AQA GCSE PHYSICS (4451)

PHYSICS



EXAM QUESTION PACK

UNIT P3 FOUNDATION TIER PHY3F PAPERS

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	



General Certificate of Secondary Education
Foundation Tier
June 2012

Physics

PHY3F

Unit Physics P3

F

Written Paper

Wednesday 30 May 2012 1.30 pm to 2.15 pm

For this paper you must have:
- a ruler.

You may use a calculator.

Time allowed
- 45 minutes

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

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

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



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ANSWER IN THE SPACES PROVIDED

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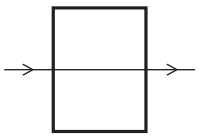
Answer **all** questions in the spaces provided.

1 A student has drawn six ray diagrams, **A**, **B**, **C**, **D**, **E** and **F**.

Only three of the ray diagrams are correct.

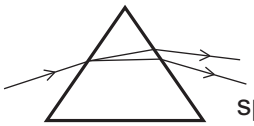
Put a tick (✓) in the box under each of the **three** correctly drawn ray diagrams.

Glass block



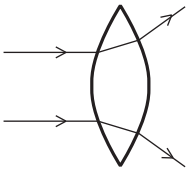
A

Glass prism



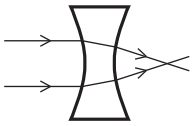
B

Glass lens



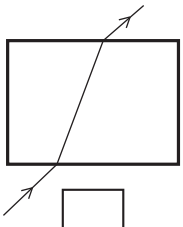
C

Glass lens



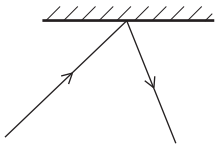
D

Glass block



E

Plane mirror



F

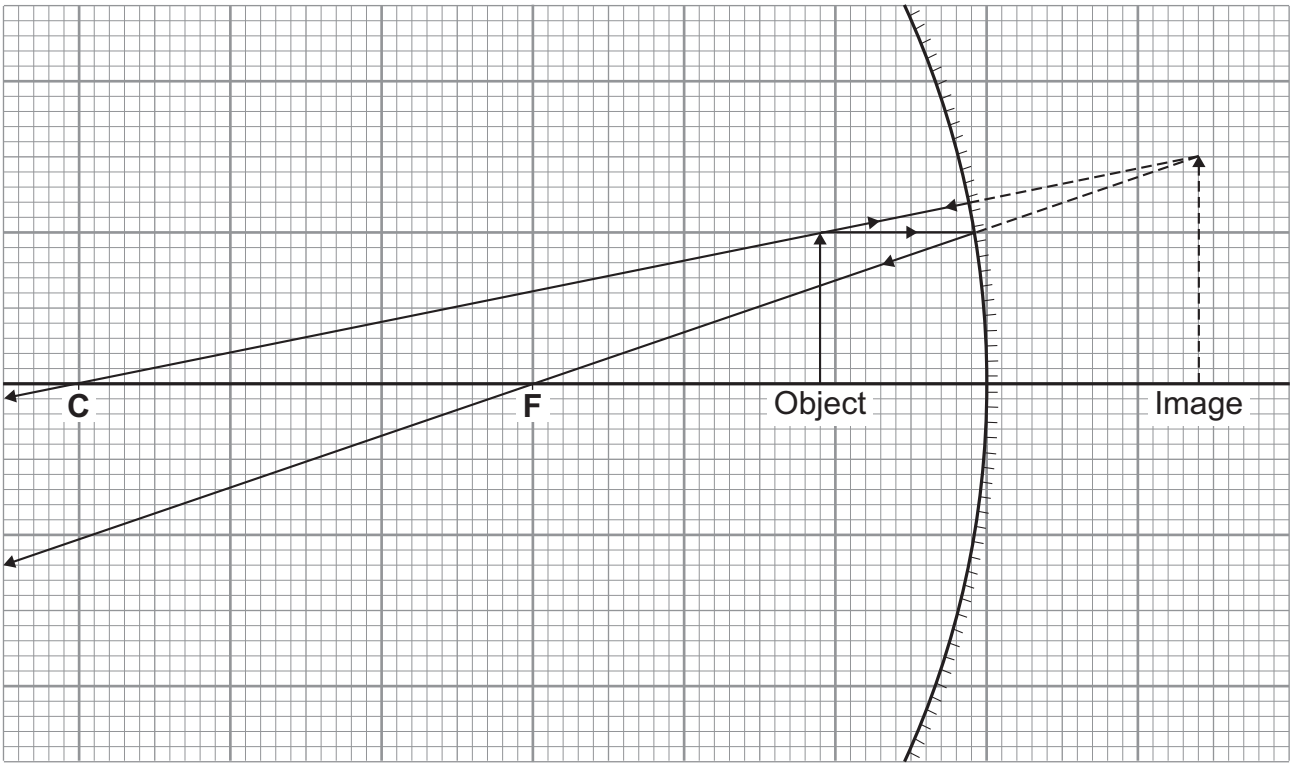
(3 marks)

3

Turn over for the next question

Do not write outside the box

2 When you look into a mirror, you see an image of yourself.
The diagram shows how the image of a near object is produced by one type of mirror.



2 (a) What type of mirror is shown in the diagram?

Draw a ring around your answer.

concave **convex** **plane**

(1 mark)

2 (b) Use the equation in the box to calculate the magnification produced by the mirror.

$$\text{magnification} = \frac{\text{image height}}{\text{object height}}$$

Show clearly how you work out your answer.

.....

.....

Magnification = ...

(2 marks)

Do not write outside the box

2 (c) Which **two** of the following words can be used to describe the image?

Put a tick (✓) in the box next to each of your **two** answers.

inverted ☐

real ☐

upright ☐

virtual ☐

(1 mark)

2 (d) Suggest **one** practical use for this type of mirror.

.....

.....

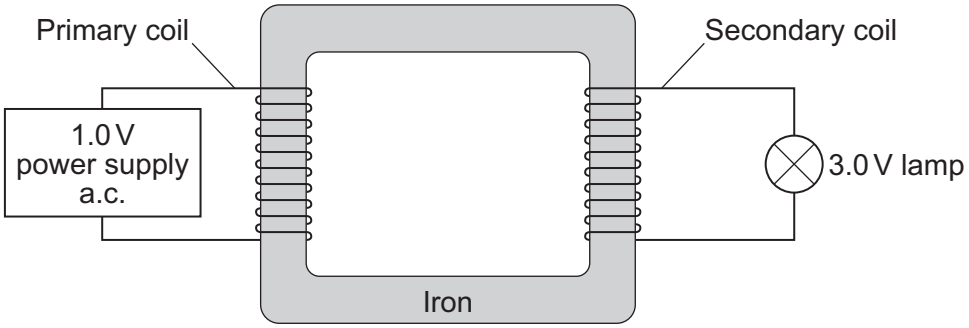
(1 mark)

5

Turn over for the next question

Do not write outside the box

3 (a) The diagram shows a simple transformer made by a student. The student has designed the transformer to light a 3.0 V lamp using a 1.0 V power supply.



3 (a) (i) What name is given to the part of the transformer that is made of iron?

Draw a ring around your answer.

centre **connector** **core**

(1 mark)

3 (a) (ii) When the power supply is switched on, the lamp is not very bright.

Suggest **one** change that the student can make to increase the brightness of the lamp. The 1.0 V power supply cannot be changed.

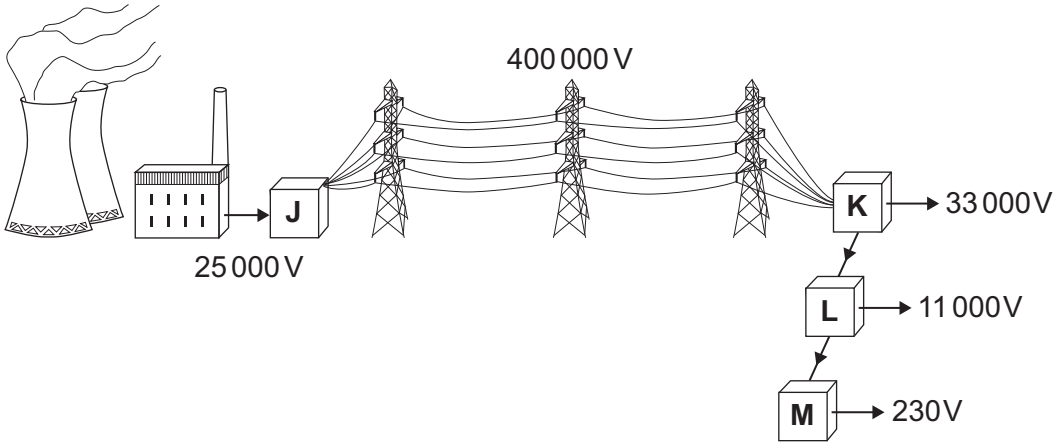
.....

.....

(1 mark)

Do not write outside the box

3 (b) The diagram shows part of the National Grid system. The transformers, **J**, **K**, **L** and **M**, are an essential part of the system.



3 (b) (i) Which transformer, **J**, **K**, **L** or **M**, is a step-up transformer?

Write your answer in the box.

(1 mark)

3 (b) (ii) Some scientists claim to have found evidence to suggest that children living near to overhead power lines are more likely to develop leukaemia. However, the scientists are not sure that the power lines are the cause of the problem.

The evidence from this and other investigations may worry some people.

What do you think scientists should do?

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

Scientists should always publish the evidence from investigations immediately.

Scientists should ignore any evidence from investigations that may worry people.

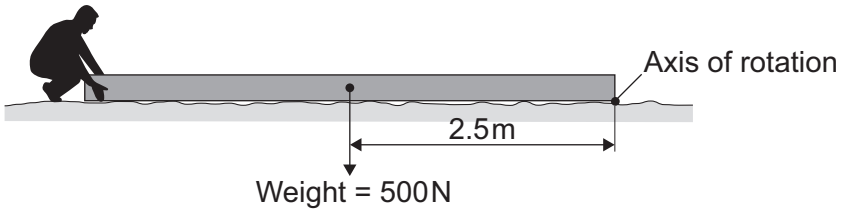
Scientists should publish the evidence from an investigation only when they have found out as many facts as possible.

(1 mark)

4

Do not write outside the box

4 The diagram shows someone starting to lift the end of a heavy wooden pole.



4 (a) Use the equation in the box to calculate the moment produced by the weight of the pole.

moment	=	force	×	perpendicular distance from the line of action of the force to the axis of rotation

.....

.....

Moment = ... Nm

(2 marks)

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

The smallest force needed to lift the end of the pole will be

bigger than
the same as
smaller than

the weight of the pole.

(1 mark)

4 (b) (ii) Give a reason for your answer to part **(b)(i)**.

.....

.....

(1 mark)

Do not write outside the box

4 (c) How could the person lifting the end of the pole increase the moment?

.....

.....

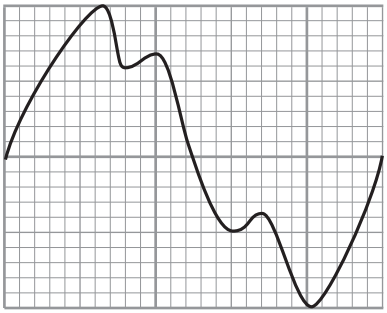
(1 mark)

5

Turn over for the next question

Do not write outside the box

5 (a) The diagrams show the waveform for a musical note played on two different instruments. The notes have the same frequency.





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

5 (a) (i) Having the same frequency means that the two notes also have the same

amplitude.
loudness.
pitch.

(1 mark)

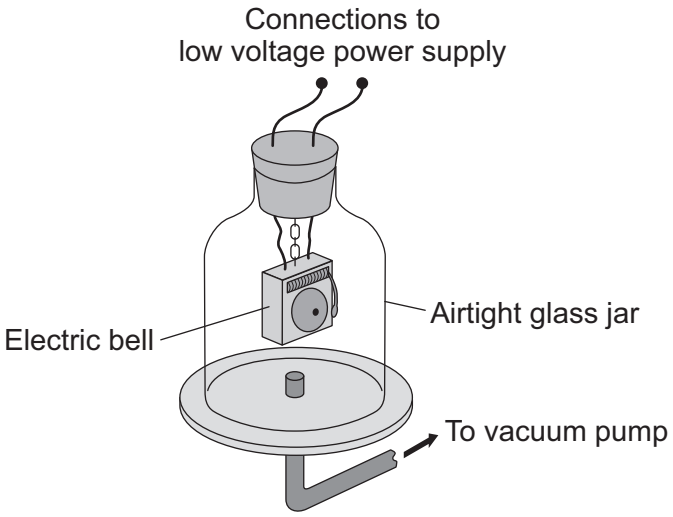
5 (a) (ii) Having different waveforms means that the two notes also have a different

amplitude.
quality.
wavelength.

(1 mark)

Do not write outside the box

5 (b) The diagram shows an electric bell inside an airtight glass jar. When the bell is switched on, someone near to the glass jar can hear the bell ringing.



The vacuum pump is now used to remove the air from inside the glass jar.

What happens to the sound from the bell after the air has been removed from the glass jar?

.....

Give a reason for your answer.

.....

.....

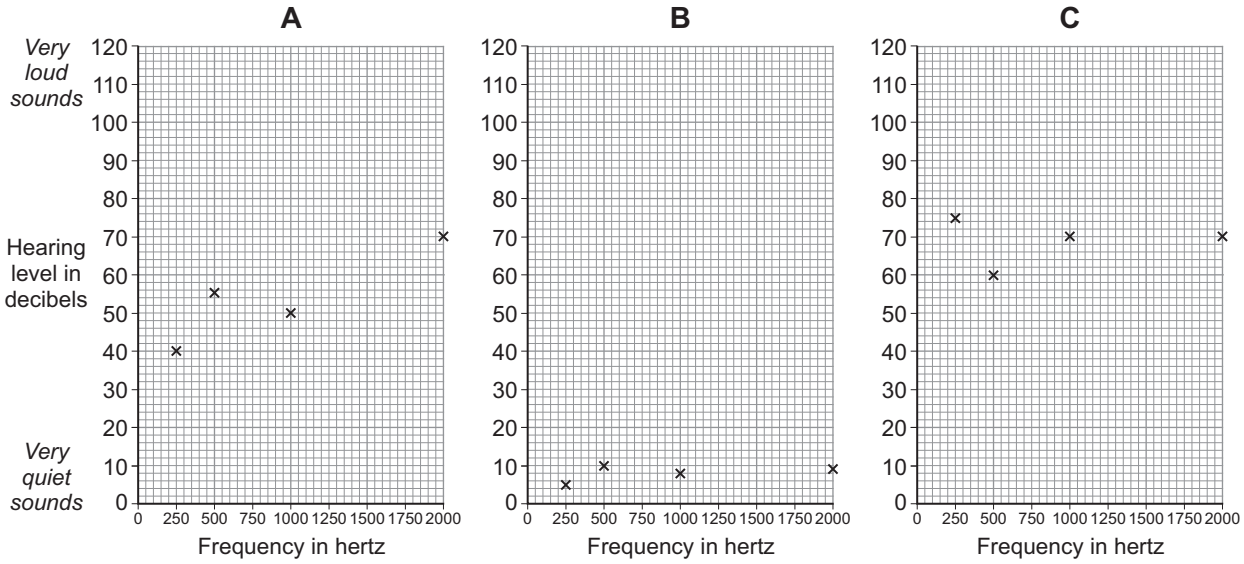
(2 marks)

Question 5 continues on the next page

Do not write outside the box

5 (c) Loud sounds can damage a person's hearing.

The graphs show the quietest sounds that three people, **A**, **B** and **C**, can hear at particular frequencies.



5 (c) (i) Only one of the three people has good hearing.

Which **one** of the people, **A**, **B** or **C**, has good hearing?

Write your answer in the box. ☐

Give a reason for your answer.

.....

.....

(2 marks)

Do not write outside the box

5 (c) (ii) The table gives the typical frequency and loudness for four sounds.

Sound	Frequency in hertz	Loudness level in decibels
Dog barking	250	65
Lawnmower	250	100
Loud shout	1000	80
Telephone ringing	2000	60

Look at the graph for person **C**.

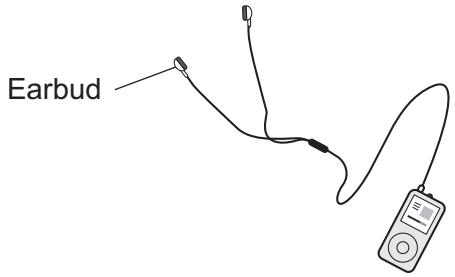
Which **two** sounds, given in the table, is person **C** able to hear?

Draw a ring around each of your **two** answers.

dog barking **lawnmower** **loud shout** **telephone ringing**

(2 marks)

5 (d) Research has shown that many teenagers are now showing signs of damaged hearing. There is a strong suggestion that listening to loud music through earbuds is partly to blame, but this has not been proved.



Suggest what teenagers who listen to music through earbuds should do to protect their hearing.

.....

.....

(1 mark)

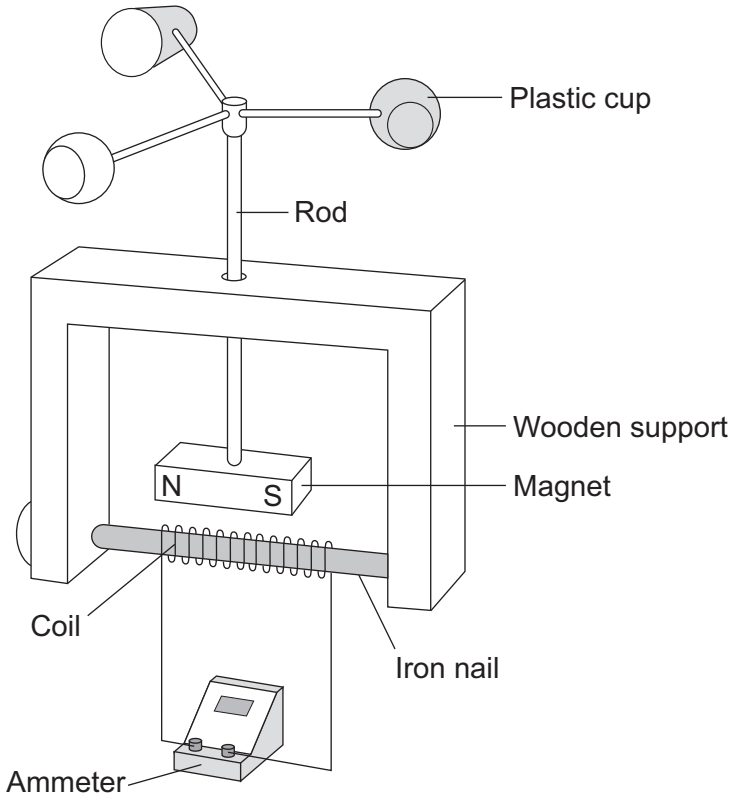
9

Turn over ▶

Do not write outside the box

6 The diagram shows a simple home-made anemometer.

An anemometer measures wind speed.



6 (a) When the wind blows, the ammeter gives a reading.

Use the correct words from the box to complete the explanation as to why this happens.

coil	**induced**	**magnet**	**produced**	**rod**

When the wind blows, the plastic cups turn.

This makes the rod and ..... turn.

The magnetic field cuts through the ..... .

A current is ..... in the coil.

This gives a reading on the ammeter.

(3 marks)

Do not write outside the box

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

When the wind speed increases, the reading on the ammeter will go

down.
to zero.
up.

(1 mark)

6 (b) (ii) Give a reason for your answer to part **(b)(i)**.

.....

.....

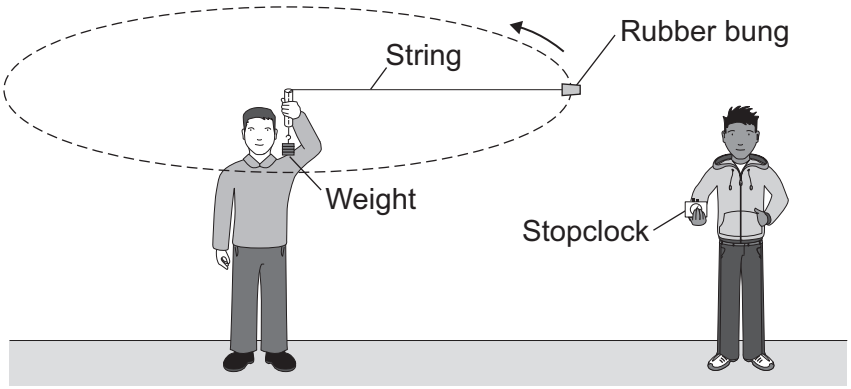
(1 mark)

5

Turn over for the next question

Do not write outside the box

7 The diagram shows the apparatus used by two students to find out how the centripetal force acting on an object affects the speed of the object.



7 (a) (i) In which direction does the centripetal force act on the rubber bung?

.....

(1 mark)

7 (a) (ii) In this investigation, what provides the centripetal force?

.....

.....

(1 mark)

7 (b) One student swung the rubber bung around in a circle at constant speed. The second student timed how long it took the rubber bung to complete 10 rotations. The students then calculated the speed of the rubber bung, using the radius of the circle and the time to complete one rotation. The students repeated this for several different values of centripetal force.

7 (b) (i) During the investigation, the radius of the circle and the mass of the rubber bung were not changed.

Explain why.

.....

.....

.....

.....

(2 marks)

Do not write outside the box

7 (b) (ii) One of the variables in this investigation was the time taken by the rubber bung to complete 10 rotations.

Which **two** words can be used to describe this variable?

Draw a ring around each of your **two** answers.

continuous **control** **dependent** **independent**

(1 mark)

7 (b) (iii) The students timed 10 rotations of the rubber bung, rather than just one rotation.

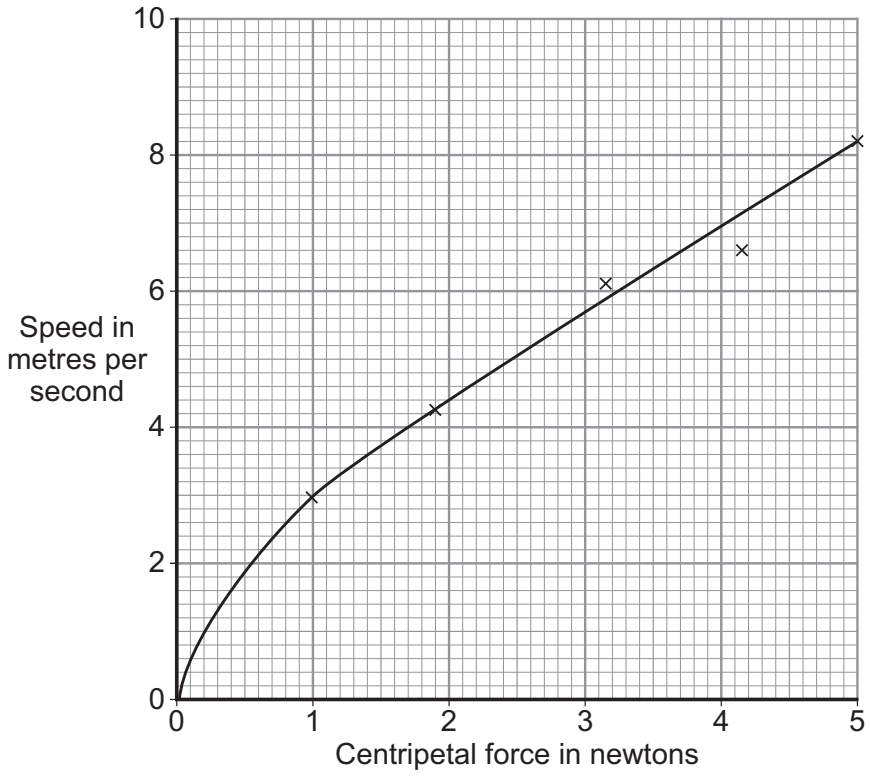
Suggest why.

.....

.....

(1 mark)

7 (c) The graph shows the students' data.



There is a relationship between the speed of an object moving in a circle and the centripetal force acting on the object.

What conclusion about this relationship can the students make from their data?

.....

.....

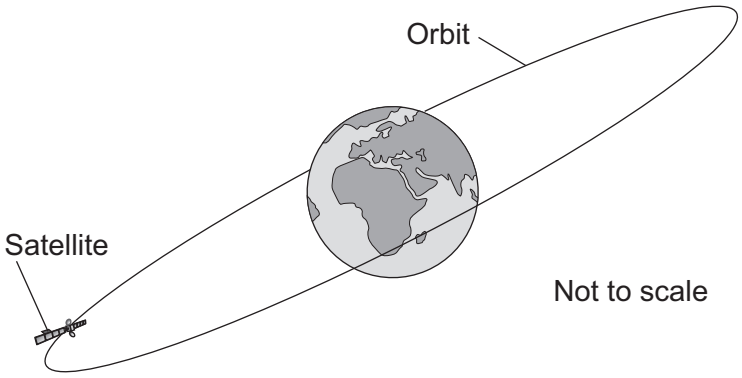
(1 mark)

Question 7 continues on the next page

Turn over ▶

Do not write outside the box

7 (d) The diagram shows a satellite in a circular orbit above the Earth.
The satellite is part of the global positioning system (GPS).
The satellite orbits the Earth **twice** every 24 hours.



7 (d) (i) What provides the centripetal force needed to keep the satellite in its orbit around the Earth?

.....

(1 mark)

7 (d) (ii) Is this satellite in a geostationary orbit?

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

Give a reason for your answer.

.....

.....

(1 mark)

9

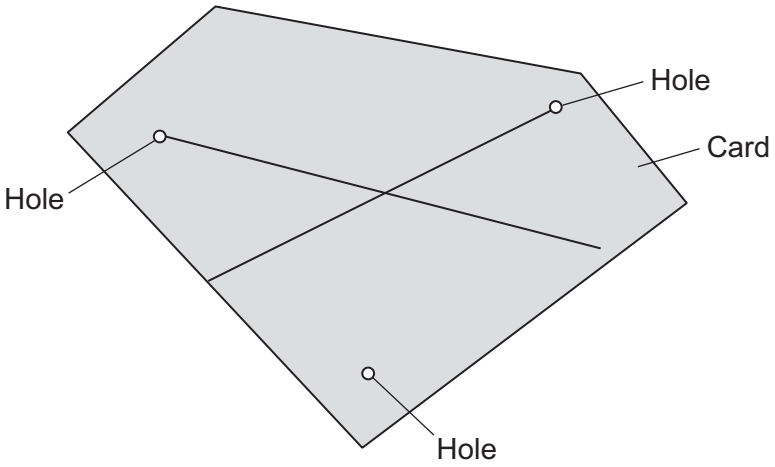
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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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8 A student was asked to find the centre of mass of a thin sheet of card. The diagram shows the result of the student's experiment. The student drew two lines onto the card. The centre of mass is where the two lines cross.



8 (a) Describe how the student found the correct positions to draw the **two** lines. You may include a labelled diagram in your answer.

.....

.....

.....

.....

.....

.....

.....

.....

(3 marks)

Do not write outside the box

8 (b) Explain how the student can check that the position found for the centre of mass is accurate.

.....

.....

.....

.....

