Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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

AQA

General Certificate of Secondary Education
Higher Tier
January 2012

Physics

PHY3H

H

Unit Physics P3

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

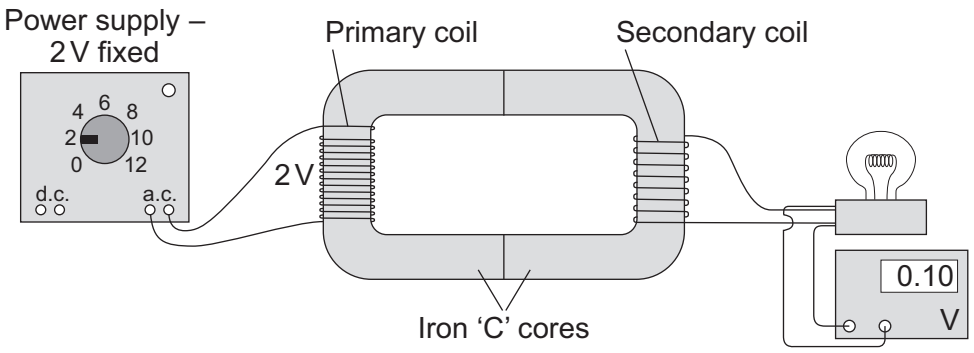
Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work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

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

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



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

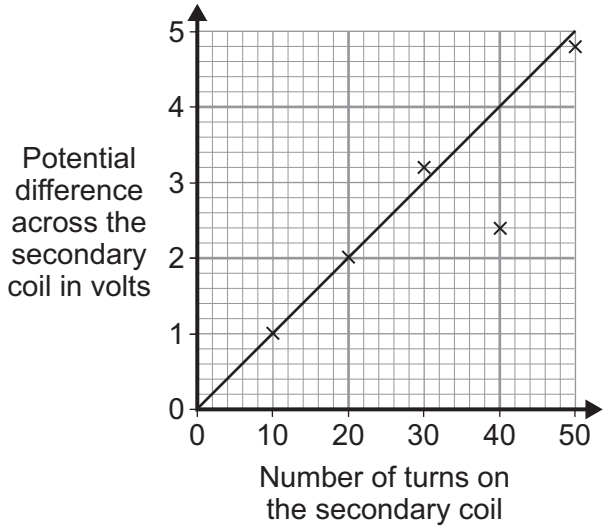
Why?

.....

.....

(1 mark)

1 (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.



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

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

(1 mark)

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

Why?

.....

.....

(1 mark)

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

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Give a reason for your answer.

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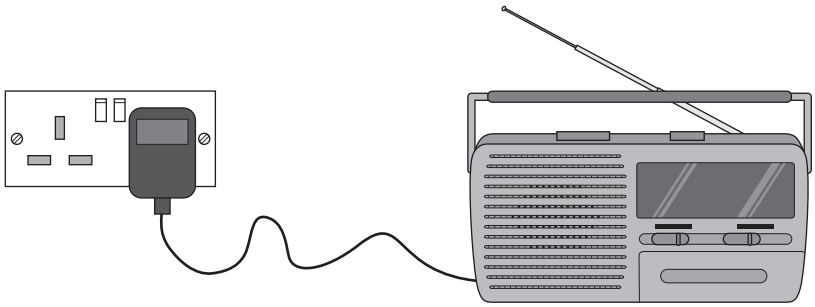
(2 marks)

1 (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?

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(1 mark)

6

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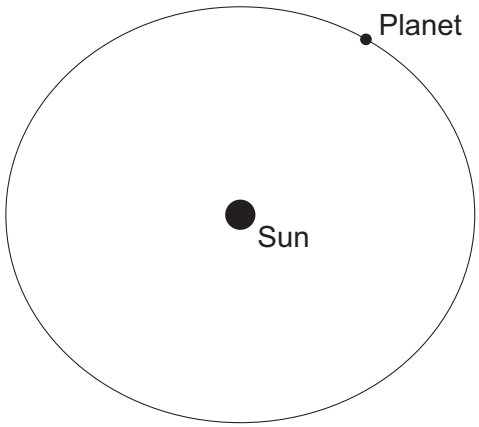
ANSWER IN THE SPACES PROVIDED

2 (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

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

.....

(1 mark)

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

What provides the centripetal force on a planet?

.....

(1 mark)

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

(1 mark)

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

1 .....

.....

