AQA GCSE PHYSICS (4451)

PHYSICS



EXAM QUESTION PACK

UNIT P1 HIGHER TIER PHY1H PAPERS

STEMUP

These questions belong to AQA, not to us.

The examination questions, mark schemes and examiner reports in this pack were written and published by AQA. They are past assessment materials, reproduced here so that students can revise from them.

What we do not own

STEMUP is not affiliated with AQA and does not own, and makes no claim to own, any of the question, mark scheme or examiner report material in this pack. AQA has not endorsed, approved or been involved in the production of it. AQA and the qualification titles used here belong to their respective owners and appear for identification only.

Where to find the originals

AQA publishes its past papers, mark schemes and examiner reports free of charge. Always check the current specification at aqa.org.uk before you revise, because content and wording can change between series.

If you hold the rights to any material in this pack and would like it amended or removed, contact admin@stemup.co.uk and we will act on it.

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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

General Certificate of Secondary Education
Higher Tier
June 2012

Science B
Unit Physics P1

Physics
Unit Physics P1

PHY1H

H

Wednesday 20 June 2012 9.00 am to 9.45 am

For this paper you must have:
- a ruler.

You may use a calculator.

Time allowed
- 45 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 45.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

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

STEMUP.CO.UK

Do not write outside the box

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

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

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

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

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

.....

.....

(1 mark)

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

.....

.....

(1 mark)

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

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

.....

Pay-back time = ...

(1 mark)

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

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

1 .....

.....

2 .....

.....

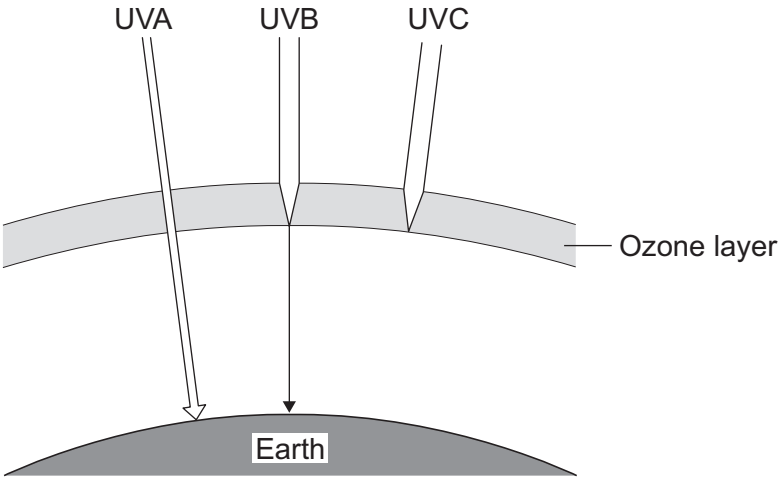
(2 marks)

5

Do not write outside the box

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

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



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

Draw a ring around your answer.

UVA **UVB** **UVC**

Give a reason for your answer.

.....

.....

(2 marks)

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

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

.....

.....

.....

.....

(2 marks)

Question 2 continues on the next page

Turn over ▶

Do not write outside the box

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

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

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

The results of their investigation are given in the table.

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

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

.....

(1 mark)

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

.....

.....

(1 mark)

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

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

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

Give **one** reason for your answer.

.....

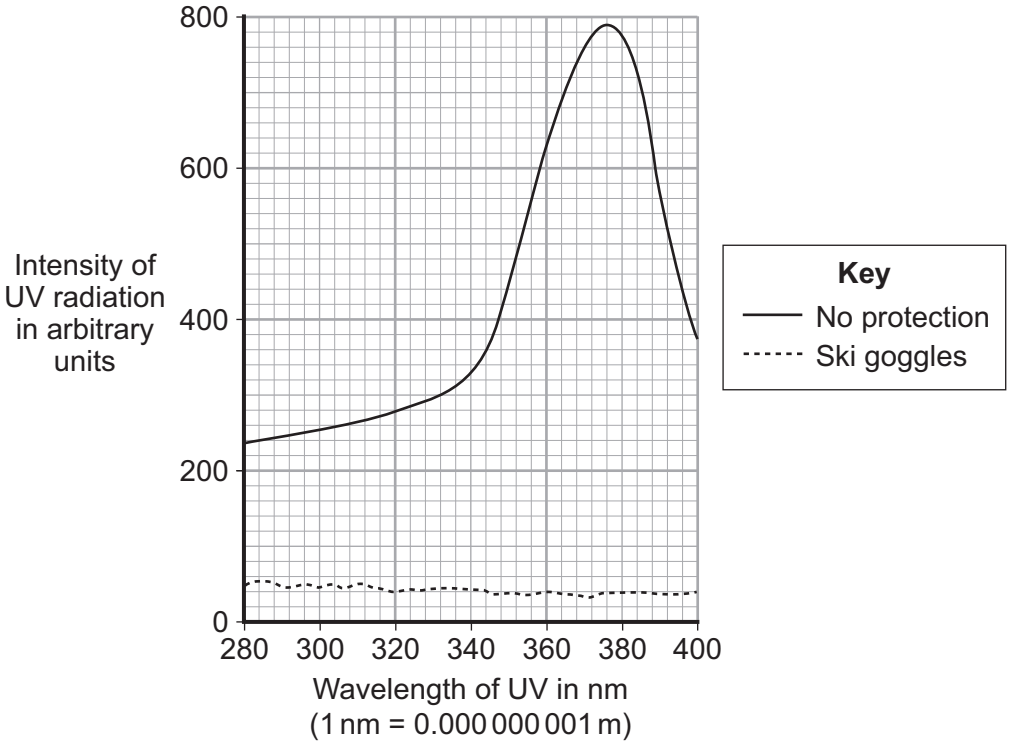
.....

(1 mark)

Do not write outside the box

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

The results of the test are shown in the graph.



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

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

Explain the reason for your answer.

.....

.....

.....

.....

(2 marks)

9

Turn over ▶

Do not write outside the box

3 Mobile phone networks send digital signals using microwaves.

3 (a) What type of radiation are microwaves?

.....

(1 mark)

3 (b) One part of a mobile phone is designed to convert an analogue signal into a digital signal.

Draw in the boxes below an example of an analogue signal and an example of a digital signal.

Analogue signal	**Digital signal**

(2 marks)

3 (c) Read the following extract taken from a newspaper.

Parents organise petition against plans to site phone mast near school

Parents continue to protest against the proposed mobile phone mast. This is despite learning that a recent national study has found no link between childhood cancer and mobile phone masts. Some scientists commenting on the study claim that the evidence is unreliable and that the long-term effect of microwave radiation has yet to be proved.

3 (c) (i) Using the information in the extract, suggest **one** reason why the parents continue to protest against the mobile phone mast.

.....

.....

(1 mark)

Do not write outside the box

3 (c) (ii) Some schools have mobile phone masts in their school grounds. The schools are paid by a mobile phone company for allowing this.

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

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

ethical and economic
economic and environmental
environmental and social

issues.

(1 mark)

5

Turn over for the next question

Do not write outside the box

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

4 (a) How is the image produced by an optical telescope on a satellite in space better than the image produced by an optical telescope on the Earth?

.....

Give a reason for your answer.

.....

.....

(2 marks)

4 (b) Scientists have observed that the wavelengths of the light from galaxies moving away from the Earth are longer than expected. This observation is called red-shift.

4 (b) (i) What does the size of the red-shift tell the scientists about the distance a galaxy is from the Earth?

.....

.....

(1 mark)

4 (b) (ii) Complete the following passage.

Red-shift provides evidence to support the 'big bang' theory. The 'big bang' theory is

one of the ways of explaining the ..... of the Universe.

(1 mark)

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

5 A homeowner had a new gas boiler installed.

5 (a) The following information is an extract from the information booklet supplied with the boiler.

Fuel	Natural Gas
Water temperature	60 °C
Energy supplied to gas boiler	8.0 kJ/s (8.0 kW)
Efficiency	0.95

5 (a) (i) Use the equation in the box to calculate the energy transferred each second by the gas boiler to the water inside the boiler.

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

Show clearly how you work out your answer.

.....

.....

Energy transferred by the gas boiler each second = ... kJ

(2 marks)

Do not write outside the box

5 (a) (ii) The energy value of the gas used in a home is measured in kilowatt-hours (kWh).

The homeowner has a pre-payment meter and pays £30 into his account. With a pre-payment meter, gas costs 15p per kilowatt-hour.

Use the equations in the box to calculate the total number of hours that the gas boiler would operate for £30.

energy transferred = power × time
total cost = number of kilowatt-hours × cost per kilowatt-hour

Show clearly how you work out your answer.

.....

.....

.....

.....

Number of hours = ...

(2 marks)

5 (b) Although the gas boiler is very efficient, some energy is wasted.

Explain what happens to the waste energy.

.....

.....

.....

.....

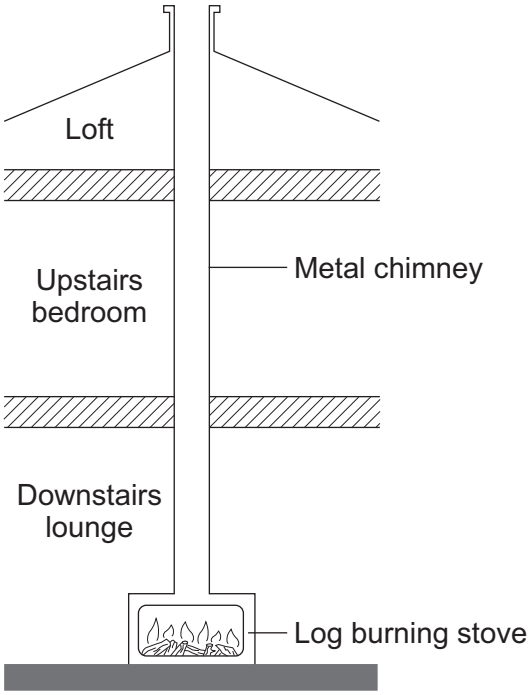
(2 marks)

6

Turn over for the next question

Do not write outside the box

6 The diagram shows how the metal chimney from a log-burning stove passes through the inside of a house.



6 (a) Explain how heat is transferred by the process of convection from the inside of the stove to the top of the chimney.

.....

.....

.....

.....

.....

(2 marks)

Do not write outside the box

6 (b) Although the outside of the chimney becomes very hot, there is no insulating material around the chimney.

6 (b) (i) Explain, in terms of the particles in a metal, how heat is transferred by conduction from the inside to the outside of the metal chimney.

.....

.....

.....

.....

.....

(2 marks)

6 (b) (ii) Suggest **one** advantage of having no insulation around the chimney.

.....

.....

(1 mark)

5

Turn over for the next question

Do not write outside the box

7 Food irradiation is a process that exposes food to radiation. Irradiation can be used to kill the bacteria that cause food poisoning or to slow down the ripening of fresh fruit and vegetables. Frozen foods and food inside packaging can also be irradiated.

7 (a) The table gives information about five radioactive isotopes.

Isotope	Half-life	Radiation emitted
Caesium-134	2.1 years	beta
Cobalt-60	5.3 years	gamma
Curium-242	160 days	alpha
Strontium-90	28 years	beta
Technetium-99	6 hours	gamma

Which of these radioactive isotopes would be most suitable for irradiating food?

.....

Explain the reasons for your choice.

.....

.....

.....

.....

.....

(3 marks)

7 (b) Many people think that food should not be irradiated. Consumer groups have said that they are worried about the nutritional value and safety of eating irradiated foods.

7 (b) (i) Suggest **one** reason why some people may be concerned about the safety of eating irradiated food.

.....

.....

(1 mark)

Do not write outside the box

7 (b) (ii) Independent scientific committees in several countries, including Sweden, Canada and the UK, have concluded that it is safe to eat irradiated food.

These scientific committees need to be independent from government influence.

Suggest why.

.....

.....

(1 mark)

7 (b) (iii) One group of scientists has compared the vitamin content of non-irradiated foods with irradiated foods.

The table below gives the data obtained for 1 kg of cooked chicken.

Vitamin	Non-irradiated food in milligrams	Irradiated food in milligrams
B6	1.22	1.35
B12	21.00	28.00
E	3.30	2.15
Niacin	58.00	55.50
Riboflavin	2.10	2.25

Considering only the data in the table, is it valid to conclude that irradiated food is less nutritional than non-irradiated food?

Explain your answer.

.....

.....

.....

.....

.....

(2 marks)

Question 7 continues on the next page

Do not write outside the box

7 (b) (iv) In a restaurant, meals with ingredients that have been irradiated must be clearly identified on the menu.

It is important that people eating in a restaurant are given this information.

Suggest why.

.....

.....

(1 mark)

7 (c) The isotope caesium-137 decays by emitting beta radiation.
Caesium-137 has a half-life of 30 years.

7 (c) (i) What is a beta particle, and from which part of an atom is a beta particle emitted?

.....

.....

(1 mark)

7 (c) (ii) A sample containing caesium-137 has a count rate of 600 counts per minute.

Calculate how long it would take for the count rate from the sample to fall to 75 counts per minute.

Show clearly how you work out your answer.

.....

.....

.....

Time taken = ... years

(2 marks)

11

END OF QUESTIONS

Copyright © 2012 AQA and its licensors. All rights reserved.

General Certificate of Secondary Education

Science B 4462 / Physics 4451

PHY1H **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

Copyright © 2012 AQA and its licensors. All rights reserved.

COPYRIGHT
AQA retains the copyright on all its publications. However, registered schools / colleges for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to schools / colleges to photocopy any material that is acknowledged to a third party even for internal use within the school / college.

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales (company number 3644723) and a registered charity (registered charity number 1073334).
Registered address: AQA, Devas Street, Manchester M15 6EX

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.

STEMUP.CO.UK

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.

STEMUP.CO.UK

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.

PHY1H

Question 1

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

Question 1 continues on the next page

STEMUP.CO.UK

PHY1H

Question 1 continued

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

STEMUP.CO.UK

PHY1H

Question 2

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

Question 2 continues on the next page

STEMUP.CO.UK

PHY1H

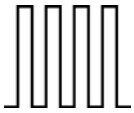
Question 2 continued

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

STEMUP.CO.UK

PHY1H

Question 3

question	answers	extra information	mark
3(a)	electromagnetic	accept em	1
3(b)	correct example of an analogue signal eg 	ignore whether AM or FM	1
	correct example of a digital signal eg 	ignore different wave heights and widths as long as square wave drawn if both diagrams are correct but drawn in the wrong box allow **1** mark	1
3(c)(i)	not proven that microwave radiation is safe **or** may yet be shown to be harmful	 accept long-term effect yet to be proven accept evidence (may be) unreliable	1
3(c)(ii)	ethical and economic		1
Total			**5**

STEMUP.CO.UK

PHY1H

Question 4

question	answers	extra information	mark
4(a)	clearer / more detailed / sharper / less distorted image any **one** from: • no light pollution • light is not scattered by the atmosphere	image is better is insufficient ignore image is bigger accept no clouds to prevent observations accept air for atmosphere accept (image) not distorted by the atmosphere accept (light) does not have to pass through the atmosphere do **not** accept in terms of distance	1 1
4(b)(i)	bigger the red-shift, further the galaxy is from the Earth	accept red-shift and distance are directly proportional accept there is a positive correlation	1
4(b)(ii)	origin / start / beginning / creation	accept expansion	1
Total			**4**

STEMUP.CO.UK

PHY1H

Question 5

question	answers	extra information	mark
5(a)(i)	7.6	allow **1** mark for correct substitution and / or transformation ie $0.95 = \frac{x}{8}$ 0.95×8.0	2
5(a)(ii)	25 (hours)	allow **1** mark for obtaining number of kWh = 200 an answer of 26(.3) gains both marks	2
5(b)	any **two** from • transferred to the surroundings / air / atmosphere • becomes spread out • shared between (many) molecules • (wasted as) heat / sound		2
Total			**6**

STEMUP.CO.UK

PHY1H

Question 6

question	answers	extra information	mark
6(a)	any **two** from: • (air) particles / molecules / atoms gain energy • (air) particles / molecules / atoms move faster • (air) particles / molecules / atoms move apart • air expands • air becomes less dense • warm / hot air / gases / particles rise	do **not** accept move more do **not** accept move with a bigger amplitude / vibrate more ignore particles expand ignore particles become less dense do **not** accept heat rises answers in terms of heat particles negates any of the mark points that includes particles	2
6(b)(i)	any **two** from • free / mobile electrons gain (kinetic) energy • free electrons collide with other (free) electrons / ions / atoms / particles • atoms / ions / particles collide with other atoms / ions / particles	accept free / mobile electrons move faster accept vibrate faster for gain energy answers in terms of heat particles negates this mark point	2
6(b)(ii)	(faster) energy / heat transfer to room(s) / house	accept room(s) / house gets warm(er) accept lounge / bedroom / loft for rooms	1
Total			**5**

STEMUP.CO.UK

PHY1H

Question 7

question	answers	extra information	mark
7(a)	cobalt-(60)		1
	gamma (radiation) will pass through food / packaging	this can score if technetium chosen	1
	long half-life so level of radiation (fairly) constant for (a number) of years	this can score if strontium / caesium is chosen accept long half-life so source does not need frequent replacement accept answers in terms of why alpha and beta cannot be used gamma kills bacteria is insufficient	1
7(b)(i)	people may link the use of radiation with illness / cancer	accept (they think) food becomes radioactive accept (they think) it is harmful to them 'it' refers to irradiated food	1
7(b)(ii)	not biased / influenced (by government views)		1

Question 7 continues on the next page

STEMUP.CO.UK

PHY1H

Question 7 continued

question	answers	extra information	mark
7(b)(iii)	any **two** from: • data refers only to (cooked) chicken • data may not generalise to other foods • the content of some vitamins increases when food / chicken is irradiated • no vitamins are (completely) destroyed • (only) two vitamins decrease (but not significantly)	marks are for the explanation only accept irradiated chicken / food contains a higher level of vitamins	2
7(b)(iv)	so can choose to eat / not eat that (particular) food	accept irradiated food may cause health problems (for some people) accept people may have ethical issues (over eating irradiated food)	1
7(c)(i)	electron from nucleus / neutron	**both** parts required	1
7(c)(ii)	90 years	allow **1** mark for showing 3 half-lives	2
Total			**11**

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

STEMUP.CO.UK

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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

General Certificate of Secondary Education
Higher Tier
January 2012

Science B
Unit Physics P1

Physics
Unit Physics P1

PHY1H

H

Monday 30 January 2012 1.30 pm to 2.15 pm

For this paper you must have:
- a ruler.

You may use a calculator.

Time allowed
- 45 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 45.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

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

STEMUP.CO.UK

Do not write outside the box

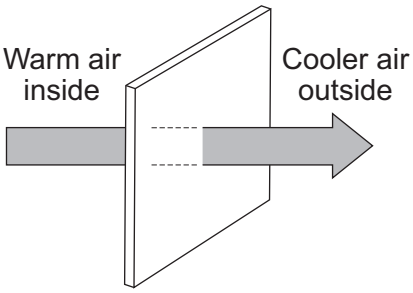
There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

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

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



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

.....

(1 mark)

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

.....

.....

.....

.....

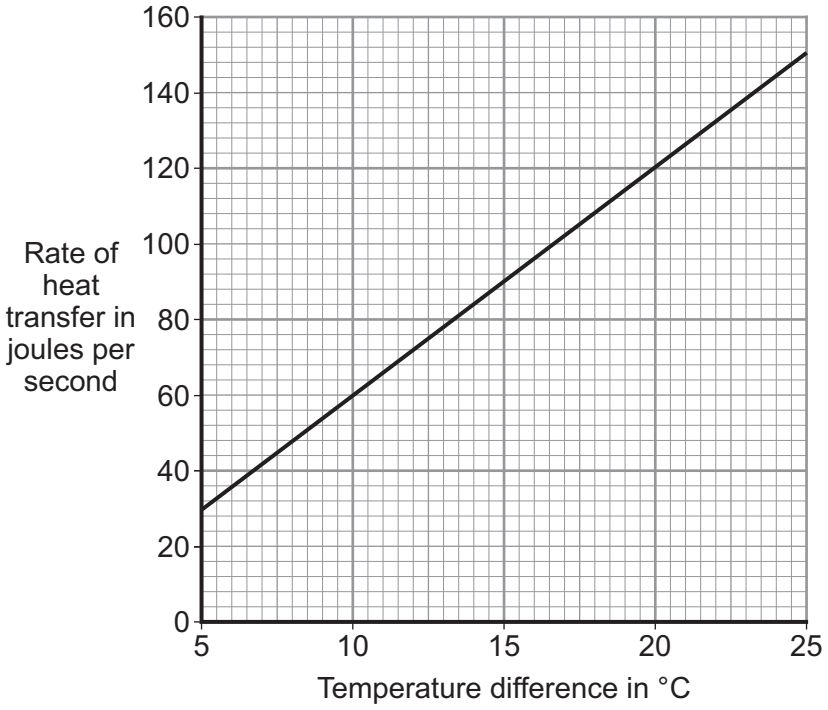
(2 marks)

Question 1 continues on the next page

Do not write outside the box

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

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



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

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

(1 mark)

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

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

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

.....

.....

.....

.....

(2 marks)

Do not write outside the box

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

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

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

Show clearly how you work out your answer.

.....

.....

.....

.....

Rate of heat transfer = ... J/s

(2 marks)

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

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

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

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

To gain full marks you must complete a calculation.

.....

.....

.....

.....

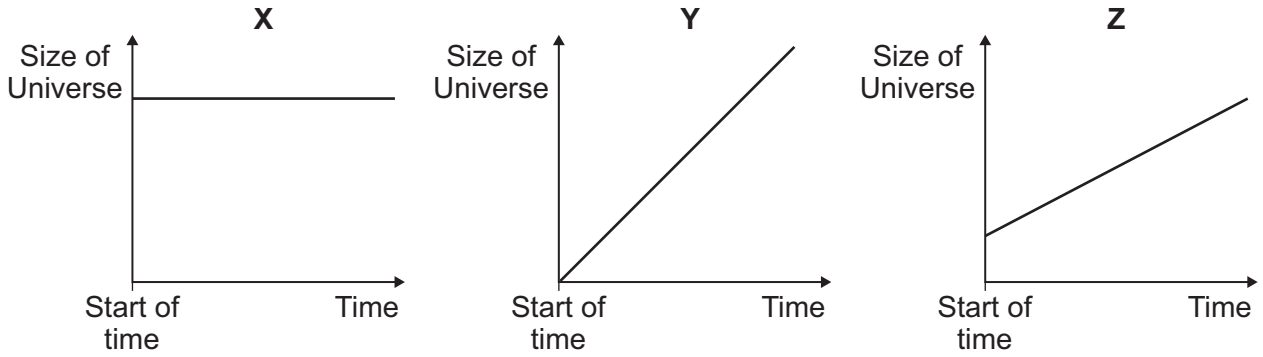
(2 marks)

10

Do not write outside the box

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

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



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

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

Explain the reason for your answer.

.....

.....

.....

.....

(3 marks)

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

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

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

to support

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

(1 mark)

Do not write outside the box

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

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

.....

.....

.....

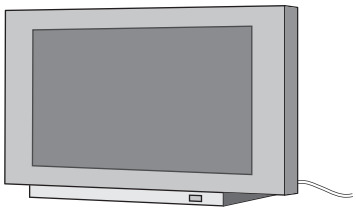
(1 mark)

5

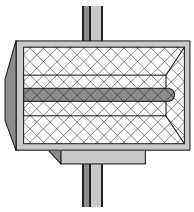
Turn over for the next question

Do not write outside the box

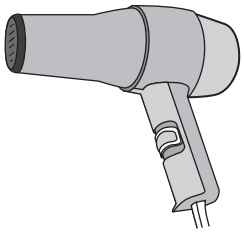
3 The data included in the diagrams gives the power of the electrical appliances.



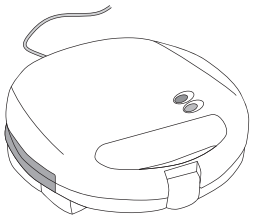
TV
160 W



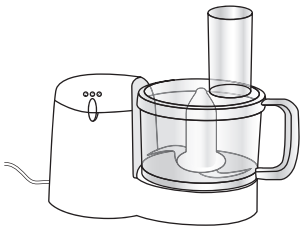
Radiant heater
1.0 kW



Hairdryer
1100 W



Sandwich toaster
1.1 kW



Food processor
0.4 kW

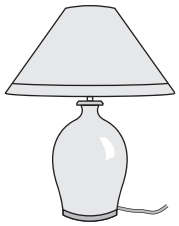


Table lamp
40 W

3 (a) (i) Which of the appliances are designed to transform electrical energy to kinetic energy?