(2 marks)

5

END OF QUESTIONS

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General Certificate of Secondary Education

Physics 4451

PHY3F Unit Physics 3

Mark Scheme

2012 examination – June series

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

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

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

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MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

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

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

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

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

2. Emboldening

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

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

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

3. Marking points

3.1 Marking of lists

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

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

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

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

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

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

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

3.2 Use of chemical symbols / formulae

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

3.3 Marking procedure for calculations

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

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

3.4 Interpretation of 'it'

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

3.5 Errors carried forward

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

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

3.6 Phonetic spelling

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

3.7 Brackets

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

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Quality of Written Communication and levels marking

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

Students will be required to:

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

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

Level 1: Basic

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

Level 2: Clear

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

Level 3: Detailed

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

PHY3F

Question 1

question	answers	extra information	mark
1	**A** **B** **E**	If more than 3 boxes are ticked, mark incorrect ones first. Mark only 3 boxes.	1 1 1
Total			**3**

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PHY3F

Question 2

question	answers	extra information	mark
2(a)	concave		1
2(b)	(x) 1.5	allow **1** mark for showing correct method ie $\frac{15}{10}$; 3/2 ; $\frac{30}{20}$ ignore any units	2
2(c)	upright virtual	both required	1
2(d)	anything practical that requires a magnified image eg shaving mirror make-up mirror	accept telescopes, solar furnaces	1
Total			**5**

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PHY3F

Question 3

question	answers	extra information	mark
3(a)(i)	core		1
3(a)(ii)	increase number of turns on <u>secondary</u> (coil) **or** reduce number of turns on <u>primary</u> (coil)	do **not** accept coils for turns	1
3(b)(i)	**J**		1
3(b)(ii)	Scientists should publish the evidence from an investigation only when they have found out as many facts as possible		1
Total			**4**

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PHY3F

Question 4

question	answers	extra information	mark
4(a)	1250	allow **1** mark for correct substitution ie 500 x 2.5 provided there is no subsequent calculation	2
4(b)(i)	smaller than		1
4(b)(ii)	force (exerted) further from axis of rotation (than the weight)	accept pivot for axis of rotation	1
4(c)	increase the force (exerted)	do **not** accept increase distance of force from axis of rotation	1
Total			**5**

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PHY3F

Question 5

question	answers	extra information	mark
5(a)(i)	pitch		1
5(a)(ii)	quality		1
5(b)	gets quieter **or** no sound (heard) sound cannot travel through a vacuum	 accept an explanation in terms of fewer (air) particles do **not** accept there is no air	1 1
5(c)(i)	**B** can hear the lowest sound levels / quietest sounds		1 1
5(c)(ii)	loud shout lawnmower		1 1
5(d)	any sensible suggestion that would reduce loudness eg turn volume down use 'external' earphones and not earbuds stop using (device)	accept use less often / for less time	1
Total			**9**

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Question 6

question	answers	extra information	mark
6(a)	magnet coil induced	correct order only	1 1 1
6(b)(i)	up		1
6(b)(ii)	magnetic field cuts through coil faster	accept magnet turns faster	1
Total			**5**

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Question 7

question	answers	extra information	mark
7(a)(i)	towards the centre of the circle	accept inwards accept a correct description 'along the string' is insufficient	1
7(a)(ii)	tension (in the string) **or** weight (on the end of the string)	accept pull of the string 'the string' is insufficient 'the student' is insufficient 'turning action' is insufficient	1
7(b)(i)	each may (also) affect the speed so only one independent variable	accept results for speed accept only one variable affects dependent variable 'fair test' is insufficient 'they are control variables' is insufficient	1 1
7(b)(ii)	continuous dependent	both required	1
7(b)(iii)	reduces (absolute) timing error (for one rotation) **or** increases / improves reliability / accuracy (for one rotation)	accept too fast to time one ignore checking for anomalous results to work out an average is insufficient	1
7(c)	speed increases with centripetal force	accept positive correlation do **not** accept proportional	1
7(d)(i)	gravitational pull (of the Earth)	accept gravity	1

Question 7 continues on the next page

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Question 7 continued

question	answers	extra information	mark
7(d)(ii)	**No** geostationary orbits once every 24 hours	both parts required – however this may have been subsumed within the reason accept a correct comparative description	1
Total			**9**

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

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	

General Certificate of Secondary Education
Foundation Tier
January 2012

Physics

PHY3F

Unit Physics P3

F

Written Paper

Monday 30 January 2012 1.30 pm to 2.15 pm

For this paper you must have:
- a ruler.

You may use a calculator.

Time allowed
- 45 minutes

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

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

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

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There are no questions printed on this page

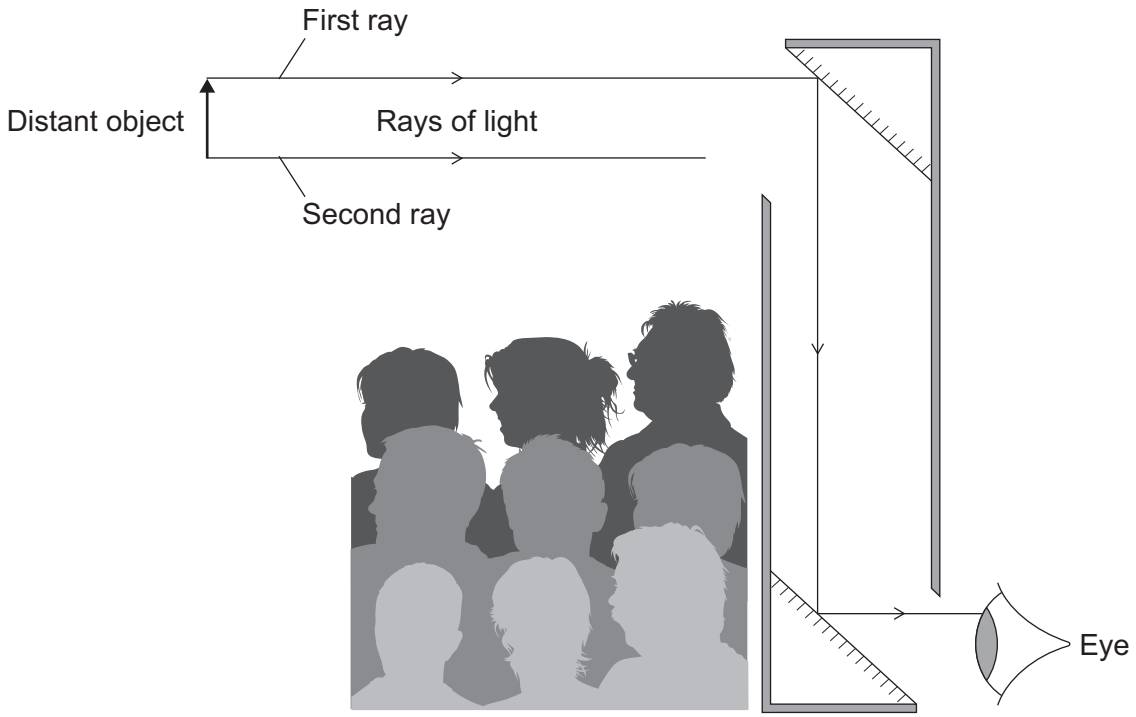
DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

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

1 The diagram shows a periscope being used to see over the heads of a crowd of people.

The periscope has been made using two plane mirrors.



1 (a) Using a ruler, complete the diagram to show how the second ray of light from a distant object reaches the person's eye.

(2 marks)

1 (b) How big is the image produced by the periscope compared to the size of the object?

.....

(1 mark)

3

Turn over for the next question

Do not write outside the box

2 (a) Starting with the smallest, list the following in order of increasing size.

Universe **Earth** **Milky Way** **Sun**

Smallest .....

.....

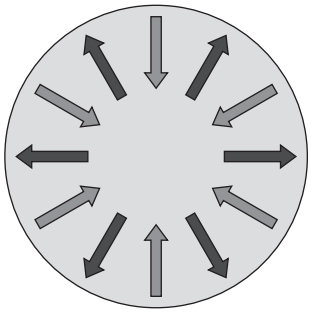
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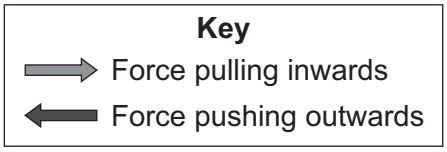
Largest .....

(2 marks)

2 (b) Stars pass through different stages during their life cycle.

The diagram shows the forces acting on the Sun during the stable stage of its life cycle.





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

During the stable stage of the Sun's life cycle, the forces pulling inwards

are

smaller than
equal to
bigger than

the forces pushing outwards.

(1 mark)

Do not write outside the box

2 (c) During its life cycle, the Sun will never go through a *supernova* stage but the star Mira will.

2 (c) (i) What is a *supernova*?

.....

(1 mark)

2 (c) (ii) Explain why the Sun will not go through the *supernova* stage but the star Mira will.

.....

.....

.....

.....

(2 marks)

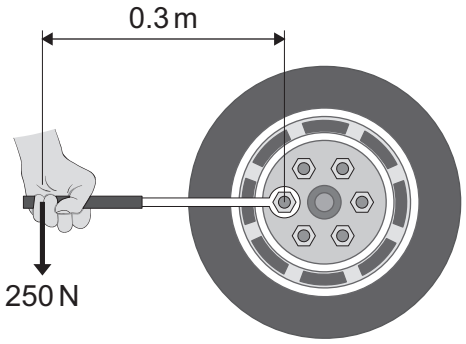
6

Turn over for the next question

Do not write outside the box

3 A company makes a wheel wrench with an extending handle. The company claims that the extending handle makes it easier to loosen the wheel nuts on a car.

The diagram shows the wheel wrench being used without the handle extended.



3 (a) (i) Use the equation in the box to calculate the moment produced by the force on the wrench.

moment = force × perpendicular distance from the line of action of the force to the axis of rotation

Show clearly how you work out your answer.

.....

.....

Moment = ... newton metres

(2 marks)

3 (a) (ii) Units can be written in words or symbols.

Which of the following is the unit for a moment written using symbols?

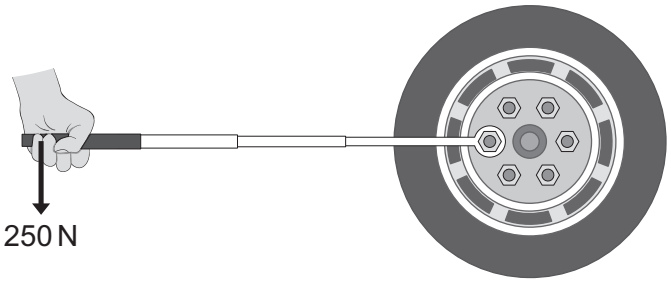
Draw a ring around your answer.

nm **Nm** **nM** **NM**

(1 mark)

Do not write outside the box

3 (b) The wheel nut will not move and so the handle of the wrench is extended.



It is now easy to loosen the wheel nut using the same force as before.

Explain why.

.....

.....

.....

.....

(2 marks)

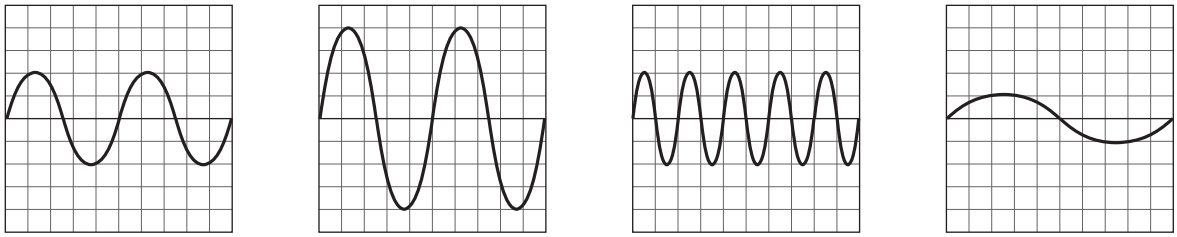
5

Turn over for the next question

Do not write outside the box

4 (a) The diagram shows four sound waves, **J**, **K**, **L** and **M**, represented on an oscilloscope screen.

They are all drawn to the same scale.



J **K** **L** **M**

4 (a) (i) Which **two** of the waves have the same amplitude?

Wave ..... and wave .....

(1 mark)

4 (a) (ii) Which of the waves would sound the loudest?

Wave .....

(1 mark)

4 (a) (iii) Only **one** of the waves is an ultrasound wave.

Which **one** is the ultrasound wave?

Wave .....

Give a reason for your answer.

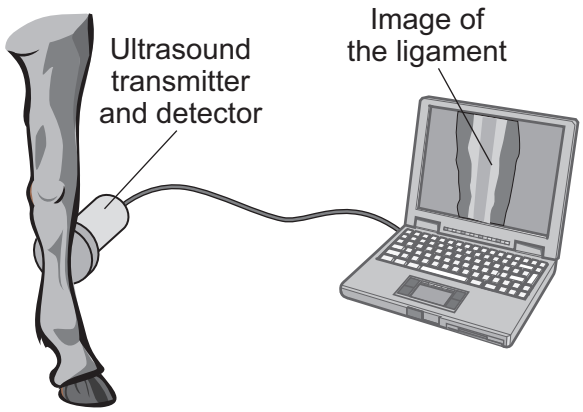
.....

.....

(2 marks)

Do not write outside the box

4 (b) The diagram shows ultrasound being used to examine the ligament inside the leg of a horse.



Use words from the box to complete the following sentences.

computer	**detector**	**transmitter**

The ..... sends pulses of ultrasound into the leg. When the ultrasound meets the ligament, some is reflected back to the ..... . The reflected pulses are converted by a ..... into an image that can be seen on the screen.

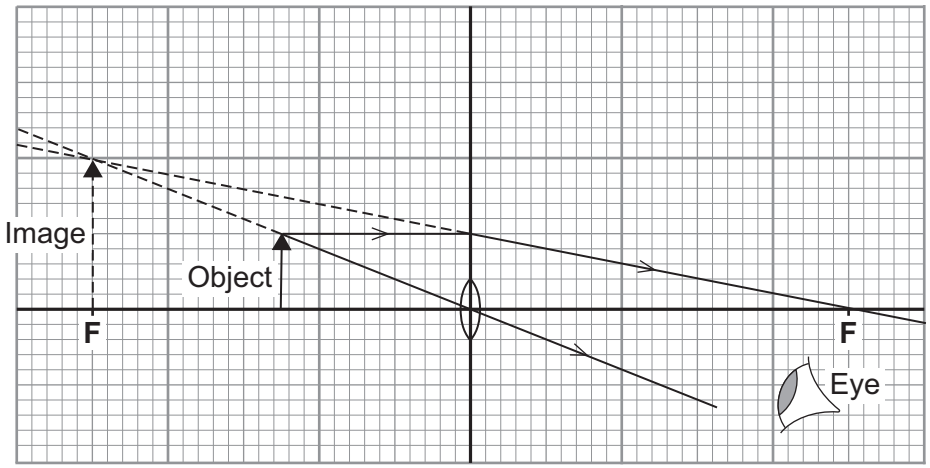
(2 marks)

6

Turn over for the next question

Do not write outside the box

5 The diagram shows a lens being used as a magnifying glass.



5 (a) (i) What type of lens is shown in the diagram?

Draw a circle around your answer.

concave **converging** **diverging**

(1 mark)

5 (a) (ii) Use the equation in the box to calculate the magnification produced by the lens.

The object and image in the diagram have been drawn to full size.

$$\text{magnification} = \frac{\text{image height}}{\text{object height}}$$

Show clearly how you work out your answer.

.....

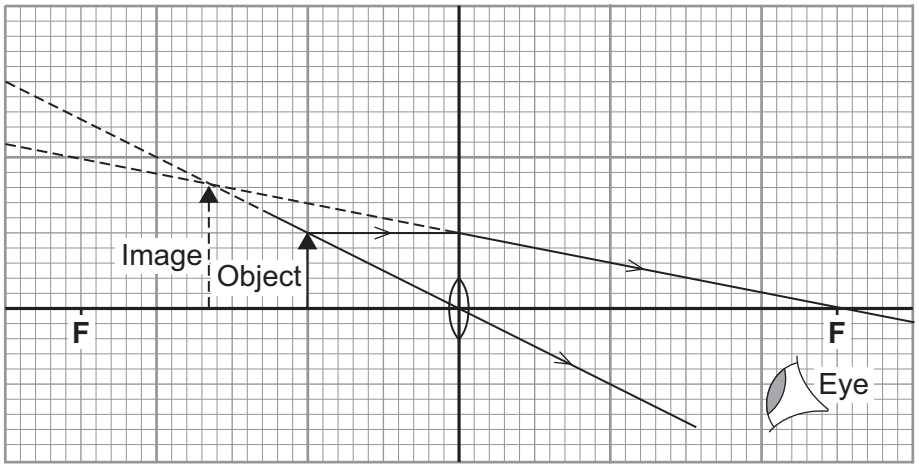
.....

Magnification = ...

(2 marks)

Do not write outside the box

5 (b) The diagram shows how the image changes when the object has been moved closer to the lens.



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

Moving the object closer to the lens

increases
does not change
decreases

the magnification produced by the lens.

(1 mark)

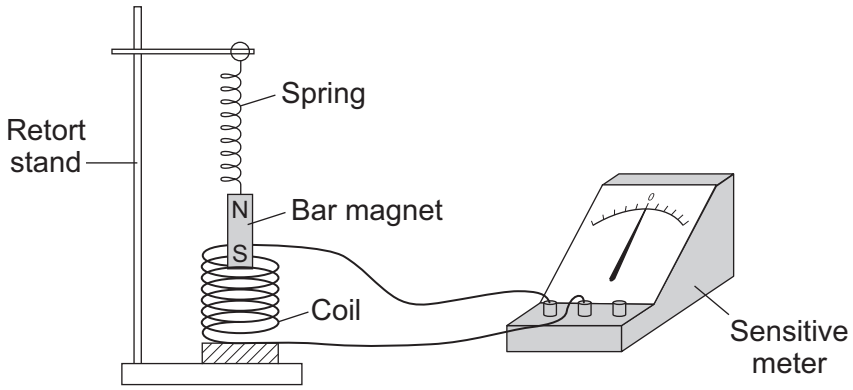
4

Turn over for the next question

Do not write outside the box

6 **Diagram 1** shows an instrument designed by a student to detect the vibrations caused by an earthquake. If the bar magnet is made to vibrate up and down, it will move into and out of the coil. This causes a potential difference to be induced across the ends of the coil.

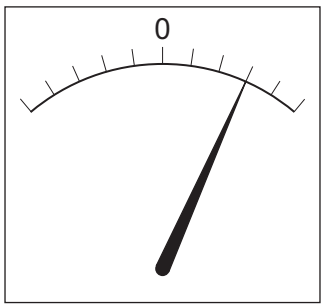
Diagram 1



6 (a) The student tests the instrument by pushing the magnet into the coil and then letting go.

Diagram 2 shows the meter reading at the moment when the magnet, moving upwards, leaves the coil.

Diagram 2



6 (a) (i) Draw a second line on **Diagram 2** to show the meter reading at the moment when the magnet, moving downwards, enters the coil.

Assume the speed of the magnet is the same as it enters and leaves the coil.

(2 marks)

Do not write outside the box

6 (a) (ii) As the magnet moves downwards, through the coil, the force from the spring causes it to slow down and then stop.

Describe how the meter reading changes as the magnet slows down **and then** stops.

.....

.....

.....

.....

(2 marks)

6 (b) Earthquakes cause the ground to vibrate up and down and also from side to side.

Which vibrations will the student's instrument detect?

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

side to side only ☐

up and down only ☐

up and down and also side to side ☐

Give a reason for your answer.

.....

.....

.....

.....

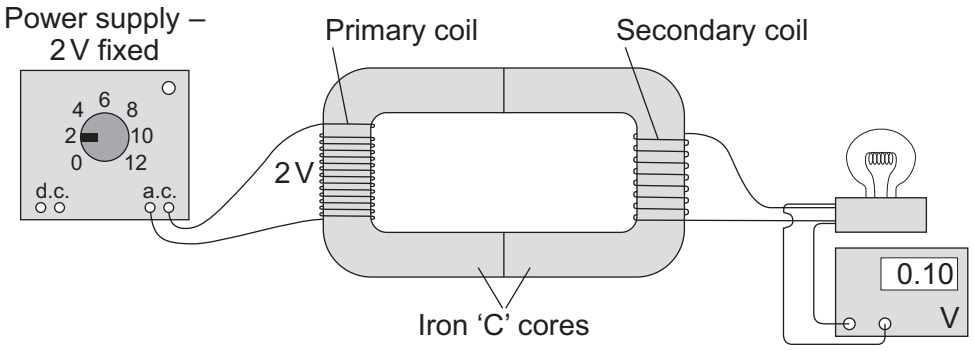
(2 marks)

6

Turn over for the next question

Do not write outside the box

7 The diagram shows the apparatus used by a student to investigate a transformer.



7 (a) The transformer made by the student would not have worked if the core had been made from aluminium and not iron.

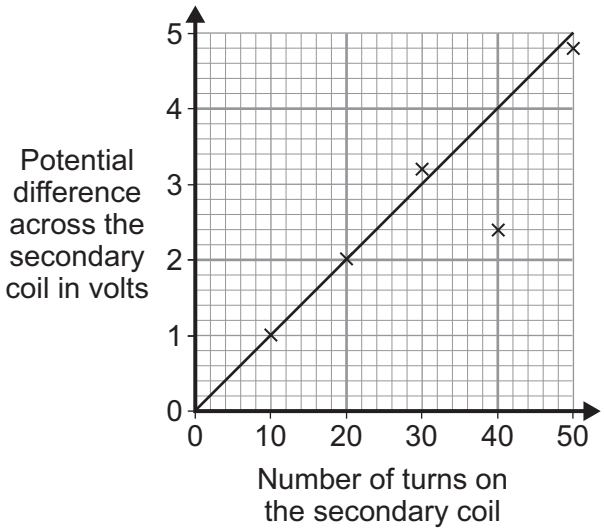
Why?

.....

.....

(1 mark)

7 (b) The student made changes to the number of turns used to make the secondary coil. He then measured the potential difference across the secondary coil after each change. The graph shows the student's results.



7 (b) (i) What range of values was used for the number of turns on the secondary coil?

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

(1 mark)

Do not write outside the box

7 (b) (ii) When he drew the line of best fit, the student ignored one of the data points.

Why?

.....

.....

(1 mark)

7 (b) (iii) What is the minimum number of turns needed on the secondary coil for the transformer to act as a step-up transformer?

.....

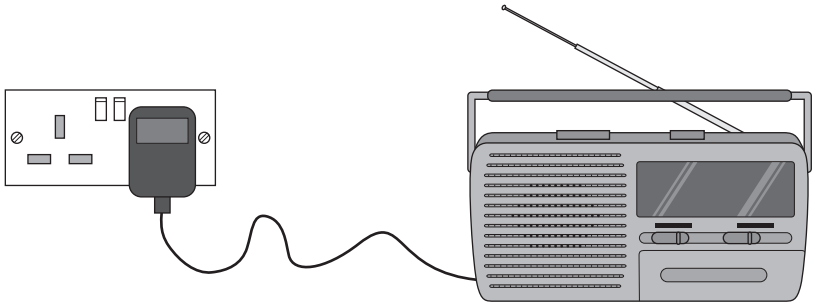
Give a reason for your answer.

.....

.....

(2 marks)

7 (c) A radio can be used with a 9 V battery or it can be plugged into the 230 V mains electricity supply using an adapter. The mains adapter contains a transformer.



Why must the mains adapter contain a transformer?

.....

.....

(1 mark)

6

Turn over for the next question

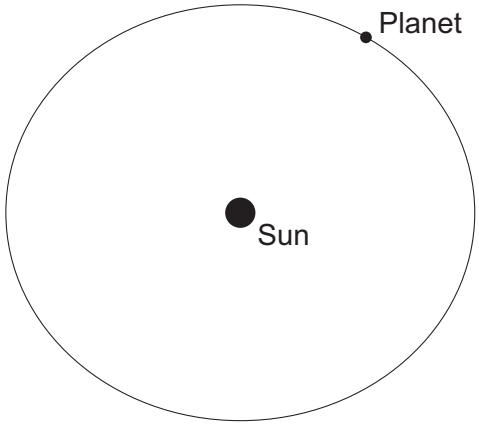
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ANSWER IN THE SPACES PROVIDED

Do not write outside the box

8 (a) The diagram shows the orbit of a planet in the Solar System. The orbit is shaped like a slightly squashed circle.



Not drawn to scale

8 (a) (i) What word is used to describe the shape of the planet's orbit?

.....

(1 mark)

8 (a) (ii) A planet is kept in its orbit by a centripetal force.

What provides the centripetal force on a planet?

.....

(1 mark)

8 (a) (iii) On the diagram above, draw an arrow to show the direction of the centripetal force acting on the planet.

(1 mark)

8 (a) (iv) Name **two** factors that affect the size of the centripetal force acting on the planet.

1 .....

.....

2 .....

.....

(2 marks)

Question 8 continues on the next page

Turn over ▶

Do not write outside the box

8 (b) In 1772, the astronomer J. Bode developed a law to calculate the distance a planet is from the Sun. Most scientists at the time did not think that the law was very important.

The table gives the distances calculated using Bode's Law and the actual distances from the Sun for the six planets known to exist in 1772.

Planet	Distance calculated using Bode's Law in AU	Actual distance in AU
Mercury	0.4	0.4
Venus	0.7	0.7
Earth	1.0	1.0
Mars	1.6	1.5
	2.8	
Jupiter	5.2	5.2
Saturn	10.0	9.5

(1 AU = distance between the Earth and the Sun)

8 (b) (i) Considering only these six planets, do you think that Bode's Law gives accurate values for the distances the planets are from the Sun?

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

Give a reason for your answer.

.....

.....

(1 mark)

Do not write outside the box

8 (b) (ii) Bode's Law predicts the existence of a planet between Mars and Jupiter.
In 1801, Ceres, the largest object between Mars and Jupiter, was discovered orbiting the Sun at a distance of 2.8 AU.
Ceres is no longer considered to be a planet.

Explain how the discovery of Ceres in 1801 may have changed scientists' opinions of Bode's Law.

.....

.....

.....

.....

(2 marks)

8 (b) (iii) Since 1801, more planets and other objects have been discovered orbiting the Sun.
These discoveries have led some scientists to develop new versions of Bode's Law.

Suggest why scientists may decide that a new version of Bode's Law is needed.

.....

.....

.....

