers	extra information	mark
7(a) E	**B**	no mark for **B** - marks are for the explanation first two mark points can score even if **A** is chosen	
	draught increases (the rate of) evaporation	accept more evaporation happens accept draught removes (evaporated) particles faster do **not** accept answers in terms of particles gaining energy from the fan / draught	1
	evaporation has a cooling effect	accept (average) kinetic energy of (remaining) particles decreases	1
	so temperature will fall faster / further		1
7(b) E	larger surface area		1
	increasing the (rate of) evaporation **or** for water to evaporate from	accept more / faster evaporation accept easier for particles to evaporate accept more particles can evaporate accept water / particles which have evaporated are trapped (in the bag) answers in terms of exposure to the Sun are insufficient	1
Total			**5**

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Question 8

question	answers	extra information	mark
8(a) E	increases the voltage (across the cables) **or** decreases the current (through the cables)		1
	reducing energy losses (in cables) **or** increases efficiency of (electricity / energy) transmission	accept heat for energy do **not** accept electricity for energy do **not** accept no energy loss accept wires do not get as hot ignore reference to travel faster	1

8(b) E — 6

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 4, and apply a 'best-fit' approach to the marking.

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant content	There is a brief description of one advantage or disadvantage of using either overhead or underground cables.	There is a description of some of the advantages **and / or** disadvantages for both overhead and underground cables, with a minimum of three points made. There must be at least **one** point for each type of cable.	There is a clear and detailed description of the advantages **and** disadvantages of overhead and underground cables, with a minimum of five points made. At least one advantage and one disadvantage for each type of cable.

Question 8 continues on the next page . . .

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Question 8 continued . . .

question	answers	extra information	mark
	examples of the points made in the response	**extra information** marks may be gained by linking an advantage for one type of cable with a disadvantage for the other type of cable eg eg overhead cables are easy to repair = 1 mark overhead cables are easier to repair = 1 mark overhead cables are easier to repair than underground cables = 2 marks	
	Overhead Advantages: • (relatively) quick / easy to repair / maintain / access • less expensive to install / repair / maintain • cables cooled by the air • air acts as <u>electrical</u> insulator • can use thinner cables Disadvantages: • spoil the landscape • greater risk of (fatal) electric shock • damaged / affected by (severe) weather • hazard to low flying aircraft / helicopters	easy to install is insufficient do **not** accept easy to spot / see a fault less expensive is insufficient accept thermal energy / heat removed by the air accept there is no need for electrical insulation (around the cables) difficult to reach is insufficient land beneath cables can still be used is insufficient accept specific examples eg high winds, ice more maintenance is insufficient kites / fishing lines can touch them is insufficient hazard to aircraft is insufficient	

Question 8 continues on the next page . . .

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Question 8 continued . . .

question	answers	extra information	mark
	Underground Advantages: • cannot be seen • no hazard to aircraft / helicopters • unlikely to be / not damaged / affected by (severe) weather (normally) no / reduced shock hazard Disadvantages: • repairs take longer / are more expensive • (more) difficult to access (cables) • (very) expensive to install • thicker cables required • need cooling systems • need layers of <u>electrical</u> insulation • land disruption (to lay cables) **or** cannot use land either side of cable path	less maintenance is insufficient installed in urban areas is insufficient accept harder to repair / maintain have to dig up for repairs is insufficient hard to locate (cables) is insufficient faults hard to find is insufficient accept damage to environment / habitat(s) accept restricted land use	

Question 8 continues on the next page . . .

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Question 8 continued . . .

question	answers	extra information	mark
8(c) E	examples of acceptable responses: • closest to cables field from underground is stronger • field from overhead cables stronger after 5 metres • field from underground cables drops rapidly • field from overhead cables does not drop much until after 20 metres • overhead field drops to zero at / after 50 metres • underground field drops to zero at / after 30 metres • (strength of) field decreases with distance for <u>both</u> types of cable	allow **1** mark for each correct point accept values between 20 and 30 inclusive if suitably amplified this may score both marks	2
8(d) A	ethical		1
Total			**11**

UMS Conversion Calculator
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