.....

.....

(1 mark)

3 (a) (ii) Which of the appliances waste energy as heat?

.....

.....

(1 mark)

3 (b) Leaving the radiant heater switched on is likely to lead to more carbon dioxide being emitted into the atmosphere than leaving the table lamp on for the same length of time.

Explain why.

.....

.....

.....

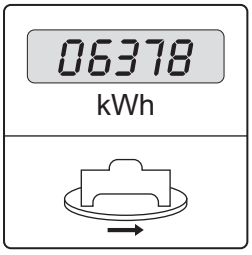
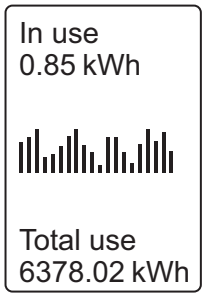
.....

(2 marks)

Do not write outside the box

3 (c) A homeowner decides to monitor the amount of electrical energy used in his home. He can do this by using the home's electricity meter or by using a separate electronic device.

The table gives some information about each method.

Electricity meter	Electronic device
Records to the nearest kilowatt-hour	Records to the nearest 1/100th kilowatt-hour
Homeowner takes readings at regular intervals	Energy use recorded continuously and stored for one year
	Displays a graph showing energy use over a period of time
	

3 (c) (i) Complete the following sentence.

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

(1 mark)

3 (c) (ii) Suggest how data collected and displayed by the electronic device could be useful to the homeowner.

.....

.....

.....

.....

.....

.....

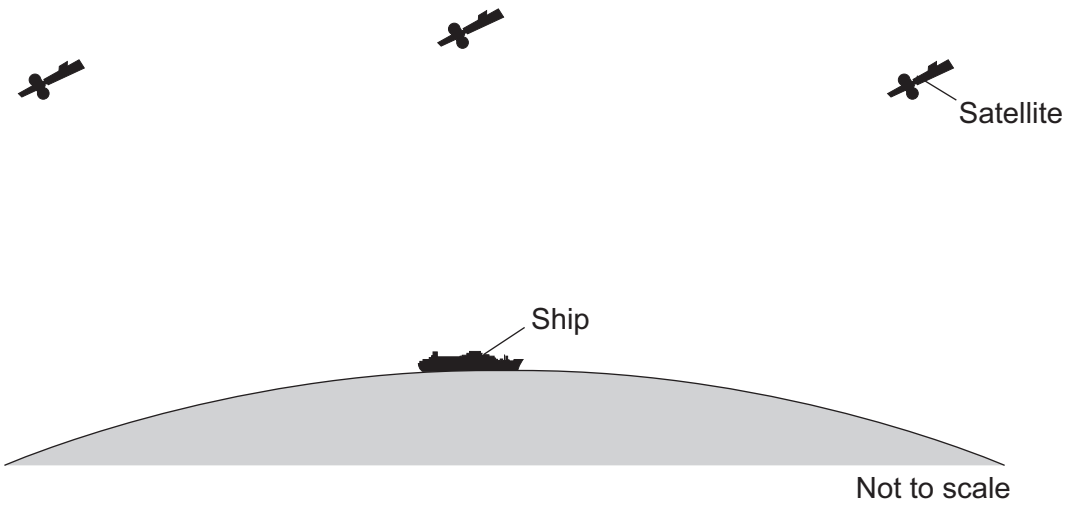
(3 marks)

8

Turn over ▶

Do not write outside the box

4 The ship in the diagram is fitted with a navigation system. The navigation system works out the location of the ship by timing the microwave signals transmitted from at least three satellites.



4 (a) Microwaves are one type of electromagnetic wave.

Give **two** properties that all electromagnetic waves have.

1 .....

.....

2 .....

.....

(2 marks)

Do not write outside the box

4 (b) The microwaves used in the navigation system are transmitted at a frequency of 1575 MHz.

Use the equation and information in the box to calculate the wavelength of the microwaves used in the navigation system.

wave speed = frequency × wavelength
microwaves travel at 300 000 000 m/s
1 MHz = 1 000 000 Hz

Show clearly how you work out your answer.

.....

.....

.....

.....

Wavelength = ... m

(3 marks)

4 (c) The ship is fitted with a metal aerial that receives the microwave signals from the satellites.

For the navigation system to work, what effect must the microwave signals have on the aerial?

.....

.....

(1 mark)

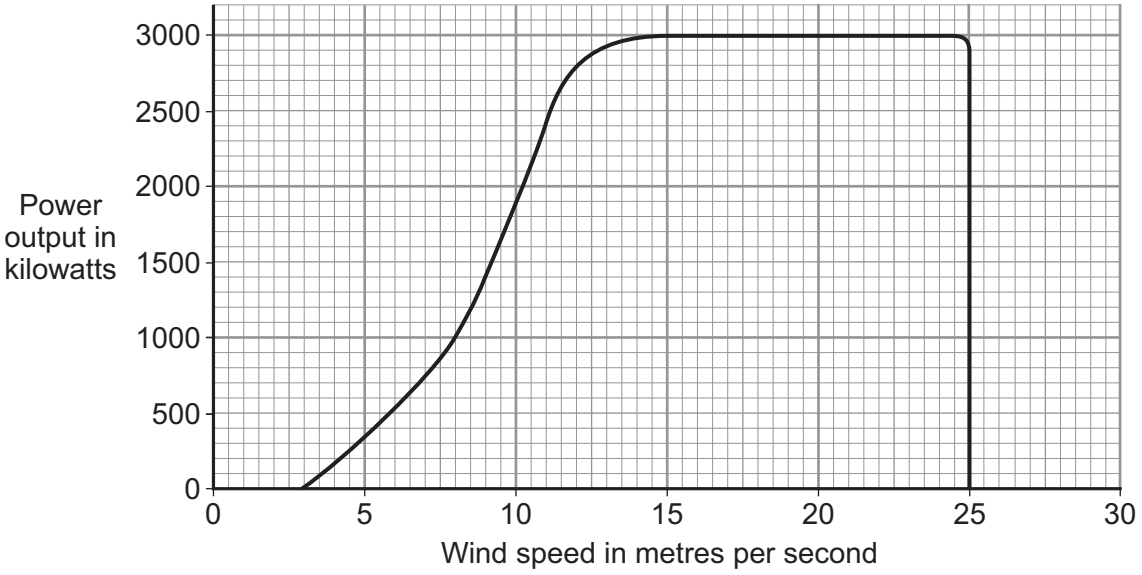
6

Turn over for the next question

Do not write outside the box

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

5 (a) The graph shows how wind speed affects the power output from one of the wind turbines.



In one 4-hour period, the wind turbine transfers 5600 kilowatt-hours of electrical energy.

Use the equation in the box and the data in the graph to calculate the average wind speed during this 4-hour period.

energy transferred = power × time

Show clearly how you work out your answer.

.....

.....

.....

.....

Average wind speed = ... m/s

(3 marks)

Do not write outside the box

5 (b) The wind turbines are linked to the National Grid by underwater cables.

5 (b) (i) What is the National Grid?

.....

.....

(1 mark)

5 (b) (ii) How is the National Grid designed to reduce energy losses during transmission?

.....

.....

.....

(1 mark)

5 (c) Read this extract from a newspaper.

> **Power crisis as island basks in sunshine**
>
> The population of a small island off the coast of Scotland decided to generate all their electricity from water and wind. However, they did not predict having a long period of warm, dry weather. A combination of low water levels and hardly any wind has drastically reduced the output from the hydroelectric power station and wind turbines.

Explain **one** way in which the islanders could try to ensure that a similar power crisis does **not** happen in the future.

.....

.....

.....

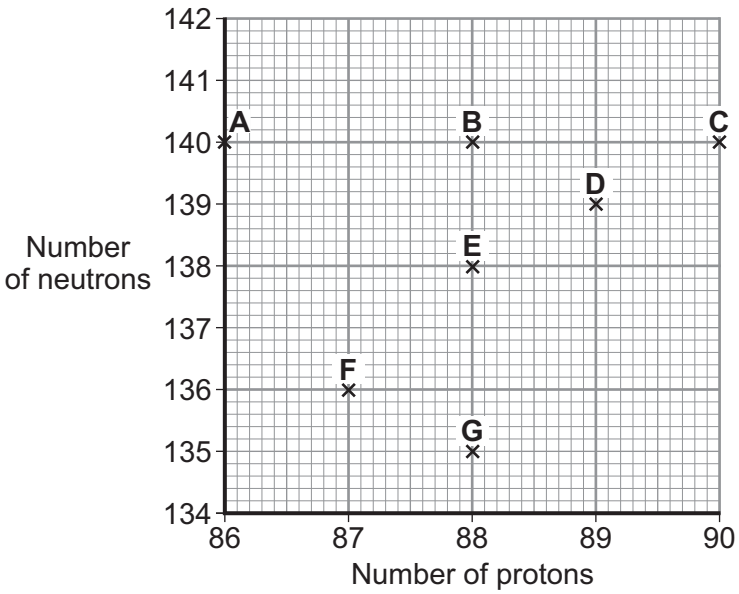
.....

(2 marks)

7

Do not write outside the box

6 (a) The chart gives the number of protons and neutrons within the nuclei of 7 different atoms, **A** – **G**.



Which of these atoms are isotopes of the same element?

.....

Give a reason for your answer.

.....

.....

(2 marks)

6 (b) Radium-226 is a radioactive isotope that decays into radon gas by emitting alpha particles.

The decay can be represented by the equation below.

$$^{226}_{88}\text{Ra} \longrightarrow \square \atop \square \text{Rn} + \text{alpha particle}$$

6 (b) (i) Complete the equation by writing the correct number in each of the boxes.

(2 marks)

Do not write outside the box

6 (b) (ii) A sample of radium-226 has a count rate of 400 counts per second.
The half-life of radium-226 is 1600 years.

How long will it be before the count rate has fallen to 50 counts per second?

Show clearly how you work out your answer.

.....

.....

.....

Length of time = ... years
(2 marks)

6 (c) In 1927, a group of women who had been employed to paint watch faces with a luminous paint sued their former employer over the illnesses caused by the paint. The women had been told that the paint, which contained radium, was harmless.

The company owners and the scientists working for the company knew that radium was harmful and took precautions to protect themselves from the radiation. The women were given no protection.

What important issue did the treatment of the women by the company owners and scientists raise?

Draw a ring around your answer.

economic **environmental** **ethical** **social**

Give a reason for your answer.

.....

.....
(2 marks)

6 (d) In the 1920s, many people, including doctors, thought that radium could be used as a treatment for a wide range of illnesses. Medical records that suggested radium could be harmful were generally ignored. When some of the women who had used the luminous paint died, their deaths were not blamed on radium.

Suggest a reason why the evidence suggesting that radium was harmful was generally ignored.

.....

.....

.....
(1 mark)

9

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

Copyright © 2012 AQA and its licensors. All rights reserved.

Version 1.0: 29/02/2012

General Certificate of Secondary Education

Science B 4462 / Physics 4451

PHY1H Unit Physics 1

Mark Scheme

2012 Examination – January 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

Copyright © 2012 AQA and its licensors. All rights reserved.

COPYRIGHT
AQA retains the copyright on all its publications. However, registered schools / colleges for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to schools / colleges to photocopy any material that is acknowledged to a third party even for internal use within the school / college.

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales (company number 3644723) and a registered charity (registered charity number 1073334).
Registered address: AQA, Devas Street, Manchester M15 6EX

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.

STEMUP.CO.UK

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.

STEMUP.CO.UK

PHY1H

Question 1

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

Question 1 continues on the next page . . .

STEMUP.CO.UK

PHY1H

Question 1 continued . . .

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

STEMUP.CO.UK

PHY1H

Question 2

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

STEMUP.CO.UK

PHY1H

Question 3

question	answers	extra information	mark
3(a)(i) G	food processor hairdryer	both required and no other either order	1
3(a)(ii) G	TV Table lamp Food processor	all required and no other any order	1
3(b) E	any **two** from: • transfers / requires / uses more energy / power • more electricity needs to be generated • more (fossil) fuels (likely) to be burnt	 accept more electricity used accept higher power accept a named fossil fuel	2
3(c)(i) G	precise	this answer only	1
3(c)(ii) E	any **three** from: • can look for trends / patterns • help reduce energy use / consumption • reduce bills • identify appliances which use a lot of energy • replace appliances with more efficient ones • see effect of leaving appliances on (standby)	 accept save money to monitor usage is insufficient answers in terms of environment are insufficient	3
Total			**8**

STEMUP.CO.UK

PHY1H

Question 4

question	answers	extra information	mark
4(a) E	any **two** from: • travel at the same speed (through a vacuum) • can travel through a vacuum / space • transfer energy • can be reflected • can be refracted • can be diffracted • can be absorbed • transverse • travel in straight lines	if a value is given it must be correct accept air for vacuum accept travel at the speed of light do **not** accept air for vacuum accept any other property common to electromagnetic waves accept travel at the same speed through a vacuum for **both** marks both radiated from the Sun is insufficient	2
4(b) E	0.19 (0)	accept any answer that rounds to 0.19 accept 0.2 for all **3** marks provided working is shown 0.2 without working gains **2** marks allow **2** marks for a correct substitution and transformation using frequency in hertz ie wavelength = $\frac{300\,000\,000}{1575\,000\,000}$ **or** allow **1** mark for changing MHz to Hz allow **1** mark for correct substitution using 1575 or incorrectly converted frequency answers 190476 and 190000 gain **2** marks	3

Question 4 continues on the next page . . .

STEMUP.CO.UK

PHY1H

Question 4 continued . . .

question	answers	extra information	mark
4(c) E	create an alternating current with the same frequency (as the microwaves / signals / 1575(MHz))	ignore reference to change in temperature	1
Total			**6**

STEMUP.CO.UK

PHY1H

Question 5

question	answers	extra information	mark
5(a) E	9	allow **2** marks for power =1400 (kW) if a subsequent calculation is shown award **1** mark only **or** allow **1** mark for correct substitution and transformation power = $\frac{5600}{4}$ allow **1** mark for using a clearly incorrect value for power to read a corresponding correct value from the graph	3
5(b)(i) E	system of cables <u>and</u> transformers	both required for the mark ignore reference to pylons inclusion of power stations / consumers negates the mark wire(s) is insufficient	1
5(b)(ii) E	(uses step-up transformer to) increase pd / voltage **or** (uses step-up transformer to) reduce current	accept (transfers energy / electricity at) high voltage accept (transfers energy / electricity at) low current ignore correct references to step-down transformers	1

Question 5 continues on the next page . . .

STEMUP.CO.UK

PHY1H

Question 5 continued . . .

question	answers	extra information	mark
5(c) E	build a power station that uses a non-renewable fuel or biofuel **or** buy (lots of) petrol / diesel generators	accept a named fuel eg coal or wood	1
	stockpile supplies of the fuel **or** fuel provides a reliable source of energy	accept fuel does not rely on the weather accept as an alternative answer idea of linking with the National Grid (1) and taking power from that when demand exceeds supply (1) **or** when other methods fail **or** when it is needed answers in terms of using other forms of renewables is insufficient	1
Total			**7**

STEMUP.CO.UK

PHY1H

Question 6

question	answers	extra information	mark
6(a) E	**B E G**	all 3 required and no other any order	1
	same number of / 88 protons (and different numbers of neutrons)	same number of electrons is insufficient	1
6(b)(i) E	222		1
	86		1
6(b)(ii) E	4800	allow **1** mark for obtaining 3 half-lives	2
6(c) E	ethical		1
	deceived / lied to (about safety of working conditions) **or** value own / scientists lives more than women **or** did not treat women humanely	accept (women) not warned of the dangers given no protection is insufficient	1

Question 6 continues on the next page . . .

STEMUP.CO.UK

PHY1H

Question 6 continued . . .

question	answers	extra information	mark
6(d) E	accept any sensible suggestion eg too many interests in continued use of radium evidence may cause public unrest doctors not want to be blamed for illnesses (caused by radium) doctors thought (possible) benefits outweighed (possible) risks	 do **not** accept not enough evidence accept doctors not wanting to be sued (for harm caused by using radium) do **not** accept did not know radium could be harmful believe radium could treat illnesses is insufficient	1
Total			**9**

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

STEMUP.CO.UK

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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

General Certificate of Secondary Education
Higher Tier
June 2011

Science B
Unit Physics P1

PHY1H

H

Physics
Unit Physics P1

Friday 17 June 2011 1.30 pm to 2.15 pm

For this paper you must have:
- a ruler.

You may use a calculator.

Time allowed
- 45 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 45.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

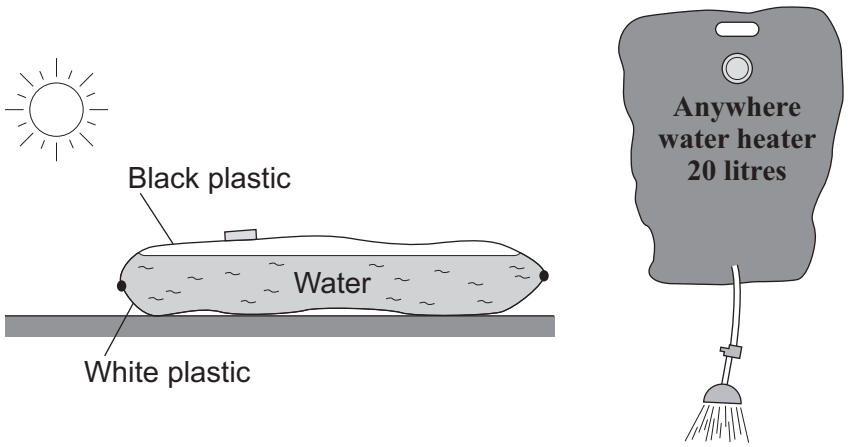
Advice
- In all calculations, show clearly how you work out your answer.

STEMUP.CO.UK

Do not write outside the box

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

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



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

.....

(1 mark)

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

.....

.....

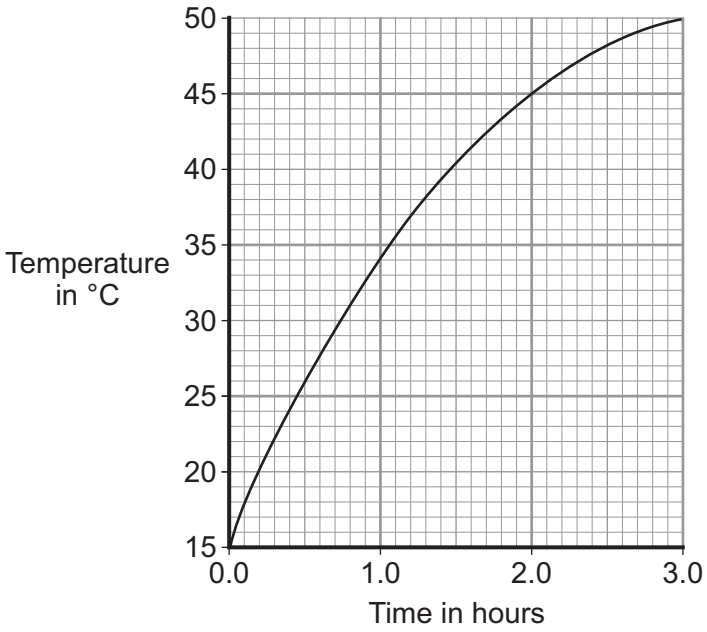
.....

.....

(2 marks)

Do not write outside the box

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



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

.....

(1 mark)

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

.....

.....

(1 mark)

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

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

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

1 .....

2 .....

(2 marks)

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

(1 mark)

8

Turn over ▶

Do not write outside the box

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

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

What is this process called?

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

decommissioning ☐

decontaminating ☐

dismantling ☐

(1 mark)

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

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

.....

.....

.....

.....

(2 marks)

Do not write outside the box

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

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

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

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

.....

.....

(1 mark)

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

.....

.....

(1 mark)

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

.....

.....

(1 mark)

Question 2 continues on the next page

Do not write outside the box

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

On what is this decision based?

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

economic issues ☐

ethical issues ☐

social issues ☐

(1 mark)

7

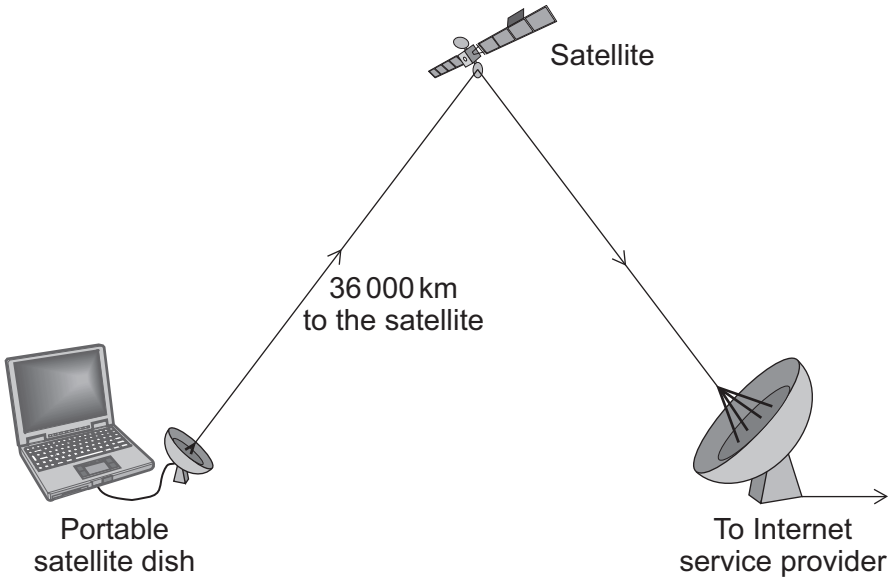
Do not write outside the box

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

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



3 (a) (i) Name the type of electromagnetic wave used to send information to and from the satellite.

.....

(1 mark)

3 (a) (ii) The information is sent to and from the satellite using a *digital signal*.

Describe a *digital signal*.

You may draw a diagram to help you answer.

.....

.....

(1 mark)

Do not write outside the box

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

.....

.....

(1 mark)

3 (b) Electromagnetic waves travel at a speed of 300 000 000 m/s.
The waves travelling to and from the satellite have a wavelength of 15 cm.

Use the equation in the box to calculate the frequency of these waves.

wave speed = frequency × wavelength

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

.....

.....

Frequency = ...

(3 marks)

3 (c) In 2009, parts of the African country Kenya, were linked to the Internet by a super-fast optical fibre. Before that, all Internet connections had to be made via a satellite link.

3 (c) (i) Complete the following sentence.

Signals can be sent along an optical fibre using either visible light or

..... .

(1 mark)

3 (c) (ii) Suggest a reason why signals sent through the optical fibre arrive faster than signals sent via a satellite link.

.....

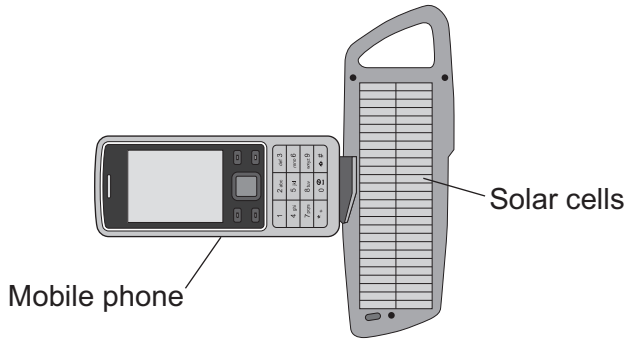
.....

(1 mark)

8

Do not write outside the box

4 (a) The diagram shows a solar powered device being used to recharge a mobile phone.



On average, the solar cells produce 0.6 joules of electrical energy each second.
The solar cells have an efficiency of 0.15.

4 (a) (i) Use the following equation to calculate the average energy input each second to the device.

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

Show clearly how you work out your answer.

.....

.....

Average energy input each second = ... J/s

(2 marks)

4 (a) (ii) Draw a labelled Sankey diagram for the solar cells.
The diagram does **not** need to be drawn to scale.

(1 mark)

Do not write outside the box

4 (a) (iii) Energy from the Sun is stored by a rechargeable battery inside the device.

Suggest **one** factor that would affect the time it takes to fully charge the battery.