(1 mark)

9

END OF QUESTIONS

There are no questions printed on this page

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Version1.0: 29/03/2012

General Certificate of Secondary Education

Physics 4451

PHY3F Unit Physics 3

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

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Marking Guidance for Examiners

GCSE Science Papers

1. General

The mark scheme for each question shows:

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

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

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

where consequential marking needs to be considered in a calculation;

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

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

2. Emboldening

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

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

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

3. Marking points

3.1 Marking of lists

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

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

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

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

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

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

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

3.2 Use of chemical symbols / formulae

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

3.3 Marking procedure for calculations

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

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

3.4 Interpretation of 'it'

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

3.5 Errors carried forward

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

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

3.6 Phonetic spelling

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

3.7 Brackets

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

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PHY3F

Question 1

question	answers	extra information	mark
1(a)	reflection shown at both mirrors ray parallel to given ray	 judge by eye	1 1
1(b)	same size		1
Total			**3**

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PHY3F

Question 2

question	answers	extra information	mark
2(a)	Earth Sun Milky Way Universe	all four in correct order allow **1** mark for Earth and Universe in correct places	2
2(b)	equal to		1
2(c)(i)	explosion (of a star)	ignore implosion	1
2(c)(ii)	only very massive stars become supernova Mira large enough but sun too small	 allow **1** mark for each statement Sun too small to give a supernova **or** Mira large enough to give a supernova	1 1
Total			**6**

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PHY3F

Question 3

question	answers	extra information	mark
3(a)(i)	75	allow **1** mark for correct substitution ie 250 x 0.3 do **not** credit if subsequent step shown allow **1** mark for an answer 7500	2
3(a)(ii)	Nm		1
3(b)	force is (applied) further from the nut / pivot / axis of rotation moment (on wrench) is larger	handle is longer is insufficient do **not** accept less force needed	1 1
Total			**5**

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PHY3F

Question 4

question	answers	extra information	mark
4(a)(i)	**J** and **L**	both required, either order	1
4(a)(ii)	**K**		1
4(a)(iii)	**L** highest frequency	 reason does not score if **L** not chosen accept most waves (on screen) do **not** accept frequency above 20 000(Hz) do **not** accept cannot hear it	1 1
4(b)	transmitter detector computer	all three in correct order allow **1** mark for one correct	2
Total			**6**

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PHY3F

Question 5

question	answers	extra information	mark
5(a)(i)	converging		1
5(a)(ii)	(x) 2	allow **1** mark for correct substitution ie 10/5 **or** 20/10 **or** 2/1 ignore any units	2
5(b)	decreases		1
Total			**4**

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PHY3F

Question 6

question	answers	extra information	mark
6(a)(i)	line 3 divisions left of zero	allow **1** mark for showing line to left of zero	2
6(a)(ii)	reading decreases (and goes) to zero		1 1
6(b)	up and down only only get a meter reading / induced p.d. when magnet moves up and down	 reason is dependent on scoring first mark accept apparatus can only detect up and down do **not** accept spring / magnet cannot move left to right / sideways / side to side	1 1
Total			**6**

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PHY3F

Question 7

question	answers	extra information	mark
7(a)	aluminium cannot be magnetised	accept aluminium is not magnetic "it" refers to aluminium do **not** accept aluminium is not easily magnetised reference to conduction and aluminium negates mark iron can be magnetised is insufficient	1
7(b)(i)	10 to 50	either order	1
7(b)(ii)	(data is) anomalous	accept does **not** fit the pattern it is an error is insufficient	1
7(b)(iii)	21	accept 22 do **not** accept any fraction of a turn ie 20.1	1
	secondary p.d. (just) larger than primary p.d. **or** there must be more turns on the secondary coil than primary coil	accept output (just) larger than input/2V do **not** accept coil for turns	1
7(c)	to reduce/step-down the (input) p.d./voltage	mains p.d. is too high is insufficient step-down transformer is insufficient answers in terms of changing/ stepping-up current **or** fuse blowing **or** not working with 230 volts are insufficient any mention of step-up negates mark stepping down both voltage/p.d. **and** current negates mark	1
Total			**6**

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PHY3F

Question 8

question	answers	extra information	mark
8(a)(i)	ellipse/elliptical	accept oval/ovoid egg shape is insufficient	1
8(a)(ii)	gravitational attraction (between the Sun and the planet)	allow (force of) gravity allow force due to mass of the planet **and** mass of the Sun the Sun is insufficient do **not** accept references to weight	1
8(a)(iii)	arrow drawn from planet pointing towards the Sun		1
8(a)(iv)	any **two** from: • mass of the planet • distance between the planet and Sun • mass of the Sun • speed of planet	 size of the planet insufficient do **not** accept references to weight accept radius of orbit size of Sun insufficient	2
8(b)(i)	YES equal/close to the actual/true distances	no mark for this, mark is for reason does not score if NO is chosen accept (calculated) data is (generally) accurate	1

Question 8 continues on the next page . . .

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PHY3F

Question 8 continued . . .

question	answers	extra information	mark
8(b)(ii)	Ceres/discovery agrees/supports prediction **or** Ceres in predicted position accept Bode's Law **or** (now) think it's important	"it" refers to Ceres/discovery	1 1
8(b)(iii)	idea of new evidence not supporting/being in agreement with existing law	accept the idea of needing to modify the law to take account of the new data do **not** accept the universe is expanding so (Bode's) data is invalid answers in terms of new technology are insufficient answers in terms of making the law better/more reliable are insufficient	1
Total			**9**

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

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	

General Certificate of Secondary Education
Foundation Tier
June 2011

Physics

PHY3F

Unit Physics P3

F

Written Paper

Friday 27 May 2011 9.00 am to 9.45 am

For this paper you must have:
- a ruler.

You may use a calculator.

Time allowed
- 45 minutes

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

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

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

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There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

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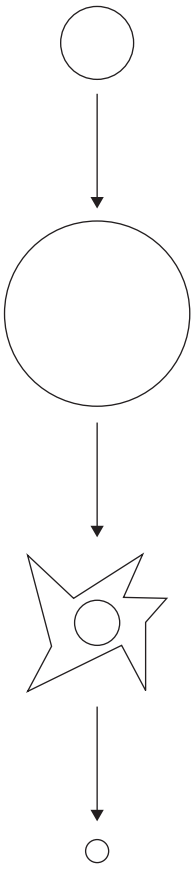
Answer **all** questions in the spaces provided.

1 The diagram shows part of the lifecycle of a very large star.

Use words or phrases from the box to complete the sentences contained in the diagram.

black hole	**red supergiant**	**supernova**	**white dwarf**

(3 marks)



The star is stable.

The star expands forming

a ..... .

The star collapses, the outer layers explode

as a ..... .

The centre collapses further and further until

it finally forms a ..... .

3

Turn over for the next question

Do not write outside the box

2 The centre of mass of an object is where the mass of the object may be thought to be concentrated.

2 (a) Use a word or phrase from the box to complete the sentence below.

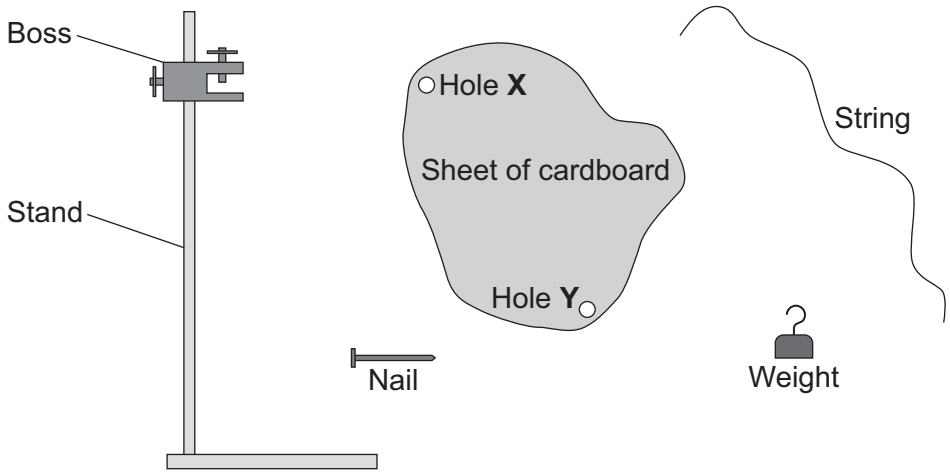
above	**below**	**to the side of**

A hanging object will come to rest with its centre of mass directly

..... the point from which it hangs.

(1 mark)

2 (b) The diagram shows the equipment that a student uses to find the centre of mass of a sheet of cardboard.
She intends to draw two lines on the sheet. The centre of mass of the sheet will be where these lines cross.



Use words from the box to complete the sentences below.

boss	**cardboard**	**nail**	**stand**	**string**	**weight**

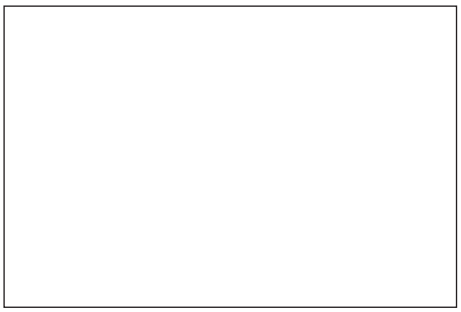
The nail is put through hole **X** in the cardboard sheet. The nail is held in the ..... . The string is tied to the weight and then the other end of the string is hung from the ..... . A line is drawn on the cardboard sheet to mark the position of the ..... . This is repeated using hole **Y**.

(3 marks)

Do not write outside the box

2 (c) The diagram below shows a plastic rectangle.

2 (c) (i) Use a ruler to draw an axis of symmetry on the rectangle.



(1 mark)

2 (c) (ii) Draw an **X** on the diagram so that the centre of the **X** marks the centre of mass of the rectangle.

(1 mark)

6

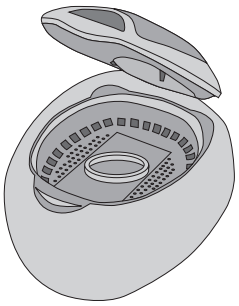
Turn over for the next question

Do not write outside the box

3 Ultrasound waves are very high frequency sound waves. They cannot be heard by humans.

3 (a) Ultrasound waves can be used to clean jewellery.

The jewellery is put into a container of cleaning fluid.



Complete each sentence to explain how ultrasound can clean jewellery.

The ultrasound generator makes the molecules of the cleaning fluid

..... . The molecules knock particles of .....

from the surface of the jewellery.

(2 marks)

3 (b) Give a medical use for ultrasound.

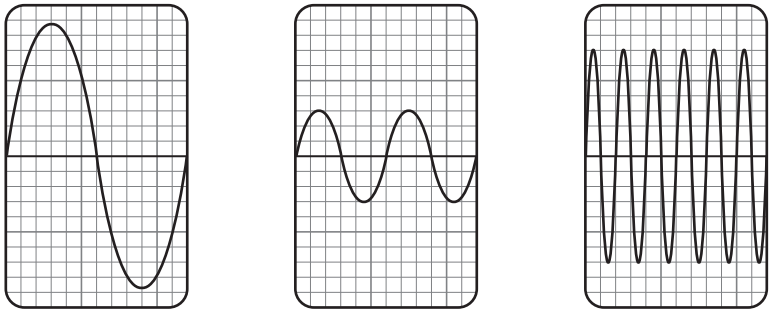
.....

(1 mark)

Do not write outside the box

3 (c) Ultrasound waves can be represented on the screen of a cathode ray oscilloscope (CRO).

The diagrams show three ultrasound waves.
Each wave is represented on an identical CRO screen, **A**, **B** and **C**.



Screen **A** Screen **B** Screen **C**

3 (c) (i) How many complete waves are shown on screen **B**? .....

(1 mark)

3 (c) (ii) Which screen shows the waves with the highest frequency?

Screen .....

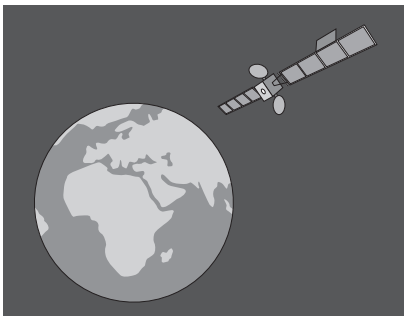
(1 mark)

5

Turn over for the next question

Do not write outside the box

4 The satellite shown in the picture is in a geostationary orbit around the Earth.



4 (a) What is the time period of a geostationary orbit?

Draw a ring around your answer.

12 hours **24 hours** **1 year**

(1 mark)

4 (b) This satellite is in orbit above the Earth's equator.

Put a tick (✓) in the box which explains why the satellite seems to remain above one place on the Earth's equator.

The satellite and the Earth both orbit the Sun at the same rate. ☐

The satellite is attracted by the Earth's gravitational force. ☐

The satellite orbits the Earth at the same rate at which the Earth revolves. ☐

(1 mark)

Do not write outside the box

4 (c) A geostationary satellite always seems to be at the same point above the surface of the Earth.

Explain the advantage of this.

.....

.....

.....

.....

(2 marks)

4 (d) Give **one** use of a satellite in a geostationary orbit.

.....

.....

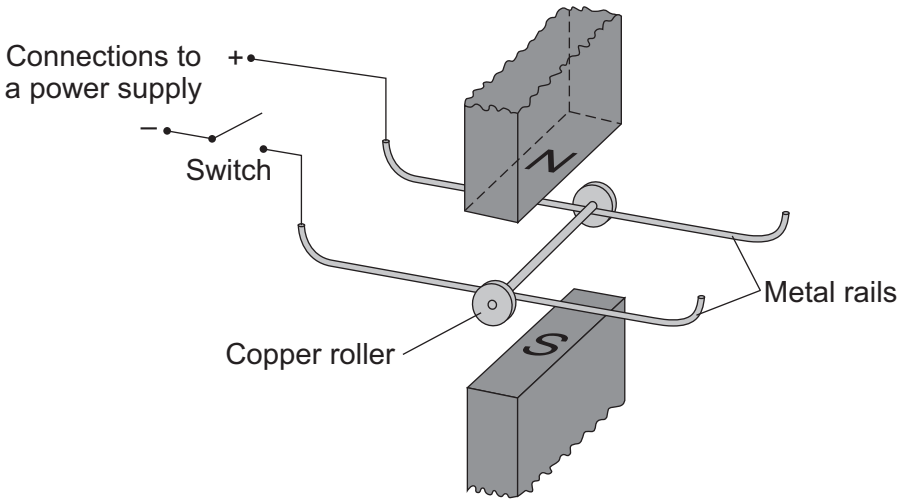
(1 mark)

5

Turn over for the next question

Do not write outside the box

5 (a) A science technician sets up the apparatus shown below to demonstrate the motor effect. He uses a powerful permanent magnet.



The copper roller is placed across the metal rails. When the switch is closed, the copper roller moves to the right.

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

This happens because copper is

- an electrical conductor.
- an electrical insulator.
- a magnetic material.

(1 mark)

5 (a) (ii) Suggest **one** change that the technician can make which will cause the copper roller to move faster.

.....

.....

(1 mark)

Do not write outside the box

5 (a) (iii) Suggest **two** changes which the technician can make, each of which will separately cause the copper roller to move to the left.

1 .....

.....

2 .....

.....

(2 marks)

5 (b) Many electrical appliances, such as vacuum cleaners, drills and CD players, contain electric motors. As more electrical appliances are developed, more electricity needs to be generated. Generating electricity often produces pollutant gases.

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

Generating more electricity to power the increasing number of electrical appliances used raises

an ethical
an environmental
a political

issue.

(1 mark)

5 (b) (ii) The number of electrical appliances used in the world's richest countries is increasing yet many people in the world's poorest countries have no access to electricity.

What type of issue does this inequality between people in different countries raise?

.....

(1 mark)

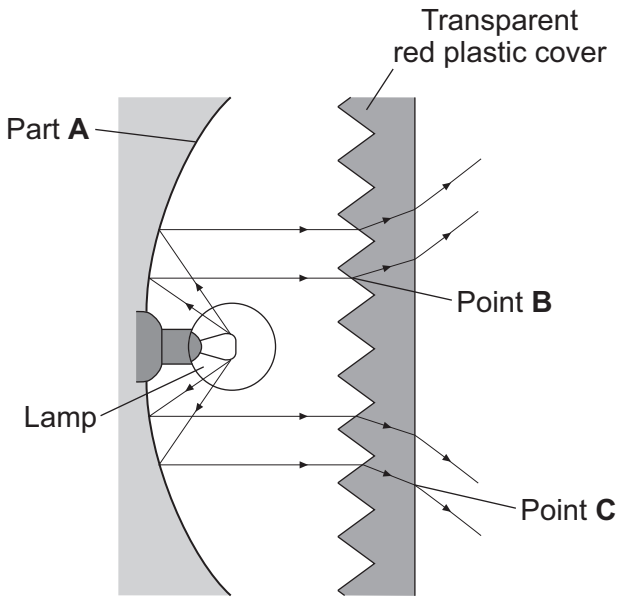
6

Turn over for the next question

Do not write outside the box

6 At night, it is important that the lights of a car can be seen by other drivers but it is dangerous if these lights dazzle them.

The diagram shows a rear light of a car.



6 (a) (i) Name part **A**.

.....

(1 mark)

6 (a) (ii) Name the process which occurs at point **B** and at point **C**.

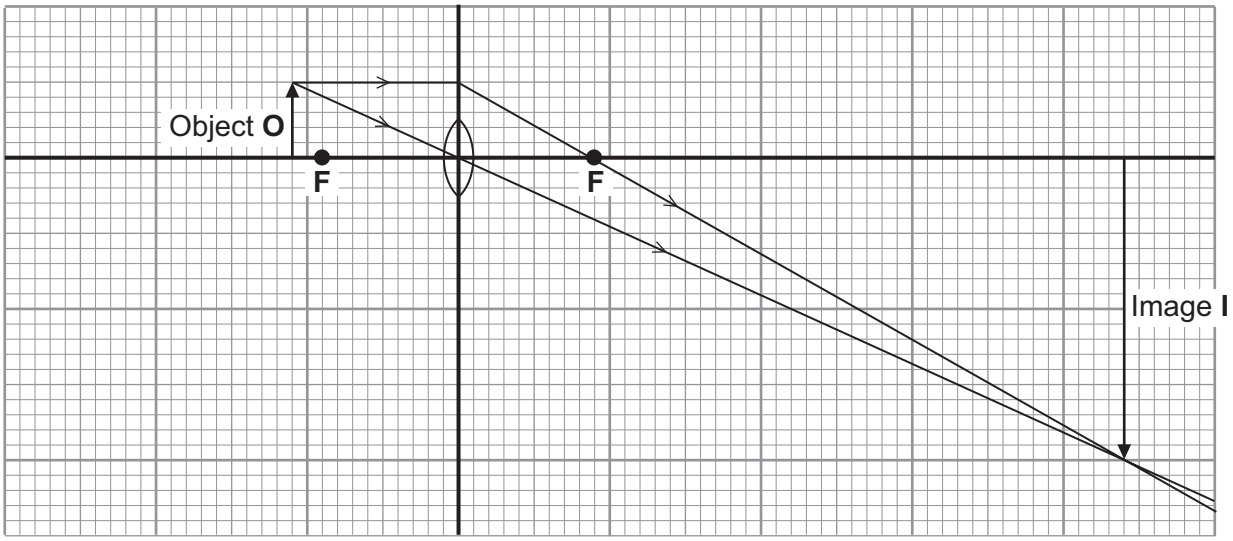
.....

(1 mark)

Do not write outside the box

6 (b) A headlamp of a car contains a lens.

The ray diagram shows the position and size of the image, **I**, of an object, **O**, formed by a lens similar to the one inside a car headlamp.



6 (b) (i) What type of lens is shown in the ray diagram?

Draw a ring around your answer.

converging **diverging** **plane**

(1 mark)

6 (b) (ii) The ray diagram is drawn to scale.

Use the equation in the box to calculate the magnification produced by the lens.

$$\text{magnification} = \frac{\text{image height}}{\text{object height}}$$

Show clearly how you work out your answer.

.....

.....

Magnification = ...

(2 marks)

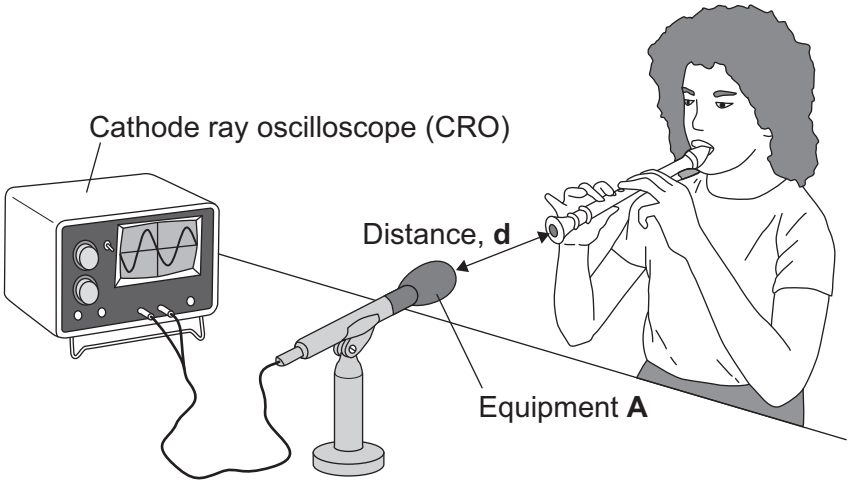
5

Turn over ▶

Do not write outside the box

7 A group of students investigates sound waves.

The diagram shows part of their investigation.



7 (a) Identify the equipment labelled **A**.

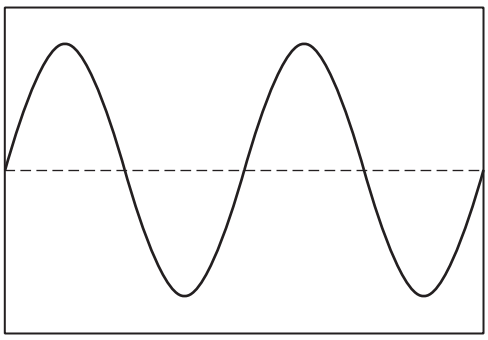
.....

(1 mark)

7 (b) The student plays the same note in the same way at different distances from equipment **A**.

Another student records the amplitude of the wave shown on the cathode ray oscilloscope (CRO).

7 (b) (i) Label this wave to show its amplitude.



(1 mark)

7 (b) (ii) Complete the sentence.

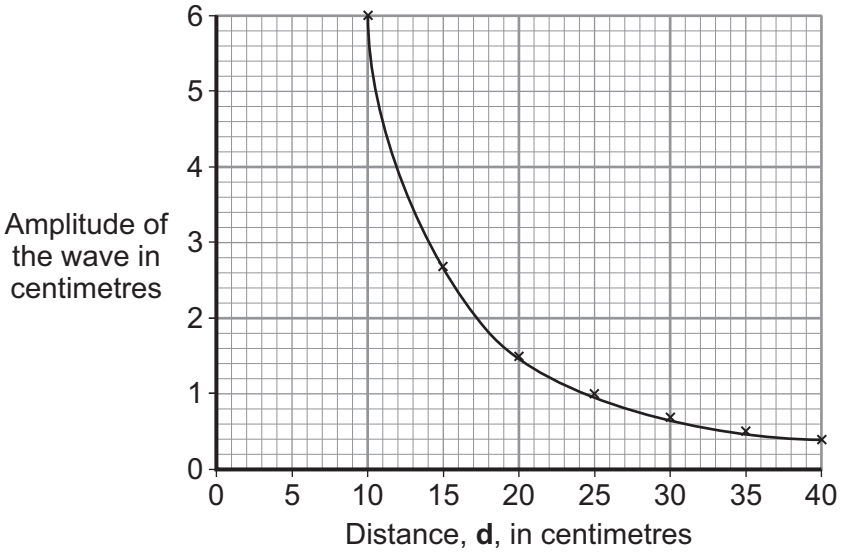
Increasing the amplitude of a sound wave will increase the .....

of the sound.

(1 mark)

Do not write outside the box

7 (c) The graph shows the students' average results from several sets of measurements.



Use the graph to find the distance, **d**, in centimetres, at which the average amplitude is likely to be 2 centimetres.

Distance = ... cm.

(1 mark)

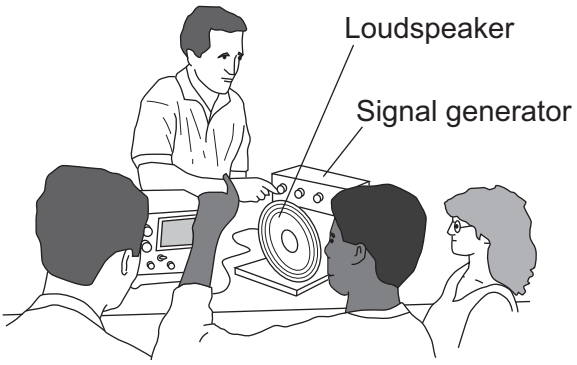
7 (d) Write a conclusion for this investigation.

.....

.....

(1 mark)

7 (e) A physics teacher uses a signal generator and a loudspeaker to demonstrate the range of hearing of a group of students.



What is the range of frequencies most humans can hear?

Most humans can hear from ..... Hz to ..... Hz.

(2 marks)

7

Do not write outside the box

8 (a) A student investigates the moment of a force.

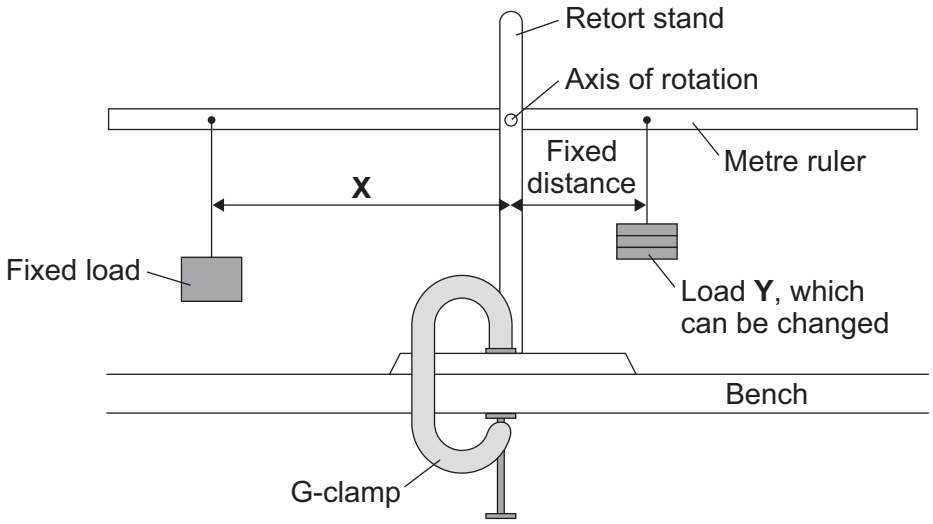
8 (a) (i) What does the word *moment* mean in this sentence?

.....

.....

(1 mark)

8 (a) (ii) The diagram shows how she sets up her apparatus.



Suggest the purpose of the G-clamp.

.....

.....

(1 mark)

Do not write outside the box

8 (a) (iii) A horizontal rod fits into a hole at the centre of the metre ruler. This is the axis of rotation. The student changes the load **Y** and adjusts the distance **X** until the metre ruler is horizontal. She takes six pairs of measurements which are shown in the table.

Load Y in newtons	Distance X in centimetres
1	7
2	14
3	21
4	28
5	35
6	42

Explain fully how distance **X** varies with load **Y**.

.....

.....

.....

.....

.....

(2 marks)

8 (a) (iv) The weight of the ruler can be ignored in this experiment.

Which statement gives the reason why?

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

The weight of the ruler is so small it is negligible. ☐

The centre of mass of the ruler is at the axis of rotation. ☐

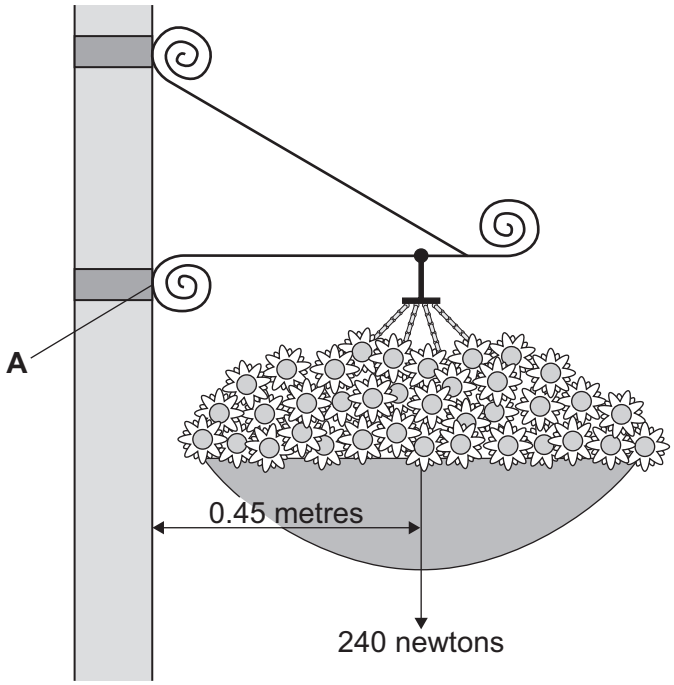
The ruler is a symmetrical object. ☐

(1 mark)

Question 8 continues on the next page

Do not write outside the box

8 (b) In the summer, a town council fits hanging baskets to some of its lamp posts.



Use the information in the diagram and the equation in the box to calculate the moment produced by the weight of the hanging basket about an axis through point **A**.

moment = force × perpendicular distance from the line of action of the force to the axis of rotation

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

.....

.....

.....

.....

Moment =.....