2 .....

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(2 marks)

Question 2 continues on the next page

2 (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)

2 (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)

2 (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.

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(2 marks)

2 (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.

.....

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.....

(1 mark)

9

Turn over for the next question

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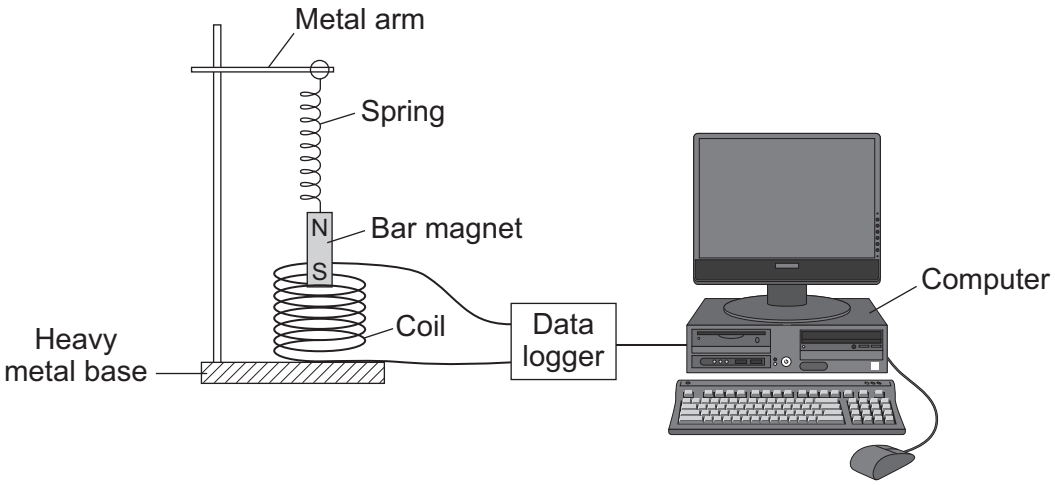
3 The diagram shows an instrument designed to detect earthquakes. An earthquake causes the ground to vibrate up and down. This causes the bar magnet to move up and down relative to the coil.



3 (a) Explain why the ground vibrations cause an electric current to be induced in the coil. The first sentence of the explanation has been done for you.

The vibrations from the ground cause the bar magnet to move up and down relative to the coil.

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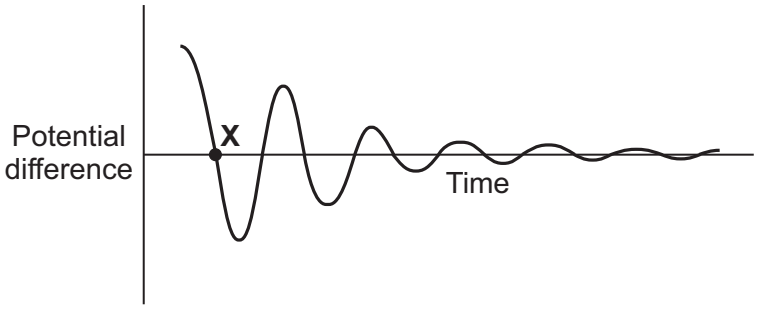
(3 marks)

Question 3 continues on the next page

3 (b) The diagram shows the data recorded by the computer following an earthquake.



Which **one** of these statements describes how the magnet is moving relative to the coil when the reading, recorded by the computer at the point marked **X**, is zero?

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

It is moving upwards through the coil. ☐

It is moving downwards through the coil. ☐

It is not moving. ☐

Give the reason for your answer.

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(2 marks)

3 (c) The instrument is not sensitive enough to detect the smaller vibrations caused by a heavy lorry driving close by.

3 (c) (i) What is meant by the *sensitivity* of an instrument?

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.....

(1 mark)

3 (c) (ii) Suggest **two** changes to the design of the instrument, each of which would make it more sensitive to small vibrations.

1 .....

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2 .....