Give a reason for your answer.

.....

.....

.....

.....

(2 marks)

4 (b) Scientists have developed a new type of solar cell with an efficiency of over 40 %. The efficiency of the solar cell was confirmed independently by other scientists.

Suggest why it was important to confirm the efficiency independently.

.....

.....

(1 mark)

4 (c) The electricity used in homes in the UK is normally generated in a fossil fuel power station.

Outline some of the advantages of using solar cells to generate this electricity.

.....

.....

.....

.....

(2 marks)

8

Turn over for the next question

Do not write outside the box

5 LOFAR is a new type of telescope designed to observe the lowest frequency radio waves. It consists of thousands of simple radio antennae linked to a super-computer. This combines all the signals to give a single output.

5 (a) (i) Give **one** reason, apart from its physical size, why a telescope such as LOFAR is positioned on the Earth and not on a satellite in space.

.....

.....

(1 mark)

5 (a) (ii) Why are the analogue signals from the antennae converted into digital signals before being sent to the computer?

.....

.....

(1 mark)

5 (b) One of the main purposes of the LOFAR telescope is to study the period of time a few hundred thousand years after the big bang. This is done by measuring the *red-shift* of the waves emitted by hydrogen atoms in very distant galaxies.

5 (b) (i) What is *red-shift*?

.....

.....

(1 mark)

5 (b) (ii) The LOFAR telescope has a sensitivity 20 times greater than other radio telescopes.

What does this statement mean?

.....

.....

(1 mark)

Do not write outside the box

5 (b) (iii) The Ancient Greeks believed that the Universe went on forever; it never changed and had no beginning. It had always existed.

How are the ideas put forward by the big bang theory different from the beliefs of the Ancient Greeks?

.....

.....

.....

.....

(2 marks)

5 (c) Some scientists are using the LOFAR super-computer for Earth based investigations. For example, to study the effect of natural gas extraction on ground levels in the Netherlands.

Suggest **one** positive benefit of developing technologies that can be used by many different groups of scientists.

.....

.....

(1 mark)

7

Turn over for the next question

Do not write outside the box

6 (a) Carbon has three naturally occurring isotopes. The isotope, carbon-14, is radioactive. An atom of carbon-14 decays by emitting a beta particle.

6 (a) (i) Complete the following sentences.

The atoms of the three carbon isotopes are the same as each other because

..... .

The atoms of the three carbon isotopes are different from each other because

..... .

(2 marks)

6 (a) (ii) What is a beta particle and from what part of an atom is it emitted?

.....

.....

(1 mark)

6 (b) Carbon-14 is constantly being made in the atmosphere, yet for most of the last million years, the amount of carbon-14 in the atmosphere has not changed.

How is this possible?

.....

.....

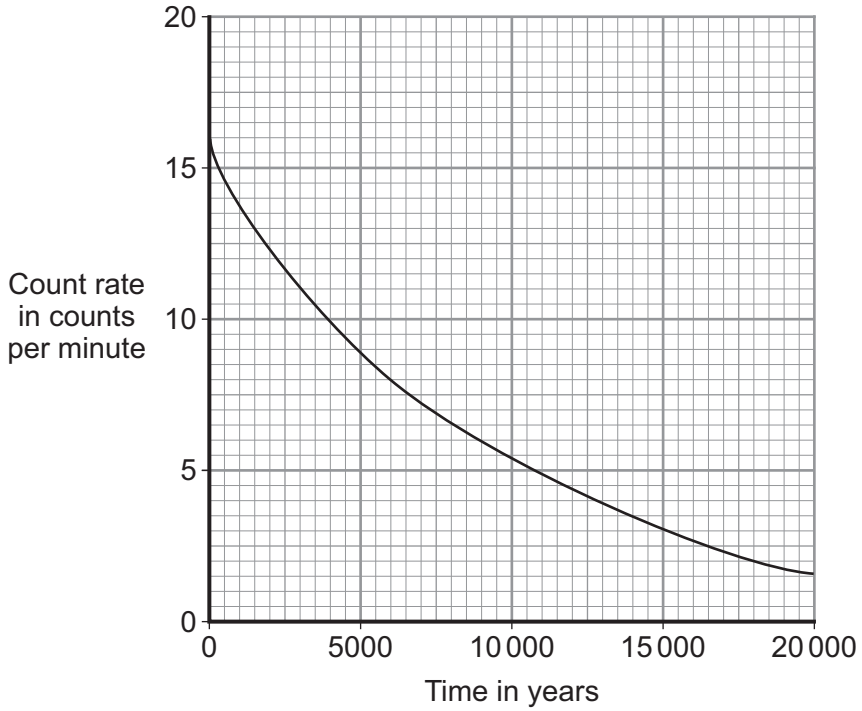
(1 mark)

Do not write outside the box

6 (c) Trees take in carbon-12 and carbon-14 from the atmosphere. After the tree dies, the proportion of carbon-14 that the tree contains decreases.

Graph **A** shows the decay curve for carbon-14.

Graph **A**



6 (c) (i) Lake Cuicocha in Ecuador was formed after a volcanic eruption.
Carbon taken from a tree killed by the eruption was found to have a count rate of 10.5 counts per minute.
At the time of the eruption, the count rate would have been 16 counts per minute.

Use graph **A** to find the age of Lake Cuicocha.

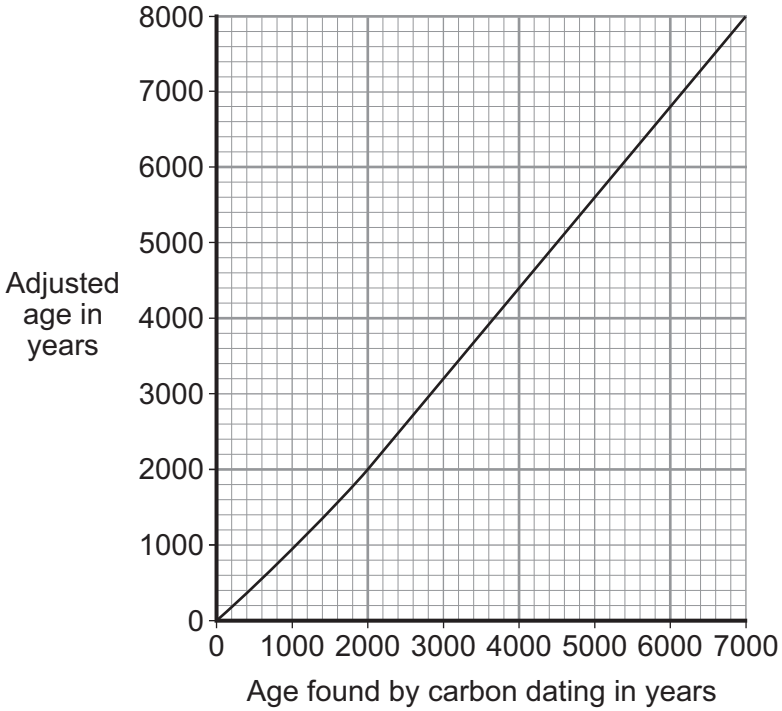
Age of Lake Cuicocha = ... years
(1 mark)

Question 6 continues on the next page

Do not write outside the box

6 (c) (ii) Finding the age of organic matter by measuring the proportion of carbon-14 that it contains is called carbon dating. This technique relies on the ratio of carbon-14 to carbon-12 in the atmosphere remaining constant. However, this ratio is not constant so the age found by carbon dating needs to be adjusted.

Graph **B**



Graph **B** is used to adjust the age of an object found by carbon dating.
The value obtained from graph **B** will be no more than 50 years different to the true age of the object.

Use graph **B** and the information above to find the maximum age that Lake Cuicocha could be.

Show clearly how you obtain your answer.

.....

.....

Maximum age of Lake Cuicocha = ... years

(2 marks)

7

END OF QUESTIONS

Copyright © 2011 AQA and its licensors. All rights reserved.

Version1.0: 29/07/2011

General Certificate of Secondary Education

Science B 4462 / Physics 4451

PHY1H Unit Physics 1

Mark Scheme

2011 Examination – June Series

STEMUP.CO.UK

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

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

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

Copyright © 2011 AQA and its licensors. All rights reserved.

COPYRIGHT
AQA retains the copyright on all its publications. However, registered centres for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to centres to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales (company number 3644723) and a registered charity (registered charity number 1073334).
Registered address: AQA, Devas Street, Manchester M15 6EX

Marking Guidance for Examiners

GCSE Science Papers

1. General

The mark scheme for each question shows:

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

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

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

where consequential marking needs to be considered in a calculation;

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

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

2. Emboldening

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

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

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

3. Marking points

3.1 Marking of lists

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

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

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

STEMUP.CO.UK

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

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

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

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

3.2 Use of chemical symbols / formulae

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

3.3 Marking procedure for calculations

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

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

3.4 Interpretation of 'it'

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

3.5 Errors carried forward

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

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

3.6 Phonetic spelling

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

3.7 Brackets

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

STEMUP.CO.UK

PHY1H

Question 1

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

Question 1 continues on the next page

PHY1H

Question 1 continued

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

PHY1H

Question 2

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

Question 2 continues on the next page

PHY1H

Question 2 continued

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

Question 2 continues on the next page

PHY1H

Question 2 continued

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

PHY1H

Question 3

question	answers	extra information	mark
3(a)(i)	microwave(s)		1
3(a)(ii)	has discrete values only **or** has only 2 states	accept can only be on or off accept made up of 1 and 0 only accept has high and low (values only) accept a diagram with discrete levels do **not** accept can be switched on and off	1
3(a)(iii)	any **one** from: • less (prone to) interference • can be (easily) processed by computers • better quality (signal) • digital signals can be restored • information / data can be compressed	it refers to signal accept no interference accept interference causes less / no permanent damage accept noise / distortion for interference accept can be processed without an analogue to digital converter better on its own is insufficient accept can send more information in same time do **not** accept faster	1

Question 3 continues on the next page

PHY1H

Question 3 continued

question	answers	extra information	mark
3(b)	2 000 000 000	allow **1** mark for correct transformation and substitution ie $\frac{300\,000\,000}{0.15}$ or $\frac{300\,000\,000}{15}$	2
	hertz	accept Hz do **not** accept hz accept kHz / MHz / GHz **but** for full credit the answer and unit must be consistent eg answers 2 GHz; 2000 MHz; 2 000 000 kHz gain **3** marks	1
3(c)(i)	infra red (radiation)	accept IR ignore reference to light	1
3(c)(ii)	travel a shorter distance	do **not** accept faster	1
Total			**8**

PHY1H

Question 4

question	answers	extra information	mark
4(a)(i)	4	allow **1** mark for correct transformation and substitution ie $\frac{0.6}{0.15}$ substitution only scores if no subsequent steps are shown	2
4(a)(ii)	diagram showing two output arrows with one arrow wider than the other with the narrower arrow labelled electrical / electricity / useful		1
4(a)(iii)	any **one** from: • time of day / year • position of solar cells • angle of solar cells (to the Sun) • latitude • cloud cover • solar cells covered in dust / dirt	accept charger for solar cells accept any reasonable suggestion that would lead to a change in intensity of sun(light) the weather is insufficient do **not** accept any physical changes to the charger eg area	1
	causes a change in intensity of sun(light)	accept brightness for intensity accept a description of the reduction of intensity	1

Question 4 continues on the next page

PHY1H

Question 4 continued

question	answers	extra information	mark
4(b)	any **one** from: • to check reliability / validity / accuracy • to avoid bias		1
4(c)	any **two** from: • produce no / less (air) pollution • energy is free • (energy) is renewable • conserves fossil fuel stocks • can be used in remote areas • do not need to connect to the National Grid	accept named pollutant accept produces no waste (gases) accept it is a free resource do **not** accept it is free	2
Total			**8**

PHY1H

Question 5

question	answers	extra information	mark
5(a)(i)	radio waves pass through the atmosphere	accept it is cheaper / easier to maintain	1
5(a)(ii)	computers process digital signals (more easily)	accept read for process accept computers cannot (easily) process analogue signals ignore references to interference	1
5(b)(i)	wavelength (of waves appears to) increase **or** wavelength moves to longer / red end of spectrum	accept answers in terms of frequency decrease accept wavelength stretched but not just wave is stretched answers involving planets negates mark	1
5(b)(ii)	can measure change 20 times smaller	accept can measure (much) smaller change accept detects with greater precision accept can show more detail / stars accept can detect weaker signals can see things more clearly is insufficient	1

Question 5 continues on the next page

PHY1H

Question 5 continued

question	answers	extra information	mark
5(b)(iii)	Universe had a start point Universe is (still) changing / expanding	mention of Earth / planets etc exploding / expanding negates answer	1 1
5(c)	any **one** from: • share ideas • can justify large development costs • makes new investigations possible	 accept cost shared saves money is insufficient accept any sensible suggestion	1
Total			**7**

PHY1H

Question 6

question	answers	extra information	mark
6(a)(i)	number of protons are the same number of neutrons are different	accept atomic number / number of electrons for number of protons accept mass numbers are different – only if the first mark is awarded	1 1
6(a)(ii)	an electron from the nucleus	both parts needed	1
6(b)	decays at the same rate as it is made	accept decays as fast as it is made accept absorbed / used by plants (in CO_2) at same rate as it is being made	1
6(c)(i)	3500	no tolerance	1
6(c)(ii)	adjusted age correctly obtained from the graph adjusted age +50	accept values between 3700–3800 inclusive accept their **(c)(i)** used correctly to obtain an adjusted age from the graph second mark can only be scored if first mark awarded if no working shown an answer between 3750–3850 inclusive scores both marks note: any line or mark made on the graph counts as working out	1 1
Total			**7**

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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

General Certificate of Secondary Education
Higher Tier
January 2011

Science B
Unit Physics P1

PHY1H

H

Physics
Unit Physics P1

Wednesday 19 January 2011 9.00 am to 9.45 am

For this paper you must have:
- a ruler.

You may use a calculator.

Time allowed
- 45 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 45.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

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

STEMUP.CO.UK

Do not write outside the box

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

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

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

How are microwaves different from radio waves?

.....

.....

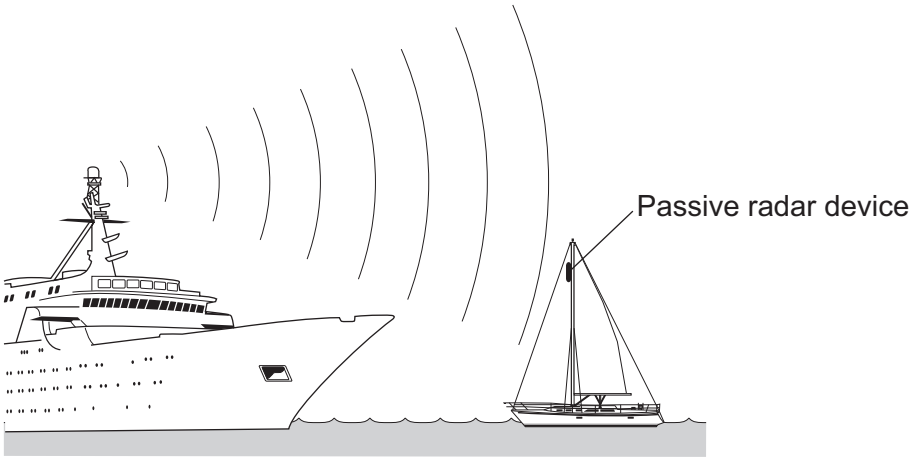
(1 mark)

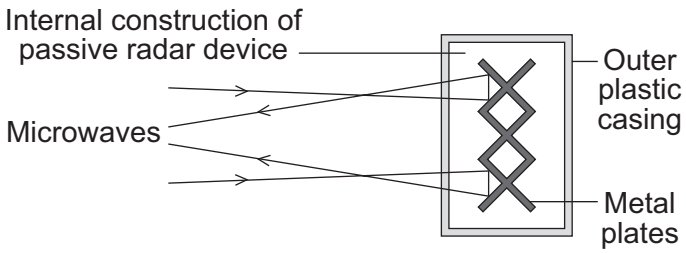
1 (b) How fast do microwaves travel through the air or a vacuum compared to radio waves?

.....

(1 mark)

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





STEMUP.CO.UK

Do not write outside the box

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

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

.....

.....

.....

.....

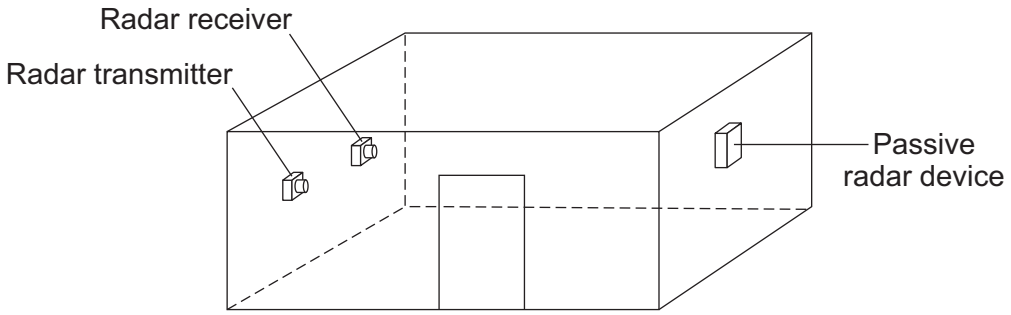
(2 marks)

Question 1 continues on the next page

Do not write outside the box

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

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



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

.....

.....

(1 mark)

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

.....

.....

(1 mark)

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

.....

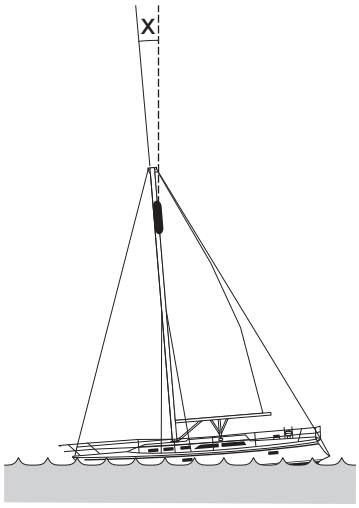
.....

(1 mark)

Do not write outside the box

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

The table gives the RCS values obtained by the scientists.



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

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

.....

.....

.....

.....

(2 marks)

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

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

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

.....

Give a reason for your answer.

.....

.....

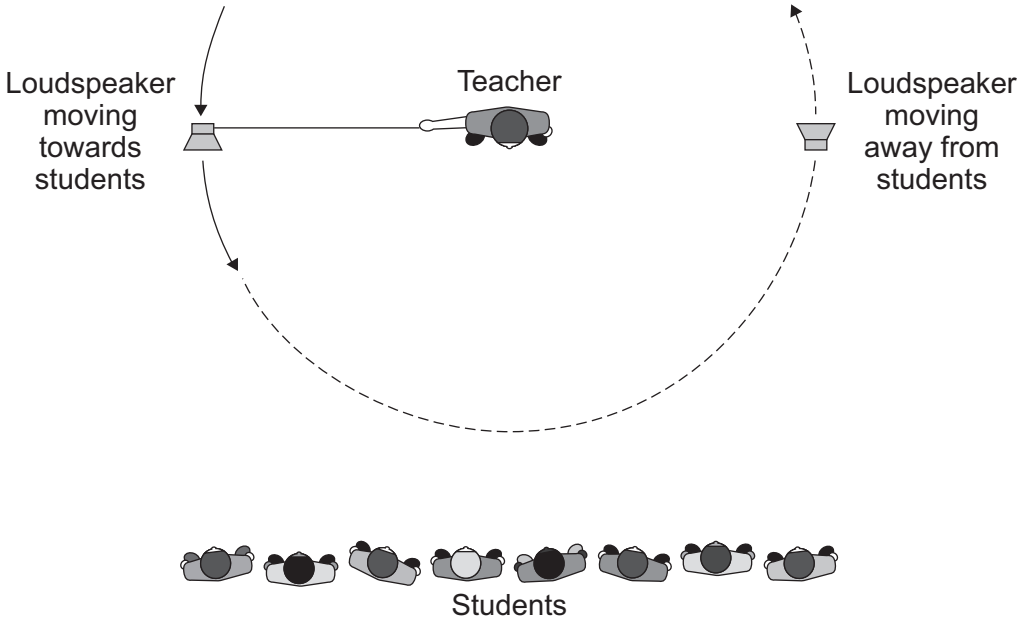
(1 mark)

10

Turn over ▶

Do not write outside the box

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



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

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

.....

.....

(1 mark)

Do not write outside the box

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

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

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

Models can help to explain an effect or theory. ☐

Models can prove that a theory is correct. ☐

Models can help to generate new ideas. ☐

(1 mark)

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

.....

.....

.....

.....

(2 marks)

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

What name is given to this theory?

.....

(1 mark)

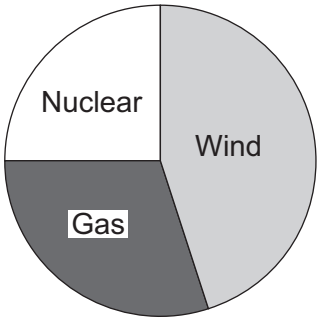
5

Turn over for the next question

Do not write outside the box

3 (a) An electricity company claims to generate all of its electricity from environmentally friendly energy sources.

The energy sources used by the company are shown in the pie chart.



Do you think that the claim made by the company is correct?

Draw a ring around your answer.

Yes **No** **Maybe**

Explain the reasons for your answer.

.....

.....

.....

.....

(2 marks)

3 (b) The government is committed to increasing the amount of electricity generated from renewable sources. A newspaper reported that:

More wind farms, wave powered generators, solar generators and nuclear power stations would need to be built

Why is the statement made in the newspaper incorrect?

.....

.....

(1 mark)

3

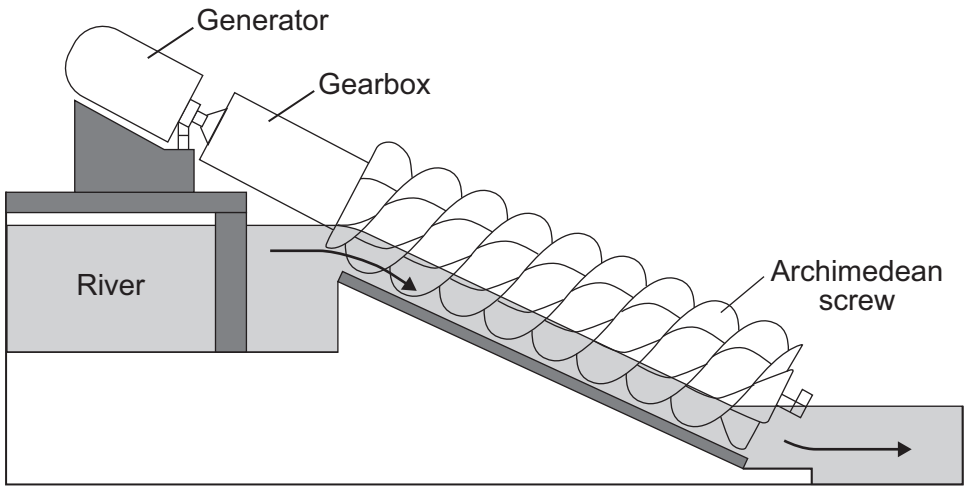
Do not write outside the box

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

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



4 (a) Each second, the *micro-hydroelectricity* generator transforms 80 000 joules of gravitational potential energy into 60 000 joules of electrical energy.

4 (a) (i) Fill in the missing word to complete the energy transformation diagram.

Gravitational potential energy of the falling water	→ ..... energy of the Archimedean screw	→ Electrical energy generated

(1 mark)

4 (a) (ii) Use the equation in the box to calculate the efficiency of the *micro-hydroelectricity* generator.

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

Show clearly how you work out your answer.

.....

.....

Efficiency = ...

(2 marks)

Do not write outside the box

4 (b) The power output from a conventional large-scale hydroelectric power station is 100 000 times more than the power output from a micro-hydroelectric system.

Give **one** disadvantage of a conventional large-scale hydroelectric power station compared to the micro-hydroelectric system.

.....

.....

(1 mark)

4 (c) The electricity generated by a micro-hydroelectric system is transferred via a transformer directly to local homes. The electricity generated by a conventional large-scale hydroelectric power station is transferred to the National Grid, which distributes the electricity to homes anywhere in the country.

4 (c) (i) What is the National Grid?

.....

.....