(3 marks)

8

END OF QUESTIONS

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Version1.0: 29/07/2011

General Certificate of Secondary Education

Physics 4451

PHY3F Unit Physics 3

Mark Scheme

2011 Examination – June Series

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

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

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

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Marking Guidance for Examiners

GCSE Science Papers

1. General

The mark scheme for each question shows:

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

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

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

where consequential marking needs to be considered in a calculation;

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

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

2. Emboldening

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

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

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

3. Marking points

3.1 Marking of lists

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

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

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

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

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

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

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

3.2 Use of chemical symbols / formulae

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

3.3 Marking procedure for calculations

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

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

3.4 Interpretation of 'it'

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

3.5 Errors carried forward

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

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

3.6 Phonetic spelling

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

3.7 Brackets

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

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PHY3F

Question 1

question	answers	extra information	mark
1	red supergiant		1
	supernova		1
	black hole		1
Total			**3**

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PHY3F

Question 2

question	answers	extra information	mark
2(a)	below		1
2(b)	boss nail string	 do **not** allow boss 	1 1 1
2(c)(i)	line from mid-point of either side to the mid-point of the opposite side	intention correct as judged by eye, use of ruler not essential do **not** allow either diagonal	1
2(c)(ii)	**X** in the centre of the rectangle		1
Total			**6**

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PHY3F

Question 3

question	answers	extra information	mark
3(a)	vibrate dirt / muck / grit / rust / dust etc.	allow move more (vigorously) but **not** just move do **not** accept bacteria	1 1
3(b)	any **one** medical use eg • scanning unborn babies • destroying (kidney) stones	ignore incorrect biological detail	1
3(c)(i)	2		1
3(c)(ii)	C		1
Total			**5**

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PHY3F

Question 4

question	answers	extra information	mark
4(a)	24 (hours)		1
4(b)	… orbits the Earth at the same rate at which the Earth revolves.		1
4(c)	any **two** from: • in contact for 24 hours • (always in) same direction • same distance (apart) • signal (always) takes same time • receiving dish does not have to move	accept always in contact do **not** accept examples in terms of monitoring	2
4(d)	communication	do **not** accept any response using observation accept a specific example satellite TV accept TV signals / mobile phones do **not** accept global positioning system (GPS)	1
Total			**5**

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Question 5

question	answers	extra information	mark
5(a)(i)	an electrical conductor		1
5(a)(ii)	increase current **or** use stronger magnets	accept increase p.d. / voltage accept move magnets closer do **not** accept use larger magnets	1
5(a)(iii)	reverse the poles / ends (of the magnet) reverse the connections (to the power supply)	either order	1 1
5(b)(i)	environmental		1
5(b)(ii)	ethical	allow political (instability) allow economic (migration)	1
Total			**6**

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PHY3F

Question 6

question	answers	extra information	mark
6(a)(i)	(concave) mirror / reflector	do **not** allow convex mirror / reflector	1
6(a)(ii)	refraction		1
6(b)(i)	converging		1
6(b)(ii)	4	allow **1** mark for correct substitution ie 20 / 5 or 4 / 1 ignore any units	2
Total			**5**

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PHY3F

Question 7

question	answers	extra information	mark
7(a)	microphone		1
7(b)(i)	vertical line from any maxima or minima to axis	do **not** penalise minor errors but do **not** allow unless intention is clear	1
7(b)(ii)	loudness / volume / intensity / energy	do **not** accept noise	1
7(c)	17	this answer only	1
7(d)	the greater the distance, the smaller the amplitude **or** there is a (strong) negative correlation between distance and amplitude **or** there is an inverse square relationship between distance and amplitude	accept volume / intensity / energy / loudness for amplitude do **not** accept distance and amplitude are inversely proportional	1
7(e)	20 Hz 20,000 Hz	either order accept 20 kHz provided unit has been clearly changed	1 1
Total			**7**

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PHY3F

Question 8

question	answers	extra information	mark
8(a)(i)	turning effect	accept turning force accept force x distance (accept symbols only if correctly defined) do **not** accept newtons x metres	1
8(a)(ii)	stop apparatus falling over	accept holds the stand in place accept make it safer / stable references to balanced / equilibrium are insufficient	1
8(a)(iii)	as x increases y increases in same proportion / ratios	 allow both marks for they are directly proportional **or** a specific example eg doubling y, doubles x allow both marks for a correct answer giving figures eg they increase in the ratio of 1 to 7 allow for **1** mark positive correlation	1 1
8(a)(iv)	the centre of mass of the ruler is at the axis of rotation		1
8(b)	108 newton metres / Nm	allow **1** mark for correct substitution ie 240 x 0.45 symbols must be correct for full credit the unit must be consistent with the numerical answer	2 1
Total			**8**

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	

General Certificate of Secondary Education
Foundation Tier
January 2011

Physics

PHY3F

Unit Physics P3

F

Written Paper

Wednesday 19 January 2011 9.00 am to 9.45 am

For this paper you must have:
- a ruler.

You may use a calculator.

Time allowed
- 45 minutes

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

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

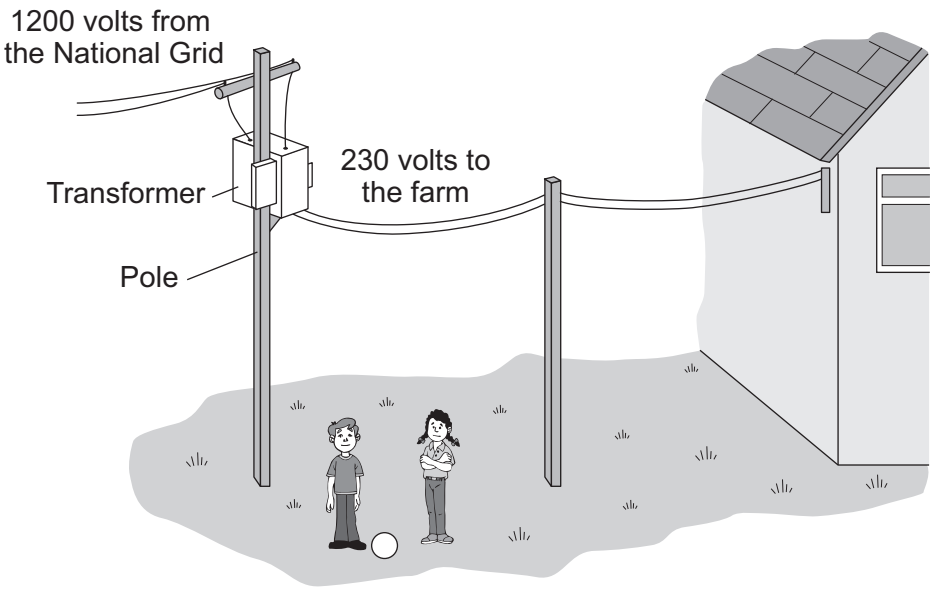
Advice
- In all calculations, show clearly how you work out your answer.

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Do not write outside the box

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

1 The diagram shows part of the system used to supply a farm with electricity.



1 (a) The core of the transformer is made of metal.

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

The metal used for the core of the transformer is

copper.
iron.
steel.

(1 mark)

1 (b) (i) What sort of transformer is shown in the diagram?

.....

(1 mark)

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

In this transformer, the number of turns on the secondary coil is

less than
the same as
greater than

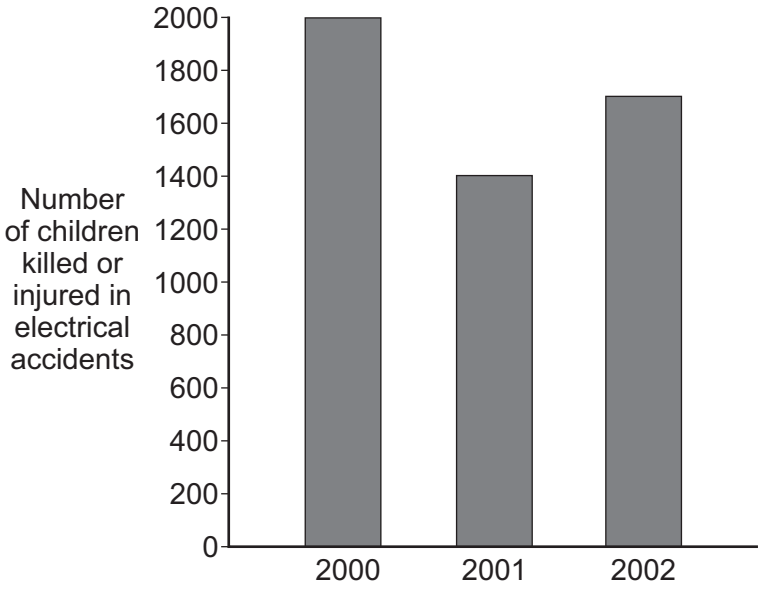
the number of turns on the primary coil.

(1 mark)

Do not write outside the box

1 (c) Transformers and other electrical equipment can be dangerous.

The following bar chart shows the numbers of children, aged 14 or under, killed or injured in electrical accidents in the UK in 2000, 2001 and 2002.



1 (c) (i) In which of these years were most children killed or injured in electrical accidents?

.....

(1 mark)

1 (c) (ii) A newspaper claims that the number of children killed or injured by electrical accidents will increase in 2011.

Which of the following gives a reason why the information given in the graph does not support this claim.

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

The pattern shows an upward trend. ☐

The pattern shows a downward trend. ☐

There is no pattern. ☐

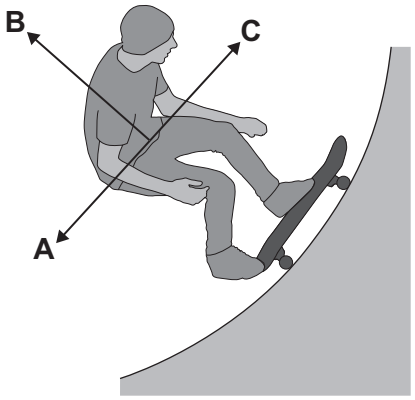
(1 mark)

5

Do not write outside the box

2 The drawing shows a skateboarder moving in a circular path.

• Centre of circular path



2 (a) (i) What is the name of the resultant force which allows the skateboarder to move in a circular path?

Draw a ring around your answer.

centripetal force **gravitational force** **weight**

(1 mark)

2 (a) (ii) In which direction, **A**, **B** or **C**, does this resultant force act on the skateboarder?

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

(1 mark)

2 (b) Another skateboarder has a smaller mass.

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

2 (b) (i) She uses the same part of the ramp at the same speed.

The force which allows her to move in a circular path will need

to

decrease.
stay the same.
increase.

(1 mark)

Do not write outside the box

2 (b) (ii) If she goes faster, this resultant force will need to

decrease.
stay the same.
increase.

(1 mark)

2 (c) On their website, the managers of a skateboard park give the following information about some of the ramps where skateboarders move in a circular path.

Name of ramp	Inside radius of the ramp in metres
Bull pit	6
Dragon's den	11
Tiger cage	8
Witch's cauldron	7

A skateboarder uses each ramp at the same speed.

Name the ramp where the resultant force on the skateboarder will need to be the greatest.

.....

Explain the reason for your answer.

.....

.....

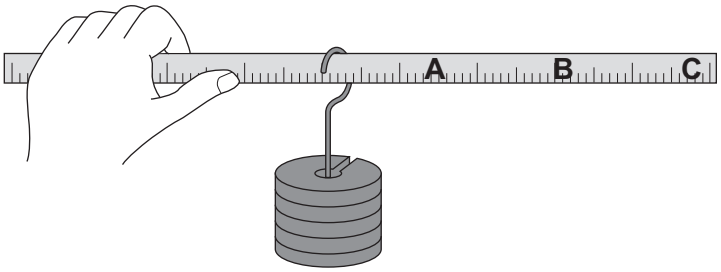
(2 marks)

6

Turn over for the next question

Do not write outside the box

3 (a) A student holds a ruler at one end and slides a weight along the ruler.



At which point, **A**, **B** or **C**, will the turning effect of the weight feel greatest?

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

(1 mark)

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

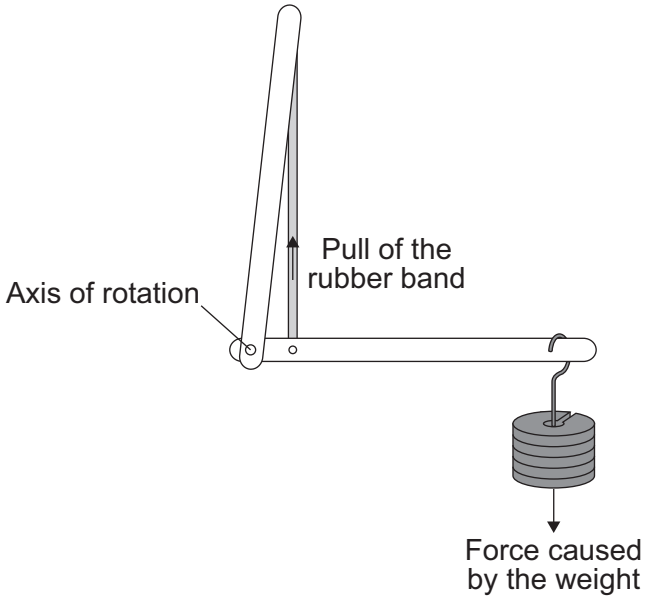
The turning effect of a force is called the

axis
equilibrium
moment

of the force.

(1 mark)

3 (c) In a human arm, the biceps muscle provides the force needed to hold the arm horizontal. A student uses a model in which a rubber band represents the biceps muscle.



Do not write outside the box

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

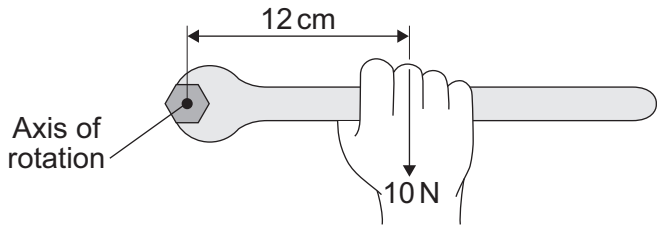
To hold the model arm horizontal, the pull from the rubber band will be

bigger than
smaller than
the same as

the force caused by the weight.

(1 mark)

3 (d) The diagram shows a long spanner.



Use the equation in the box to calculate the moment, in N cm, being produced.

moment	=	force	×	perpendicular distance from the line of action of the force to the axis of rotation

Show clearly how you work out your answer.

.....

.....

Moment = ... N cm

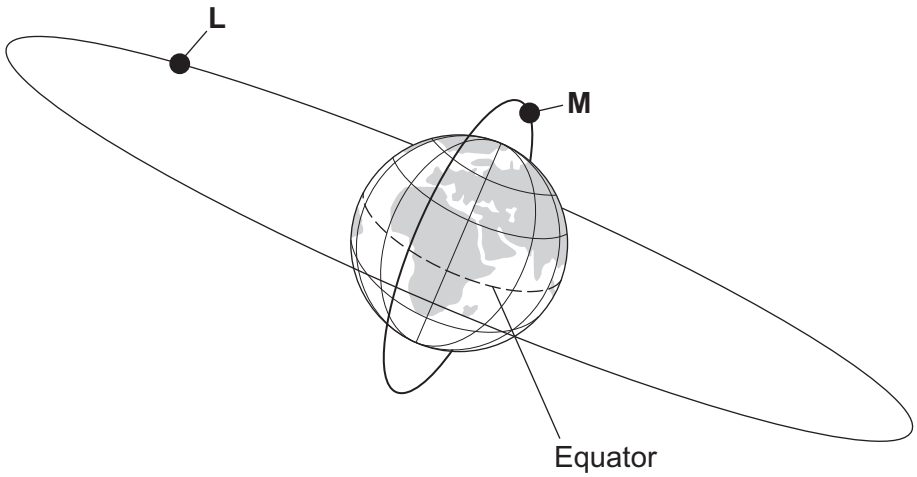
(2 marks)

5

Turn over for the next question

Do not write outside the box

4 The diagram, which is not to scale, shows two satellites, **L** and **M**, orbiting the Earth.



4 (a) Complete the following table.

Each letter, **L** or **M**, may be used once, more than once or not at all.

Statement about the satellite	**Letter for the satellite**
It is used as a monitoring satellite.	
It is a geostationary satellite.	
It takes 24 hours to complete its orbit.	

(2 marks)

4 (b) Complete the following sentence.

To stay in its present orbit around the Earth, each satellite must move at a particular ..... .

(1 mark)

Do not write outside the box

4 (c) Thousands of satellites are now in orbit around the Earth. A student used the Internet to collect information about some of them.

Name of satellite	Average distance from the centre of the Earth in kilometres	Speed in kilometres per second	Time taken to orbit the Earth
The Moon	391 400	1.01	28 days
GEO	42 200	3.07	1 day
Navstar	26 600	3.87	12 hours
Lageos	12 300	5.70	3.8 hours
HST	7 000	7.56	97 mins
ISS	6 700	7.68	92 mins

4 (c) (i) The Moon takes a longer time than any of the other satellites to orbit the Earth.

Give **one** other way in which the Moon is different from the other satellites in the table.

.....

.....

(1 mark)

4 (c) (ii) What conclusion on the relationship between the *average distance* and *speed* can the student come to on the basis of this data?

.....

.....

(1 mark)

4 (c) (iii) What conclusion on the relationship between the *speed* and the *time taken to orbit the Earth* can the student come to on the basis of this data?

.....

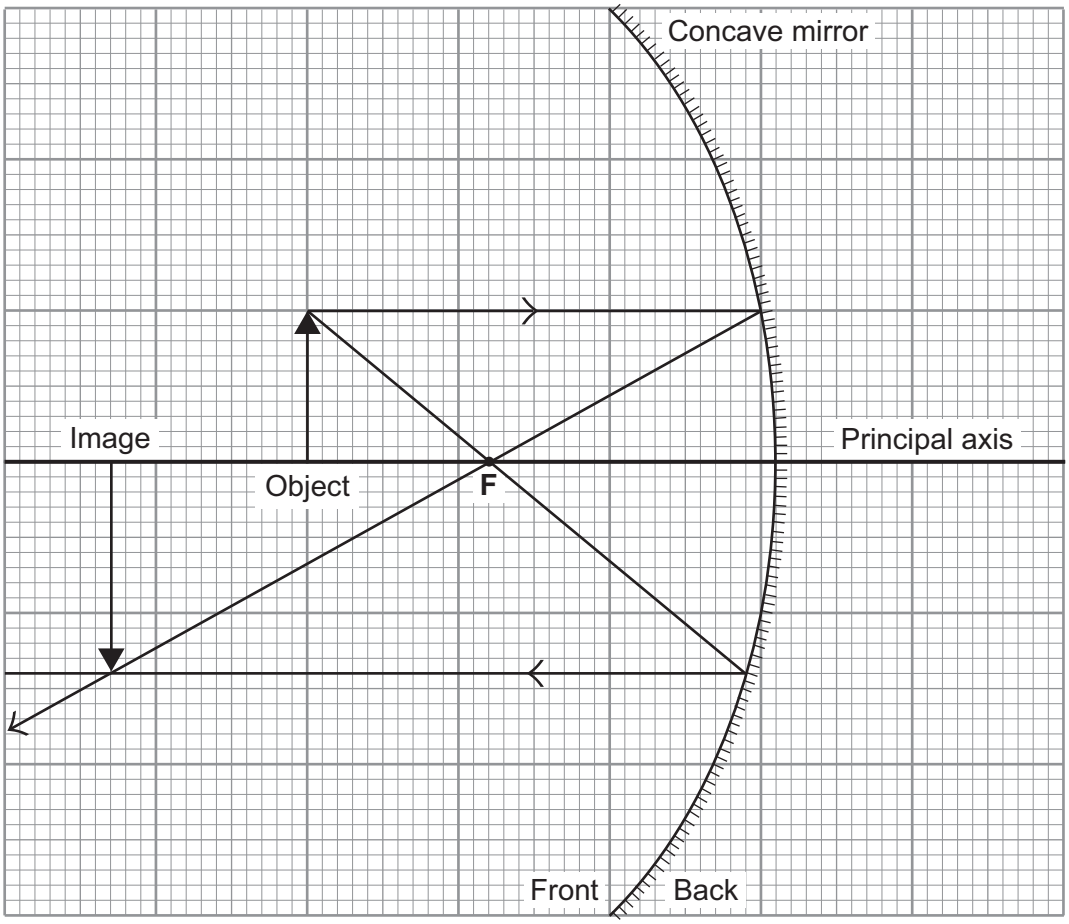
.....

(1 mark)

6

Do not write outside the box

5 The ray diagram shows the image formed by a concave mirror.



Use the equation in the box to calculate the magnification.

$$\text{magnification} = \frac{\text{image height}}{\text{object height}}$$

Show clearly how you work out your answer.

.....

.....

Magnification = ...

(2 marks)

2

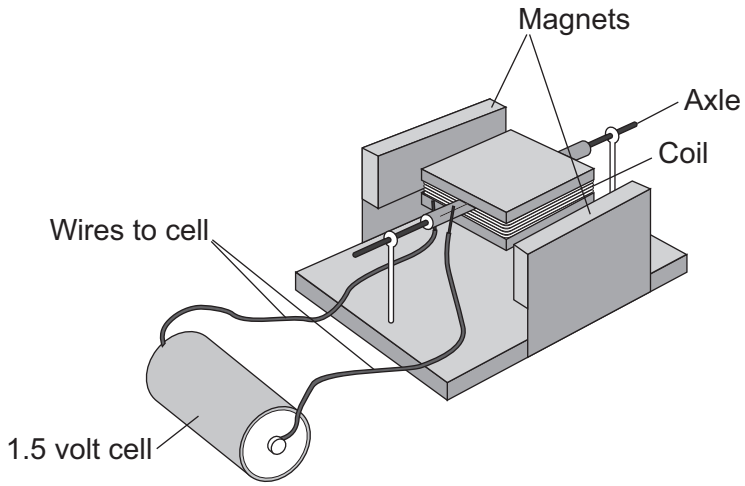
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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

Do not write outside the box

6 (a) Complete the description of the device shown below by drawing a ring around the correct line in each box.



6 (a) (i) The device is being used as

an electric motor.
a generator.
a transformer.

(1 mark)

6 (a) (ii) The coil needs a flick to get started. Then one side of the coil is pushed by the

cell
coil
force

and the other side is pulled, so that the coil spins.

(1 mark)

Do not write outside the box

6 (b) Suggest **two** changes to the device, each one of which would make the coil spin faster.

1 .....

.....

2 .....

.....

(2 marks)

6 (c) Suggest **two** changes to the device, each one of which would make the coil spin in the opposite direction.

1 .....

.....

2 .....

.....

(2 marks)

6

Turn over for the next question

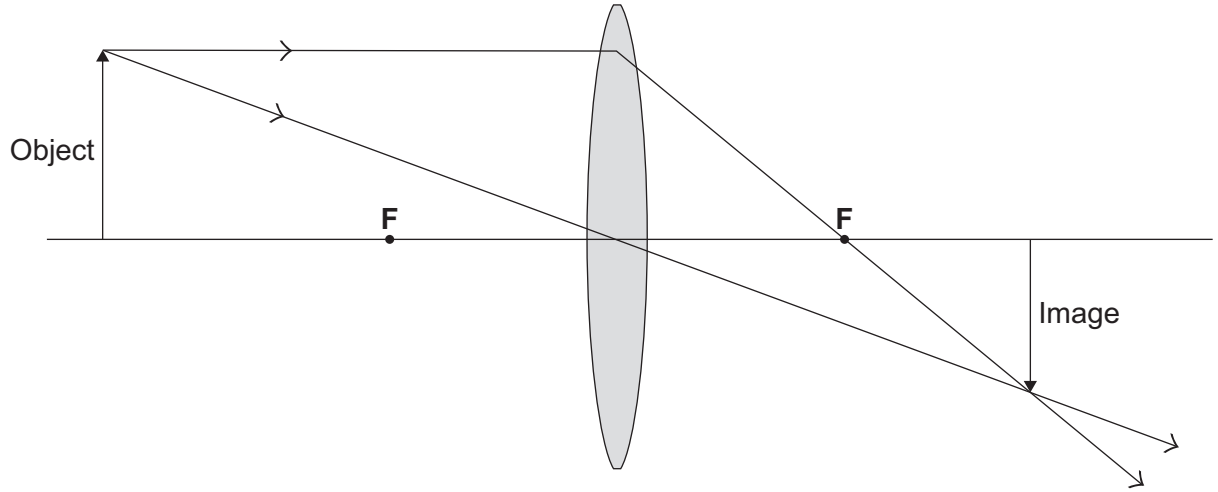
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ANSWER IN THE SPACES PROVIDED

Do not write outside the box

7 The diagram shows a lens, the position of an object and the position of the image of the object.



7 (a) What type of lens is shown?

.....

(1 mark)

7 (b) What is the name of the points, **F**, shown each side of the lens?

.....

(1 mark)

7 (c) (i) The image is real and can be put on a screen.

How can you tell **from the diagram** that the image is real?

.....

.....

(1 mark)

7 (c) (ii) Draw a ring around a word in the box which describes the image produced by the lens.

inverted	**larger**	**upright**

(1 mark)

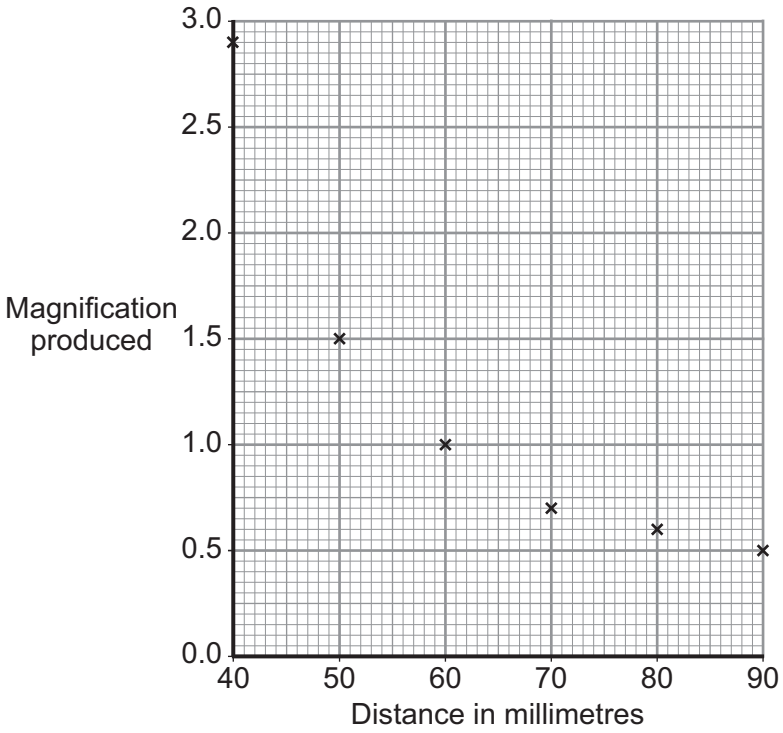
Turn over ▶

Do not write outside the box

7 (d) A student investigates the relationship between the distance from the object to the lens and the magnification produced by the lens.
The student's results are given in the table.
The student did not repeat any measurements.

Distance in millimetres	Height of object in millimetres	Height of image in millimetres	Magnification produced
40	20	58	2.9
50	20	30	1.5
60	20	20	1.0
70	20	14	0.7
80	20	12	0.6
90	20	10	0.5

The student plots the points for a graph of *magnification produced* against *distance*.



7 (d) (i) Draw a *line of best fit* for these points.

(1 mark)

Do not write outside the box

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

A line graph has been drawn because both variables are

described as being

categoric.
continuous.
discrete.

(1 mark)

7 (d) (iii) Describe the relationship between *magnification produced* and *distance*.

.....

.....

.....