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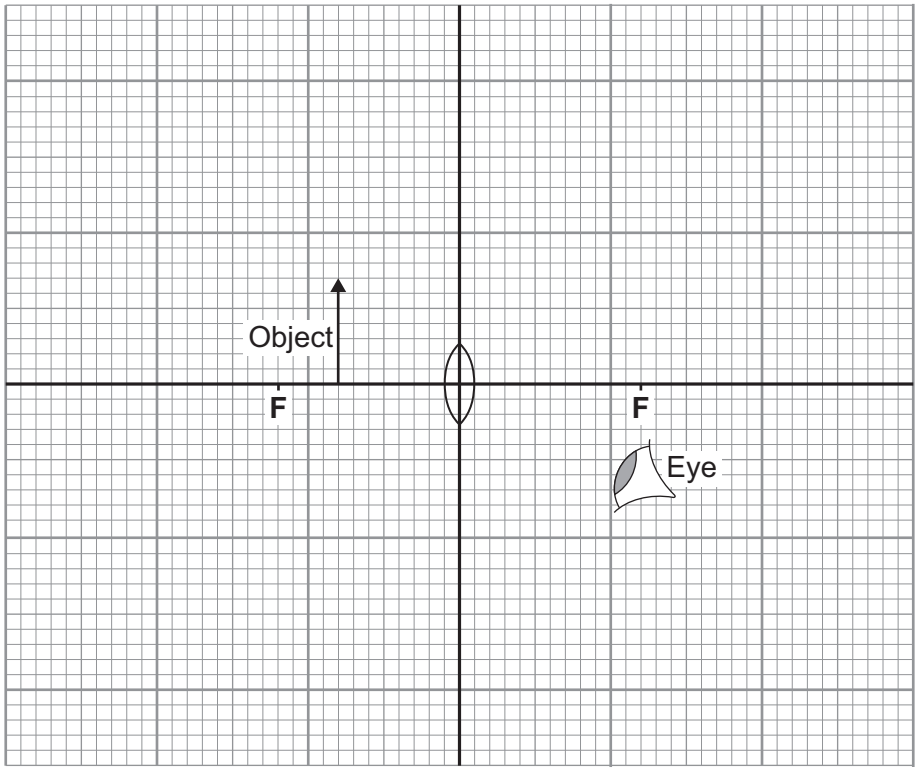
(2 marks)

8

Turn over for the next question

4 (a) The diagram shows a converging lens being used as a magnifying glass.

4 (a) (i) On the diagram, use a ruler to draw two rays from the top of the object which show how and where the image is formed. Represent the image by an arrow drawn at the correct position.



(3 marks)

4 (a) (ii) 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.

.....

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Magnification = ...

(2 marks)

4 (b) A camera also uses a converging lens to form an image.

Describe how the image formed by the lens in a camera is different from the image formed by a lens used as a magnifying glass.

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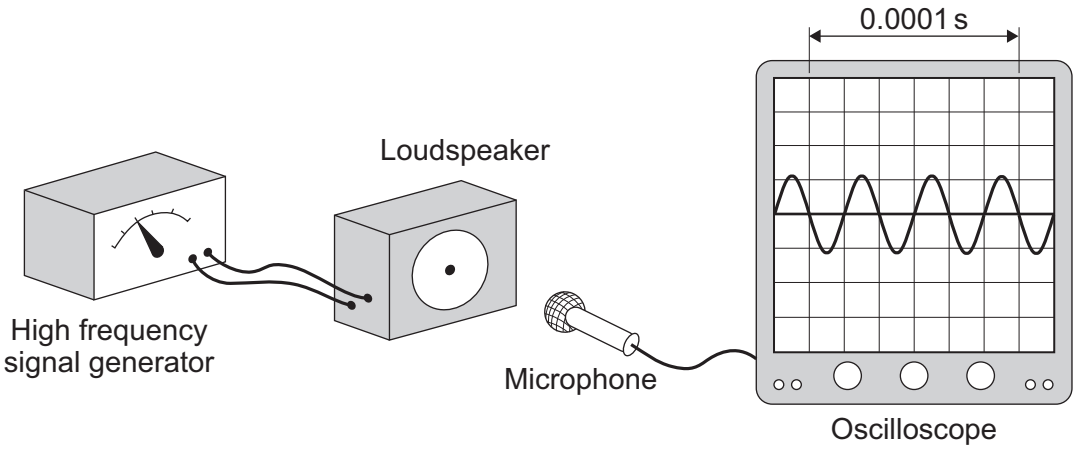
(2 marks)

7

Turn over for the next question

5 (a) The diagram shows a microphone being used to detect the output from a loudspeaker. The oscilloscope trace shows the wave pattern produced by the loudspeaker.



5 (a) (i) How many waves are produced by the loudspeaker in 0.0001 seconds?

.....