(1 mark)

4 (c) (ii) Explain why transferring the electricity directly to local homes is more efficient than using the National Grid to distribute the electricity.

.....

.....

.....

.....

(2 marks)

7

Turn over for the next question

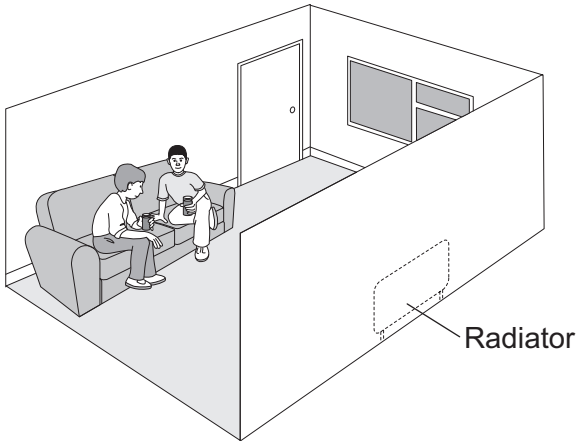
Do not write outside the box

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

5 (a) The diagram shows the position of a radiator inside a room. The radiator is made from metal and is painted white.



5 (a) (i) Heat is transferred from the hot water inside the metal radiator to the air touching the outside surface of the radiator.

What name is given to this method of heat transfer?

.....

(1 mark)

5 (a) (ii) Explain, in terms of the particles in the metal, how heat is transferred through the radiator.

.....

.....

.....

.....

(2 marks)

5 (a) (iii) What name is given to the main method by which heat is transferred from the radiator to the people on the other side of the room?

.....

(1 mark)

Question 5 continues on the next page

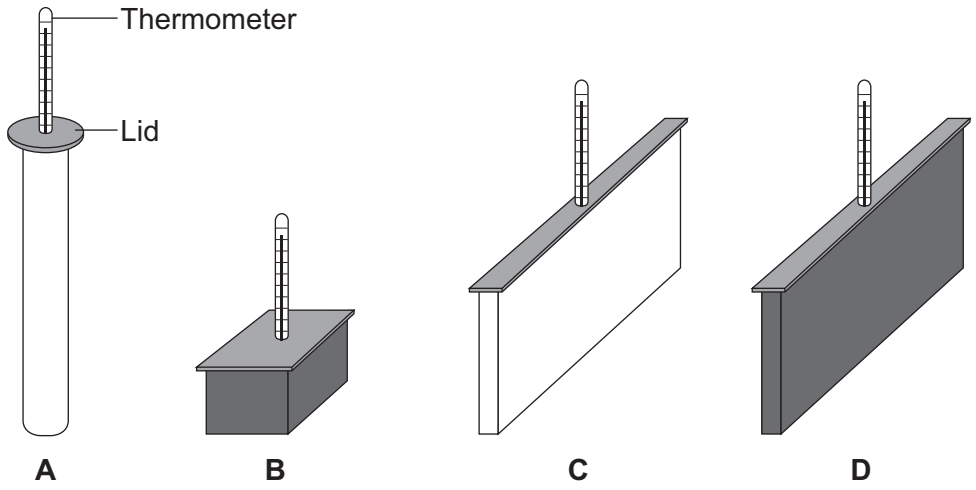
Turn over ▶

STEMUP.CO.UK

Do not write outside the box

5 (b) A student investigated the effect of shape and colour on heat transfer.

The student used metal containers with the same volume but with different shapes and outside colour. The containers were each filled with water at 100 °C.
After 20 minutes the temperature of the water inside each container was measured.



The results from the investigation are given in the table.

Container	Colour	Temperature after 20 minutes in °C	Temperature fall in °C
A	White	86	14
B	Black	86	14
C	White	73	27
D	Black	60	40

5 (b) (i) The student uses the results in the table to see if shape has affected heat transfer.

Which containers should the student compare to do this?

.....

Give a reason for your answer.

.....

.....

(1 mark)

Do not write outside the box

5 (b) (ii) Explain why the temperature of the water in both containers **A** and **B** fell by the same amount.

.....

.....

.....

.....

(2 marks)

5 (b) (iii) A central heating system has several radiators joined together. The hot water goes from the boiler, through each radiator in turn and then back to the boiler for reheating.

Give **one** reason, other than appearance, why it might **not** be a good idea to paint radiators black.

.....

.....

(1 mark)

8

Turn over for the next question

Do not write outside the box

6 (a) The table gives information about some ways of reducing the energy consumption in a house.

Method of reducing energy consumption	Installation cost in £	Annual saving on energy bills in £
Cavity wall insulation	250	115
Jacket for hot water tank	12	35
Upgraded central heating controls	310	80

Show that over 5 years, the most cost-effective method of reducing energy consumption is to install cavity wall insulation.

.....

.....

.....

.....

(2 marks)

6 (b) Any device that transforms energy will waste energy.

Why must the total energy input to such a device always equal the total energy output from the device?

.....

.....

(1 mark)

Do not write outside the box

6 (c) A holiday cottage has a pre-payment electricity meter. The electricity is charged at the rate of 20 p per kWh. A £2 coin is put into the meter and a 2.5 kW fire switched on.

Use the equations in the box to work out how many hours it will be before £2 runs out. Assume that no other electrical device is switched on.

energy transferred = power × time

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

Show clearly how you work out your answer.

.....

.....

.....

.....

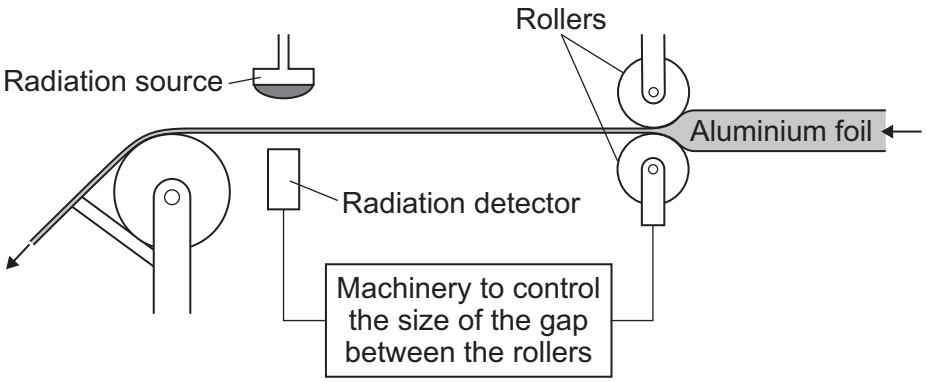
Time = ... hours
(2 marks)

5

Turn over for the next question

Do not write outside the box

7 The diagram shows a system used to control the thickness of aluminium foil as it is being rolled. A radiation source and detector are used to monitor the thickness of the foil.



7 (a) Which type of source, alpha, beta or gamma, should be used in this control system?

.....

Explain why each of the other two types of source would **not** be suitable.

.....

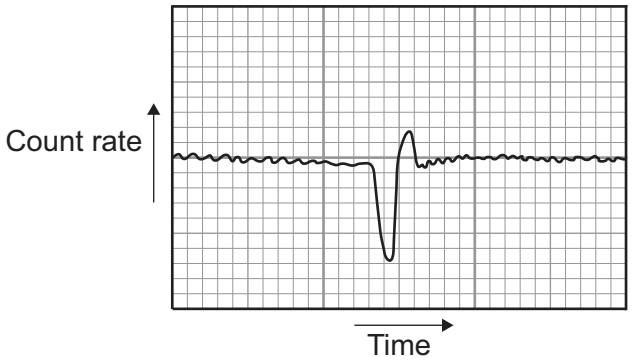
.....

.....

.....

(3 marks)

7 (b) The chart shows how the count rate recorded by the detector varies over a short period of time.



Do not write outside the box

Use the graph to explain how the thickness of the foil changes, and how the control system responds to this change.

.....

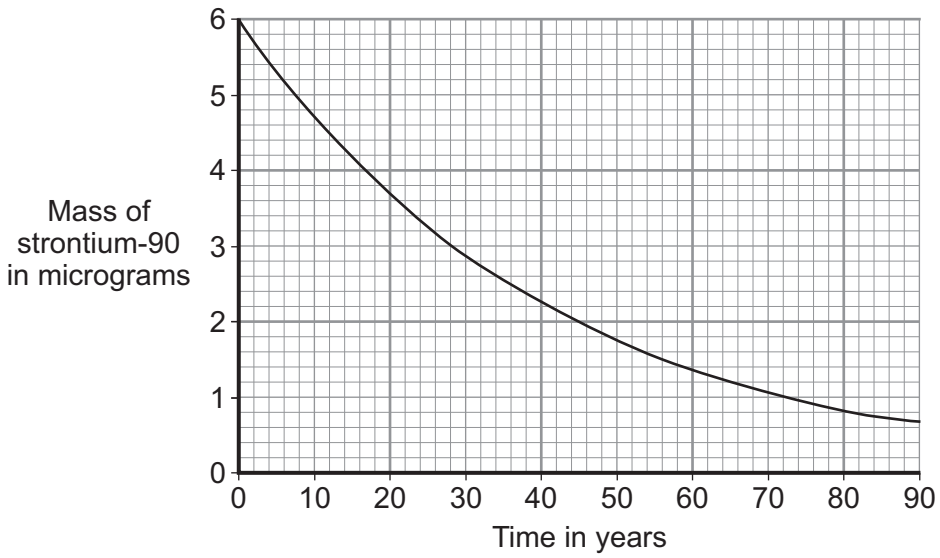
.....

.....

.....

(2 marks)

7 (c) When first used, the radiation source contains 6 micrograms of strontium-90.
The graph shows how the mass of the strontium-90 will decrease as the nuclei decay.



The control system will continue to work with the same source until 75% of the original strontium-90 nuclei have decayed.

After how many years will the source need replacing?

Show clearly your calculation and how you use the graph to obtain your answer.

.....

.....

.....

Number of years = ...

(2 marks)

7

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

Copyright © 2011 AQA and its licensors. All rights reserved.

Version 1.0: 24/02/2011

General Certificate of Secondary Education

Science B 4462 / Physics 4451

PHY1H Unit Physics 1

Mark Scheme

2011 Examination – January Series

STEMUP.CO.UK

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

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

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

Copyright © 2011 AQA and its licensors. All rights reserved.

COPYRIGHT
AQA retains the copyright on all its publications. However, registered centres for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to centres to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales (company number 3644723) and a registered charity (registered charity number 1073334).
Registered address: AQA, Devas Street, Manchester M15 6EX

STEMUP.CO.UK

Marking Guidance for Examiners

GCSE Science Papers

1. General

The mark scheme for each question shows:

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

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

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

where consequential marking needs to be considered in a calculation;

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

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

2. Emboldening

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

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

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

3. Marking points

3.1 Marking of lists

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

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

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

STEMUP.CO.UK

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

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

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

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

3.2 Use of chemical symbols / formulae

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

3.3 Marking procedure for calculations

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

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

3.4 Interpretation of 'it'

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

3.5 Errors carried forward

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

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

3.6 Phonetic spelling

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

3.7 Brackets

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

STEMUP.CO.UK

PHY1H

Question 1

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

Question 1 continues on the next page . . .

STEMUP.CO.UK

PHY1H

Question 1 continued . . .

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

STEMUP.CO.UK

PHY1H

Question 2

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

STEMUP.CO.UK

PHY1H

Question 3

question	answers	extra information	mark
3(a)		marks are awarded only for the reason but must match the ringed answer for both marks a **MAYBE** answer should include a **YES** and **NO** response answers in terms of the sources being renewable or non-renewable are insufficient	2
	any **two** from: **YES** answers may include:		
	• wind produces no pollutant gases	accept wind burns no fuel accept CO_2 / SO_2 / oxides of nitrogen / greenhouse gas for pollutant gases	
	• nuclear produces no pollutant gases	accept nuclear burns no fuel	
	• (burning) gas does not produce SO_2	accept gas does not cause acid rain do **not** accept they don't / none produce pollutant gases	
	NO answers may include:		
	• nuclear produces <u>radioactive</u> waste		
	• (burning) gas produces CO_2 / pollutant gases / air pollution	accept contributes to global warming / greenhouse effect	

Question 3 continues on the next page . . .

STEMUP.CO.UK

PHY1H

Question 3 continued . . .

question	answers	extra information	mark
3(b)	nuclear power stations use a non-renewable fuel	accept uranium / plutonium is non-renewable do **not** accept some are unrenewable	1
Total			**3**

STEMUP.CO.UK

PHY1H

Question 4

question	answers	extra information	mark
4(a)(i)	kinetic	accept KE do **not** accept movement	1
4(a)(ii)	0.75 **or** 75 %	allow **1** mark for correct substitution ie $\frac{60\,000}{80\,000}$ an answer 0.75 % **or** 0.75 with a unit gains **1** mark only an answer 75 with or without a unit gains **1** mark only	2
4(b)	any **one** from: • large areas of land are flooded • peoples homes may be destroyed • habitat (of animals and plants) lost / damaged	 uses large areas of land / takes up large areas of land is insufficient construct is neutral very noisy is neutral	1

Question 4 continues on the next page . . .

STEMUP.CO.UK

PHY1H

Question 4 continued . . .

question	answers	extra information	mark
4(c)(i)	system of cables and transformers	both required for the mark accept power lines / wires for cables ignore reference to pylons inclusions of power stations / consumers negates answer	1
4(c)(ii)	less energy loss / wasted (in the cables) as the cables are shorter	accept heat for energy do **not** accept no energy loss do **not** accept electricity for energy	1 1
Total			**7**

STEMUP.CO.UK

PHY1H

Question 5

question	answers	extra information	mark
5(a)(i)	conduction		1
5(a)(ii)	free / mobile electrons gain (kinetic) energy free electrons collide with other (free) electrons / ions / atoms / particles	accept free / mobile electrons move faster an answer in terms of atoms / particles gaining (kinetic) energy (and) colliding with / vibrating and passing energy to other atoms / particles gains **1** mark only answers in terms of heat particles negate	1 1
5(a)(iii)	convection		1
5(b)(i)	**A** and **C** **or** **B** and **D** only one (independent) variable **or** different shapes but the same colour	this mark only scores if a correct pair is chosen **and** a correct reason given both required and none other both required and none other accept only the shape changes	1

Question 5 continues on the next page . . .

STEMUP.CO.UK

PHY1H

Question 5 continued . . .

question	answers	extra information	mark
5(b)(ii)	**B** radiates heat faster **or** **B** is a better emitter (of heat) but **B** has a smaller (surface) area **or** **B** has a smaller (surface) area: volume ratio	converse answer in terms of **A** gains full marks allow **2** marks for both lose the same quantity / amount of heat in the same time **or** both have same rate of heat loss allow **1** mark for both lose the same quantity / amount of heat	1 1
5(b)(iii)	any **one** from: • transfer a lot of heat (too rapidly) • water temperature drops too rapidly • water too cold for the next radiator	 accept (significantly) more heat will be lost from the first radiator mention of absorption of heat negates mark	1
Total			**8**

STEMUP.CO.UK

PHY1H

Question 6

question	answers	extra information	mark
6(a)	total saving shown for each method ie: cavity wall £325 jacket £163 central heating £90	allow **1** mark for one correctly calculated value **or** allow **1** mark for showing energy bill savings for each method over 5 years ie: cavity wall £575 jacket £175 central heating £400 there are no marks for calculation of payback time	2
6(b)	energy cannot be destroyed	accept energy is conserved ignore reference to created	1
6(c)	4 (hours)	allow **1** mark for obtaining number of kWh = 10 **or** energy transferred = 10	2
Total			**5**

STEMUP.CO.UK

PHY1H

Question 7

question	answers	extra information	mark
7(a)	beta		1
	alpha: would not pass through (the aluminium / foil)		1
	gamma: no change in count rate when thickness changes	must be a connection between detection / count rate / passing through and change in thickness	1
7(b)	foil thickness increases then decreases (then back to normal / correct thickness)	a description of count rate changes is insufficient	1
	gap between rollers decreases, then increases (then back to correct size) **or** pressure from rollers increases then decreases	accept tightness for pressure answers may link change in thickness and gap width for full credit ie: foil thickness increases so gap between rollers decreases (1) foil thickness decreases so gap between rollers increases (1)	1

Question 7 continues on the next page . . .

STEMUP.CO.UK

PHY1H

Question 7 continued . . .

question	answers	extra information	mark
7(c)	56 (years)	accept any value between 55-57 inclusive allow **1** mark for correct calculation of mass remaining as 1.5 (micrograms) allow **1** mark for a mass of 4.5 micrograms plus correct use of graph with an answer of 12 maximum of **1** compensation mark can be awarded	2
Total			**7**

STEMUP.CO.UK

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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

AQA

General Certificate of Secondary Education
Higher Tier
June 2010

Science B
Unit Physics P1

PHY1H

H

Physics
Unit Physics P1

Thursday 24 June 2010 1.30 pm to 2.15 pm

For this paper you must have:
- a ruler.

You may use a calculator.

Time allowed
- 45 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 45.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

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

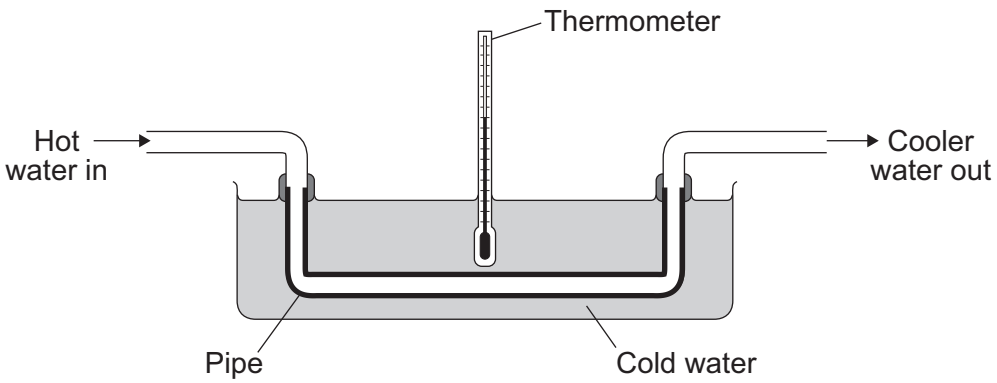
STEMUP.CO.UK

Do not write outside the box

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

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

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



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

.....

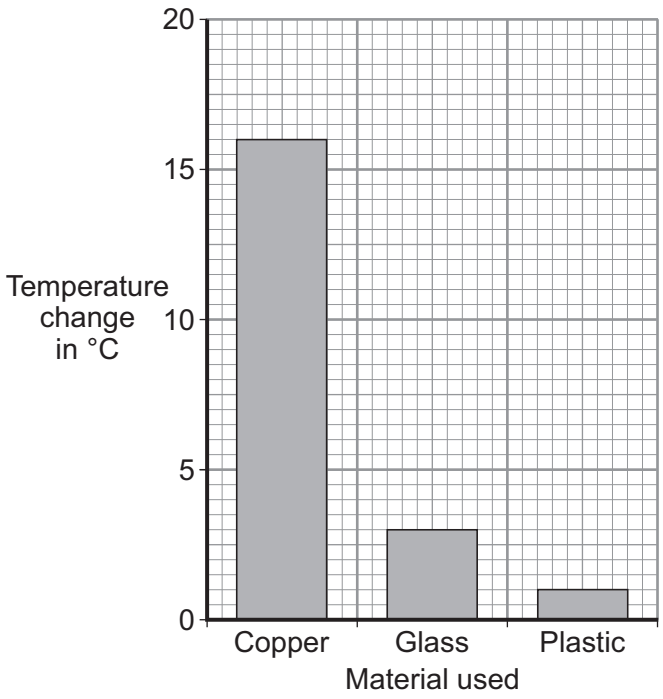
(1 mark)

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

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

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

Do not write outside the box



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

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

.....

(1 mark)

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

.....

.....

(1 mark)

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

.....

Give a reason for your answer.

.....

.....

.....

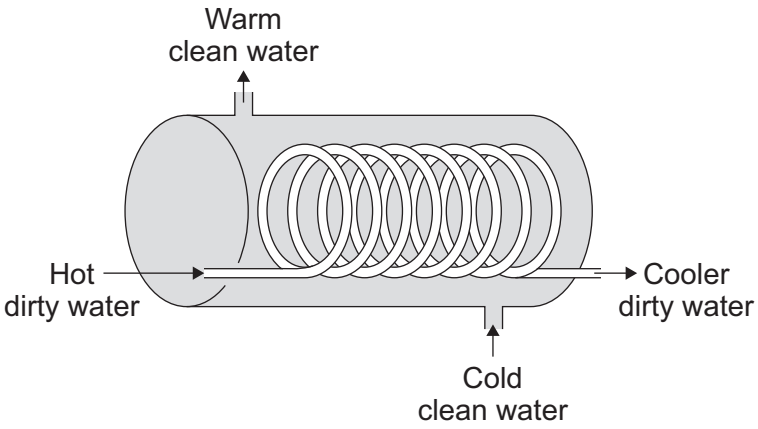
(2 marks)

Question 1 continues on the next page

Turn over ▶

Do not write outside the box

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



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

.....

.....

(1 mark)

6

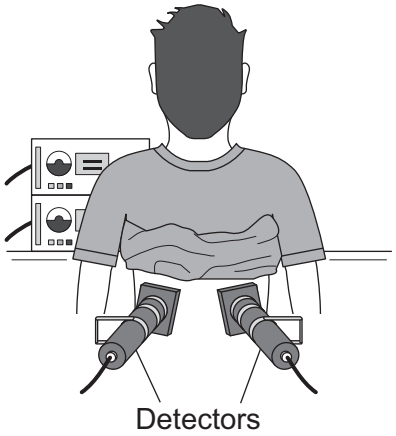
Do not write outside the box

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



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

Technetium-99 emits *gamma radiation*.

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

1 .....

.....

2 .....

.....

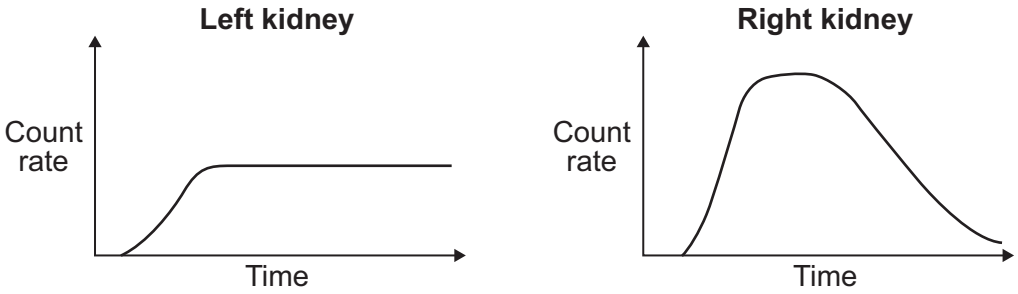
(2 marks)

Do not write outside the box

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

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

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



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

.....

.....

(1 mark)

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

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

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

Only the right kidney is working correctly. ☐

Only the left kidney is working correctly. ☐

Both kidneys are working correctly. ☐

Explain the reason for your answer.

.....

.....

.....

.....

(3 marks)

Question 2 continues on the next page

Turn over ▶

Do not write outside the box

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

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

.....

.....

(1 mark)

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

.....

.....

.....

.....

(2 marks)

9

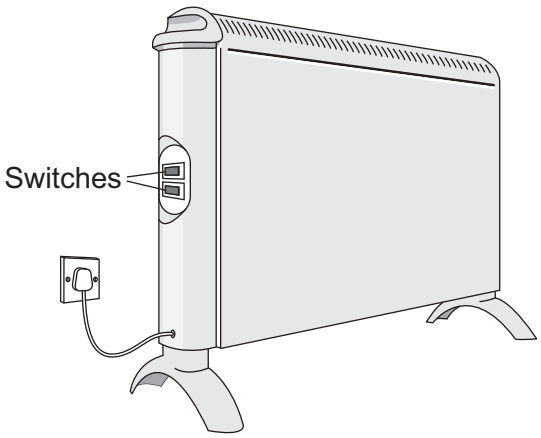
Do not write outside the box

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

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



Setting	Power in watts
Low	700
Medium	1400
High	

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

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

.....

Power = ... kilowatts

(1 mark)

3 (a) (ii) The heater is used on the **high** power setting. It is switched on for $1\frac{1}{2}$ hours.

Use the equation in the box to work out the energy transferred from the mains to the heater in $1\frac{1}{2}$ hours.

energy transferred = power × time

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

.....