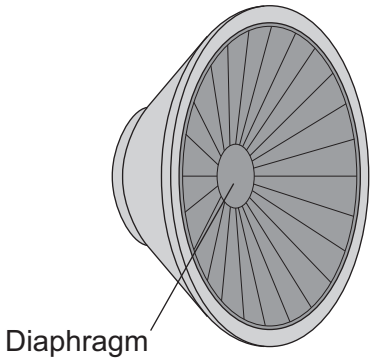
(2 marks)

8

Turn over for the next question

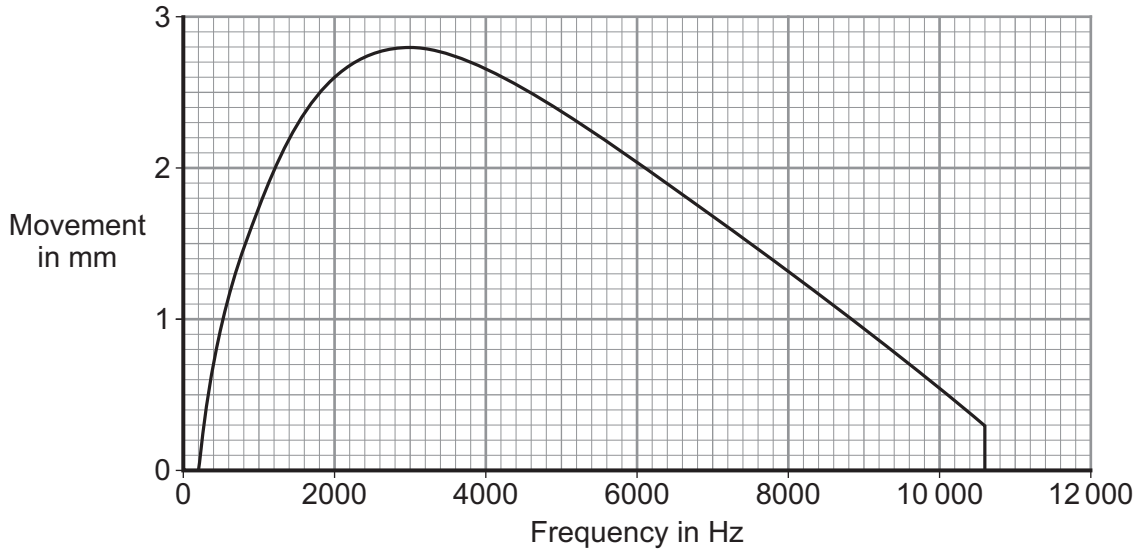
Do not write outside the box

8 The diaphragm of a loudspeaker moves in and out.



A team of scientists investigated loudspeakers.

The scientists measured the size of the movement of the diaphragm for signals of different frequencies.
They kept all the other variables constant.
The graph shows the average results for a large number of tests on one of the loudspeakers.



8 (a) What is the frequency of the highest pitched sound which this loudspeaker produces?

Frequency = ... Hz
(1 mark)

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8 (b) The greater the movement of the diaphragm, the greater the amplitude of the sound produced.

What is the frequency of the loudest sound which this loudspeaker produces?

Show clearly on the graph how you get to your answer and then complete this answer space.

Frequency = ... Hz

(2 marks)

8 (c) Can this loudspeaker produce the full range of sound which most people can hear?

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

Yes ☐ No ☐

Explain the reason for your answer.

.....

.....

.....

.....

(2 marks)

8 (d) Use **one** word to complete the sentence.

Repeating tests a large number of times and taking the average of the results

improves the ..... .

(1 mark)

8 (e) Why did the scientists keep all the other variables constant?

.....

.....

(1 mark)

7

END OF QUESTIONS

There are no questions printed on this page

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Version1.0: 24/02/2011

General Certificate of Secondary Education

Physics 4451

PHY3F Unit Physics 3

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

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Marking Guidance for Examiners

GCSE Science Papers

1. General

The mark scheme for each question shows:

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

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

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

where consequential marking needs to be considered in a calculation;

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

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

2. Emboldening

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

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

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

3. Marking points

3.1 Marking of lists

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

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

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

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

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

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

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

3.2 Use of chemical symbols / formulae

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

3.3 Marking procedure for calculations

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

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

3.4 Interpretation of 'it'

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

3.5 Errors carried forward

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

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

3.6 Phonetic spelling

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

3.7 Brackets

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

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PHY3F

Question 1

question	answers	extra information	mark
1(a)	iron	accept any unambiguous correct indication	1
1(b)(i)	step-down (transformer)	do **not** accept down step or a description	1
1(b)(ii)	less than	accept any unambiguous correct indication	1
1(c)(i)	2000		1
1(c)(ii)	There is no pattern.		1
Total			**5**

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PHY3F

Question 2

question	answers	extra information	mark
2(a)(i)	centripetal force	accept any unambiguous correct indication	1
2(a)(ii)	**B**		1
2(b)(i)	decrease	accept any unambiguous correct indication	1
2(b)(ii)	increase	accept any unambiguous correct indication	1
2(c)	Bull pit smallest (inside) radius	 accept smallest diameter / circumference	1 1
Total			**6**

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PHY3F

Question 3

question	answers	extra information	mark
3(a)	**C**		1
3(b)	moment	accept any unambiguous correct indication	1
3(c)	bigger than	accept any unambiguous correct indication	1
3(d)	120 (Ncm)	allow **1** mark for correct substitution ie 12 × 10	2
Total			**5**

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PHY3F

Question 4

question	answers	extra information	mark
4(a)	all correct **M** **L** **L**	allow **1** mark for 2 correct	2
4(b)	speed	accept 'velocity'	1
4(c)(i)	any **one** from: • it's natural • slowest • furthest (from the centre of the Earth)	accept 'others are artificial / made by humans'	1
4(c)(ii)	as the (average) distance decreases the speed increases	accept 'there is a negative correlation (between them)' do **not** accept 'they are inversely proportional'	1
4(c)(iii)	as the speed increases the time (taken) decreases	accept 'there is a negative correlation (between them)' do **not** accept 'they are inversely proportional'	1
Total			**6**

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Question 5

question	answers	extra information	mark
5	1.4	allow **1** mark for correct substitution ie 14 ÷ 10 **or** 28 ÷ 20	2
Total			**2**

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PHY3F

Question 6

question	answers	extra information	mark
6(a)(i)	an electric motor		1
6(a)(ii)	force		1
6(b)	any **two** from: • more powerful magnet • reduce the gap (between magnet and coil) • increase the area of the coil • more powerful cell • more turns (on the coil)	 do **not** allow 'bigger magnet' do **not** allow 'bigger cell' accept battery for cell accept add a cell accept increase current / potential difference allow 'more coils on the coil' do **not** allow 'bigger coil'	2
6(c)	reverse the (polarity) of the cell reverse the (polarity) of the magnet	allow 'turn the cell the other way round' accept battery for cell allow 'turn the magnet the other way up'	1 1
Total			**6**

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PHY3F

Question 7

question	answers	extra information	mark
7(a)	converging (lens)	accept 'convex (lens)' accept biconvex	1
7(b)	(principal) foci	accept 'focus' / 'focuses' / 'focis' focal point(s)	1
7(c)(i)	formed where (real) rays (of light) intersect / meet / cross	accept rays (of light) pass through the image accept 'image is on the opposite side (of the lens to the object)' accept (construction) lines cross over a response relating to a screen or similar is neutral lines are solid and not dotted is neutral	1
7(c)(ii)	inverted	accept any unambiguous correct indication	1
7(d)(i)	smooth curve which matches the points	judge by eye but do **not** accept point to point by ruler or otherwise	1
7(d)(ii)	continuous		1

Question 7 continues on the next page . . .

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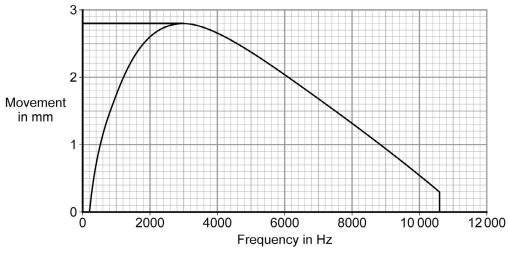
Question 7 continued . . .

question	answers	extra information	mark
7(d)(iii)	as distance increases, magnification decreases	accept negative correlation a statement 'inversely proportional' is incorrect and limits maximum mark for this part question to **1**	1
	further detail eg magnification falls steeply between 40 and 50 cm **or** magnification begins to level out after / at 70 cm		1
Total			**8**

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PHY3F

Question 8

question	answers	extra information	mark
8(a)	10 600 (Hz)	accept 10.6 kHz	1
8(b)	3000 (Hz)	allow **1** mark for a line drawn to show greatest movement (allow only if frequency is between 2800 and 3200) accept other indication of correctly using the graph  	2
8(c)	(No)	no marks for just the ticked box reasons can score even if yes is ticked	
	(human hearing) range is 20 – 20 000 (Hz)	accept (most) people hear up to 20 000 (Hz) / 20 kHz	1
	any **one** from: • range on graph is within this range • range on graph starts after 20 Hz • range on graph is from to 200 – 10 600 (Hz) • range on graph finishes before 20 000 Hz		1

Question 8 continues on the next page . . .

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Question 8 continued . . .

question	answers	extra information	mark
8(d)	reliability	this answer only	1
8(e)	only 1 variable affects dependent variable / size of movement **or** there is only one independent variable **or** to be able to compare (effect of different frequencies)	accept 'results' for 'size of movement' fair test is insufficient do **not** accept to control the experiment	1
Total			**7**

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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

General Certificate of Secondary Education
Foundation Tier
June 2010

Physics

PHY3F

F

Unit Physics P3

Written Paper

Friday 28 May 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. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

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

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

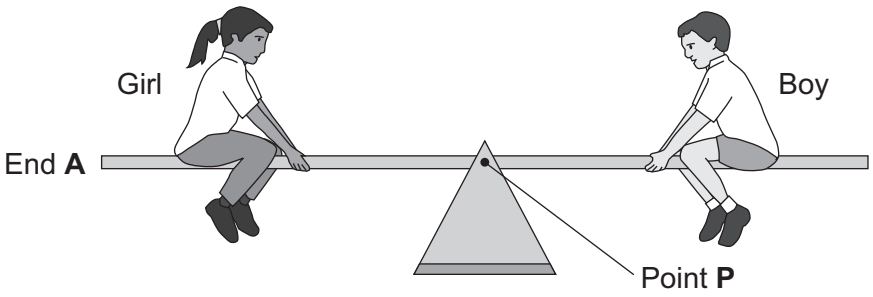
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Do not write outside the box

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

1 Two children visit a playground.

1 (a) The diagram shows them on a see-saw. The see-saw is balanced.



Complete the following sentences by drawing a ring around the correct word or line in the box.

1 (a) (i) The turning effect of the girl's weight is called her

force.
load.
moment.

(1 mark)

1 (a) (ii) Point **P** is the axis of

balance
rotation
turning

of the see-saw.

(1 mark)

1 (a) (iii) To make end **A** of the see-saw go up,

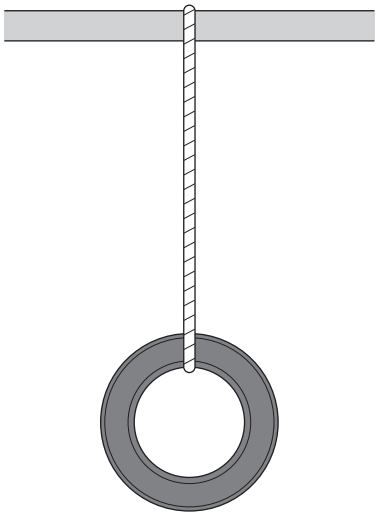
the boy moves nearer to point **P**.
the girl moves nearer to point **P**.
the girl moves nearer to end **A**.

(1 mark)

Do not write outside the box

1 (b) In another part of the playground, a tyre has been suspended from a bar.

1 (b) (i) Draw an **X** on the diagram so that the centre of the **X** marks the centre of mass of the tyre.



(1 mark)

1 (b) (ii) Complete the sentence by using the correct word or phrase from the box.

above	**below**	**to the left of**	**to the right of**

If the suspended tyre is pushed, it will come to rest with its centre of mass directly ..... the point of suspension.

(1 mark)

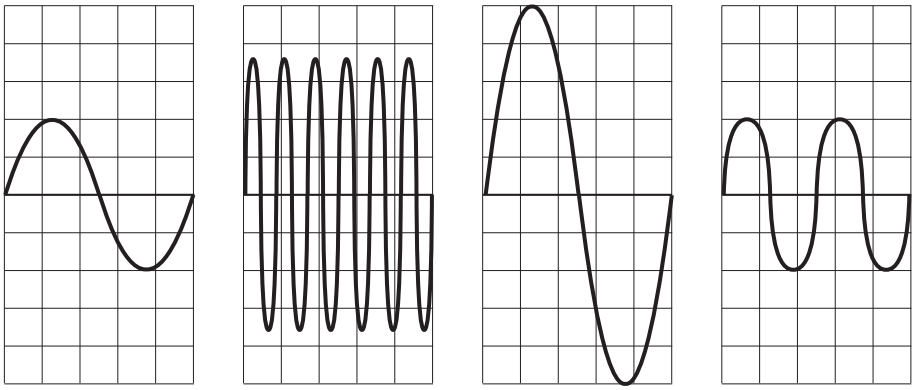
5

Turn over for the next question

Do not write outside the box

2 (a) (i) A sound wave can be represented as a wave on the screen of an oscilloscope.

The diagrams **A**, **B**, **C** and **D** show different screens for the same settings of an oscilloscope.



A **B** **C** **D**

Which diagram represents the sound with the highest frequency?

Diagram ☐

(1 mark)

2 (a) (ii) Complete the sentences using the correct name from the box.

a loudspeaker	**a microphone**	**an ultrasound transmitter**

Information is transferred from a sound wave to an oscilloscope by

..... .

(1 mark)

Do not write outside the box

2 (b) Complete the sentences by drawing a ring around the correct word in the box.

2 (b) (i) The pitch of a note increases as the

amplitude
frequency
wavelength

increases.

(1 mark)

2 (b) (ii) The loudness of a note decreases as the

amplitude
frequency
wavelength

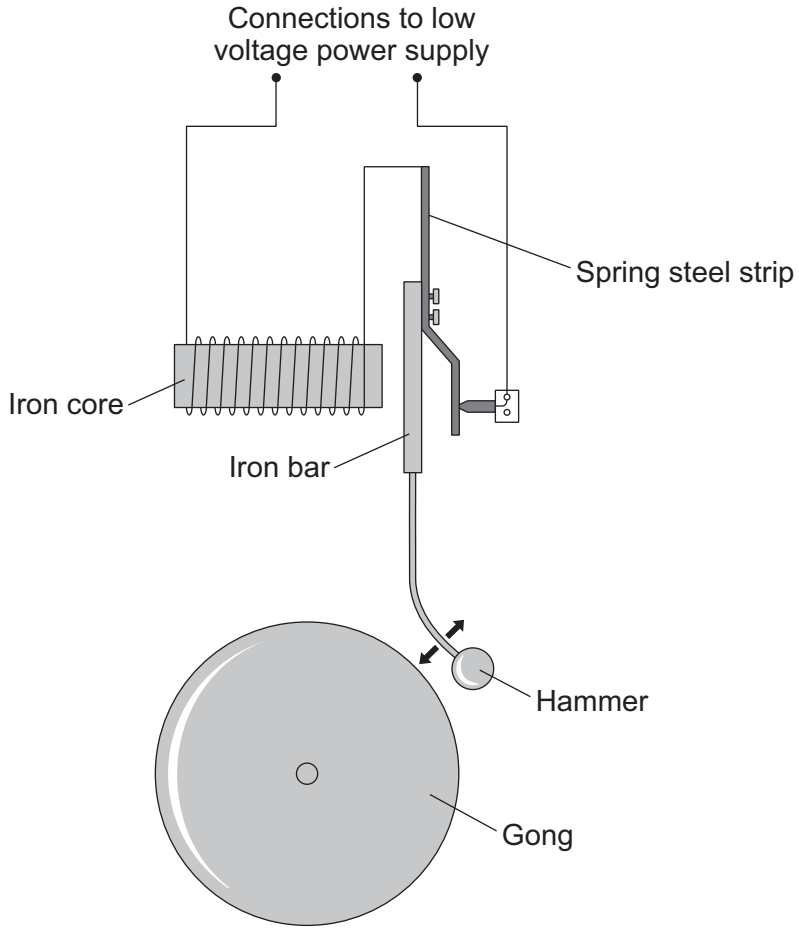
decreases.

(1 mark)

Question 2 continues on the next page

Do not write outside the box

2 (c) The diagram shows part of the inside of an electric bell.



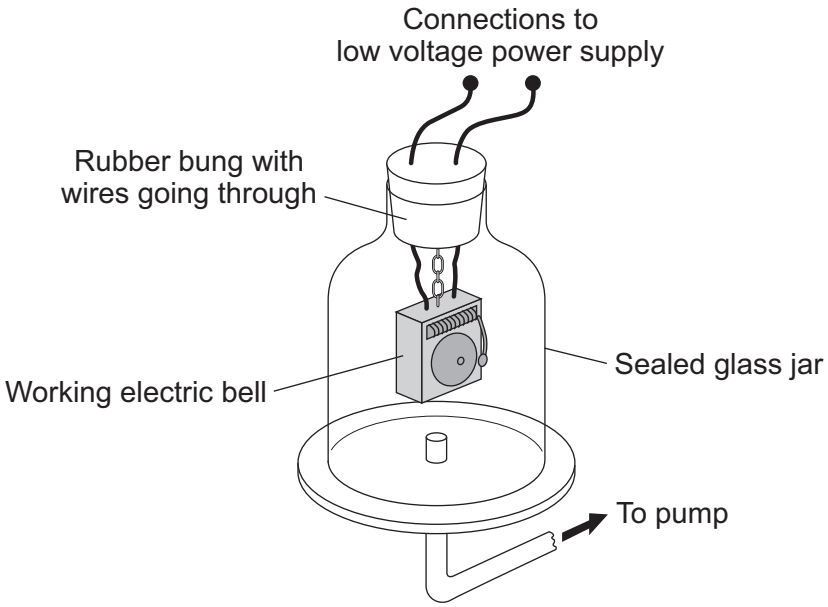
Name the part of the bell which contains the iron core and attracts the iron bar.

.....

(1 mark)

Do not write outside the box

2 (d) A group of students use a pump to remove all the air from around a working electric bell in a sealed glass jar.



2 (d) (i) What will happen to the sound which they hear from the bell after all the air is removed from the sealed glass jar?

.....

.....

(1 mark)

2 (d) (ii) Explain your answer to part (d)(i).

.....

.....

(1 mark)

7

Turn over ▶

Do not write outside the box

3 The hammer throw is an athletic event.

The athlete throws a heavy metal ball attached by a wire to a handle.



3 (a) The hammer thrower swings the hammer round in a circle before letting go.

He swings the hammer slowly at first and then faster.

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

As the speed of the swing increases, the centripetal force on the

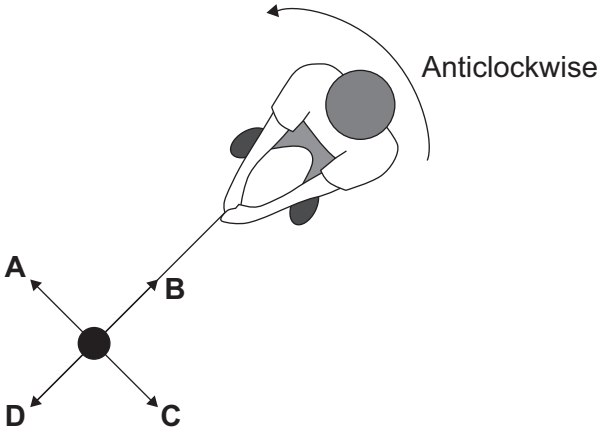
hammer

decreases.
does not change.
increases.

(1 mark)

Do not write outside the box

3 (b) The diagram shows an overhead view of a hammer thrower swinging the hammer anticlockwise in a circle.



3 (b) (i) In which direction, **A**, **B**, **C** or **D**, does the centripetal force act on the hammer?

(1 mark)

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

The centripetal force is provided by the

air resistance.
gravitational force.
tension in the wire.

(1 mark)

3 (b) (iii) At the instant shown in the diagram above, the athlete lets go of the handle.

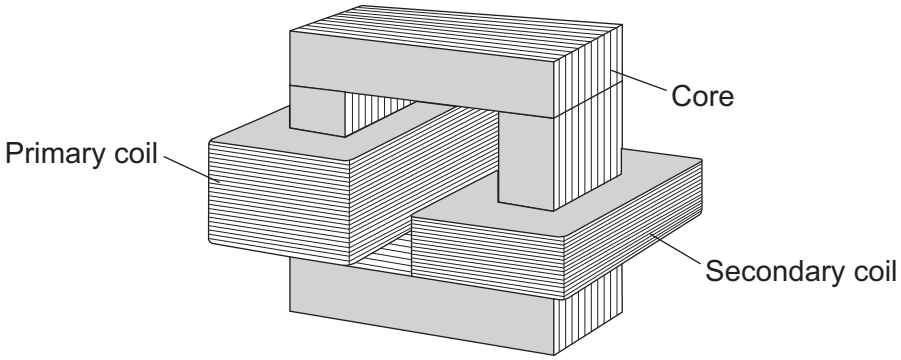
In which direction, **A**, **B**, **C** or **D**, does the hammer move?

(1 mark)

4

Do not write outside the box

4 A teacher demonstrates a small transformer.



4 (a) (i) What is the core made of?

Draw a ring around the correct word in the box.

aluminium	**copper**	**iron**

(1 mark)

4 (a) (ii) The potential difference (p.d.) across the secondary coil is less than the p.d. across the primary coil.

What sort of transformer is it?

.....

(1 mark)

4 (b) Where is a step-up transformer used as part of the National Grid?

.....

(1 mark)

Do not write outside the box

4 (c) The teacher writes a note about the transformer but leaves **five** spaces.

Use the correct words from the box to complete the spaces.

coil	**core**	**current**	**ends**	**field**	**wire**

A transformer works because an alternating ..... in the primary ..... produces a changing magnetic ..... in the ..... and then in the secondary coil.

This induces an alternating potential difference across the ..... of the secondary coil.

(5 marks)

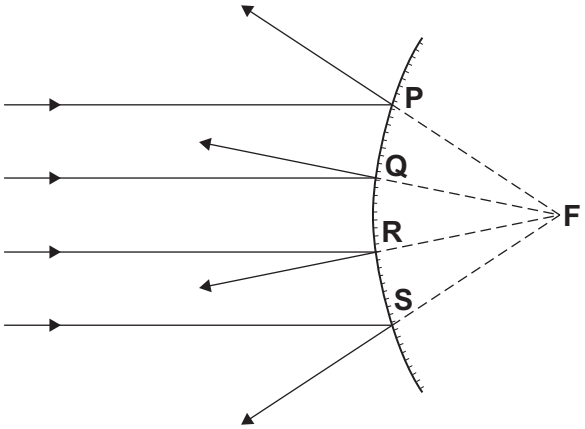
8

Turn over for the next question

Do not write outside the box

5 (a) A student uses a ray box and a curved mirror.

The diagram shows the mirror and parallel rays of light from the ray box.



5 (a) (i) What type of mirror is shown in the diagram?

.....

(1 mark)

5 (a) (ii) What is point **F** called?

.....

(1 mark)

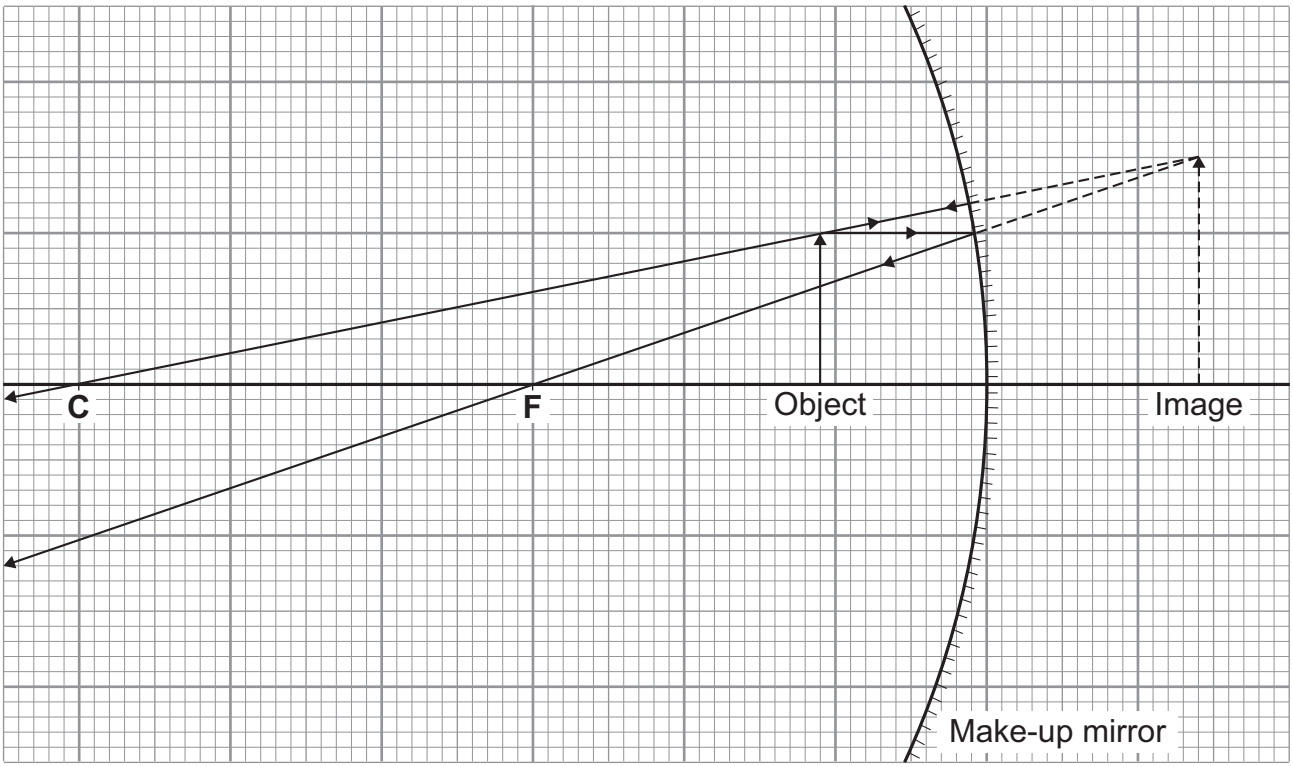
5 (a) (iii) What is the process that takes place at points **P**, **Q**, **R** and **S**?

.....

(1 mark)

Do not write outside the box

5 (b) The diagram shows an object and its image in a curved make-up mirror.



5 (b) (i) What type of mirror is shown in the diagram?

.....

(1 mark)

5 (b) (ii) Use the equation in the box to calculate the magnification produced by the mirror.

$$\text{magnification} = \frac{\text{image height}}{\text{object height}}$$

Show clearly how you work out your answer.

.....

.....

Magnification = ...

(2 marks)

6

Turn over ▶

Do not write outside the box

6 (a) A student finds data on the Internet for her project on the Solar System.
She checks this data on other websites.

The table shows the checked data.

Name of planet	Diameter in km	Distance from Sun in millions of km	Period in days
Mercury	4840	58	87
Venus	12390	108	224
Earth	12760	149	365
Mars	6800	228	686
Jupiter	142800	778	4332
Saturn	119400	1428	10759
Uranus	47600	2870	30685
Neptune	48400	4497	60190

6 (a) (i) In the table, the period of each planet is given in days.

What is meant by the *period* of a planet?

.....

(1 mark)

6 (a) (ii) Suggest why the student checks the data on other websites.

.....

.....

(1 mark)

6 (a) (iii) What is the relationship, if any, between a planet's distance from the Sun and its period?

.....

.....

(1 mark)

Do not write outside the box

6 (a) (iv) What is the relationship, if any, between a planet's diameter and its period?

.....

.....