(1 mark)

5 (a) (ii) How many waves are produced by the loudspeaker every second? Assume the input to the loudspeaker does not change.

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(1 mark)

5 (a) (iii) A person with normal hearing cannot hear the sound produced by the loudspeaker.

Explain why.

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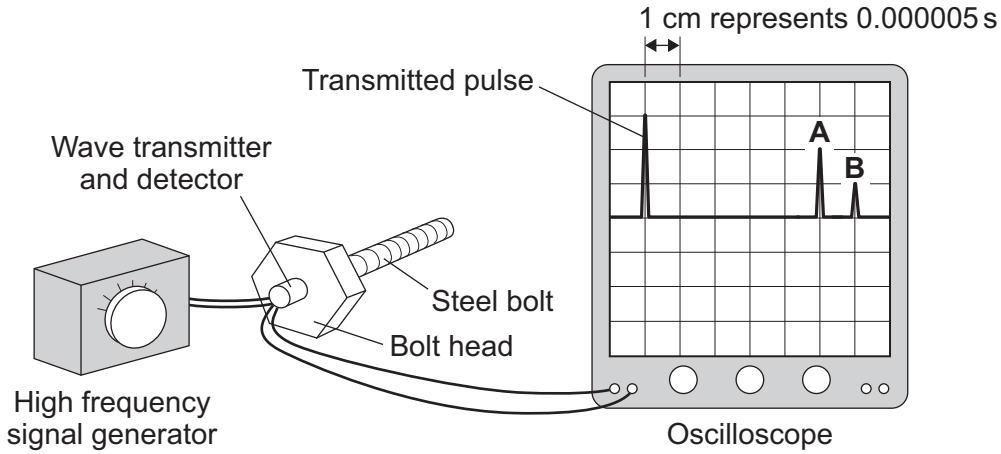
(2 marks)

5 (b) The diagram shows how a very high frequency sound wave can be used to check for internal cracks in a large steel bolt. The oscilloscope trace shows that the bolt does have an internal crack.



5 (b) (i) Explain what happens to produce pulse **A** and pulse **B**.

.....

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(2 marks)

5 (b) (ii) Use the information in the diagram and the equation in the box to calculate the distance from the head of the bolt to the internal crack.

distance = speed × time

Speed of sound through steel = 6000 m/s

Show clearly how you work out your answer.

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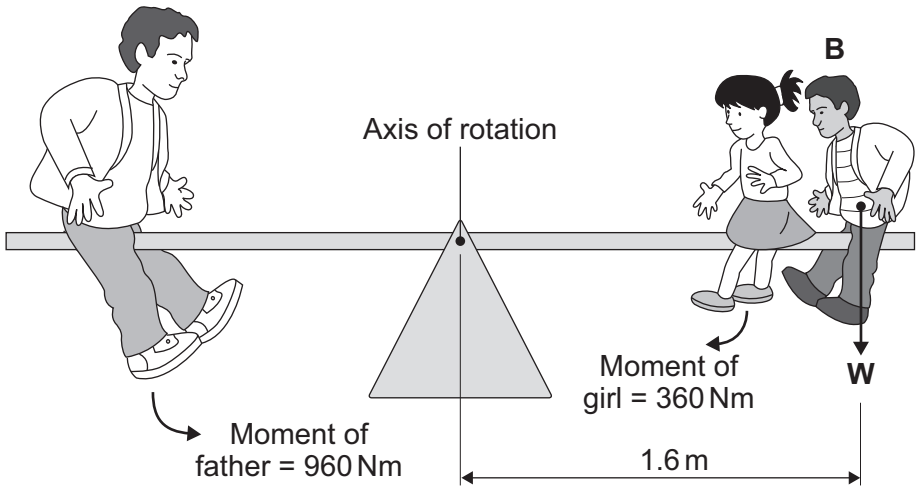
(3 marks)

9

Turn over ▶

6 The diagram shows a father and his two children sitting on a playground see-saw. The see-saw is not moving.



6 (a) What is the total clockwise moment of the two children about the axis of rotation?

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Explain the reason for your answer.

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(3 marks)

6 (b) (i) What is the clockwise moment of the boy, **B**, about the axis of rotation?

.....

Moment = ... Nm

(1 mark)

6 (b) (ii) Use the information in the diagram and the equation in the box to calculate the weight, **W**, of the boy, **B**.

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.

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Weight of boy **B** = ... N

(2 marks)

6

END OF QUESTIONS

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