.....

.....

Energy transferred = ...

(3 marks)

Do not write outside the box

3 (a) (iii) This type of heater is a very efficient device.

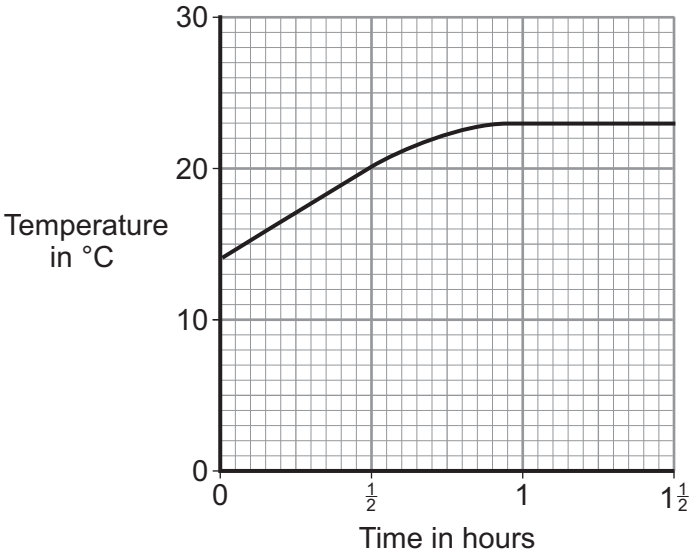
What is meant by a device being very efficient?

.....

.....

(1 mark)

3 (b) The graph shows how the temperature of a room changes during the $1\frac{1}{2}$ hours that the heater is used.



After 1 hour, the temperature of the room has become constant, even though the heater is still switched on.

Explain why.

.....

.....

.....

.....

(2 marks)

7

Turn over ▶

Do not write outside the box

4 (a) Microwaves and visible light are two types of electromagnetic wave. Both can be used for communications.

4 (a) (i) Give **two** properties that are common to both visible light and microwaves.

1 .....

.....

2 .....

.....

(2 marks)

4 (a) (ii) Name **two** more types of electromagnetic wave that can be used for communications.

..... and .....

(1 mark)

4 (b) Wi-Fi is a system that joins computers to the internet without using wires. Microwaves, with a wavelength of 12.5 cm, are used to link a computer to a device called a router. Microwaves travel through the air at 300 000 000 m/s.

Use the equation in the box to calculate the frequency of the microwaves used to link the computer to the router.

wave speed = frequency × wavelength

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

.....

.....

.....

Frequency = ...

(3 marks)

Do not write outside the box

4 (c) Wi-Fi is used widely in schools. However, not everyone thinks that this is a good idea.

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

However, one group of scientists said that there is no reason why Wi-Fi should not be used in schools. These scientists also suggested that there is a need for further research.

4 (c) (i) Suggest what the politician could have done to persuade people that what he said was not just an opinion.

.....

.....

(1 mark)

4 (c) (ii) Why did the group of scientists suggest that there is a need for further research?

.....

.....

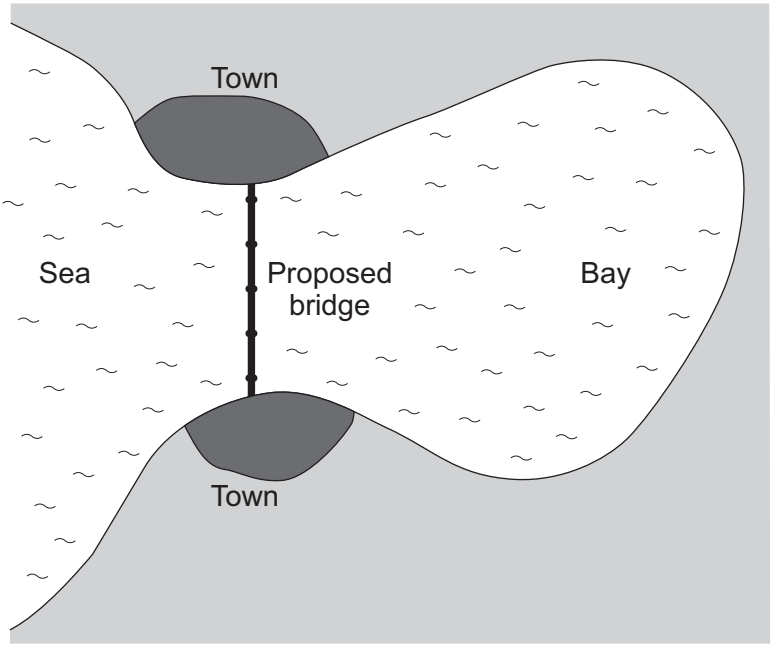
(1 mark)

8

Turn over for the next question

Do not write outside the box

5 The map shows the positions of two towns on either side of a very large coastal bay in England. The map also shows where a bridge may be built to link the towns. The road journey from one town to the other is about 60 kilometres at present.



5 (a) It is estimated that building turbines and generators inside the legs of the bridge would produce enough electricity for both towns. In addition, enough electricity would be generated to run electric buses over the bridge between the two towns.

5 (a) (i) If the bridge is built, what form of renewable energy will be used to generate the electricity?

.....

(1 mark)

5 (a) (ii) Most people living in the area are in favour of the proposed bridge.

Suggest **three** reasons why people would be in favour of building the bridge and the associated electricity generating scheme.

Reason 1 .....

.....

Reason 2 .....

.....

Reason 3 .....

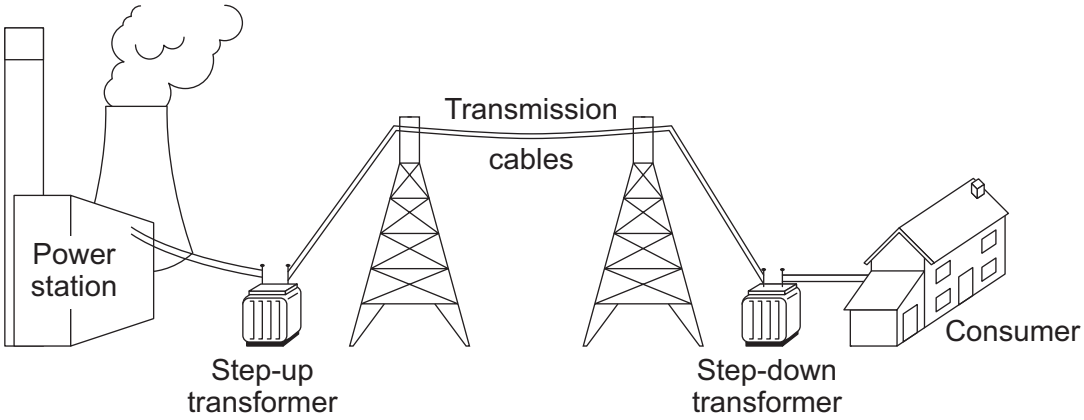
.....

(3 marks)

Do not write outside the box

5 (b) Even with the proposed bridge, the two towns will need to stay connected to the National Grid.

The diagram shows part of the National Grid.



5 (b) (i) Give **one** reason why the towns need to stay connected to the National Grid.

.....

.....

(1 mark)

5 (b) (ii) Explain how the step-up transformer increases the efficiency of the National Grid.

.....

.....

.....

.....

(2 marks)

7

Turn over ▶

Do not write outside the box

6 (a) In 1929, the astronomer Edwin Hubble observed that the light from galaxies that are moving away from the Earth showed a *red-shift*.

What is *red-shift*?

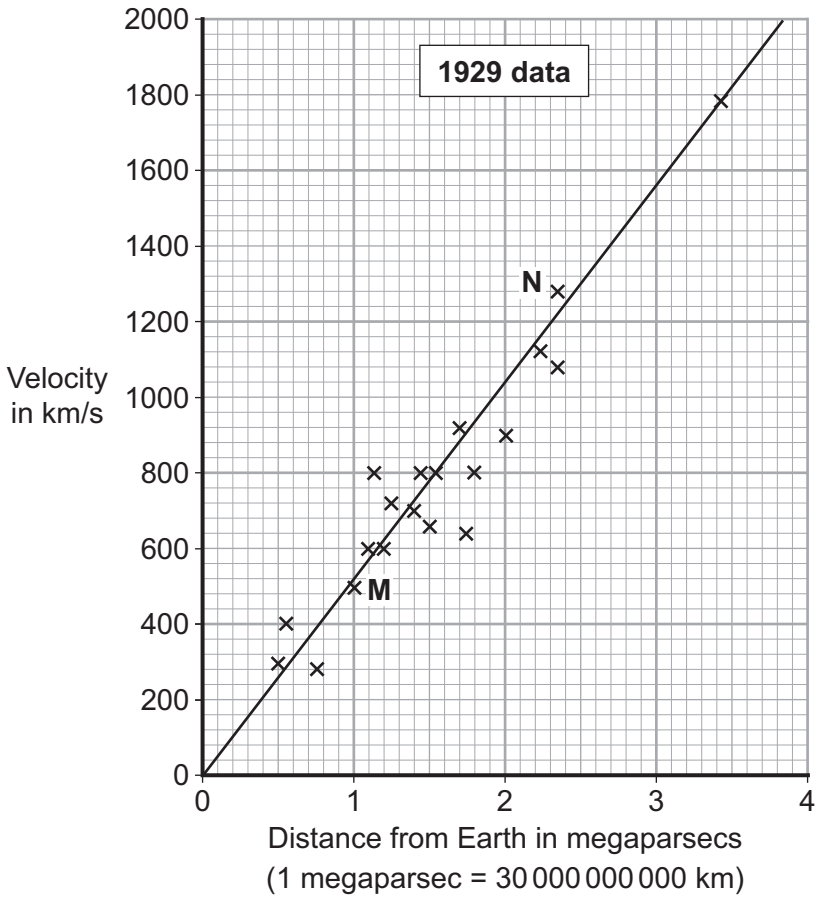
.....

.....

(1 mark)

6 (b) By measuring the red-shift, Hubble was able to calculate the speed at which the galaxies are moving away from the Earth. He was also able to calculate the distance of these galaxies from the Earth.

The graph shows some of the data calculated by Hubble.



Do not write outside the box

6 (b) (i) The data from two galaxies, **M** and **N**, has been included in the graph. The light from galaxy **M** has a smaller red-shift than the light from galaxy **N**.

What does the difference in red-shift tell scientists about the two galaxies, **M** and **N**?

.....

.....

.....

(2 marks)

6 (b) (ii) The gradient of the line drawn on the graph gives a number known as the Hubble constant. The Hubble constant can be used to estimate when the universe began.

Use the graph to calculate the value of the Hubble constant.

Show clearly how you obtained your answer.

.....

.....

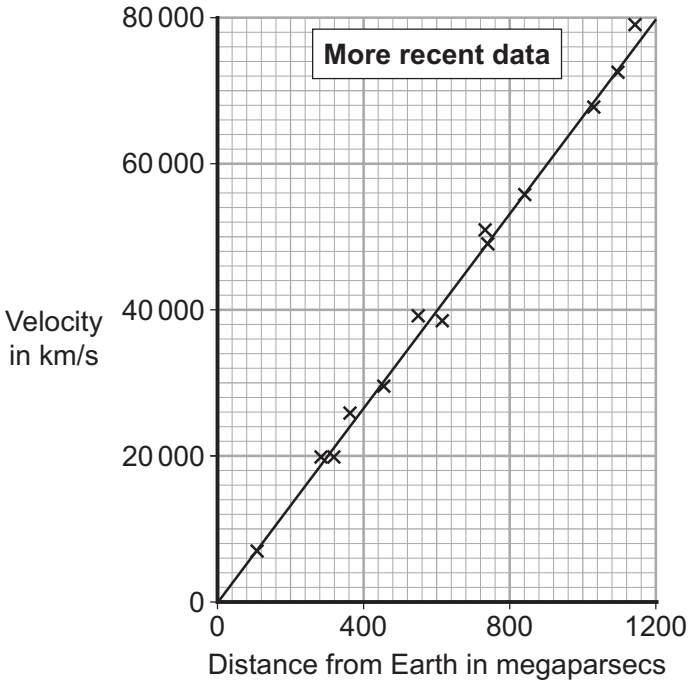
Hubble constant = ... km/s per megaparsec

(2 marks)

Question 6 continues on the next page

Do not write outside the box

6 (b) (iii) More recently, data has been obtained from more distant galaxies.



The results from the more recent data give a totally different value for the Hubble constant to the one calculated from the 1929 data.

Which set of data, the 1929 or the more recent, is most likely to give the value closest to the true value for the Hubble constant?

Draw a ring around your answer.

1929 **more recent**

Give a reason for your answer.

.....

.....

(1 mark)

Do not write outside the box

6 (c) The Andromeda galaxy is not moving away from the Earth. It is actually moving towards the Earth. This means that the light from Andromeda shows a blue-shift.

How do the wavelength and frequency of the light from Andromeda seem to have changed when viewed from the Earth?

.....

.....

.....

.....

(2 marks)

8

END OF QUESTIONS

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Copyright © 2010 AQA and its licensors. All rights reserved.

STEMUP.CO.UK

Version : 29/07/2010

General Certificate of Secondary Education

Science B 4462 / Physics 4451

PHY1H Unit Physics 1

Mark Scheme

2010 Examination – June Series

STEMUP.CO.UK

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

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

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

Copyright © 2010 AQA and its licensors. All rights reserved.

COPYRIGHT
AQA retains the copyright on all its publications. However, registered centres for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to centres to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales (company number 3644723) and a registered charity (registered charity number 1073334).
Registered address: AQA, Devas Street, Manchester M15 6EX

Marking Guidance for Examiners

GCSE Science Papers

1. General

The mark scheme for each question shows:

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

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

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

where consequential marking needs to be considered in a calculation;

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

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

2. Emboldening

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

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

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

3. Marking points

3.1 Marking of lists

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

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

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

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

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

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

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

3.2 Use of chemical symbols / formulae

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

3.3 Marking procedure for calculations

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

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

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

3.4 Interpretation of 'it'

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

3.5 Errors carried forward

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

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

3.6 Phonetic spelling

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

3.7 Brackets

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

3.8 Unexpected Correct Answers not in the Mark Scheme

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

PHY1H

Question 1

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

Question 1 continues on the next page . . .

PHY1H

Question 1 continued . . .

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

PHY1H

Question 2

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

Question 2 continues on the next page . . .

PHY1H

Question 2 continued . . .

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

PHY1H

Question 3

question	answers	extra information	mark
3(a)(i)	2.1	correct answer only	1
3(a)(ii)	3.15 **or** their (a)(i) × 1.5 correctly calculated	allow **1** mark for correct substitution ie 2.1 × 1.5 **or** their (a)(i) × 1.5	2
	kilowatt-hour	accept kWh **or** a substitution 2100 × 5400 scores **1** mark 2100 × 5400 incorrectly calculated with answer in joules scores **2** marks an answer of 11 340 000 scores **2** marks an answer of 11 340 000 J scores **3** marks	1
3(a)(iii)	most (input) energy is usefully transformed	accept does not waste a lot of energy accept most of the output / energy is useful do **not** accept it does not waste energy	1

Question 3 continues on the next page . . .

PHY1H

Question 3 continued . . .

question	answers	extra information	mark
3(b)	the room is losing energy / heat		1
	at the same rate as the heater supplies it	this mark only scores if the first is scored do **not** accept heater reaches same temperature as room / surroundings rate of heat gain = rate of heat loss scores both marks	1
Total			**7**

PHY1H

Question 4

question	answers	extra information	mark
4(a)(i)	any **two** from: • travel at the same speed (through a vacuum) • can travel through a vacuum / space • transfer energy • can be reflected • can be refracted • can be diffracted • can be absorbed • can be transmitted • transverse	 accept travel at the speed of light accept air for vacuum do **not** accept air for vacuum accept any other property common to electromagnetic waves accept travel at the same speed through a vacuum for both marks do **not** accept both radiated from the Sun	2
4(a)(ii)	infra red radio(waves)	**both** required for the mark accept IR for infra red	1

Question 4 continues on the next page . . .

PHY1H

Question 4 continued . . .

question	answers	extra information	mark
4(b)	2400000000	correct transformation and substitution gains **1** mark ie $\frac{300000000}{0.125}$ **or** $\frac{300000000}{12.5}$ an answer of 24000000 gains **1** mark **either** 2400000 kHz **or** 2400 MHz scores **3** marks but the symbol only scores the 3rd mark if it is correct in every detail	2
	hertz	accept Hz do **not** accept hz	1
4(c)(i)	presented (scientific) evidence / data	do an experiment / investigation is insufficient	1
4(c)(ii)	to find out if there is a hazard (or not)	accept to find out if it is safe accept not enough evidence to make a decision not enough evidence is insufficient	1
Total			**8**

PHY1H

Question 5

question	answers	extra information	mark
5(a)(i)	tidal / tides	do **not** accept water / waves	1
5(a)(ii)	any **three** from: • shorter journey time • less pollution from traffic • energy source is free • energy source / tides are predictable • produces less / no pollutant gases (than fuel burning power stations) • conserves supplies of fossil fuels • uses renewable energy (to generate electricity) • provides employment • no visual / noise pollution	accept easier to go from town to town accept less petrol / fuel used accept CO_2 / carbon emissions reduced accept no CO_2 / greenhouse gases produced accept air pollution for pollutant gases less harm to the environment is insufficient the electricity is cheaper is insufficient do **not** accept produces no radioactive waste the pollution mark scores twice only if it is clear one reference is to traffic and the other is to electricity generation	3

Question 5 continues on the next page . . .

PHY1H

Question 5 continued . . .

question	answers	extra information	mark
5(b)(i)	(sometimes) electricity demand may be greater than supply (of electricity from the system) **or** can sell (excess) electricity (to the National Grid)	accept in case turbines / generators fail	1
5(b)(ii)	decreases the current reducing energy loss (along cables)	accept increases the voltage accept less heat / thermal energy lost / produced	1 1
Total			**7**

PHY1H

Question 6

question	answers	extra information	mark
6(a)	wavelength (of light appears to) increase	accept frequency (appears to) decrease accept light moves to the red end of the spectrum do **not** accept it moves to the red end of the spectrum do **not** accept light becomes redder	1
6(b)(i)	**M** is closer (to the Earth) than **N** **M** is moving (away from the Earth) slower than **N**		1 1
6(b)(ii)	520	an answer between 510 and 530 inclusive gains **1** mark	2
6(b)(iii)	more recent data more reliable **or** improved equipment / techniques **or** data obtained from more (distant) galaxies	no mark for this but must be given to gain reason mark accept data is more accurate more technology is insufficient accept a wider range of data accept data closer to the line of best fit **or** data less scattered accept no anomalous result(s) accept all data fits the pattern	 1
6(c)	wavelength is decreased frequency is increased		1 1
Total			**8**

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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

AQA

General Certificate of Secondary Education
Higher Tier
January 2010

Science B
Unit Physics P1

Physics
Unit Physics P1

PHY1H

H

Written Paper

Wednesday 20 January 2010 9.00 am to 9.45 am

For this paper you must have:
- a ruler.

You may use a calculator.

Time allowed
- 45 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Answers written in margins or on blank pages will not be marked.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 45.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

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

STEMUP.CO.UK

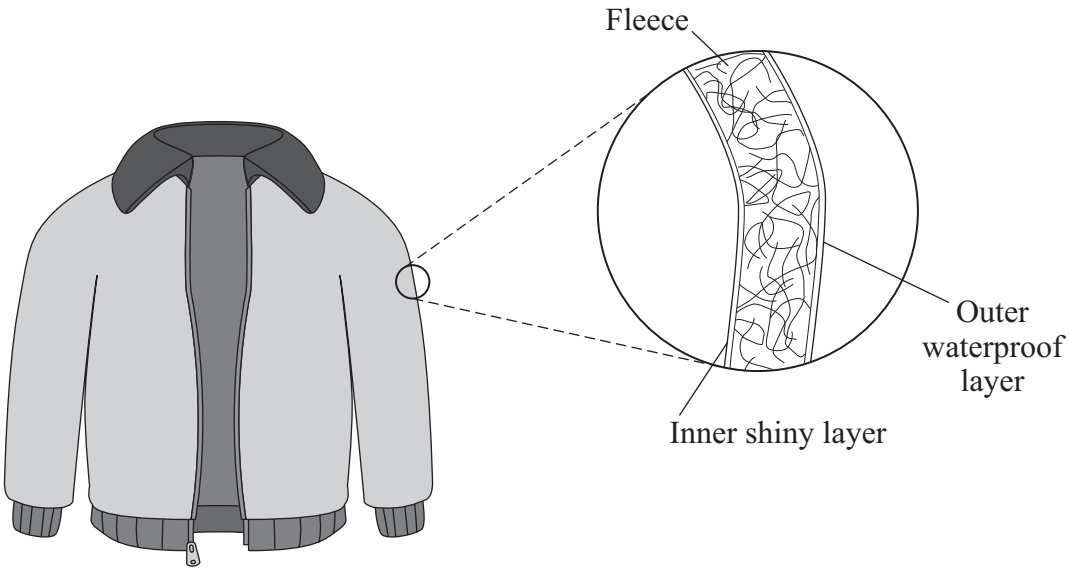
There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Areas outside the box will not be scanned for marking

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

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



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

Which process of heat transfer will it reduce?

.....

(1 mark)

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

.....

.....

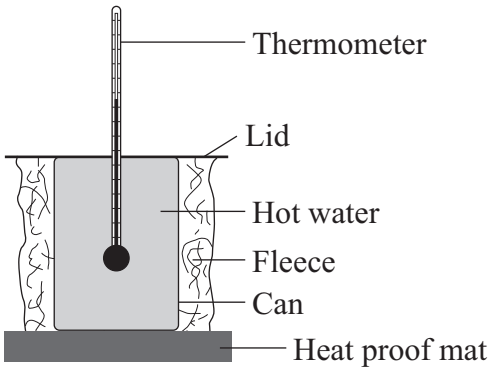
(1 mark)

Question 1 continues on the next page

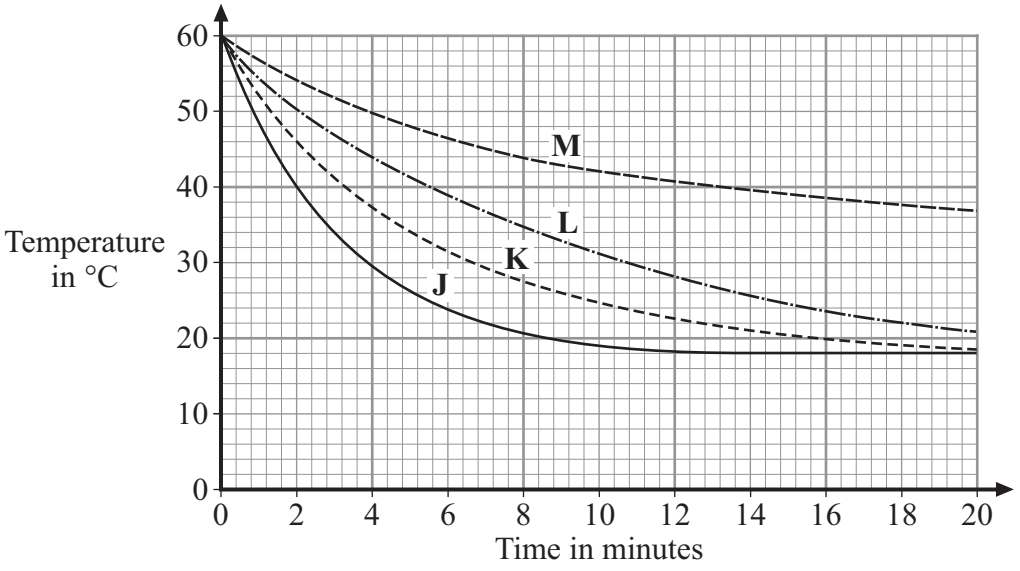
Turn over ▶

Areas outside the box will not be scanned for marking

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



The graph shows the student's results.



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

.....

.....

(1 mark)

Areas outside the box will not be scanned for marking

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

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

.....

.....

(1 mark)

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

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

.....

(1 mark)

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

.....

Give a reason for your answer.

.....

.....

.....

.....