(1 mark)

6 (b) What is the force which provides the centripetal force to keep planets in their orbits?

.....

(1 mark)

6 (c) What is the name of the galaxy which contains the Solar System?

.....

(1 mark)

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

hundreds
thousands
millions
billions

The universe is made up of ... of galaxies. *(1 mark)*

7

Turn over for the next question

Do not write outside the box

7 (a) Read this passage from a health leaflet.

> Most children can hear the full range of sounds which can be detected by the human ear. But as people get older, they cannot hear the higher frequencies.

7 (a) (i) Complete this statement.

Most children can detect sounds in the frequency range

..... Hz to ..... Hz.

(1 mark)

7 (a) (ii) What word is used to describe sound with a frequency so high that it cannot be heard by humans?

.....

(1 mark)

7 (b) Read this cutting from a newspaper.

> A shopkeeper has fitted a special loudspeaker outside his store.
> "We used to have gangs of young people out there," he said, "but now, when I switch on the special loudspeaker, they hate the sound and go away."
> Older people are not bothered by the sound because the frequency is too high for them to hear it.

Some people support the use of the special loudspeaker but other people do not.

Give **one** reason against its use.

.....

.....

(1 mark)

7 (c) Machines are often very noisy. They transfer energy, and some of the energy is transformed into sound.

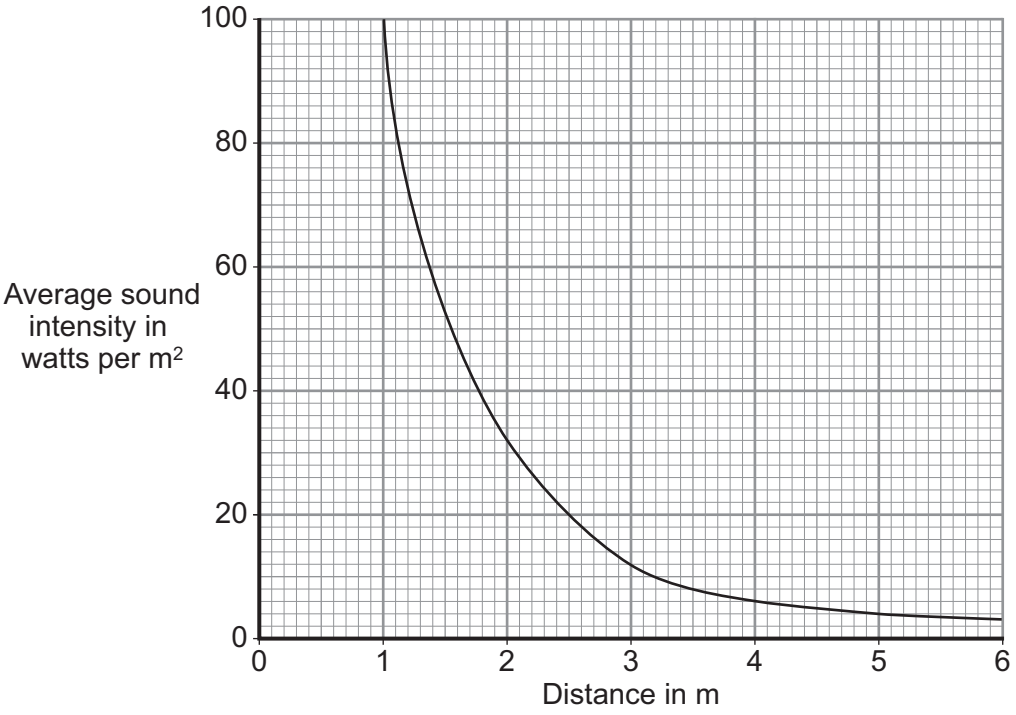
What is the cause of the sound?

.....

(1 mark)

Do not write outside the box

7 (d) Sound from a machine may damage the hearing of people who work close by. A safety officer measures the sound intensity at different distances from a noisy machine. The average results are shown on the graph.



7 (d) (i) Describe the pattern shown by the graph.

Use one or more examples from the graph to support your description.

.....

.....

.....

.....

(2 marks)

7 (d) (ii) Average results were plotted.

Explain why taking results several times and then calculating average values is more reliable than taking only a single result.

.....

.....

.....

.....

(2 marks)

8

END OF QUESTIONS

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Version : 29/07/2010

General Certificate of Secondary Education

Physics 4451

PHY3F Unit Physics 3

Mark Scheme

2010 Examination – June Series

STEMUP.CO.UK

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

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

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

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Marking Guidance for Examiners

GCSE Science Papers

1. General

The mark scheme for each question shows:

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

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

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

where consequential marking needs to be considered in a calculation;

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

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

2. Emboldening

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

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

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

3. Marking points

3.1 Marking of lists

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

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

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

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

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

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

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

3.2 Use of chemical symbols / formulae

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

3.3 Marking procedure for calculations

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

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

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

3.4 Interpretation of 'it'

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

3.5 Errors carried forward

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

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

3.6 Phonetic spelling

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

3.7 Brackets

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

3.8 Unexpected Correct Answers not in the Mark Scheme

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

PHY3F

Question 1

question	answers	extra information	mark
1(a)(i)	moment		1
1(a)(ii)	rotation		1
1(a)(iii)	the girl moves nearer to point **P**		1
1(b)(i)	**X** drawn in the centre of the space enclosed by the tyre	judge by eye	1
1(b)(ii)	below		1
Total			**5**

PHY3F

Question 2

question	answers	extra information	mark
2(a)(i)	**B**		1
2(a)(ii)	microphone		1
2(b)(i)	frequency		1
2(b)(ii)	amplitude		1
2(c)	electromagnet	do **not** accept just 'magnet' accept solenoid accept coil	1
2(d)(i)	(sound will) get less / get quieter / stop / go silent	accept faint buzzing noise	1
2(d)(ii)	**either** sound cannot travel through a vacuum **or** no particles / molecules to vibrate	 accept sound requires a medium accept fewer particles to transfer the sound accept only the vibration of the wires / parts (will transfer the sound)	1
Total			**7**

PHY3F

Question 3

question	answers	extra information	mark
3(a)	increases		1
3(b)(i)	**B**		1
3(b)(ii)	tension in the wire		1
3(b)(iii)	**C**		1
Total			**4**

PHY3F

Question 4

question	answers	extra information	mark
4(a)(i)	iron		1
4(a)(ii)	step-down (transformer)		1
4(b)	any **one** from: • after the power station • after the generator • before the power lines • before the pylons		1
4(c)	each correct (1) current coil field core ends	in its correct place	5
Total			**8**

PHY3F

Question 5

question	answers	extra information	mark
5(a)(i)	convex	accept 'diverging' do **not** accept convexed	1
5(a)(ii)	(principal) focus	accept 'focal (point)'	1
5(a)(iii)	reflection	accept angle of reflection	1
5(b)(i)	concave	accept 'converging' do **not** accept concaved	1
5(b)(ii)	(×) 1.5 / (×) 1½	**either** 30 ÷ 20 (1) **or** 3 ÷ 2 (1) **or** 15 ÷ 10 (1) ignore any units	2
Total			**6**

PHY3F

Question 6

question	answers	extra information	mark
6(a)(i)	time (for a planet) to orbit / go round the Sun	accept 'planet's year' accept time to rotate the Sun just 'year' is insufficient do **not** accept Earth year / time for Earth to orbit the Sun do **not** accept time for a planet to revolve any reference to distance negates the answer	1
6(a)(ii)	**either** information from the internet is not always reliable / accurate **or** data is (more) reliable (if it has been checked)	 accept to check it is correct / accurate / valid	1
6(a)(iii)	the greater the distance (from the Sun) the greater the (planet's) period	accept positive correlation accept if one increases then the other increases accept as distance increases it's longer do **not** accept they are (directly) proportional do **not** accept quicker period	1
6(a)(iv)	there is no relationship	accept 'none' / 'it is random' / 'no pattern'	1

Question 6 is continued on the next page . . .

PHY3F

Question 6 continued . . .

6(b)	(Sun's / star's) gravity		1
6(c)	(the) Milky Way	accept 'milky way'	1
6(d)	billions		1
Total			**7**

PHY3F

Question 7

question	answers	extra information	mark
7(a)(i)	20 (Hz) to 20 000 (Hz) / 20 kHz	**or** reversed order	1
7(a)(ii)	ultrasound / ultrasonic	do **not** accept sonic	1
7(b)	examples discriminates against (young) people who are not being a nuisance discriminates against young people (just) moves the group to another meeting place discourages young people from shopping distresses babies it's morally / ethically wrong	allow any reasonable response 'it bothers young people' is insufficient ignore reference to animals ignore damages hearing	1
7(c)	(mechanical) vibration	accept vibrations in the air / particles	1
7(d)(i)	the sound intensity gets (much) less the greater the distance from (the source of) the sound correct comparison from the graph eg sound is 100 (w/m²) at 1 (m) but only 20 (w/m²) at 2.5 (m)	allow the closer you are to the machine the more likely it is to damage your hearing accept the graph falls steeply (at first) and then more gently	1 1

Question 7 is continued on the next page . . .

PHY3F

Question 7 continued . . .

question	answers	extra information	mark
7(d)(ii)	any **two** from: • (so) data can be compared • anomalous results can be checked / removed / identified • more than one set of data • intensity / loudness fluctuates	increases reliability is insufficient improves accuracy is insufficient fair test is insufficient	2
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	
8	
TOTAL	

General Certificate of Secondary Education
Foundation Tier
January 2010

Physics

PHY3F

Unit Physics P3

F

Written Paper

Wednesday 20 January 2010 9.00 am to 9.45 am

For this paper you must have:
- a ruler.

You may use a calculator.

Time allowed
- 45 minutes

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

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

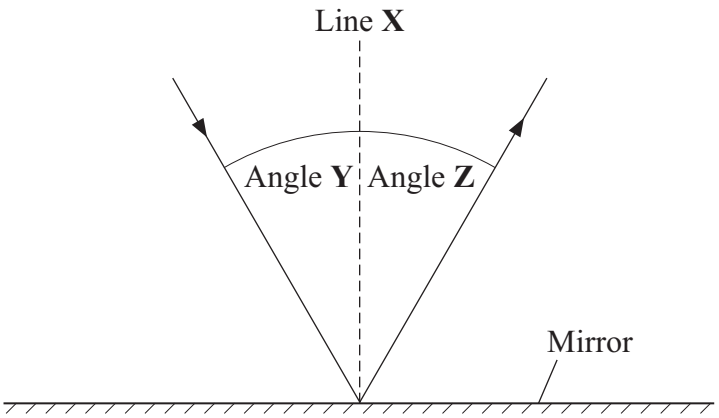
Advice
- In all calculations, show clearly how you work out your answer.

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Areas outside the box will not be scanned for marking

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

1 (a) The following diagram shows a ray of light which is reflected by a mirror.



1 (a) (i) Use **one** word from the box to complete the sentence.

concave	**convex**	**plane**

The mirror is a ..... mirror.

(1 mark)

1 (a) (ii) Complete the sentence.

Line **X** is a vertical line at right angles to the mirror and is called the

..... .

(1 mark)

Areas outside the box will not be scanned for marking

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

1 (a) (iii) Angle **Y** is called the angle of

incidence
reflection
refraction

.

(1 mark)

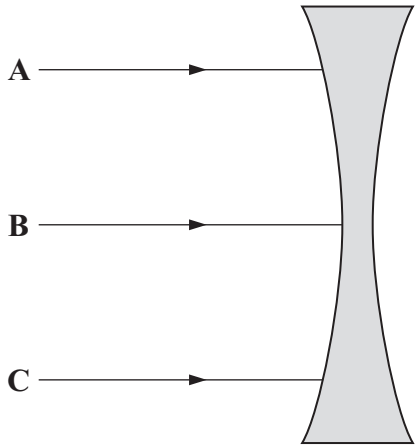
1 (a) (iv) If angle **Y** is doubled, then angle **Z** will

be halved
stay the same
be doubled

.

(1 mark)

1 (b) The following diagram shows the side view of a lens and three parallel rays of light, **A**, **B** and **C**.



1 (b) (i) Use **one** word from the box to complete the sentence.

converging	**diverging**	**plane**

The diagram shows a ..... lens.

(1 mark)

1 (b) (ii) Add to the diagram to show what will happen to **each** of the three rays of light, **A**, **B** and **C**.

(2 marks)

7

Turn over ▶

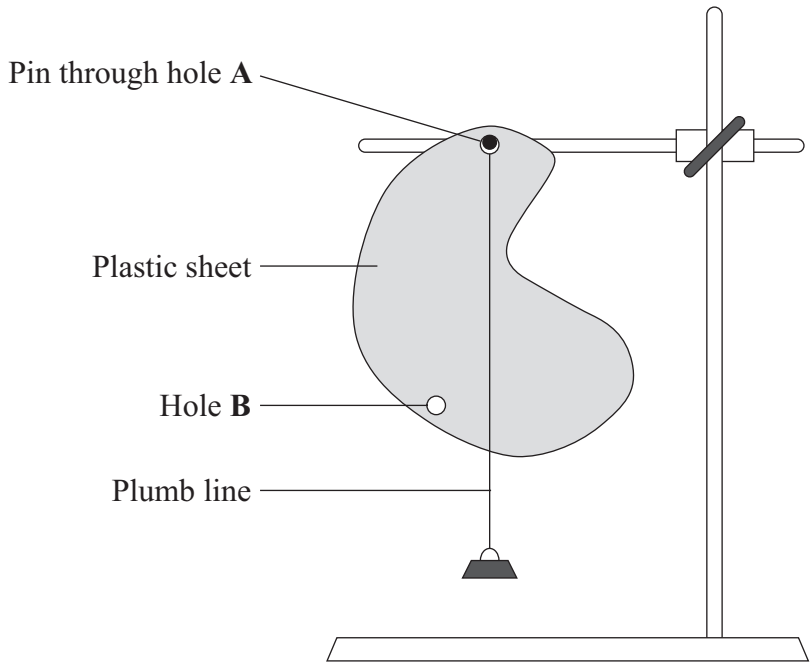
Areas outside the box will not be scanned for marking

2 The diagram shows how a student can find the centre of mass of a thin flat sheet of plastic.

Part of his equipment is a plumb line. This is a weight fastened to one end of a piece of string.

He hangs the sheet and the plumb line from a pin through hole **A**.

2 (a) Mark an **X** on the diagram so that the centre of the **X** marks the likely position of the centre of mass of the plastic sheet.

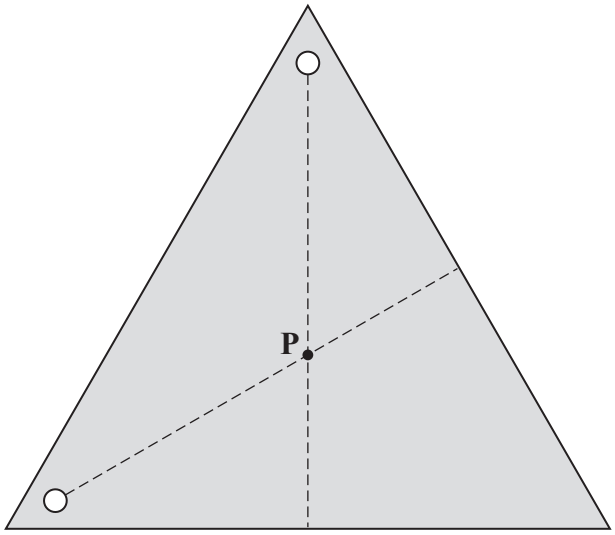


(1 mark)

Areas outside the box will not be scanned for marking

2 (b) The dashed lines on the diagram below show the position of the plumb line from each hole when the student uses a different plastic sheet.

Point **P** is on both the dashed lines.



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

Point **P** shows the

axis
centre of mass
moment
symmetry

of the plastic sheet.

(1 mark)

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

A plumb line always hangs so that it is

curved
horizontal
parallel
vertical

.

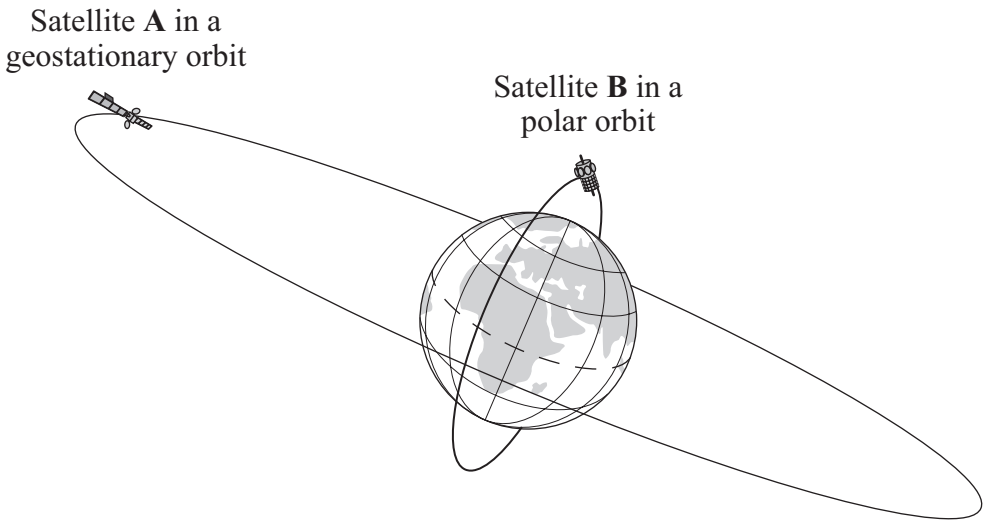
(1 mark)

3

Areas outside the box will not be scanned for marking

3 The diagram shows two satellites orbiting the Earth.

Both satellites have the same mass.



3 (a) Complete the following sentences by drawing a ring around the correct line in each box.

3 (a) (i) The time taken for one orbit by satellite **A** is

less than
the same as
greater than

the time taken for one orbit by satellite **B**.

(1 mark)

3 (a) (ii) The force of attraction between the Earth and satellite **A** is

less than
the same as
greater than

the force of attraction between the Earth and satellite **B**.

(1 mark)

Areas outside the box will not be scanned for marking

3 (a) (iii) The gravitational force of attraction between the Earth and a satellite

provides a | centripetal / cosmic / friction | force.

(1 mark)

3 (a) (iv) The time taken for satellite **A** to complete one orbit is | 24 hours / 1 week / 1 month / 1 year | .

(1 mark)

3 (b) Use phrases from the box to complete the sentences.

geostationary orbit	**high polar orbit**	**low polar orbit**

3 (b) (i) Communications satellites are usually put in a ..... .

(1 mark)

3 (b) (ii) Monitoring satellites are usually put in a ..... .

(1 mark)

6

Turn over for the next question

Areas outside the box will not be scanned for marking

4 (a) The table gives information about the frequencies in the hearing ranges of six different mammals.

Name of mammal	Frequencies in hearing range
Bat	20 Hz → 160 kHz
Dog	20 Hz → 30 kHz
Dolphin	40 Hz → 110 kHz
Elephant	5 Hz → 10 kHz
Human	20 Hz → 20 kHz
Tiger	30 Hz → 50 kHz

4 (a) (i) Which mammal in the table can hear the highest frequency?

.....

(1 mark)

4 (a) (ii) Which mammal in the table, apart from humans, **cannot** hear ultrasound?

.....

(1 mark)

4 (a) (iii) Give **one** example of a frequency which an elephant can hear but which a tiger **cannot** hear.

Include the unit in your answer.

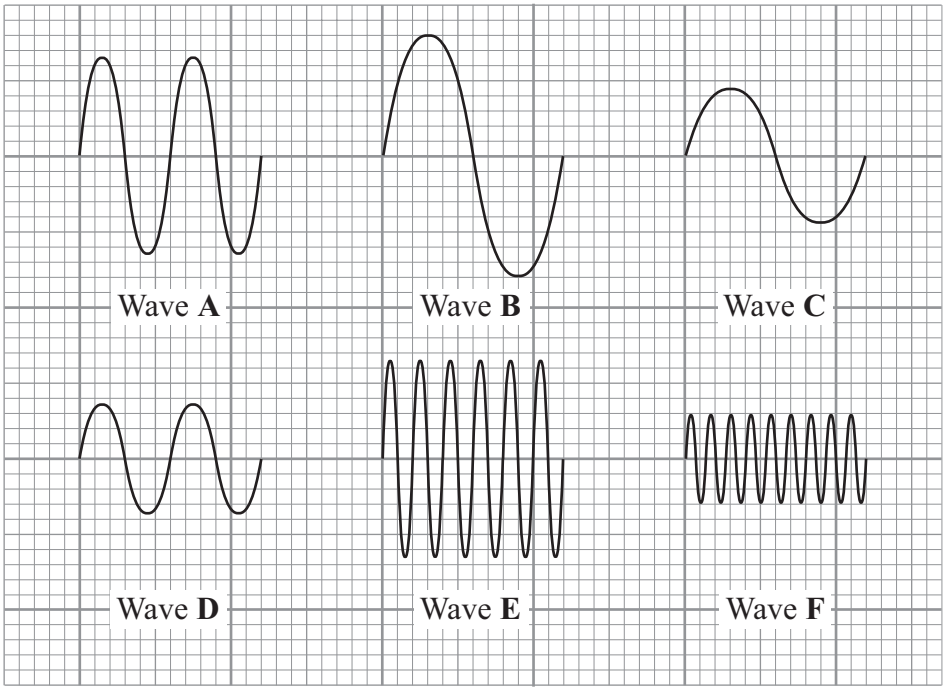
Frequency .....

(1 mark)

Areas outside the box will not be scanned for marking

4 (b) The diagrams show six sound waves, **A**, **B**, **C**, **D**, **E** and **F**, represented on an oscilloscope screen.

They are all drawn to the same scale.



4 (b) (i) Which **one** of the waves has the greatest amplitude?

Wave ..... .

(1 mark)

4 (b) (ii) Which **one** of the waves has the highest frequency?

Wave ..... .

(1 mark)

5

Turn over for the next question

Areas outside the box will not be scanned for marking

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

5 (a) (i) Stars form when enough dust and gas from space is pulled together

by | centripetal / gravitational / magnetic | attraction.

(1 mark)

5 (a) (ii) Stars give out energy for millions of years by their nuclei | burning / joining / splitting | .

(1 mark)

5 (a) (iii) When gravitational forces balance radiation pressure, a star is | shrinking / stable / swelling | .

(1 mark)

5 (b) The Universe is made up of billions of galaxies.

5 (b) (i) What is a galaxy?

.....

.....

(1 mark)

5 (b) (ii) Name the galaxy which contains the Sun.

.....

(1 mark)

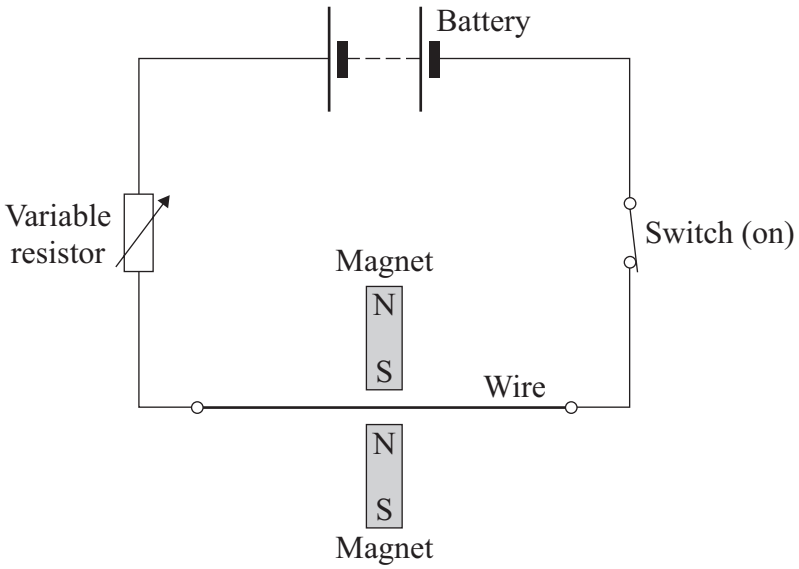
5

Areas outside the box will not be scanned for marking

6 A student investigates the electromagnetic force acting on a wire which carries an electric current. The wire is in a magnetic field.

The diagram shows the circuit which the student uses.

6 (a) Draw an **X** on the diagram, with the centre of the **X** in the most strongest part of the magnetic field.



(1 mark)

6 (b) Give **one** change that she can make to the magnets to **decrease** the electromagnetic force on the wire.

.....

.....

(1 mark)

6 (c) The student wants to change the electromagnetic force on the wire without changing the magnets or moving their position.

6 (c) (i) Give **one** way in which she can **increase** the electromagnetic force.

.....

.....

(1 mark)

6 (c) (ii) Give **one** way in which she can **reverse** the direction of the electromagnetic force.

.....

.....

(1 mark)

4

Turn over ▶

Areas outside the box will not be scanned for marking

7 A student collects data from the Internet about planets in the solar system. She arranges the data into a table.

Name of the planet	Distance from the Sun in millions of kilometres	Time taken for one orbit of the Sun in years	Time taken to spin on its axis in hours	Average temperature on the side facing the Sun in °C
Mercury	60	0.24	1400	+430
Venus	110	0.60	5800	+470
Earth	150	1	24	+20
Mars	230	2	25	–20
Jupiter	780	12	10	–150
Saturn	1400	30	10	–180
Uranus	2900	84	17	–220
Neptune	4500	160	16	–230

7 (a) Name the **two** variables in the student's table which **always** have the relationship:

As one increases, so does the other.

..... and .....

(1 mark)

7 (b) (i) Give an example of **two** variables in the student's table which **generally** have the relationship:

As one increases, the other decreases.

..... and .....

(1 mark)

7 (b) (ii) Which piece of data does not seem to fit the relationship in (b)(i)?

.....

(1 mark)

Areas outside the box will not be scanned for marking

7 (c) Scientists plan to launch a satellite which will orbit Mars above its equator. It will be a geostationary satellite.

How many hours will it take to orbit Mars?

..... hours

(1 mark)

7 (d) Mars has two moons.

Neither of them is in a geostationary orbit and they both take different times to orbit the planet.

Which **one** of these statements is correct.
Put a tick (✓) in the box next to your answer.

The two moons will always be above the same point on the surface of Mars. ☐

The two moons will be in different positions at different times. ☐

You can never see both moons at the same time. ☐

(1 mark)

7 (e) Use words from the box to complete the **three** spaces in the passage.

circular	**direction**	**friction**	**gravitational**	**speed**	**universal**

The moons of the planet Neptune move in circular paths around the planet.

They continuously accelerate towards the centre of Neptune.

The acceleration changes the ..... of each moon but does not change its ..... . The force causing the acceleration is a ..... force.