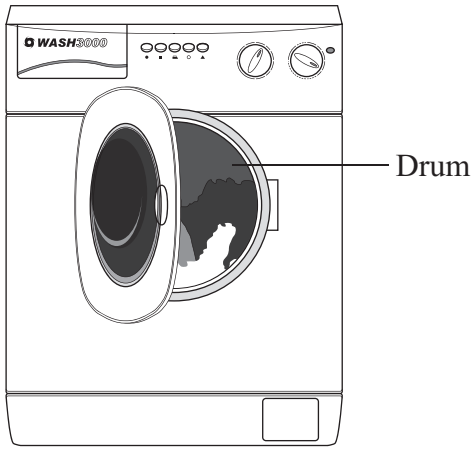
(2 marks)

7

Turn over for the next question

Areas outside the box will not be scanned for marking

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



2 (a) Complete the following sentences.

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

..... energy.

(1 mark)

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

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

(1 mark)

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

.....

.....

(1 mark)

Areas outside the box will not be scanned for marking

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

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

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

Explain what being *more energy efficient* means.

.....

.....

.....

.....

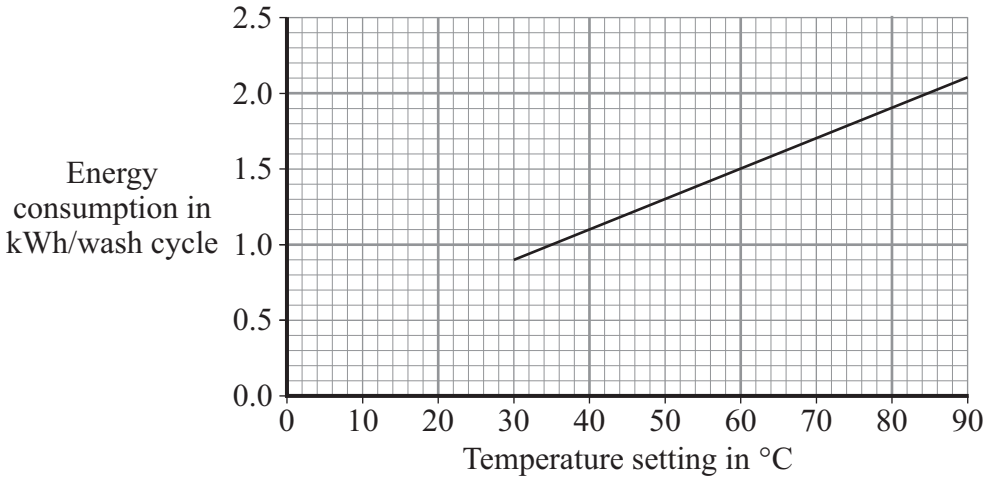
(2 marks)

Question 2 continues on the next page

Turn over ▶

Areas outside the box will not be scanned for marking

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



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

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

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

Show clearly how you work out your answer.

.....

.....

Money saved = ... p

(2 marks)

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

.....

.....

(1 mark)

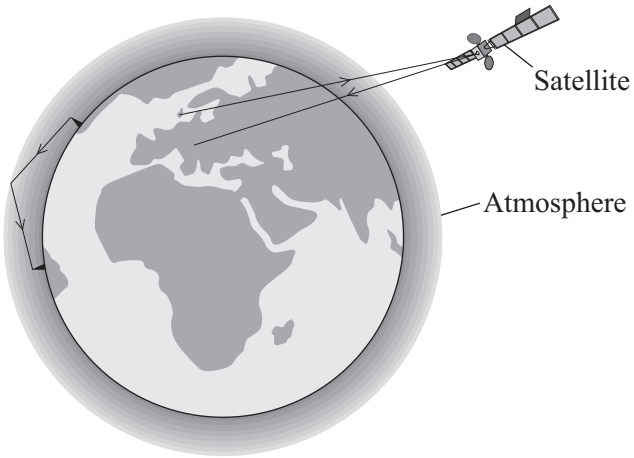
8

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Areas outside the box will not be scanned for marking

3 (a) Electromagnetic waves have many uses. The diagram shows two ways of sending information using electromagnetic waves.



3 (a) (i) What type of wave is used to send information to and from satellites?

.....

(1 mark)

3 (a) (ii) What property of this type of wave makes it suitable for satellite communications?

.....

(1 mark)

3 (b) The diagram shows two types of signal that can be used to send information. One of the signals is an analogue signal. The other is a digital signal.



Describe the differences between an analogue signal and a digital signal.

.....

.....

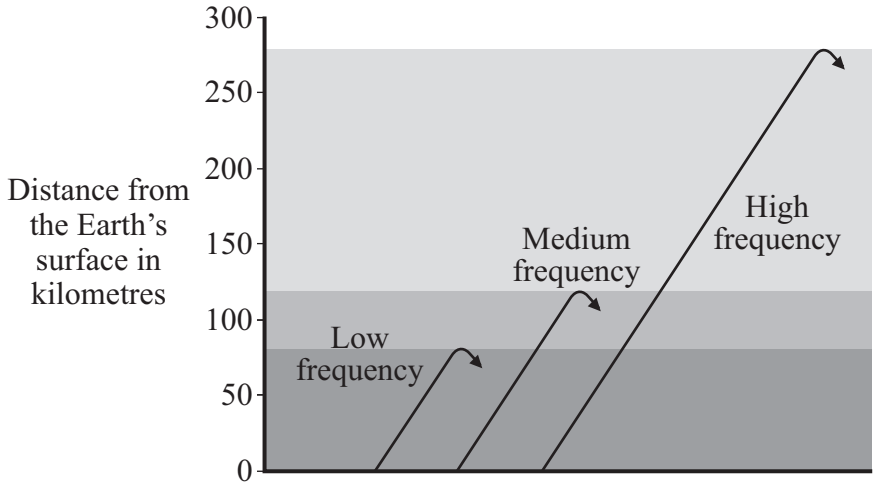
.....

.....

(2 marks)

Areas outside the box will not be scanned for marking

3 (c) Different frequency radio waves travel different distances through the atmosphere before being reflected.



Use the information in the diagram to describe the connection between the frequency of a radio wave and the distance the radio wave travels through the atmosphere before it is reflected.

.....

.....

(1 mark)

3 (d) Electromagnetic waves travel at a speed of 300 000 000 m/s.

A radio station transmits waves with a wavelength of 20 metres.

Use the equation in the box to calculate the frequency, in kilohertz (kHz), of these waves.

wave speed = frequency × wavelength

Show clearly how you work out your answer.

.....

.....

.....

Frequency = ... kHz

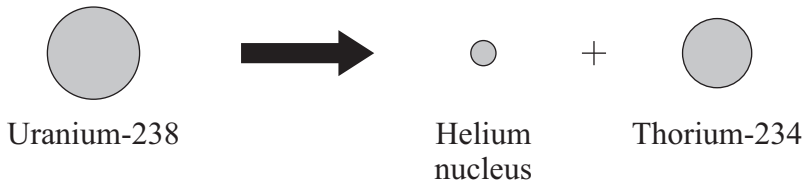
(2 marks)

7

Turn over ▶

Areas outside the box will not be scanned for marking

4 (a) Some rocks inside the Earth contain uranium-238, a radioactive isotope of uranium. When an atom of uranium-238 decays, it gives out radiation and changes into a thorium-234 atom.



4 (a) (i) What type of radiation is emitted when a uranium-238 atom decays?

.....

(1 mark)

4 (a) (ii) From which part of a uranium-238 atom is the radiation emitted?

.....

(1 mark)

4 (a) (iii) Uranium-235 is another isotope of uranium.

How is an atom of uranium-235 similar to an atom of uranium-238?

.....

(1 mark)

4 (b) Uranium-238 has a half-life of 4500 million years.

4 (b) (i) When the Earth was formed, there was twice as much uranium-238 in the rocks as there is now.

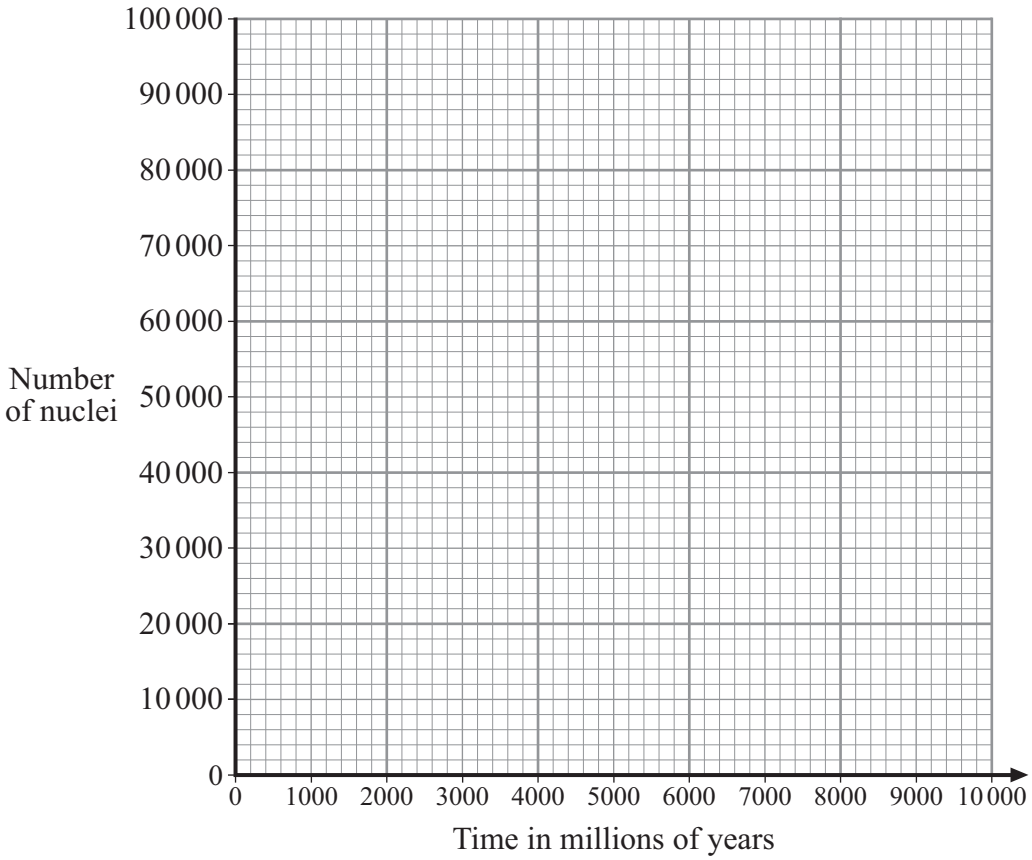
What is the age of the Earth?

.....

(1 mark)

Areas outside the box will not be scanned for marking

4 (b) (ii) Complete the graph to show how the number of nuclei in a sample of uranium-238 will change with time.
Initially, there were 100 000 nuclei in the sample.



(2 marks)

6

Turn over for the next question

Areas outside the box will not be scanned for marking

5 Over the next 15 years, some of the older nuclear power stations will be closed down, and the process of *decommissioning* will start. In the same period, several countries plan to build a number of new nuclear power stations.

5 (a) (i) What does it mean to *decommission* a nuclear power station?

.....

.....

(1 mark)

5 (a) (ii) How does *decommissioning* affect the overall cost of electricity generated using nuclear fuels?

.....

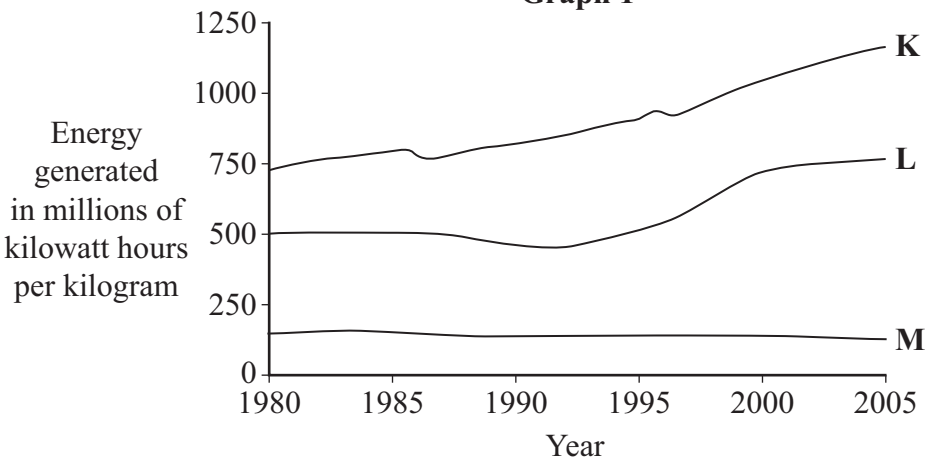
.....

(1 mark)

5 (b) Uranium is a fuel used in nuclear power stations to generate electricity.

Graph 1 compares how the electricity generated from one kilogram of nuclear fuel changed between 1980 and 2005 in three different types of nuclear power station.

Graph 1



5 (b) (i) Compare the efficiency of the three types of power station, **K**, **L** and **M**, between 1980 and 2005.

.....

.....

.....

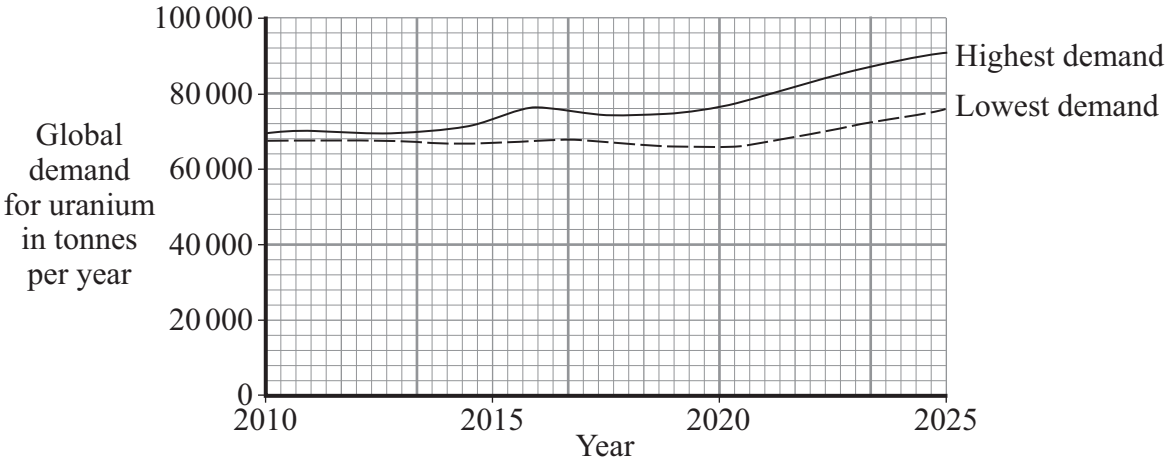
.....

(2 marks)

Areas outside the box will not be scanned for marking

Graph 2 shows two different predictions for the global growth in uranium demand over the next 15 years.

Graph 2



(1 tonne = 1000 kg)

5 (b) (ii) Suggest reasons why it is **not** possible to predict accurately how much uranium will be needed in 2025.

.....

.....

.....

.....

(2 marks)

6

Turn over for the next question

Areas outside the box will not be scanned for marking

6 The 'Big Bang' theory is one theory of the origin of the Universe.

6 (a) (i) Explain what is meant by the 'Big Bang' theory.

.....

.....

.....

.....

(2 marks)

6 (a) (ii) The light arriving from distant galaxies provides scientists with evidence to support the 'Big Bang' theory.

Explain how.

.....

.....

.....

.....

(2 marks)

6 (b) At a meeting held in 2005, a group of scientists claimed that new data had been collected that showed the 'Big Bang' theory to be wrong. Other scientists said that there was no reason to doubt the 'Big Bang' theory.

What should scientists do when a theory does **not** appear to be supported by new data?

.....

.....

.....

.....

(2 marks)

Areas outside the box will not be scanned for marking

6 (c) Scientists can answer many questions about the Universe, but not the question:

Why was the Universe created?

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

.....

.....

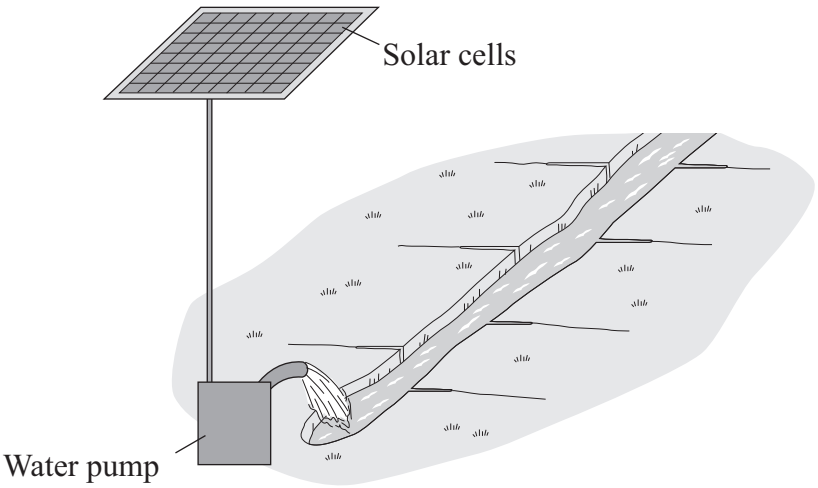
(1 mark)

7

Turn over for the next question

Areas outside the box will not be scanned for marking

7 The farmers in a village in India use solar powered water pumps to irrigate the fields.



On average, a one square metre panel of solar cells receives 5 kWh of energy from the Sun each day.
The solar cells have an efficiency of 0.15

7 (a) (i) Use the following equation to calculate the electrical energy available from a one square metre panel of solar cells.

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

Show clearly how you work out your answer.

.....

.....

Electrical energy = ... kWh
(2 marks)

7 (a) (ii) On average, each solar water pump uses 1.5 kWh of energy each day.

Calculate the area of solar cells required by one solar water pump.

Area = ... square metres
(1 mark)

Areas outside the box will not be scanned for marking

7 (b) Give **one** reason why the area of solar cells needed will probably be greater than the answer to part (a)(ii).

.....

.....

(1 mark)

4

END OF QUESTIONS

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Copyright © 2010 AQA and its licensors. All rights reserved.

Version : 24/02/2010

General Certificate of Secondary Education

Science B 4462/ Physics 4451

PHY1H Unit Physics 1

Mark Scheme

2010 examination - January series

STEMUP.CO.UK

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

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

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

Copyright © **2010.** AQA and its licensors. All rights reserved.

COPYRIGHT
AQA retains the copyright on all its publications. However, registered centres for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to centres to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales (company number 3644723) and a registered charity (registered charity number 1073334).
Registered address: AQA, Devas Street, Manchester M15 6EX
Dr Michael Cresswell Director General

MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

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

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

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

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

2. Emboldening

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

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

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

3. Marking points

3.1 Marking of lists

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

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

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

STEMUP.CO.UK

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

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

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

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

3.2 Use of chemical symbols / formulae

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

3.3 Marking procedure for calculations

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

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

3.4 Interpretation of 'it'

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

3.5 Errors carried forward

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

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

3.6 Phonetic spelling

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

3.7 Brackets

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

STEMUP.CO.UK

PHY1H

Question 1

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

STEMUP.CO.UK

PHY1H

Question 2

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

Question 2 continues on the next page . . .

STEMUP.CO.UK

PHY1H

Question 2 continued . . .

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

STEMUP.CO.UK

PHY1H

Question 3

question	answers	extra information	mark
3(a)(i)	microwaves		1
3(a)(ii)	can pass through the ionosphere	accept travels in a straight line accept atmosphere for ionosphere do **not** accept air for ionosphere	1
3(b)	any **two** from: • analogue is continuously varying • digital has only discrete values • digital is less prone to interference (than analogue) • digital can be processed more easily (than analogue) by a computer	 do **not** accept analogue has many values accept digital is on or off accept digital is 1 or 0 accept digital is binary accept digital is easier to restore	2
3(c)	higher the frequency, further the wave travels (into the atmosphere before reflection)		1
3(d)	15 000	allow **1** mark for correct transformation and substitution ie $\frac{300\,000\,000}{20}$ an answer of 15 000 000 only gains **1** mark allow both marks for an answer of 15 MHz (unit must be changed) an answer of 15 gains no credit	2
Total			**7**

STEMUP.CO.UK

PHY1H

Question 4

question	answers	extra information	mark
4(a)(i)	alpha (particle)		1
4(a)(ii)	(unstable) nucleus	accept (unstable) nuclei do **not** accept middle do **not** accept helium nucleus	1
4(a)(iii)	same number of protons	accept same number of electrons accept same atomic / proton number accept they both have 92 protons same number of neutrons negates answer	1
4(b)(i)	4500 million years	do **not** accept 4500 years	1
4(b)(ii)	curve starting at 100 000 with a correct general shape passing through (4500, 50 000) and (9000, 25 000)	 allow **1** mark for points plotted **or** line passing through (4500, 50 000) and (9000, 25 000)	1 1
Total			**6**

STEMUP.CO.UK

PHY1H

Question 5

question	answers	extra information	mark
5(a)(i)	(dismantle and) remove radioactive waste / materials / fuels	accept nuclear for radioactive do **not** accept knock down / shut down	1
5(a)(ii)	increases it	do **not** accept it has a negative effect	1
5(b)(i)	**K** most efficient **or** **M** least efficient (efficiency) of **K** and **L** increases, (efficiency) of **M** (almost) constant / slightly reduced	if efficiency is not mentioned it must be implied answers in terms of energy generated only gains no credit accept **K** and / or **L** are more efficient than **M** all 3 power stations must be mentioned to get this mark	1 1
5(b)(ii)	any **two** from: • do not know how many (nuclear) power stations there will be • power stations may continue to increase in efficiency • do not know what type of power station new ones will be • do not know future energy / electricity demands • may be new uses for uranium	accept new methods may be found to generate electricity / energy accept other ways of generating energy may be expanded accept we may become more energy efficient	2
Total			**6**

STEMUP.CO.UK

PHY1H

Question 6

question	answers	extra information	mark
6(a)(i)	Universe began at a (very) small (initial) point	'it' refers to Universe	1
	'explosion' sent matter outwards **or** 'explosion' causing Universe to expand	accept gas / dust for matter accept rapid expansion for explosion	1
6(a)(ii)	light shows a red shift	owtte the term red shift on its own does not score a mark	1
	galaxies moving away (from the Earth)	'it' refers to light 'they' refers to galaxies accept star for galaxy do **not** accept planet for galaxy	1
6(b)	check reliability / validity of data	accept check data accept collect more data	1
	amend theory **or** discount the data	accept replace old theory with new theory	1
6(c)	answer involves (religious) belief **or** no / insufficient evidence	accept it cannot be tested	1
Total			**7**

STEMUP.CO.UK

PHY1H

Question 7

question	answers	extra information	mark
7(a)(i)	0.75	allow **1** mark for correct transformation and substitution ie 0.15 × 5	2
7(a)(ii)	2	accept 1.5 ÷ their (a)(i) correctly calculated	1
7(b)	any **one** from: • seasonal <u>changes</u> • cloud cover	accept specific <u>changes</u> in conditions eg shorter hours of daylight in winter accept idea of <u>change</u> must be stated or unambiguously implied eg demand for water will not (always) match supply of solar energy do **not** accept figures are average on its own do **not** accept solar panels are in the shade	1
Total			**4**

STEMUP.CO.UK

Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature								

For Examiner's Use

General Certificate of Secondary Education
June 2009

SCIENCE B
Unit Physics P1

PHY1H
H

PHYSICS
Unit Physics P1

Higher Tier

Friday 19 June 2009 9.00 am to 9.45 am

For this paper you must have:
- a ruler.

You may use a calculator.

Time allowed: 45 minutes

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

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Answers written in margins or on blank pages will not be marked.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The maximum mark for this paper is 45.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

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

STEMUP.CO.UK

Areas outside the box will not be scanned for marking

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

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

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

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

.....

(1 mark)

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

.....

(1 mark)

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

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

.....

Give a reason for your answer.

.....

.....

(2 marks)

Areas outside the box will not be scanned for marking

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

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

.....

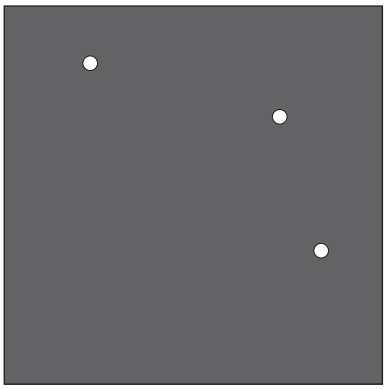
.....

.....