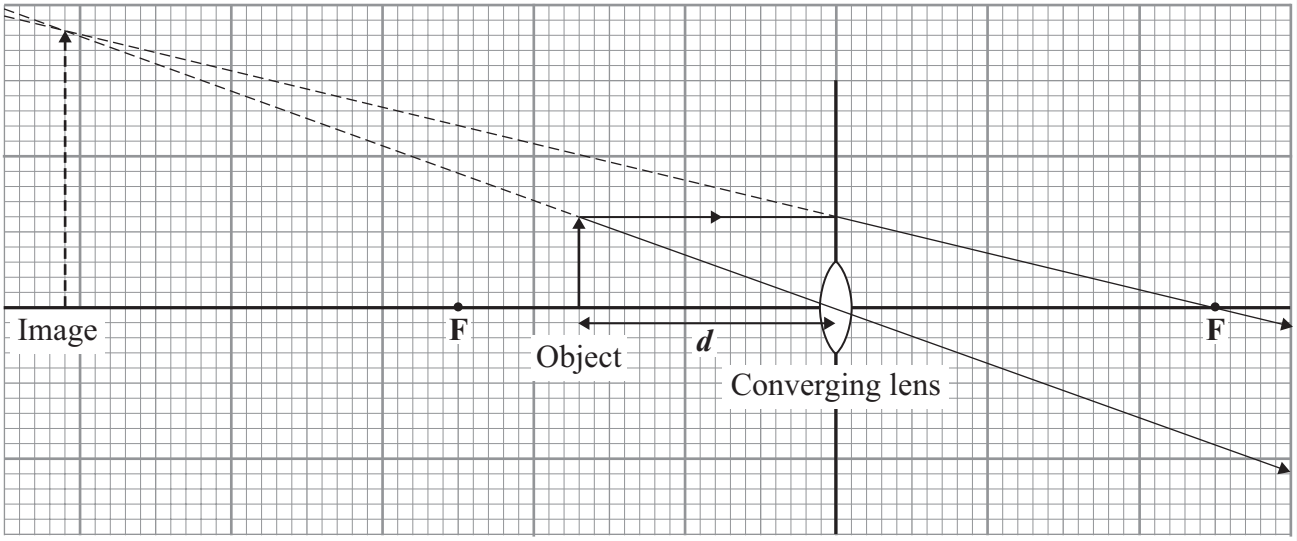
(2 marks)

7

Areas outside the box will not be scanned for marking

8 A student investigates how the magnification of an object changes at different distances from a converging lens.

The diagram shows an object at distance ***d*** from a converging lens.



8 (a) (i) The height of the object and the height of its image are drawn to scale.

Use the equation in the box to calculate the magnification produced by the lens shown in the diagram.

$$\text{magnification} = \frac{\text{image height}}{\text{object height}}$$

Show clearly how you work out your answer.

.....

.....

.....

Magnification = ...

(2 marks)

8 (a) (ii) The points **F** are at equal distances on either side of the centre of the lens.

State the name of these points.

.....

(1 mark)

Areas outside the box will not be scanned for marking

8 (a) (iii) Explain how you can tell, **from the diagram**, that the image is virtual.

.....

.....

(1 mark)

Question 8 continues on the next page

Areas outside the box will not be scanned for marking

8 (b) The student now uses a different converging lens. He places the object between the lens and point **F** on the left.

The table shows the set of results that he gets for the distance ***d*** and for the magnification produced.

Distance *d* measured in cm	**Magnification**
5	1.2
10	1.5
15	2.0
20	3.0
25	6.0

His friend looks at the table and observes that when the distance doubles from 10 cm to 20 cm, the magnification doubles from 1.5 to 3.0.

His friend's conclusion is that:

The magnification is directly proportional to the distance of the object from the lens.

His friend's observation is correct but his friend's conclusion is **not** correct.

8 (b) (i) Explain, with an example, why his friend's conclusion is **not** correct.

.....

.....

.....

.....

(2 marks)

8 (b) (ii) Write a correct conclusion.

.....

.....

(1 mark)

Areas outside the box will not be scanned for marking

8 (b) (iii) The maximum range of measurements for ***d*** is from the centre of the lens to **F** on the left.

The student **cannot** make a correct conclusion outside this range.

Explain why.

.....

.....

(1 mark)

8

END OF QUESTIONS

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ANSWER IN THE SPACES PROVIDED

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Version : 24/02/2010

General Certificate of Secondary Education

Physics 4451

PHY3F Unit Physics 3

Mark Scheme

2010 examination - January series

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

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

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

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Dr Michael Cresswell Director General

MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

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

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

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

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

2. Emboldening

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

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

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

3. Marking points

3.1 Marking of lists

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

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

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

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

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

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

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

3.2 Use of chemical symbols / formulae

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

3.3 Marking procedure for calculations

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

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

3.4 Interpretation of 'it'

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

3.5 Errors carried forward

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

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

3.6 Phonetic spelling

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

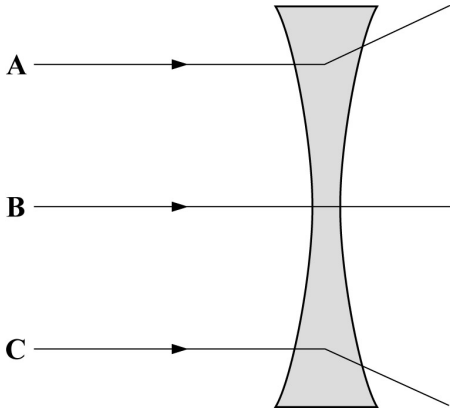
3.7 Brackets

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

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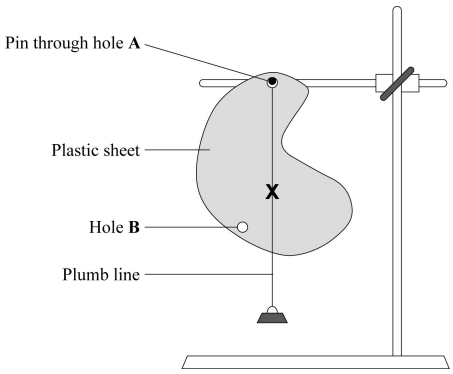
Question 1

question	answers	extra information	mark
1(a)(i)	plane	accept any unambiguous indication	1
1(a)(ii)	normal		1
1(a)(iii)	incidence	accept any unambiguous indication	1
1(a)(iv)	be doubled	accept any unambiguous indication	1
1(b)(i)	diverging	accept any unambiguous indication	1
1(b)(ii)	**B** continues in a straight line (1) **A** refracted upwards and **C** refracted downwards (1)	accept any reasonable freehand attempt by eye ignore what happens in the lens **example** 	2
Total			**7**

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Question 2

question	answers	extra information	mark
2(a)	centre of **X** on the plumb line and between the level of the captions 'plastic sheet' and 'hole **B**'	**example**  	1
2(b)	centre of mass	accept any unambiguous indication	1
2(c)	vertical	accept any unambiguous indication	1
Total			**3**

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Question 3

question	answers	extra information	mark
3(a)(i)	greater than	accept any unambiguous indication	1
3(a)(ii)	less than	accept any unambiguous indication	1
3(a)(iii)	centripetal	accept any unambiguous indication	1
3(a)(iv)	24 hours	accept any unambiguous indication	1
3(b)(i)	geostationary (orbit)		1
3(b)(ii)	low polar (orbit)	do **not** accept just 'polar (orbit)'	1
Total			**6**

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Question 4

question	answers	extra information	mark
4(a)(i)	bat(s)		1
4(a)(ii)	elephant(s)		1
4(a)(iii)	any example in the inclusive range 5 ↔ 29 Hz / hertz	appropriate number and unit both required	1
4(b)(i)	**B**		1
4(b)(ii)	**F**		1
Total			**5**

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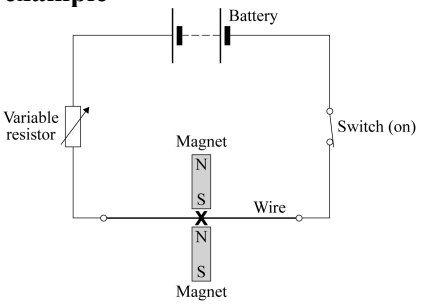
Question 5

question	answers	extra information	mark
5(a)(i)	gravitational	accept any unambiguous indication	1
5(a)(ii)	joining	accept any unambiguous indication	1
5(a)(iii)	stable	accept any unambiguous indication	1
5(b)(i)	collection of billions of stars	do **not** credit just 'millions of stars' ignore reference to planets, moons etc	1
5(b)(ii)	Milky Way	allow 'milky way' and other minor misspellings	1
Total			**5**

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Question 6

question	answers	extra information	mark
6(a)	centre of the **X** midway between the poles	intention correct as judged by eye **example**  	1
6(b)	move the poles further apart	accept turn for move accept ends / magnets for poles accept use weaker magnets do **not** accept use smaller magnets	1
6(c)(i)	add more cells (to the battery) **or** reduce the resistance (of the variable resistor)	do **not** accept 'use a bigger battery' accept increase the potential difference / voltage accept increase the current do **not** accept any changes to the magnets, to the wire or to their relative positions	1

Question 6 continues on the next page . . .

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Question 6 continued . . .

question	answers	extra information	mark
6(c)(ii)	reverse (the polarity of) the battery	accept turn the battery / cells round accept swap the connections to the battery do **not** accept any changes to the magnets, to the wire or to their relative positions	1
Total			**4**

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Question 7

question	answers	extra information	mark
7(a)	distance (from the Sun in millions of km) and time taken for orbit	both required in either order **not** just 'time taken'	1
7(b)(i)	**either** distance (from the Sun in millions of km) **or** time taken for orbit (and) (average) temperature	 **not** just 'time taken' both required in either order	1
7(b)(ii)	(+) 430 / (+) 470 **or** Mercury / Venus		1
7(c)	25 (hours)	do **not** accept 24 (hours)	1
7(d)	...different positions at different times		1
7(e)	…direction…speed gravitational	both and in the correct order	1 1
Total			**7**

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PHY3F

Question 8

question	answers	extra information	mark
8(a)(i)	answer in the range 3.0 ↔ 3.1 inclusive	accept for 1 3.6 ÷ 1.2 or 3.7÷1.2 or 36 ÷ 12 or 37÷12 or 18 ÷ 6 or 18.5 ÷ 6 or 10.2 ÷ 3.4 or 102 ÷ 34 or answer in the range but with a unit eg 3 cm	2
8(a)(ii)	(principal) focus / focal (point(s)) / foci / focus	accept 'focusses' accept focals do **not** accept focal length	1
8(a)(iii)	at the intersection of virtual / imaginary rays	**or** 'where virtual / imaginary rays cross' **or** the rays of (real) light do not cross **or** the image on the same side (of the lens) as the object **or** the image is drawn as a dotted line **or** the image is upright do **not** accept 'cannot be put on a screen' do **not** accept any response which refers to reflected rays	1

Question 8 continues on the next page . . .

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Question 8 continued . . .

question	answers	extra information	mark
8(b)(i)	another correct observation about relationship between values of **d** (1) (but) not the same relationship between corresponding values for magnification (1)	**example** 15 is three times bigger than 5 but 2.0 is not three times bigger than 1.2	2
8(b)(ii)	when the distance / **d** increases the magnification increases	**or** the converse accept 'there is a (strong) positive correlation' do **not** accept any response in terms of proportion / inverse proportion	1
8(b)(iii)	(student has) no evidence (outside this range)	accept data / results / facts for 'evidence'	1
Total			**8**

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Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

For Examiner's Use

General Certificate of Secondary Education
June 2009

PHYSICS
Unit Physics P3

PHY3F

F

Foundation Tier

Wednesday 10 June 2009 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. 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.

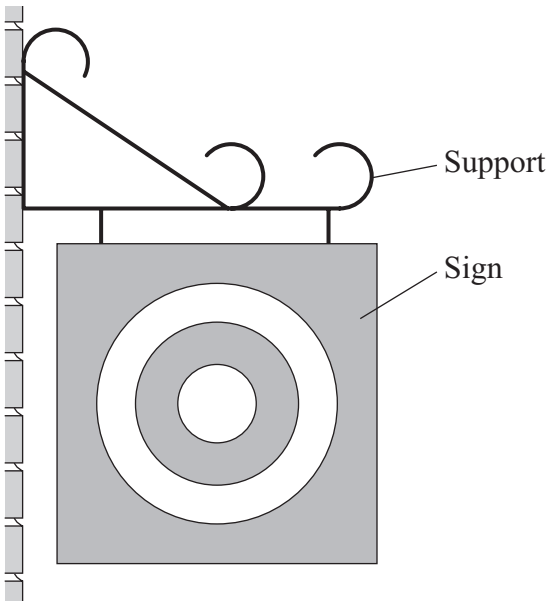
For Examiner's Use			
Question	Mark	Question	Mark
1		7	
2		8	
3			
4			
5			
6			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

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Areas outside the box will not be scanned for marking

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

1 The drawing shows a sign which hangs outside a shop.



1 (a) Draw an **X** on the sign so that the centre of your **X** is at the centre of mass of the sign.

(1 mark)

1 (b) Use a ruler to draw **one** axis of symmetry on the sign.

(1 mark)

1 (c) One force which acts on the sign is its weight.

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

The moment of the weight produces

an accelerating
a balancing
a turning

effect.

(1 mark)

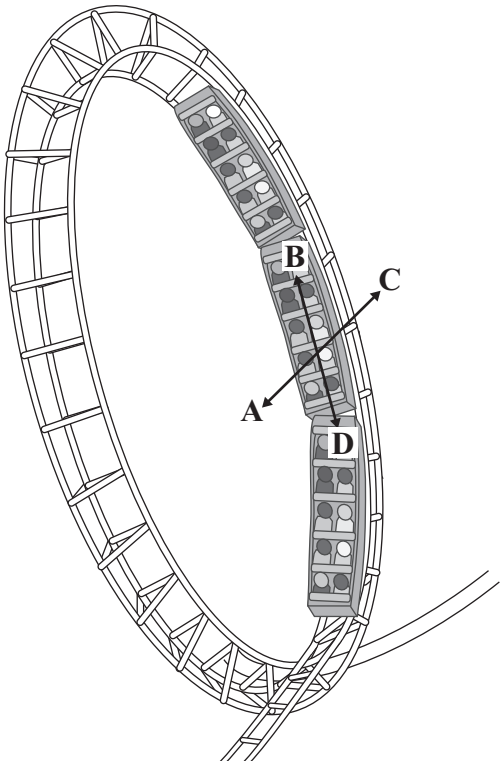
3

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

2 The drawing shows a set of carriages on a roller coaster.
The carriages are moving upwards in a nearly circular path at a constant speed.



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

2 (a) (i) The carriages will accelerate because of a change in their

direction
mass
speed

.

(1 mark)

2 (a) (ii) The resultant force which causes the carriages to accelerate is the

circular
centripetal
gravity

force.

(1 mark)

Areas outside the box will not be scanned for marking

2 (b) In which direction, **A**, **B**, **C** or **D**, does the resultant force act?

Write your answer in the box. ☐

(1 mark)

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

The resultant force will need to be greater if the

mass of the passengers is greater
radius of the circle is greater
speed of the carriages is less

.

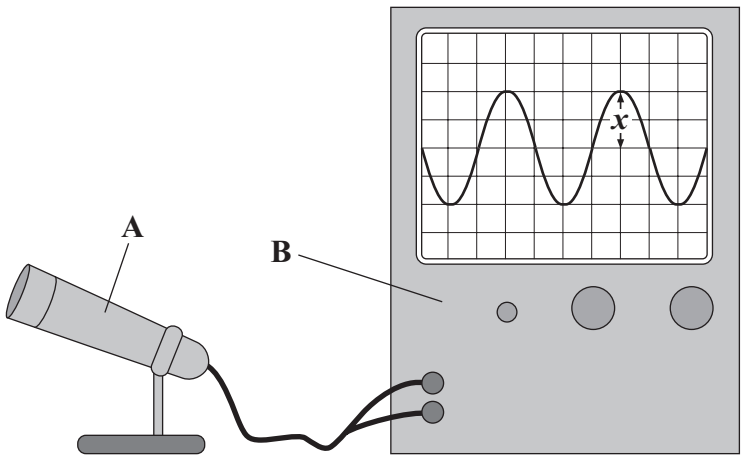
(1 mark)

4

Turn over for the next question

Areas outside the box will not be scanned for marking

3 (a) A student uses two pieces of equipment, **A** and **B**, to display a sound wave.



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

a loudspeaker	**a microphone**	**an oscilloscope**	**a screen**

A is ..... and **B** is ..... .

(2 marks)

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

the amplitude	**half the amplitude**	**the frequency**	**half the frequency**

The distance ***x*** marked on the diagram measures .....of the sound wave.

(1 mark)

3 (a) (iii) Complete the sentence.

The distance ***x*** becomes smaller. This is because the sound has

become ..... .

(1 mark)

Areas outside the box will not be scanned for marking

3 (b) There is no air in space.

Astronauts in space cannot hear sounds from outside their spacesuits.

Explain this.

.....

.....

.....

.....

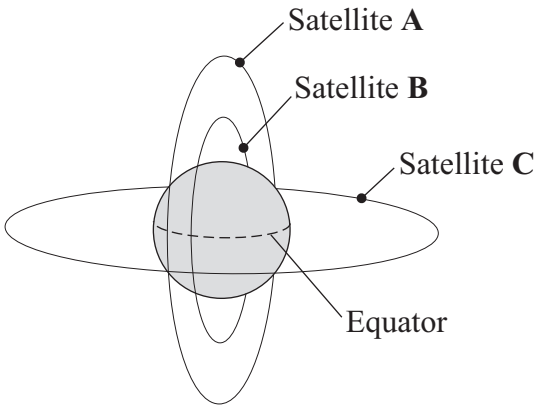
(2 marks)

6

Turn over for the next question

Areas outside the box will not be scanned for marking

4 (a) The following diagram shows three satellites, **A**, **B** and **C**, in orbit around the Earth. The diagram is not to scale.



4 (a) (i) Complete the following table. Each letter may be used once, more than once or not at all.

Description of satellite	**Is this satellite A, B or C?**
It is in a low polar orbit.	
It is in a geostationary orbit.	
It is used as a monitoring satellite.	

(3 marks)

4 (a) (ii) How long does a satellite in a geostationary orbit take to complete one orbit?

..... hours

(1 mark)

Areas outside the box will not be scanned for marking

4 (b) A rocket is used to carry a satellite into position.

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

As the distance between the rocket and the Earth increases, the force of

gravity between the rocket and the Earth

decreases
stays the same
increases

.

(1 mark)

4 (c) Satellites cost many millions of pounds to build and to put into orbit. Some people think that this is a waste of money.

4 (c) (i) Suggest **one** reason why some people may have this opinion.

.....

.....

.....

(1 mark)

4 (c) (ii) Suggest **one** reason why other people may disagree with this opinion.

.....

.....

.....

(1 mark)

7

Turn over for the next question

Areas outside the box will not be scanned for marking

5 In the diagram below, a frog sits on a rock in a pond.

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

5 (a) (i) The frog can see its image in the pond because the surface of the pond acts

like a | concave / convex / plane | mirror.

(1 mark)

5 (a) (ii) Draw a ring around each of **two** words from the box below to describe the image in the pond.

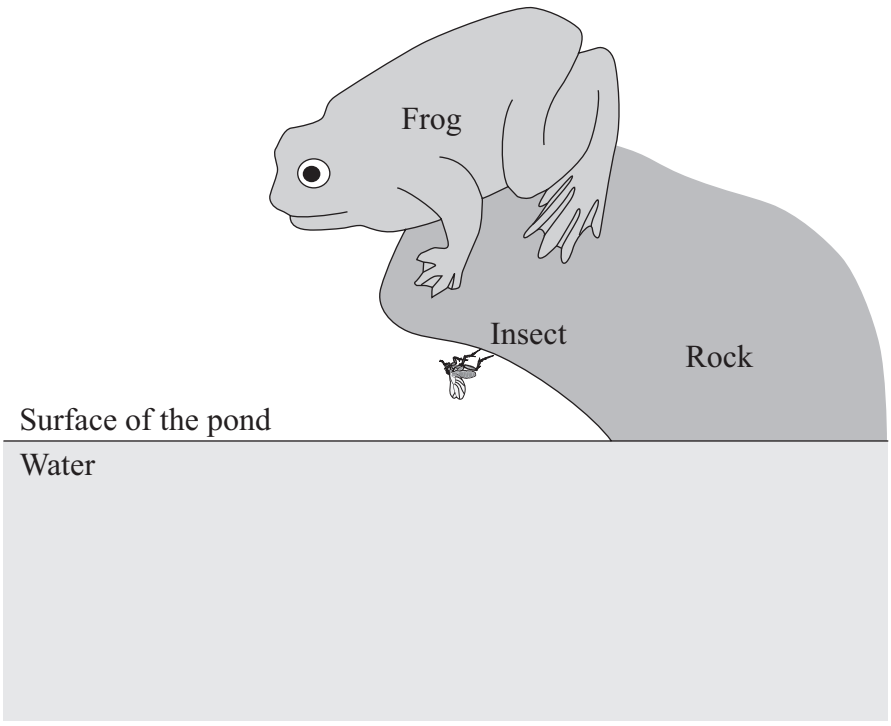
bigger	**inverted**	**real**	**smaller**	**upright**	**virtual**

(2 marks)

5 (b) There is an insect underneath the rock.

Use a ruler to draw rays of light on the diagram to show how the frog uses reflection to see the insect.

Mark the direction of the rays.



(3 marks)

6

Areas outside the box will not be scanned for marking

6 This passage is from a science magazine.

> *A star forms when enough dust and gas are pulled together. Masses smaller than a star may also be formed when dust and gas are pulled together.*

6 (a) What is the force which pulls the dust and gas together?

.....

(1 mark)

6 (b) Complete the sentences.

6 (b) (i) The smaller masses may be attracted by the star and become

..... .

(1 mark)

6 (b) (ii) Our nearest star, the Sun, is stable because the gravitational forces and the radiation pressure are ..... .

(1 mark)

6 (b) (iii) The Sun is one of billions of stars in the galaxy called the

..... .

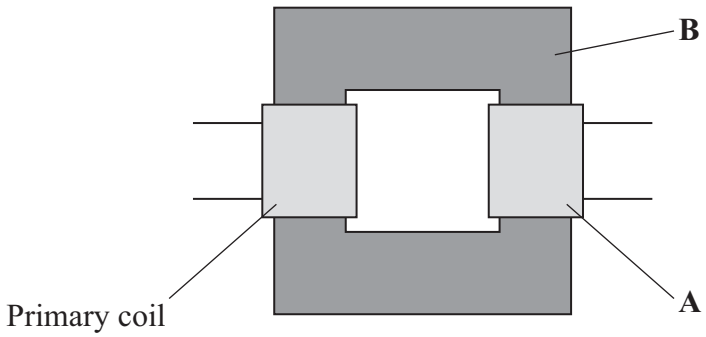
(1 mark)

4

Turn over for the next question

Areas outside the box will not be scanned for marking

7 (a) The diagram shows a transformer.



7 (a) (i) What is part **A**?

.....

(1 mark)

7 (a) (ii) What is part **B** and what is it made of?

.....

.....

(2 marks)

7 (a) (iii) When there is an alternating current in the primary coil, what is produced in part **B**?

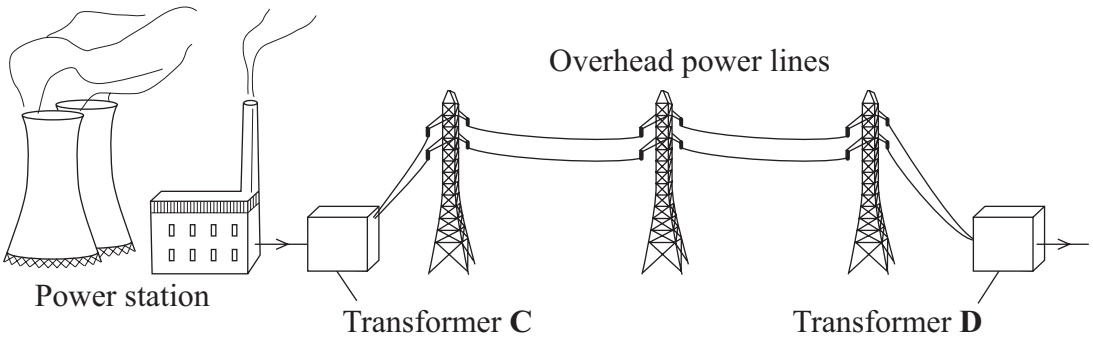
.....

.....

(2 marks)

Areas outside the box will not be scanned for marking

7 (b) Transformers are used in the National Grid. The diagram shows part of the National Grid.



Complete the **two** spaces in the sentence.

Transformer **C** is a ..... transformer and transformer **D** is

a ..... transformer. *(1 mark)*

7 (c) This is an item from a newspaper.

> **Health at risk from power lines?**
>
> Are high voltage power lines a health risk to people who live near them?
>
> Some scientists think that scientific evidence shows that they are.
>
> Other scientists do not think that the scientific evidence supports this conclusion.

Which **two** suggestions would reduce the possible risk to people's health?
Put a tick (✓) in the box next to your answers.

Do not build new houses near to existing power lines. ☐

Move the power lines so that they take the shortest routes. ☐

Move each power station to the centre of the nearest city. ☐

Build new power lines away from where people live. ☐

Use more transformers in the National Grid. ☐

(2 marks)

8

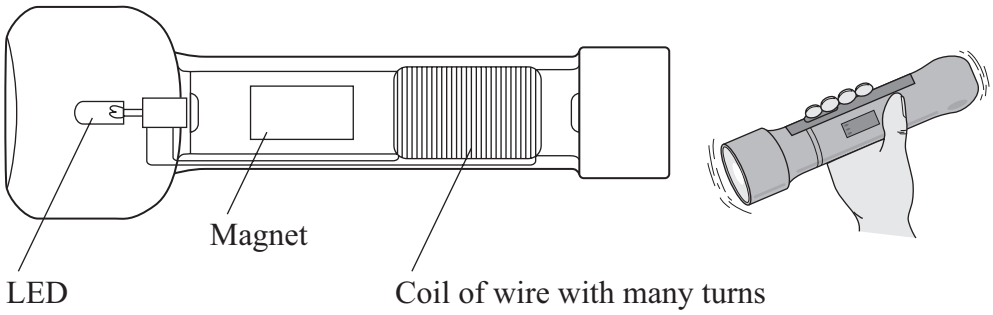
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8 The diagram shows some parts of a torch which works without batteries.
The coil is part of a complete circuit with the LED (light-emitting diode).

You have to shake the torch for a short time and then it is ready to use.



8 (a) Arrange the letters, **A**, **B**, **C**, **D** and **E**, in the correct order to explain how shaking the torch produces an electric current.

A An electric current is induced in the circuit.

B The magnetic field cuts through the coil.

C The magnet moves in and out of the coil.

D A potential difference (p.d.) is induced across the ends of the coil.

E The torch is shaken to and fro.

The first letter has been done for you.

E				

(2 marks)

8 (b) Give **two** changes which you would make to the design of the torch to increase the size of the induced potential difference.

1 .....

.....

2 .....

.....

(2 marks)

Areas outside the box will not be scanned for marking

8 (c) A few minutes after shaking, the LED gets dimmer and then stops giving out light.

A student tests the torch. She shakes it for a period of time. Then she switches it on and times how long the light lasts.

These are her results.

Period of time torch is shaken measured in seconds	**How long the light lasts measured in seconds**
30	168
60	312
90	420
120	546
150	654

8 (c) (i) What conclusion can the student come to on the basis of these results?

.....

.....

(1 mark)

8 (c) (ii) The student's friend says that the results are **not** reliable. Her friend is correct.

Give **two** reasons why.

1 .....

.....

.....

2 .....

.....

.....