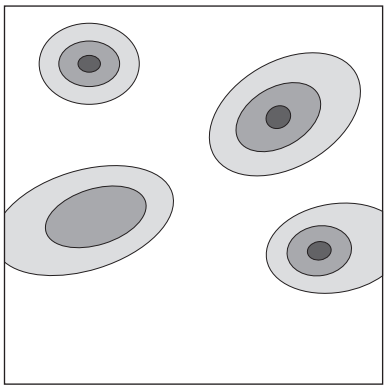
.....

(2 marks)

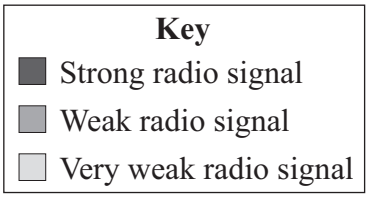
1 (d) The pictures represent the images produced using a visible light telescope and a radio telescope. Both images are of the same part of the sky. The shading on the radio telescope image represents the strength of the radio signals.



Visible light image



Radio telescope image



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

.....

.....

(1 mark)

7

Turn over ▶

Areas outside the box will not be scanned for marking

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

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

.....

.....

(1 mark)

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

.....

.....

(1 mark)

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

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

.....

.....

(1 mark)

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

.....

.....

(1 mark)

Areas outside the box will not be scanned for marking

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

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

This is partly because of the

economic
environmental
ethical

issues involved in using children in scientific research.

(1 mark)

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

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

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

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

Why is using the same test important?

.....

.....

(1 mark)

Question 2 continues on the next page

Areas outside the box will not be scanned for marking

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

Answer yes or no. .....

Give a reason for your answer.

.....

.....

(1 mark)

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

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

.....

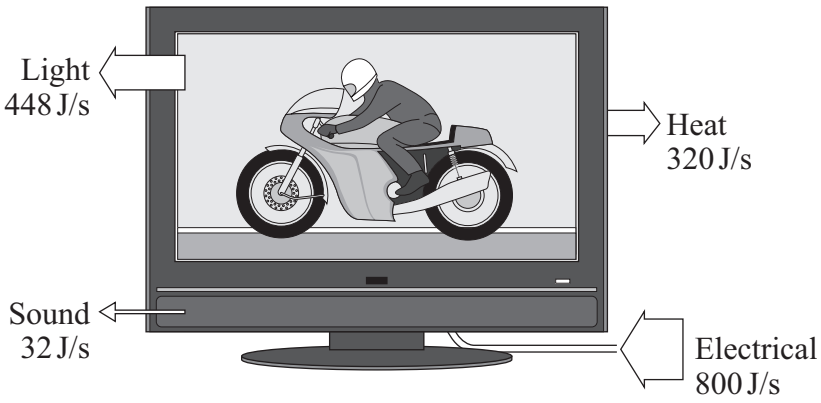
.....

(1 mark)

8

Areas outside the box will not be scanned for marking

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



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

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

Show clearly how you work out your answer.

.....

.....

Efficiency = ...

(2 marks)

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

.....

.....

(1 mark)

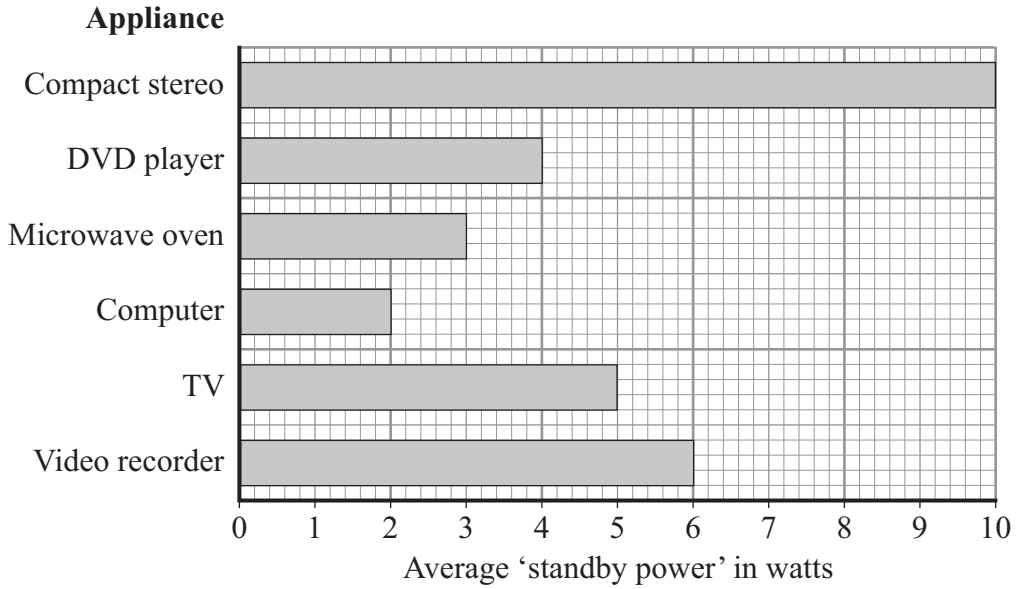
Question 3 continues on the next page

Turn over ▶

Areas outside the box will not be scanned for marking

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

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



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

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

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

Show clearly how you work out your answer.

.....

.....

Energy wasted = ... kilowatt-hours

(2 marks)

Areas outside the box will not be scanned for marking

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

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

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

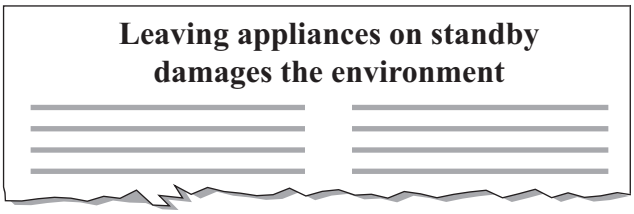
Show clearly how you work out your answer.

.....

Cost = ... p

(1 mark)

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



Explain why leaving appliances on standby damages the environment.

.....

.....

.....

.....

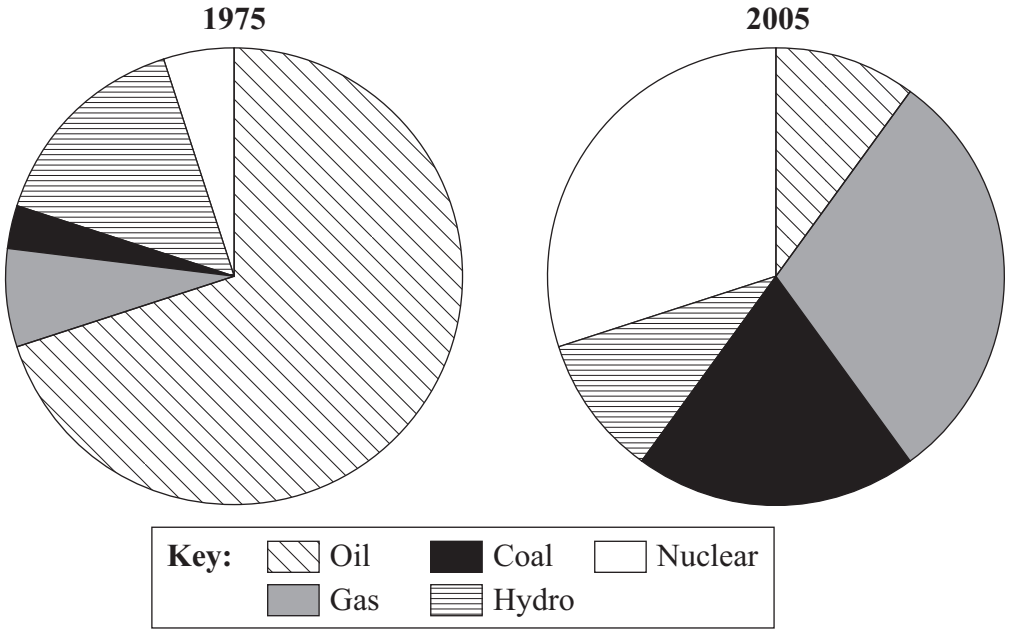
(2 marks)

8

Turn over for the next question

Areas outside the box will not be scanned for marking

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



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

.....

.....

(1 mark)

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

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

.....

(1 mark)

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

.....

.....

.....

.....

(2 marks)

Areas outside the box will not be scanned for marking

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

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

1 .....

.....

2 .....

.....

(2 marks)

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

Why is the waste from a nuclear power station dangerous?

.....

.....

(1 mark)

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

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

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

.....

.....

.....

.....

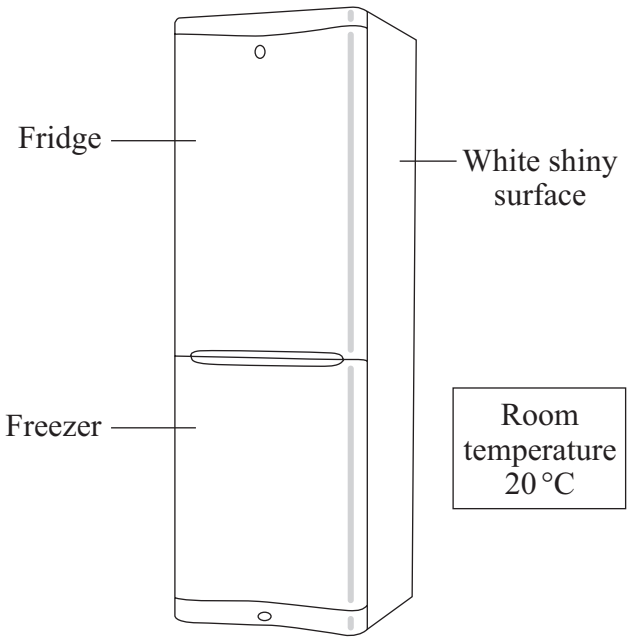
(2 marks)

9

Turn over ▶

Areas outside the box will not be scanned for marking

5 The diagram shows a fridge-freezer.



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

.....

(1 mark)

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

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

Draw a ring around your answer.

the fridge **the freezer**

Give a reason for your answer.

.....

.....

(1 mark)

Areas outside the box will not be scanned for marking

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

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

1 .....

.....

2 .....

.....

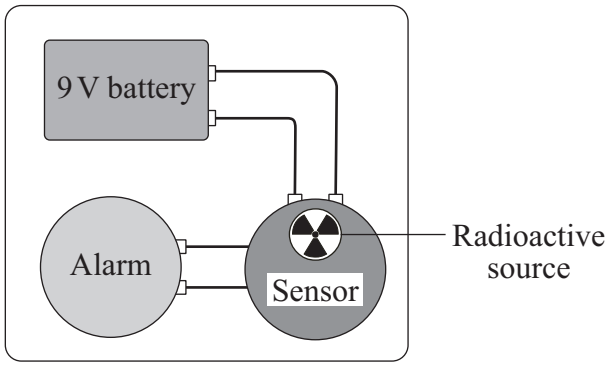
(2 marks)

4

Turn over for the next question

Areas outside the box will not be scanned for marking

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



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

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

Why not?

.....

.....

(1 mark)

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

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

.....

.....

(1 mark)

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

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

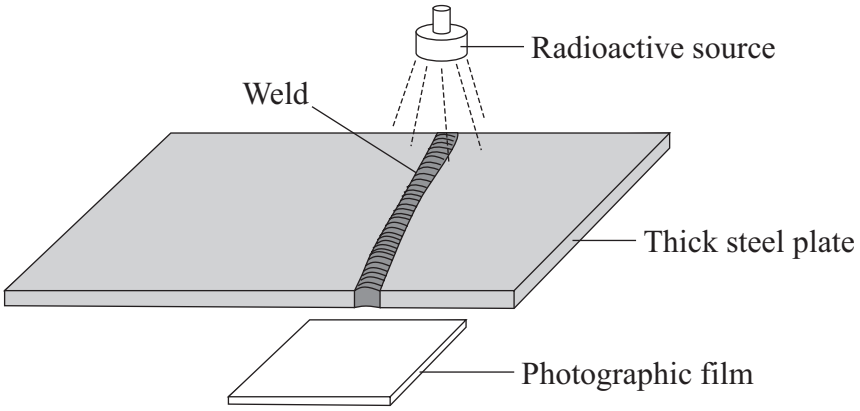
.....

.....

(1 mark)

Areas outside the box will not be scanned for marking

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



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

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

.....

(1 mark)

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

.....

.....

(1 mark)

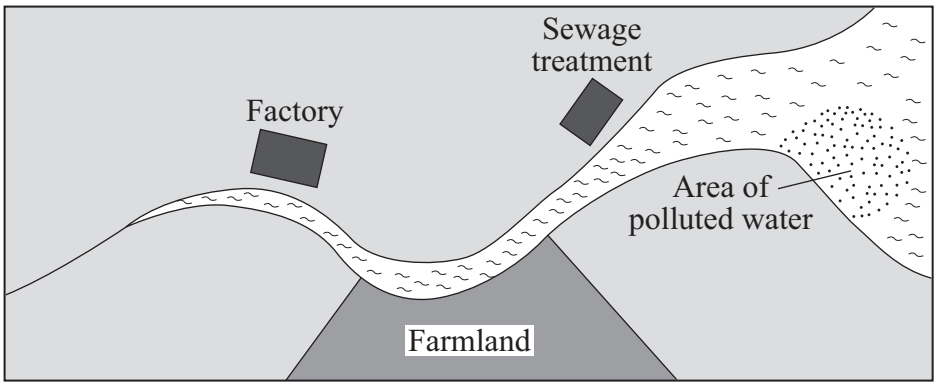
Question 6 continues on the next page

Turn over ▶

Areas outside the box will not be scanned for marking

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

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



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

.....

.....

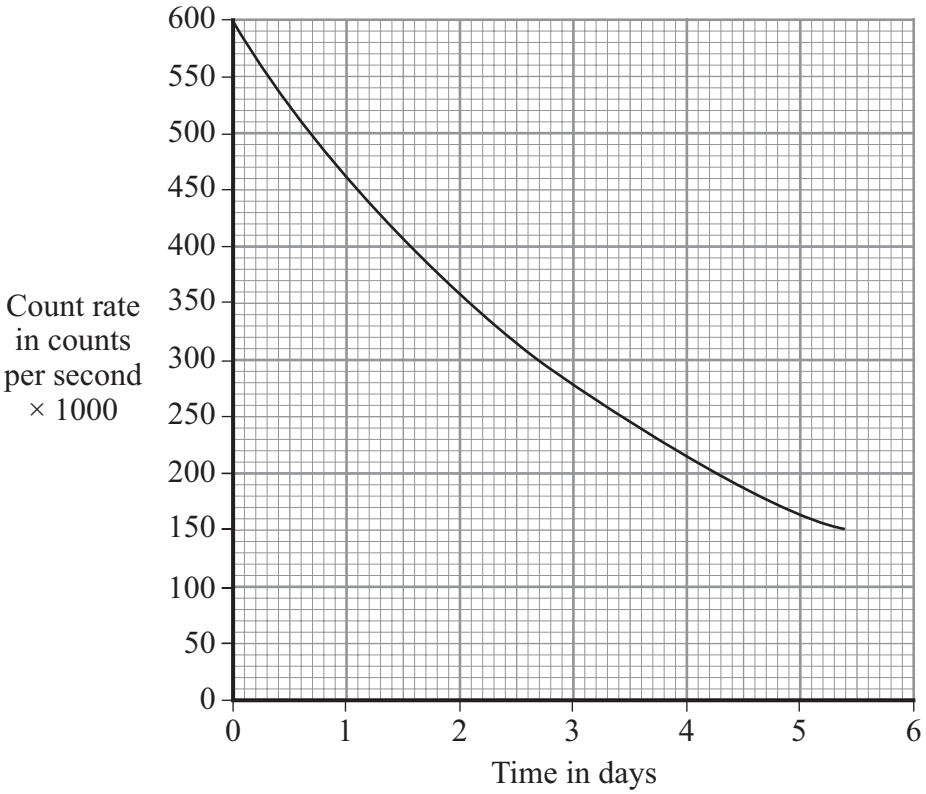
.....

.....

(2 marks)

Areas outside the box will not be scanned for marking

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



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

Show clearly on the graph how you obtain your answer.

.....

.....

Half-life = ... days

(2 marks)

9

END OF QUESTIONS

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Copyright © 2009 AQA and its licensors. All rights reserved.

Version 1.0: 21.07

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Science B 4462 / Physics 4451

PHY1H Unit 1 Physics

Mark Scheme

2009 examination – June series

STEMUP.CO.UK

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

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

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

Copyright © 2009 AQA and its licensors. All rights reserved.

COPYRIGHT
AQA retains the copyright on all its publications. However, registered centres for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to centres to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales (company number 3644723) and a registered charity (registered charity number 1073334).
Registered address: AQA, Devas Street, Manchester M15 6EX
Dr Michael Cresswell Director General

MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

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

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

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

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

2. Emboldening

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

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

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

3. Marking points

3.1 Marking of lists

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

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

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

STEMUP.CO.UK

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

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

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

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

3.2 Use of chemical symbols / formulae

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

3.3 Marking procedure for calculations

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

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

3.4 Interpretation of 'it'

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

3.5 Errors carried forward

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

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

3.6 Phonetic spelling

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

3.7 Brackets

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

STEMUP.CO.UK

PHY1H

Question 1

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

Question 1 continues on the next page . . .

STEMUP.CO.UK

PHY1H

Question 1 continued . . .

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

STEMUP.CO.UK

PHY1H

Question 2

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

Question 2 continues on the next page . . .

STEMUP.CO.UK

PHY1H

Question 2 continued . . .

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

STEMUP.CO.UK

PHY1H

Question 3

question	answers	extra information	mark
3(a)(i)	0.6	accept 60% allow **1** mark for useful energy = 480 answer 0.6 with any unit or 60 gains **1** mark only	2
3(a)(ii)	transferred to surroundings	accept goes into the air accept heats the surroundings up accept gets spread out accept transferred into heat (only) do **not** accept wasted / lost unless qualified destroyed negates mark transferred into light / sound negates mark	1
3(b)(i)	1.75	allow **1** mark for converting to kW answers of 0.7, 0.525, 0.35, 0.875, 1.05, 5.25 gains **1** mark answers of 1750 or 17.5 gains **1** mark	2
3(b)(ii)	21p or £0.21 or their (b)(i) × 12		1

Question 3 continues on the next page . . .

STEMUP.CO.UK

PHY1H

Question 3 continued . . .

question	answers	extra information	mark
3(c)	any **two** from: • (more) electricity needs to be generated • (more) power stations needed • (more) fossil fuels burnt • (more) pollutant gases emitted	(more) electricity is being used accept named fossil fuel accept named gas accept harmful for pollutant accept greenhouse gases accept atmospheric pollution accept answer in terms of any form of electricity generation and an associated environmental problem	2
Total			**8**

STEMUP.CO.UK

PHY1H

Question 4

question	answers	extra information	mark
4(a)	decrease in oil PLUS any **one** from: • increase in (proportion of) coal • increase in (proportion of) nuclear • increase in (proportion of) gas	must have decrease in (proportion of) oil <u>and</u> increase in (proportion of) coal / nuclear / gas	1
4(b)(i)	(nuclear) fission	accept fision do **not** accept any answer that looks like fusion	1
4(b)(ii)	<u>water</u> heated to produce (high pressure) steam <u>steam</u> turns turbine which drives generator		1 1

Question 4 continues on the next page . . .

STEMUP.CO.UK

PHY1H

Question 4 continued . . .

question	answers	extra information	mark
4(b)(iii)	any **two** from: • produces no pollutant gases • it is reliable **or** can generate all of the time • concentrated energy source **or** produces a lot of energy from a small mass • produces only small volume of (solid) waste • fossil fuels will last longer • will need to buy less fuel from other countries	accept named gas or greenhouse gases accept no atmospheric pollution accept harmful for pollutant accept does not contribute to global warming do **not** accept no pollution on its own do **not** accept better for the environment unless qualified accept a named fossil fuel accept fossil fuels are running out do **not** accept fossil fuels are non-renewable unless qualified accept no new fossil fuel power stations needed do **not** accept it is cheap do **not** accept import less electricity	2
4(b)(iv)	it is / can be radioactive **or** emits radiation (from the nuclei)	do **not** accept answers in terms of kills cells / cancer accept emits gamma (rays)	1

Question 4 continued on the next page . . .

STEMUP.CO.UK

PHY1H

Question 4 continued . . .

question	answers	extra information	mark
4(c)	coal (burning) power stations / burning coal produces carbon dioxide	they refers to coal-burning power stations accept sulfur dioxide / nitrogen oxides for CO_2	1
	(increased) CO_2 increases / contributes to / causes global warming / greenhouse effect	mention of ozone layer negates this mark do **not** accept CO_2 warms atmosphere	1
Total			**9**

STEMUP.CO.UK

PHY1H

Question 5

question	answers	extra information	mark
5(a)	conduction	do **not** accept conductor	1
5(b)	the freezer greater <u>temperature</u> difference (between freezer and room)	both parts needed do **not** accept because it is the coldest	1
5(c)	any **two** from: • poor absorber of heat / radiation • reflects heat / radiation (from room away from fridge-freezer) • reduces heat transfer <u>into</u> the fridge-freezer • reduces power consumption of fridge-freezer	accept does not absorb heat poor emitter of heat / radiation is neutral do **not** accept it is a bad conductor / good insulator	2
Total			**4**

STEMUP.CO.UK

PHY1H

Question 6

question	answers	extra information	mark
6(a)(i)	gamma hardly ionises the air	accept does not ionise accept gamma radiation is not charged do **not** accept answers in terms of danger of gamma or other properties	1
6(a)(ii)	half-life (too) short	accept need frequent replacement 'it' refers to curium-242	1
6(a)(iii)	(two) fewer neutrons	accept different numbers of neutrons if a number is specified it must be correct do **not** accept more neutrons unless curium-244 is specified	1
6(b)(i)	gamma	accept correct symbol	1
6(b)(ii)	both absorbed by the metal / steel / weld	only scores if (b)(i) is correct accept cannot pass through the metal / steel / weld	1
6(c)(i)	put source into water at **one** point on bank see if radiation is detected in polluted area	accept the idea of testing different parts of the river bank at different times accept idea of tracing	1 1
6(c)(ii)	2.7 (days)	allow **1** mark for showing correct use of the graph	2
Total			**9**

STEMUP.CO.UK

Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

For Examiner's Use

General Certificate of Secondary Education
January 2009

SCIENCE B
Unit Physics P1

PHY1H

H

PHYSICS
Unit Physics P1

Higher Tier

Monday 19 January 2009 9.00 am to 9.45 am

For this paper you must have:
- a ruler.

You may use a calculator.

Time allowed: 45 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Answers written in margins or on blank pages will not be marked.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The maximum mark for this paper is 45.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

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

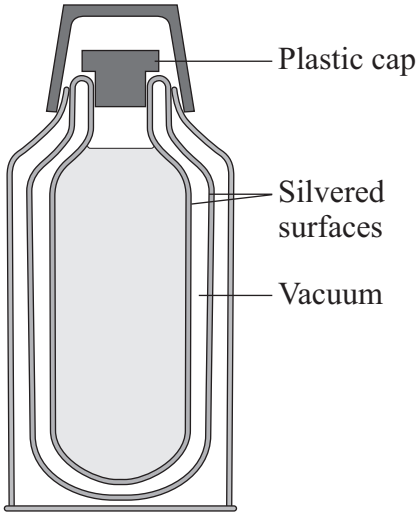
For Examiner's Use			
Question	Mark	Question	Mark
1		3	
2		4	
		5	
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

STEMUP.CO.UK

Areas outside the box will not be scanned for marking

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

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



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

The first row has been done for you.

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

(2 marks)

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

.....

.....

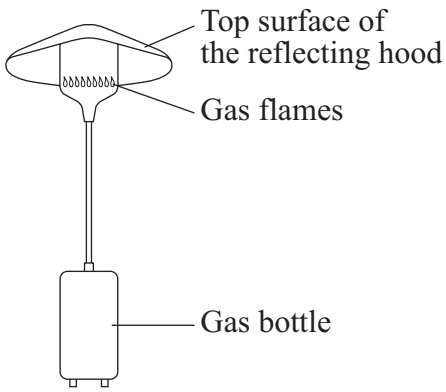
.....

.....

(2 marks)

Areas outside the box will not be scanned for marking

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



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

.....

.....

.....

(2 marks)

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

Draw and label a Sankey diagram for the patio heater.