(2 marks)

7

END OF QUESTIONS

There are no questions printed on this page

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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Physics 4451

PHY3F Unit 3 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

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Dr Michael Cresswell Director General

MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

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

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

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

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

2. Emboldening

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

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

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

3. Marking points

3.1 Marking of lists

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

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

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

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

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

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

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

3.2 Use of chemical symbols / formulae

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

3.3 Marking procedure for calculations

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

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

3.4 Interpretation of 'it'

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

3.5 Errors carried forward

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

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

3.6 Phonetic spelling

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

3.7 Brackets

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

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PHY3F

Question 1

question	answers	extra information	mark
1(a)	centre of **X** at the centre of the concentric circles	judge by eye that the intention is correct	1
1(b)	drawn from any corner to the diagonally opposite corner **or** from the mid-point of any side to the mid-point of the opposite side	judge by eye that the intention is correct if more than one axis of symmetry has been drawn, accept only if both / all are correct	1
1(c)	a turning	accept any unambiguous indication	1
Total			**3**

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PHY3F

Question 2

question	answers	extra information	mark
2(a)(i)	direction	accept any unambiguous indication	1
2(a)(ii)	centripetal	accept any unambiguous indication	1
2(b)	**A**	accept any unambiguous indication	1
2(c)	mass of the passengers is greater	accept any unambiguous indication	1
Total			**4**

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PHY3F

Question 3

question	answers	extra information	mark
3(a)(i)	(**A** =) a microphone (**B** =) an oscilloscope	correct order essential **or** cathode ray oscilloscope **or** CRO	1 1
3(a)(ii)	the amplitude	accept any unambiguous indication	1
3(a)(iii)	quieter / softer	do **not** accept less (which could refer to the amplitude, frequency or wavelength)	1
3(b)	sound cannot travel through a vacuum / (empty) space / free space (because) there is / are nothing / no particles to vibrate	accept there is no medium for the sound to travel through accept (because) there is / are nothing / no particles between them and the source (of the sound)	1 1
Total			**6**

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PHY3F

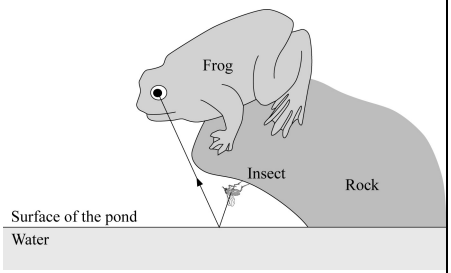
Question 4

question	answers	extra information	mark
4(a)(i)	**B** **C** **B**	letters must be clear and unambiguous but they may be lower case	1 1 1
4(a)(ii)	24 (hours)		1
4(b)	decreases	accept any unambiguous indication	1
4(c)(i)	money could be (better) used ..... to relieve poverty / reduce taxes / cure cancer etc		1
4(c)(ii)	satellites are used ..... to monitor the weather / for communications / for spying / for satnav(s) etc		1
Total			**7**

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PHY3F

Question 5

question	answers	extra information	mark
5(a)(i)	plane	accept any unambiguous indication	1
5(a)(ii)	upright virtual	accept any unambiguous indication	1 1
5(b)	reflection takes place at the surface of the pond and angle of incidence = angle of reflection reflected ray is a straight line to frog's eye through the air correct direction arrow **either** from insect **or** to frog's eye	as judged by eye only one arrow essential but do **not** accept if either arrow contradicted example of a fully correct response  	1 1 1
Total			**6**

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PHY3F

Question 6

question	answers	extra information	mark
6(a)	gravitational	accept gravity do **not** accept weight	1
6(b)(i)	planet(s)	accept comet(s) accept asteroid(s) do **not** accept moon(s)	1
6(b)(ii)	balanced	accept equal / the same / are in equilibrium	1
6(b)(iii)	Milky Way	accept milky way	1
Total			**4**

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PHY3F

Question 7

question	answers	extra information	mark
7(a)(i)	secondary(coil) / output (coil)	do **not** accept just coil	1
7(a)(ii)	core (laminated soft) iron	do **not** accept for either mark it is made out of iron ore allow **1** mark for 'it is made out of iron core'	1 1
7(a)(iii)	magnetic field (which is) changing / alternating	accept magnetism / magnetic force direction (of field) changes / strength (of field) varies scoring second mark is dependent on first mark	1 1
7(b)	...step-up .... step-down ...	both in the correct order	1
7(c)	Do not build new houses .... Build new power lines away	 deduct **1** mark for any other(s) to a minimum total of (0)	1 1
Total			**8**

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PHY3F

Question 8

question	answers	extra information	mark
8(a)	C → B (1st two boxes) D → A (end two boxes)	allow **1** mark for either linkage in any position	1 1
8(b)	any **two** from: • more powerful / stronger magnet • smaller gap between coil and magnet • coil with more turns / longer coil • coil with bigger area	do **not** accept just bigger magnet accept more coils do **not** accept just bigger coil do **not** accept just more wire do **not** accept shake faster do **not** accept shake for longer	2
8(c)(i)	the longer the torch is shaken, the longer the light lasts	accept the converse accept it is a (strong) positive (non-linear) relationship do **not** accept '.... are (directly) proportional ....'	1

Question 8 is continued on the next page . . .

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PHY3F

Question 8 continued . . .

question	answers	extra information	mark
8(c) (ii)	any **two** from: • if this investigation is repeated the result would not be the same • rate / amplitude / angle of shaking could vary • personal judgement when the LED / light has 'gone out' • results / data / measurements have not been repeated / averaged		2
Total			**7**

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Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature								

For Examiner's Use

General Certificate of Secondary Education
January 2009

PHYSICS
Unit Physics P3

PHY3F

F

Foundation Tier

Monday 19 January 2009 9.00 am to 9.45 am

For this paper you must have:
- a ruler.

You may use a calculator.

Time allowed: 45 minutes

Instructions
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- Fill in the boxes at the top of this page.
- Answer **all** questions.
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For Examiner's Use			
Question	Mark	Question	Mark
1		7	
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3			
4			
5			
6			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

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Areas outside the box will not be scanned for marking

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

1 Electricity is generated in power stations. It is then sent to all parts of the country through a network of cables.

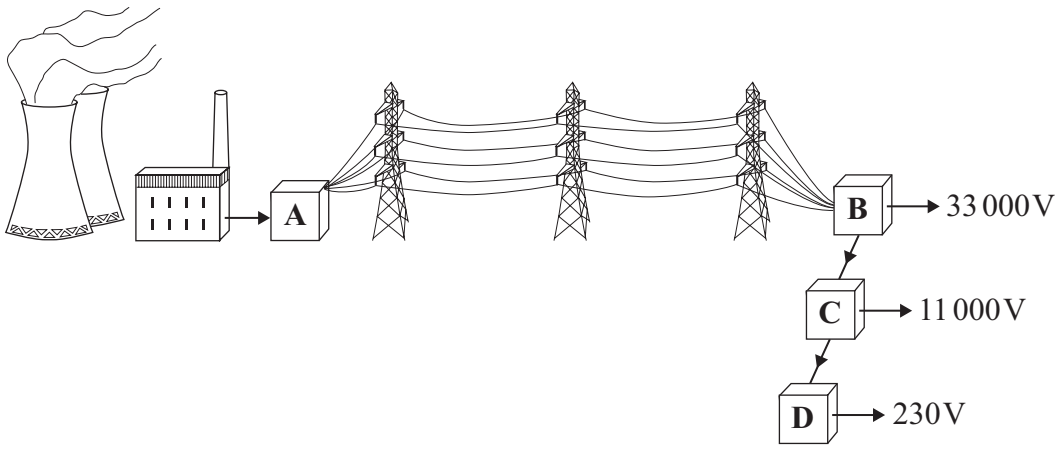
1 (a) Complete the following sentence by using **one** of the words in the box.

Grid	**Power**	**Supply**

The network is called the National ..... .

(1 mark)

1 (b) In the diagram, **A**, **B**, **C** and **D** are transformers.



1 (b) (i) Which transformer, **A**, **B**, **C** or **D**, is a step-up transformer?

Transformer .....

(1 mark)

1 (b) (ii) Which transformer, **A**, **B**, **C** or **D**, will supply homes, offices and shops?

Transformer .....

(1 mark)

Areas outside the box will not be scanned for marking

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

In a step-down transformer, the potential difference (p.d.) across the

primary coil is

less than
the same as
more than

the p.d. across the secondary coil.

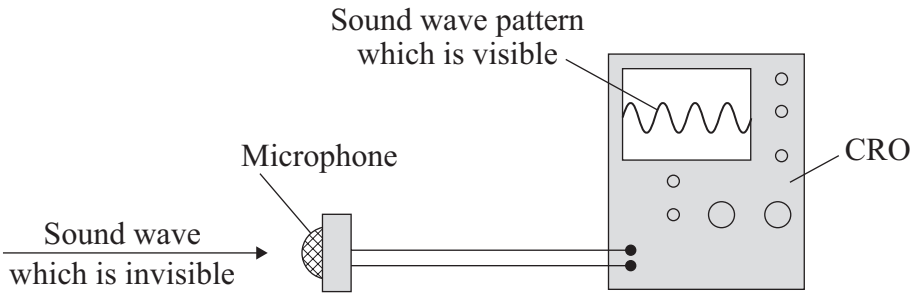
(1 mark)

4

Turn over for the next question

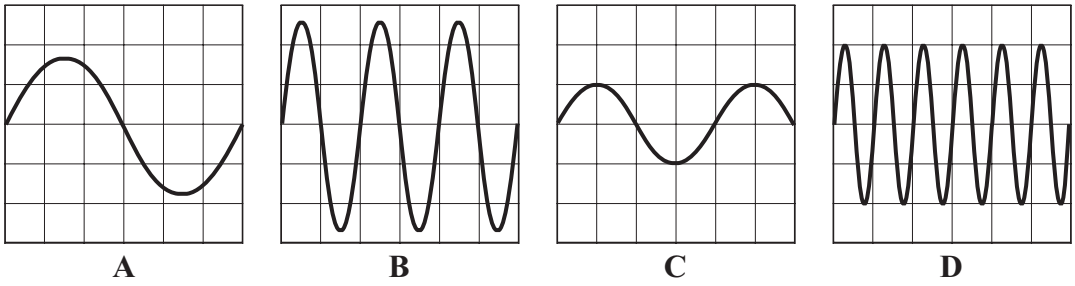
Areas outside the box will not be scanned for marking

2 A microphone and a cathode ray oscilloscope (CRO) can be used to show the pattern of a sound wave.



Four sound wave patterns, **A**, **B**, **C** and **D**, are shown.

They are all drawn to the same scale.



2 (a) Which **one** of the patterns has the smallest amplitude? .....

2 (b) Which **one** of the patterns has the lowest frequency? .....

(2 marks)

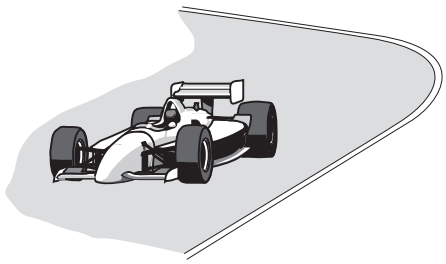
2

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

Areas outside the box will not be scanned for marking

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



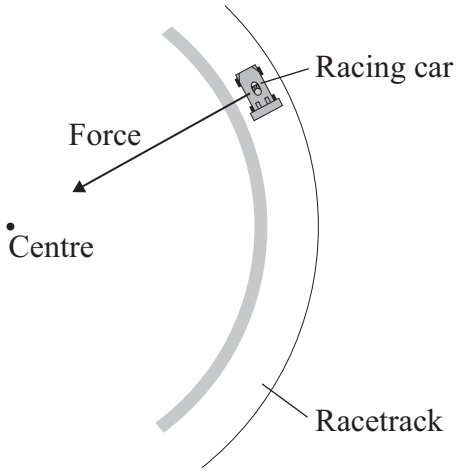
A racing car can accelerate by changing

its direction only
its speed only
either its direction or its speed

.

(1 mark)

3 (b) A racing car moves round a circular part of a racetrack.



A force acts on the racing car. The force is towards the centre of the circular part of the racetrack.

Areas outside the box will not be scanned for marking

Complete the following sentences by drawing a ring around the correct line in each of the boxes.

3 (b) (i) The force is caused by

electrostatics
friction
gravity

.

(1 mark)

3 (b) (ii) The force is a

centripetal force
circular force
perpendicular force

.

(1 mark)

3 (b) (iii) If another racing car has a greater mass and travels at the same speed around the same racetrack, then the force will need to

decrease
stay the same
increase

.

(1 mark)

3 (b) (iv) When the racing car goes faster, the force will need to

decrease
stay the same
increase

.

(1 mark)

Question 3 continues on the next page

Areas outside the box will not be scanned for marking

3 (c) This is an item from a newspaper.

No to racetrack plan

At last night's meeting, one local resident said, "The racetrack will be noisy but motor racing leads to safety improvements in all our cars."

"We'll need better brakes. Motor racing encourages speeding and leads to more accidents", said another.

Most of the residents were against the plan to build a racetrack.

Do you agree with most of the residents?

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

Yes ☐ No ☐ Not sure ☐

.....

.....

.....

.....

(2 marks)

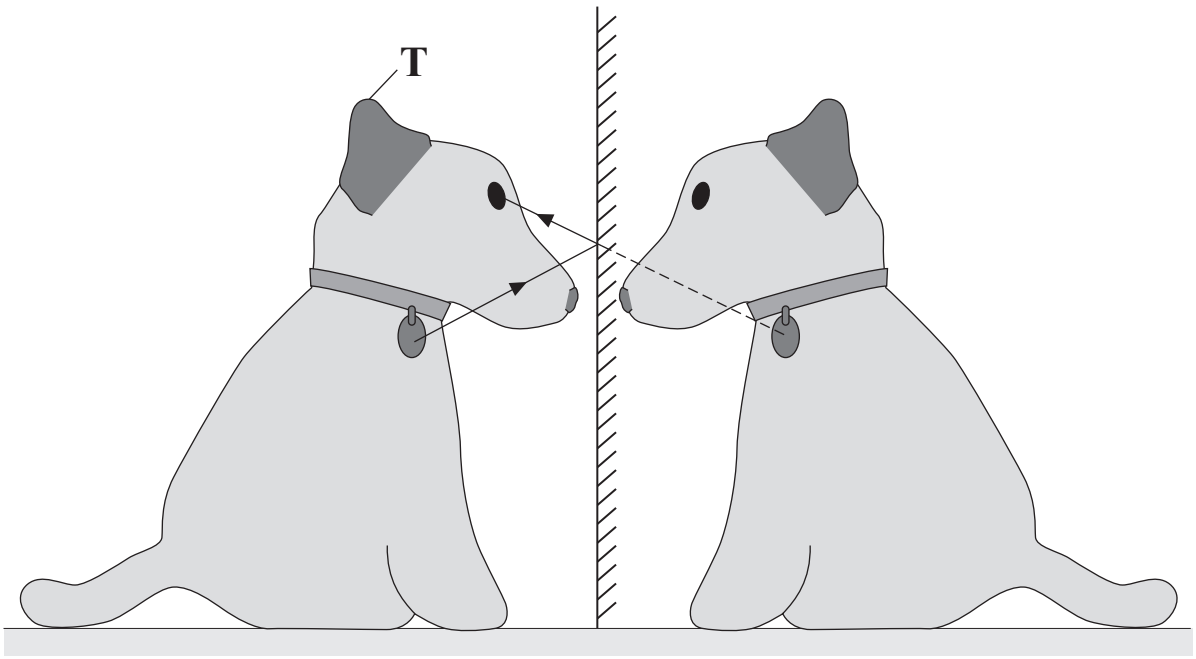
7

Turn over for the next question

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4 A puppy can see an image of himself in a plane mirror.



The diagram shows how the puppy can see his disc.

4 (a) On the diagram, use a ruler to draw a ray to show how the puppy can see the top of his ear, which is marked as **T**. *(3 marks)*

4 (b) What is a plane mirror?

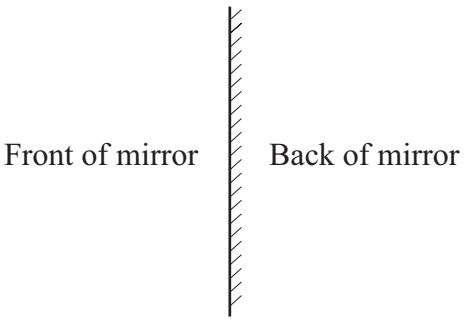
.....

.....

(1 mark)

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4 (c) In the puppy diagram, a plane mirror is shown as follows.



Name the type of mirror shown in each of the following diagrams.

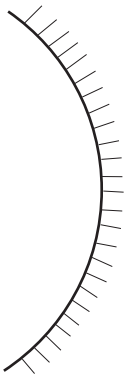
4 (c) (i)



This is a ..... mirror.

(1 mark)

4 (c) (ii)



This is a ..... mirror.

(1 mark)

6

Turn over ▶

Areas outside the box will not be scanned for marking

5 (a) Choose the best words from the box to complete the following sentences.

billions	**fission**	**friction**	**fusion**	**gases**
gravity	**liquids**	**millions**	**thousands**	

5 (a) (i) Stars form when enough dust and ..... from space are pulled together by ..... .

(2 marks)

5 (a) (ii) Stars are able to give out energy for millions of years by the process of

..... .

(1 mark)

5 (a) (iii) The Sun is one of many ..... of stars in our galaxy.

(1 mark)

5 (b) What is the name of our galaxy?

.....

(1 mark)

5

Areas outside the box will not be scanned for marking

6 Many electrical appliances use the circular motion produced by their electric motor.

6 (a) Put ticks (✓) in the boxes next to **all** the appliances in the list which have an electric motor.

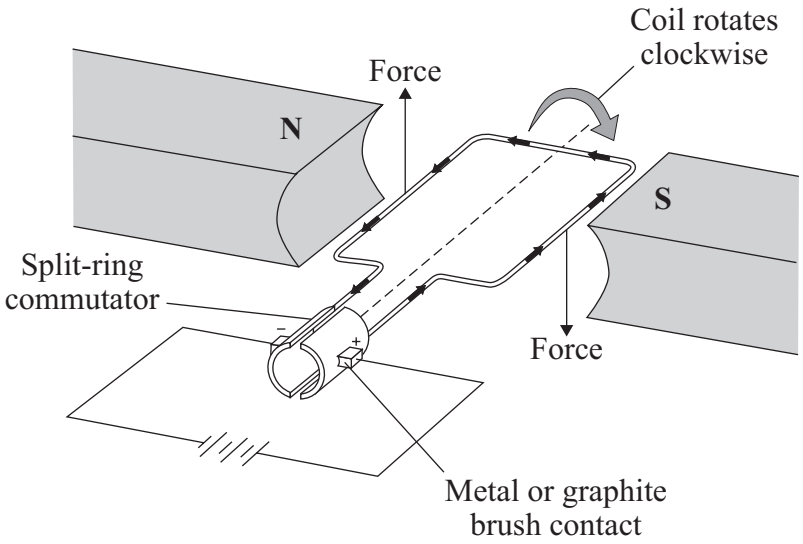
electric drill	☐
electric fan	☐
electric food mixer	☐
electric iron	☐
electric kettle	☐
electric screwdriver	☐

(2 marks)

Question 6 continues on the next page

Areas outside the box will not be scanned for marking

6 (b) One simple design of an electric motor is shown in the diagram. It has a coil which spins between the ends of a magnet.



6 (b) (i) Give **two** ways of reversing the direction of the forces on the coil in the electric motor.

1 .....

.....

2 .....

.....

(2 marks)

6 (b) (ii) Give **two** ways of increasing the forces on the coil in the electric motor.

1 .....

.....

2 .....

.....

(2 marks)

6

Turn over for the next question

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Areas outside the box will not be scanned for marking

7 (a) This information is from a science magazine.

> Electronic systems can be used to produce ultrasonic waves.
> These waves have a frequency higher than the upper limit for hearing in humans.

Complete the sentence by choosing the correct number from the box.

20	**2000**	**20 000**	**200 000**

The upper limit for hearing in humans is a frequency of ..... Hz.

(1 mark)

7 (b) An electronic system produces ultrasound with a frequency of 500 kHz.

What does the symbol kHz stand for?

.....

(1 mark)

7 (c) (i) State **one** industrial use for ultrasound.

.....

(1 mark)

7 (c) (ii) State **one** medical use for ultrasound.

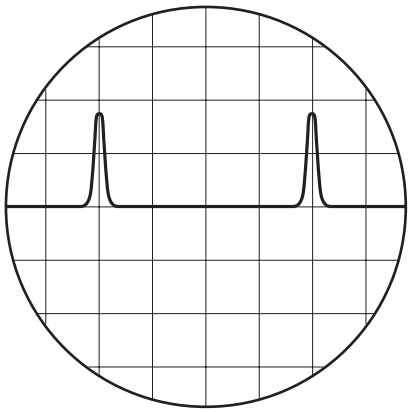
.....

(1 mark)

Areas outside the box will not be scanned for marking

7 (d) An ultrasound detector is connected to an oscilloscope.

The diagram shows centimetre squares on an oscilloscope screen.
Each horizontal division represents 2 microseconds.



Calculate the time, in microseconds, between one peak of one ultrasound pulse and the peak of the next.

.....

Time = ... microseconds
(1 mark)

7 (e) Ultrasounds are partially reflected when they reach a boundary between two different media.
The time taken for the reflection from the boundary to reach the detector can be seen from the screen.

What can be calculated from this time interval?

.....

.....
(2 marks)

7 (f) Explain what action scientists should take if they find evidence that ultrasonic waves may be harmful to human health.

.....

.....

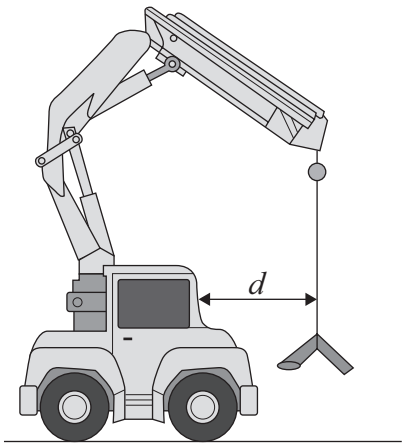
.....
(2 marks)

9

Turn over ▶

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8 The diagram shows a small mobile crane. It is used on a building site.



The distance, *d*, is measured to the front of the cab.

The table shows information from the crane driver's handbook.

Load in kilonewtons (kN)	**Maximum safe distance, *d*, in metres (m)**
10	6.0
15	4.0
24	2.5
40	1.5
60	1.0

8 (a) What is the relationship between the load and the maximum safe distance?

.....

.....

.....

(2 marks)

Areas outside the box will not be scanned for marking

8 (b) The crane driver studies the handbook and comes to the conclusion that a load of 30 kN would be safe at a distance, *d*, of 2.0 metres.

Is the driver correct?

Explain your answer.

.....

.....

.....

.....

(2 marks)

8 (c) What is the danger if the driver does not follow the safety instructions?

.....

.....

(1 mark)

8 (d) How should the data in the table have been obtained?

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

average results from an opinion poll of mobile crane drivers ☐

copied from a handbook for a similar crane ☐

results of experiments on a model mobile crane ☐

results of experiments on this mobile crane ☐

(1 mark)

6

END OF QUESTIONS

There are no questions printed on this page

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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Physics 4451

PHY3F Unit Physics 3

Mark Scheme

2009 examination – January series

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PHY3F

Question 1

question	answers	extra information	mark
1(a)	grid	accept any unambiguous indication	1
1(b)(i)	A (only)		1
1(b)(ii)	D (only)		1
1(c)	more than	accept any unambiguous indication	1
Total			**4**

Question 2

question	answers	extra information	mark
2(a)	C (only)		1
2(b)	A (only)		1
Total			**2**

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PHY3F

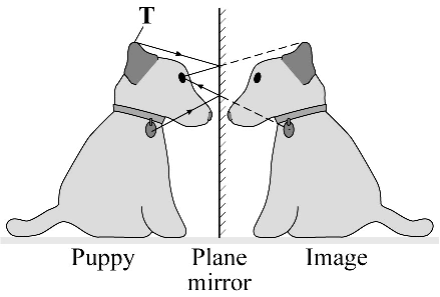
Question 3

question	answers	extra information	mark
3(a)	either its direction or its speed		1
3(b)(i)	friction		1
3(b)(ii)	centripetal		1
3(b)(iii)	increase		1
3(b)(iv)	increase		1
3(c)	examples (yes) noisy (1) disturbs people living nearby (1) (yes) encourages people to drive fast (1) which makes (road) accidents more serious/likely (1) (no) leads to improvements in safety features (1) such as better brakes (1) (don't know) noisy (1) but new tyres have a better grip (1)	whichever box has been ticked, the mark(s) is/are for an appropriate response note, accept responses which assume that the public may use the racetrack	2
Total			**7**

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PHY3F

Question 4

question	answers	extra information	mark
4(a)	reflection at the mirror of ray from tip of real puppy's ear to real puppy's eye (1) accurate (1) arrow to show correct direction (1)	may be drawn freehand ruler must have been used and the reflected ray is an extension of the straight line from point virtual ear however the virtual part of the line need not be shown only one arrow needs to be shown but there must be no contradiction example of (3) mark response  	3
4(b)	flat	accept 'it's not curved/bent' accept 'it's straight'	1

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PHY3F

Question 4 continued

question	answers	extra information	mark
4(c)(i) & (ii)	convex (1) concave (1)	if correct names but order reversed (1)	2
Total			**6**

Question 5

question	answers	extra information	mark
5(a)(i)	gases (1) gravity (1)	correct order essential for credit	2
5(a)(ii)	fusion		1
5(a)(iii)	billions		1
5(b)	Milky Way	u.c. initials not essential	1
Total			**5**

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PHY3F

Question 6

question	answers	extra information	mark
6(a)	electric drill, electric fan, electric food mixer and electric screwdriver	all four ticked and no others (2) **either** all four of these ticked and only one other (1) **or** any three of these ticked and none/one/two of the others (1)	2
6(b)(i)	reverse (the direction of the) current (1) reverse (the direction of the) magnetic field (1)	**or** reverse the connections (to the battery) **or** reverse the (magnetic) poles /ends do **not** credit 'swap the magnets (around)'	2

Question 6 continues on the next page

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PHY3F

Question 6 continued

6(b)(ii)	any **two** from: • increase the strength of the magnet(s)/ (magnetic) field • increase the current • reduce the gap (between coil/armature and poles/ magnets) • increase the turns (on the coil/armature)	 do **not** credit 'use a bigger magnet' allow 'increase the voltage/p.d.' allow add cells/batteries allow increase the (electrical) energy allow increase the power supply allow 'decrease the resistance' allow 'increase charge' allow ' increase the electricity' do **not** credit 'use a bigger battery' allow increase the (number of) coils do **not** credit 'use a bigger coil'	2
Total			**6**

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PHY3F

Question 7

question	answers	extra information	mark
7(a)	20 000	accept any unambiguous indication	1
7(b)	kilohertz	credit misspellings credit '1000 hertz' or '1000 Hz' accept 1000 oscillations/beats/waves per second	1
7(c)(i)	cleaning (e.g. something delicate such as a watch)	**or** quality control/flaw detection credit any appropriate extra Specification response e.g. sonar	1
7(c)(ii)	pre-natal (scanning)	do **not** credit just 'scanning'/medical scanning/ scanning a baby credit any appropriate extra Specification response e.g. destruction of (kidney) stones or cleaning teeth	1
7(d)	8 (μs)		1
7(e)	distance (1) between the boundary and the detector (1)	accept 'between the boundary and the source' accept any correct use of speed = distance/time	2

Question 7 continues on the next page

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Question 7 continued

question	answers	extra information	mark
7(f)	examples publish/tell doctors/the public (1) ... their evidence/results/ research/data (1) carry out more research/ tests (1) ... to make sure/check reliability (1)	allow a wide variety of appropriate responses valid point (1) appropriate example/ qualification/expansion/etc. (1) allow just 'stop using them/ultrasonic waves' (1) allow using them (only) for industrial purposes (1)	2
Total			**9**

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PHY3F

Question 8

question	answers	extra information	mark
8(a)	any **two** from: • inversely proportional • as the load gets bigger the (maximum safe) distance gets less • load × distance = 60 (kNm)	allow 'as the mass increases the distance decreases' accept an unspecified response e.g. 'big load at a short distance' for (1)	2
8(b)	yes, because 30 × 2 = 60 (2)	accept for (1) a correct but insufficiently explained response e.g. 'yes because it's safe' accept for (2) a correct response which is sufficiently explained e.g. 'yes, because 60 (kNm) at 1 metre is safe and 30 (kNm) is half the load at twice the distance do **not** accept 'no' and do not accept just 'yes' do **not** accept 'yes, because 30 is between 24 and 40 and 2 is between 2.5 and 1.5' do **not** accept 'the crane/ cable may break' or other dangers	2
8(c)	the crane may/will topple over/fall over/forward		1
8(d)	results of experiments on this mobile crane	accept any unambiguous indication	1
Total			**6**

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