(2 marks)

1 (b) (iii) State why the total energy supplied to the patio heater must always equal the total energy transferred by the patio heater.

.....

.....

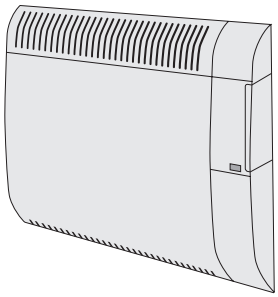
(1 mark)

9

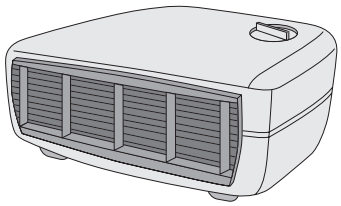
Turn over ▶

Areas outside the box will not be scanned for marking

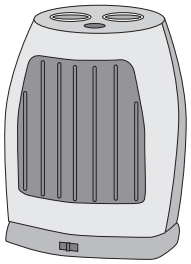
2 The pictures show three different types of electric heater.



400 W oil-filled panel heater (wall mounted)
- 3 heat settings
- Efficient background heat
- Safety overheat cut-out



3 kW fan heater
- 2 heat settings
- Power indicator light
- Cool air fan setting



1800 W ceramic heater
- 2 heat settings
- 8 hour timer
- Power indicator light
- Safety overheat cut-out

2 (a) The ceramic heater is run on full power for 5 hours.

Use the following equation to calculate, in kilowatt-hours, the amount of energy transferred from the mains to the heater.

energy transferred = power × time

Show clearly how you work out your answer.

.....

.....

Energy transferred = ... kilowatt-hours

(2 marks)

2 (b) Which heater will be the most expensive to run on its highest heat setting?

.....

(1 mark)

Areas outside the box will not be scanned for marking

2 (c) A heater is needed for a small office.

Comparing each type of heater with the other two, give **one** advantage of using each type of heater in the office.

oil-filled panel heater .....

.....

fan heater .....

.....

ceramic heater .....

.....

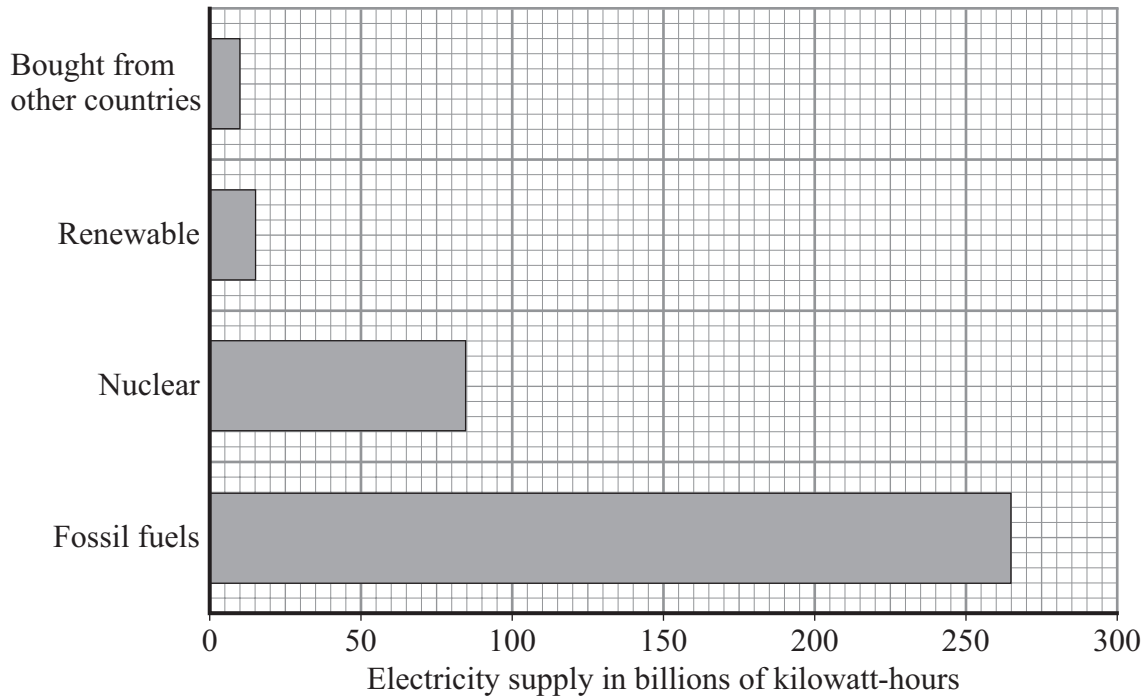
(3 marks)

6

Turn over for the next question

Areas outside the box will not be scanned for marking

3 The bar chart shows how the UK's electricity demands in 2007 were met.



3 (a) What proportion of electricity was generated using renewable energy sources?

Show clearly how you work out your answer.

.....

.....

.....

.....

(2 marks)

Areas outside the box will not be scanned for marking

3 (b) By 2020, most of the UK's nuclear reactors and one-third of coal-fired power stations are due to close, yet the demand for electricity is expected to increase.

Four students, **A**, **B**, **C** and **D**, were asked how a demand of 380 billion kilowatt-hours could be met. They made the suggestions given in the table.

Student	Fossil fuels	Nuclear	Renewable	Bought from other countries
A	200	100	40	40
B	80	240	40	20
C	160	80	100	40
D	280	0	100	0

3 (b) (i) Which student has made the suggestion most likely to result in the lowest carbon dioxide emissions?

.....

Give a reason for your answer.

.....

.....

(2 marks)

3 (b) (ii) Suggest **one** realistic way in which a householder could help to reduce the annual electricity demand.

.....

.....

(1 mark)

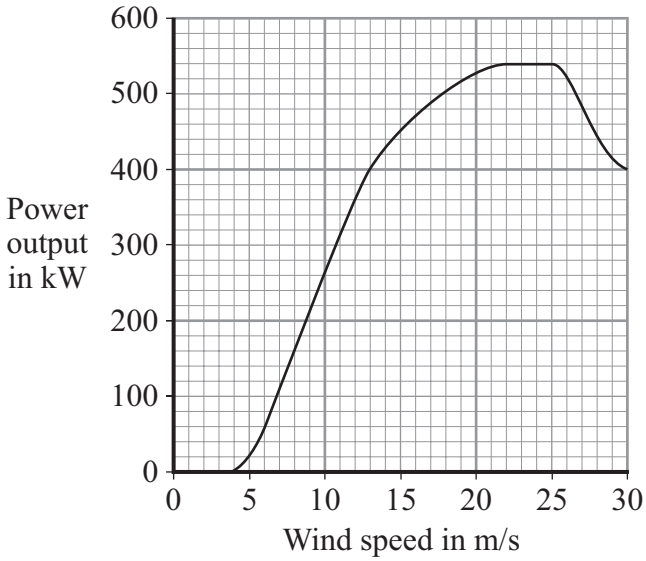
Question 3 continues on the next page

Turn over ▶

Areas outside the box will not be scanned for marking

3 (c) To increase the amount of electricity generated using renewable energy resources would probably involve erecting many new wind turbines.

The graph shows the power curve of a wind turbine.



3 (c) (i) Describe, in detail, how the power output of the turbine varies with the wind speed.

.....

.....

.....

.....

.....

.....

(3 marks)

3 (c) (ii) Give **one** disadvantage of using wind turbines to generate a high proportion of the electricity required in the UK.

.....

.....

(1 mark)

9

Areas outside the box will not be scanned for marking

4 Most elements have some *isotopes* which are *radioactive*.

4 (a) What is meant by the terms:

4 (a) (i) *isotopes*

.....

.....

(1 mark)

4 (a) (ii) *radioactive*?

.....

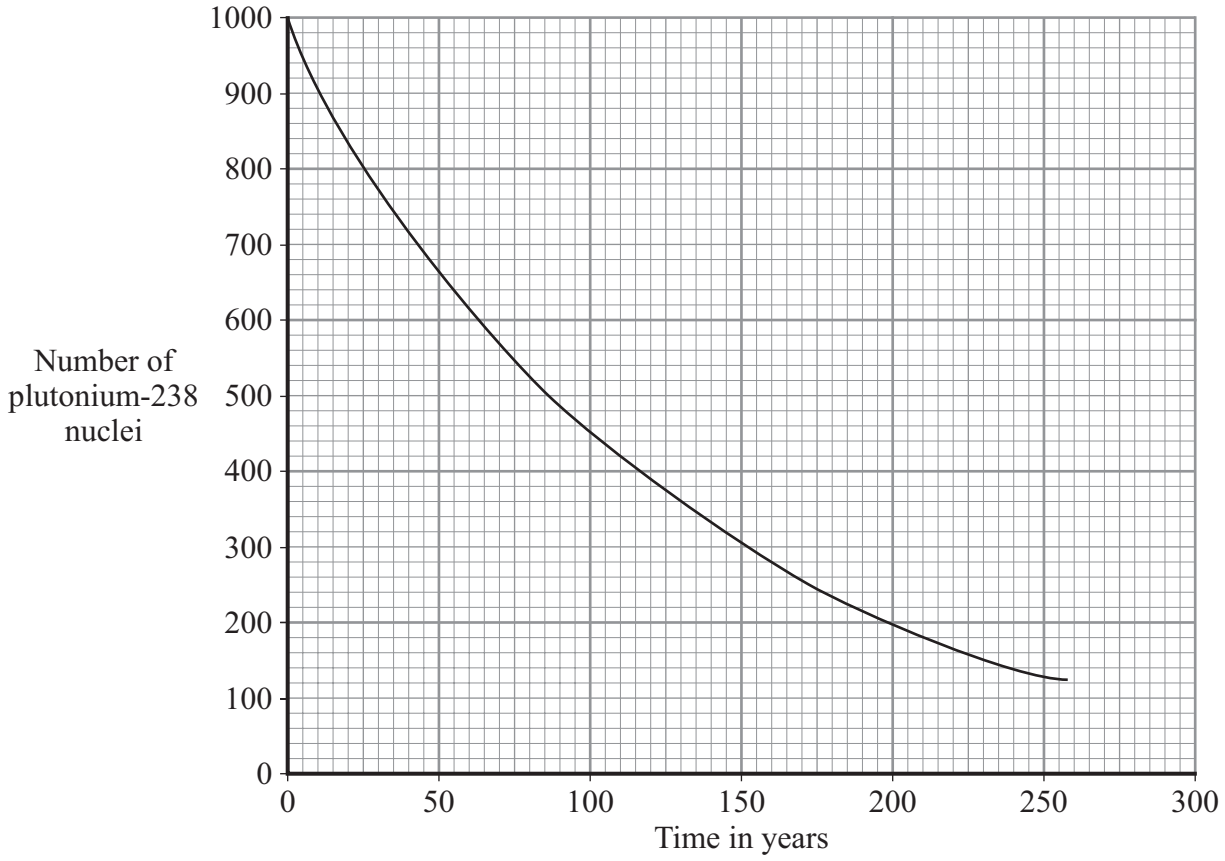
.....

(1 mark)

Question 4 continues on the next page

Areas outside the box will not be scanned for marking

4 (b) The graph shows how the number of nuclei in a sample of the radioactive isotope plutonium-238 changes with time.



Use the graph to find the half-life of plutonium-238.

Show clearly on the graph how you obtain your answer.

Half-life = ... years

(2 marks)

4 (c) The Cassini spacecraft launched in 1997 took seven years to reach Saturn.
The electricity to power the instruments on board the spacecraft is generated using the heat produced from the decay of plutonium-238.

4 (c) (i) Plutonium-238 decays by emitting alpha particles.

What is an alpha particle?

.....

(1 mark)

Areas outside the box will not be scanned for marking

4 (c) (ii) During the 11 years that Cassini will orbit Saturn, the output from the generators will decrease.

Explain why.

.....

.....

.....

.....

(2 marks)

4 (d) Plutonium-238 is highly dangerous. A tiny amount taken into the body is enough to kill a human.

4 (d) (i) Plutonium-238 is unlikely to cause any harm if it is outside the body but is likely to kill if it is inside the body.

Explain why.

.....

.....

.....

.....

(2 marks)

4 (d) (ii) In 1964, a satellite powered by plutonium-238 was destroyed, causing the release of radioactive material into the atmosphere.

Suggest why some environmental groups protested about the launch of Cassini.

.....

.....

(1 mark)

10

Turn over ▶

Areas outside the box will not be scanned for marking

5 (a) Microwaves are one type of electromagnetic wave.

5 (a) (i) Which type of electromagnetic wave has a lower frequency than microwaves?

.....

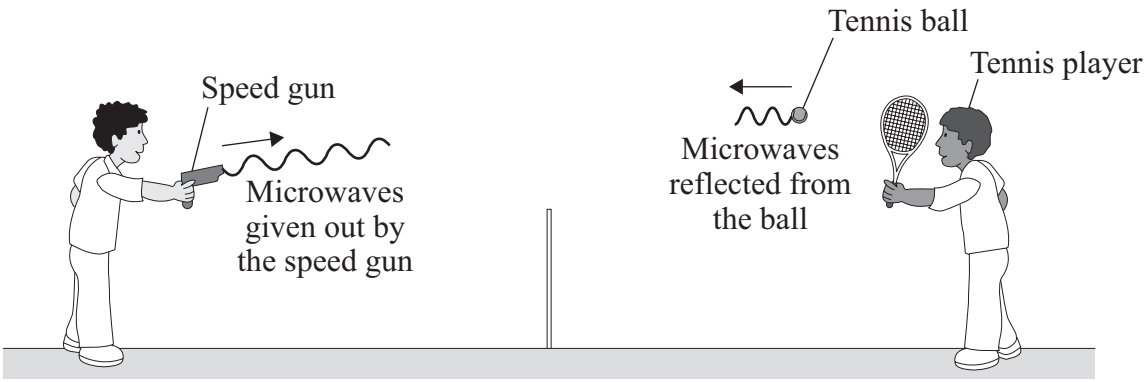
(1 mark)

5 (a) (ii) What do all types of electromagnetic wave transfer from one place to another?

.....

(1 mark)

5 (b) The picture shows a tennis coach using a speed gun to measure how fast the player serves the ball.



5 (b) (i) The microwaves transmitted by the speed gun have a frequency of 24 000 000 000 Hz and travel through the air at 300 000 000 m/s.

Use the equation in the box to calculate the wavelength of the microwaves emitted from the speed gun.

wave speed = frequency × wavelength

Show clearly how you work out your answer.

.....

.....

Wavelength = ... m

(2 marks)

Areas outside the box will not be scanned for marking

5 (b) (ii) Some of the microwaves transmitted by the speed gun are absorbed by the ball.

What effect will the absorbed microwaves have on the ball?

.....

.....

(1 mark)

5 (b) (iii) Some of the microwaves transmitted by the speed gun are reflected from the moving ball back towards the speed gun.

Describe how the wavelength and frequency of the microwaves change as they are reflected from the moving ball.

.....

.....

.....

.....

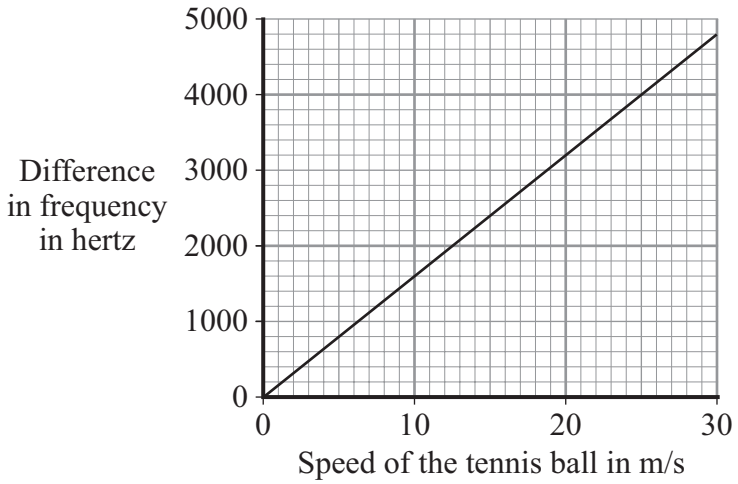
(2 marks)

Question 5 continues on the next page

Areas outside the box will not be scanned for marking

5 (c) The difference in frequency between the transmitted and reflected waves is detected by the speed gun. This data is processed by a computer chip inside the speed gun, and then displayed as a speed.

5 (c) (i) The graph shows that the difference in frequency between the transmitted and reflected waves is directly proportional to the speed of the moving ball.



Why has a line graph been used to display the data?

.....

.....

(1 mark)

5 (c) (ii) Is it better to transfer the data to the computer as an analogue signal or as a digital signal?

.....

Give a reason for your answer.

.....

.....

(1 mark)

Areas outside the box will not be scanned for marking

5 (c) (iii) What is the difference between an analogue signal and a digital signal?

You may draw a labelled diagram to help you with your answer.

.....

.....

.....

.....

(2 marks)

11

END OF QUESTIONS

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Copyright © 2009 AQA and its licensors. All rights reserved.

Version : 1:0 09/02/09

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Science B 4462/ Physics 4451

PHY1H Unit Physics 1

Mark Scheme

2009 examination – January series

STEMUP.CO.UK

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

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

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

Copyright © **2009.** AQA and its licensors. All rights reserved.

COPYRIGHT
AQA retains the copyright on all its publications. However, registered centres for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to centres to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales (company number 3644723) and a registered charity (registered charity number 1073334).
Registered address: AQA, Devas Street, Manchester M15 6EX
Dr Michael Cresswell Director General

STEMUP.CO.UK

PHY1H

Question 1

<table>
<tr><th>question</th><th>answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>1(a)(i)</td><td>silvered surfaces

radiation

plastic cap

conduction

convection } both required

<table>
<tr><th></th><th>conduction</th><th>convection</th><th>radiation</th></tr>
<tr><td>vacuum</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>silvered surfaces</td><td></td><td></td><td>✓</td></tr>
<tr><td>plastic cap</td><td>✓</td><td>✓</td><td></td></tr>
</table>
</td><td>more than the correct number of ticks in a row negates the mark</td><td>1

1

(1)

(1)</td></tr>
<tr><td>1(a)(ii)</td><td>

because there are no particles in a vacuum

conduction and convection need particles / medium</td><td>any mention of air or any other substance in a vacuum scores zero

accept atoms / molecules for particles
accept vacuum is empty space
accept there is nothing in a vacuum
accept there is no air / gas in the vacuum

need reference to both conduction and convection
accept correct descriptions</td><td>1

1</td></tr>
</table>

Question 1 continues on the next page

STEMUP.CO.UK

PHY1H

Question 1 continued

question	answers	extra information	mark
1(b)(i)	less heat lost (to air above the heater)	do **not** accept **no** heat lost	1
	light shiny surfaces are poor emitters (of radiation) **or** dull, matt surfaces are good emitters (of radiation)	accept radiators for emitters references to reflection are neutral do **not** credit answers which infer reflection from the underside of the hood ignore correct reference to absorption	1
1(b)(ii)	correct output arrow n heat arrows ıergy form eg light	flow charts score zero ignore input	1 1
1(b)(iii)	energy cannot be destroyed	accept (principle of) conservation of energy do **not** accept because energy cannot be lost without clarification	1
Total			**9**

STEMUP.CO.UK

PHY1H

Question 2

question	answers	extra information	mark
2(a)	9	allow **1** mark for correct substitution (1.8 × 5) an answer of 9000 gains **1** mark an answer of 2 or 15 gains **1** mark	2
2(b)	(3 kW) fan heater	accept 3 kW accept the middle one	1

Question 2 continues on the next page

STEMUP.CO.UK

PHY1H

Question 2 continued

2(c)		features common to more than one heater, treat as neutral	
	<u>oil-filled</u>		
	low level heat		1
	cannot be knocked over / space saving / no trailing wires **or** more control over heat output	do **not** accept just wall-mounted do **not** accept just 3 heat settings	
	<u>fan</u>		
	warms (office) rapidly **or** can be used to cool air (in summer)	 accept can be used as a fan accept cool air fan (setting) accept 'it has a cool air setting in case it gets too hot' do **not** accept a specific reference to cooling the heater	1
	<u>ceramic</u>		
	can be switched on for set periods of time **or** can be switched on before office is used / switched off automatically at night	do **not** accept just has a timer	1
Total			**6**

STEMUP.CO.UK

PHY1H

Question 3

question	answers	extra information	Mark
3(a)	1/25 **or** 1:25 **or** 0.04	accept 4 % **or** $\frac{15}{375}$ **or** $\frac{3}{75}$ **or** 1 in *25* for both marks allow **1** mark for total of 375 allow **1** mark for a clearly correct method using a clearly incorrect total do **not** accept 1:26	2
3(b)(i)	**B** (only) burning fossil fuels produces carbon dioxide / carbon (emissions) **or** nuclear fuels don't produce carbon dioxide	do **not** credit reason if **B** is not chosen insufficient – smallest amount of fossil fuels accept less carbon dioxide	1 1
3(b)(ii)	accept anything reasonable eg increased level of insulation use energy efficient light bulbs do not leave appliances on standby switch thermostats down (1 ^{o}C) generate own electricity install solar panels	accept insulate accept specific examples eg loft	1

Question 3 continues on the next page

STEMUP.CO.UK

PHY1H

Question 3 continued

question	answers	extra information	Mark
3(c)(i)	any **three** from: • no power output until wind speed exceeds 4 m/s • output rises rapidly after 4 m/s • output begins to level out / rises less rapidly at / after 13 m/s • output peaks at 21 / 22 m/s • output constant between 21 / 22 and 25 / 26 m/s • output falls (rapidly) after 25 / 26 m/s	accept for **1** mark goes up then comes down	3
3(c)(ii)	any **one** from: • unreliable energy source • dilute energy source • take up too much land	accept wind does not always blow accept need thousands / lots of turbines ignore reference to visual / noise pollution ignore reference to kill birds	1
Total			**9**

STEMUP.CO.UK

PHY1H

Question 4

question	answers	extra information	mark
4(a)(i)	(atoms / elements with) the same number of protons but different numbers of neutrons	accept (atoms / elements with) different mass number but same atomic number	1
4(a)(ii)	substances that give out radiation	accept alpha, beta or gamma for radiation accept an unstable nucleus that decays radioactive decay takes place is insufficient	1
4(b)	85 years	± 2 years allow **1** mark for showing correct method on the graph	2
4(c)(i)	a helium nucleus	accept 2 neutrons and 2 protons accept $_2{}^4He$ do **not** accept helium atom	1
4(c)(ii)	the rate of decay (of plutonium) decreases less heat produced	accept fewer (plutonium) nuclei (to decay) accept radioactivity decreases do **not** accept energy for heat	1 1

Question 4 continues on the next page

STEMUP.CO.UK

PHY1H

Question 4 continued

question	answers	extra information	mark
4(d)(i)	(outside the body) alpha (particles) cannot penetrate into the body (inside the body) (heat produced from decay) damages / kills cells / tissues	 accept causes cancer for damages / kills cells / tissues accept **highly** toxic	 1 1
4(d)(ii)	any **one** from: • worried same could happen again • an accident may cause radiation to be spread around the Earth / atmosphere • idea of soil contamination resulting from accident / release of radioactive material • idea of negative effect on health resulting from accident / release of radioactive material	 accept any sensible suggestion	1
Total			**10**

STEMUP.CO.UK

PHY1H

Question 5

question	answers	extra information	mark
5(a)(i)	radio(waves)		1
5(a)(ii)	energy	correct answer only	1
5(b)(i)	0.0125 (m)	allow **1** mark for correct transformation and substitution	2
5(b)(ii)	make it hot(ter)	do **not** accept cook it accept (air) particles inside ball will move faster accept water in the ball gets hotter	1
5(b)(iii)	wavelength decreases frequency increases	ignore reference to speed	1 1
5(c)(i)	both variables are continuous	accept the data is continuous	1

Question 5 continues on the next page

STEMUP.CO.UK

PHY1H

Question 5 continued

question	answers	extra information	Mark
5(c)(ii)	digital data can be (easily) processed by a computer **or** digital analogue data cannot (easily) be processed by a computer	both parts needed do **not** accept answers in terms of interference / quality / clearer signals	1
5(c)(iii)	<u>digital</u> a signal that has only two states / discrete values <u>analogue</u> a signal that varies continuously	accept can only be on or off accept made up of 1 and 0 only allow both marks for two correct diagrams correctly labelled digital and analogue allow **1** mark for two correct diagrams but not labelled	1 1
Total			**11**

STEMUP.CO.UK