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

F

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.

There are no questions printed on this page

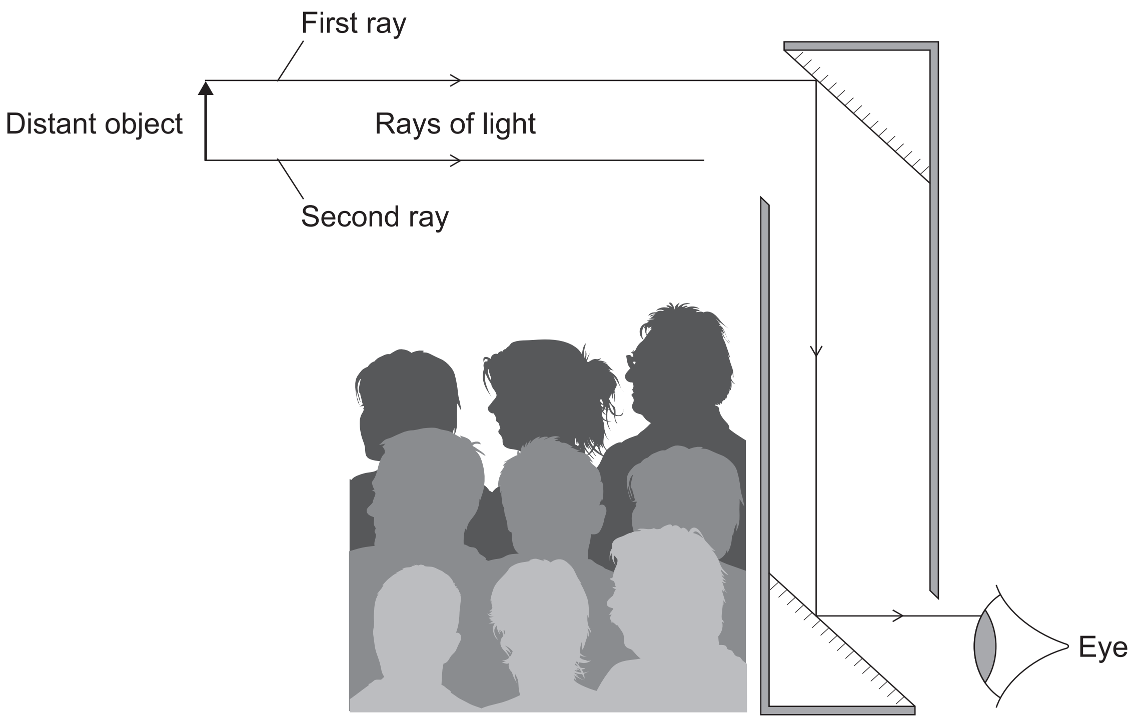
DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

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

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

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

Smallest ....

....

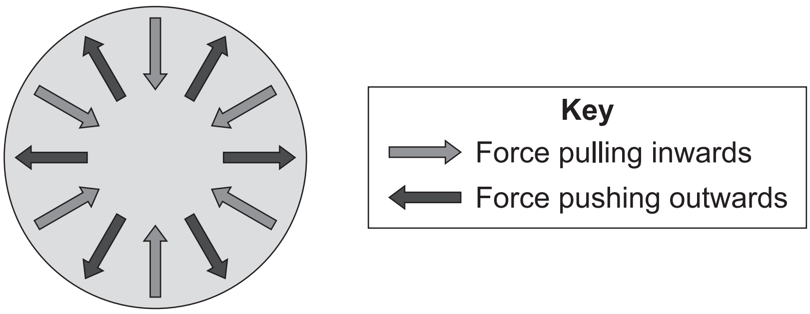
....

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

	smaller than	
are	equal to	the forces pushing outwards.
	bigger than	

(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)

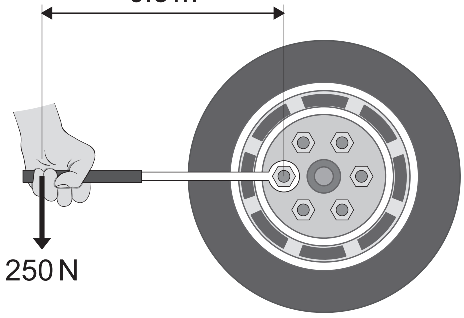
6

Turn over for the next question

Turn over ▶

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?

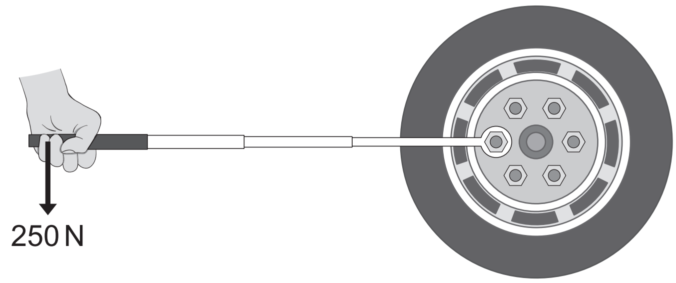
Draw a ring around your answer.

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)

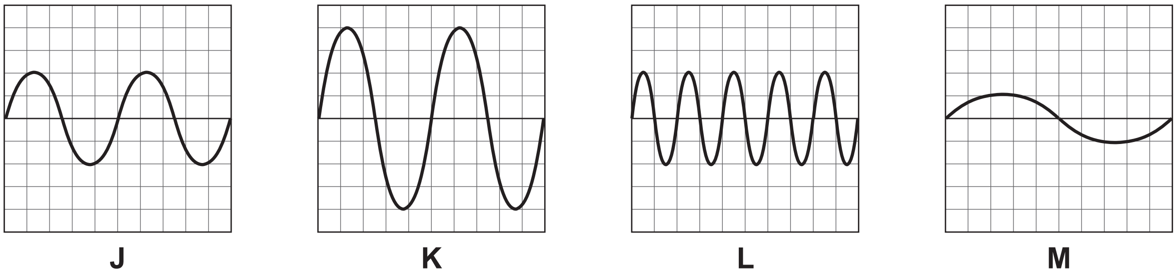
5

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.



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.

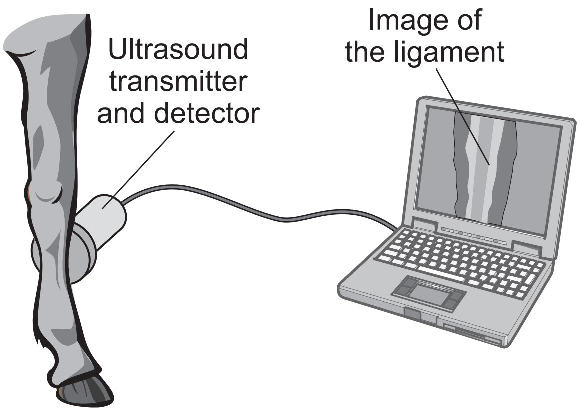
....

....

(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**

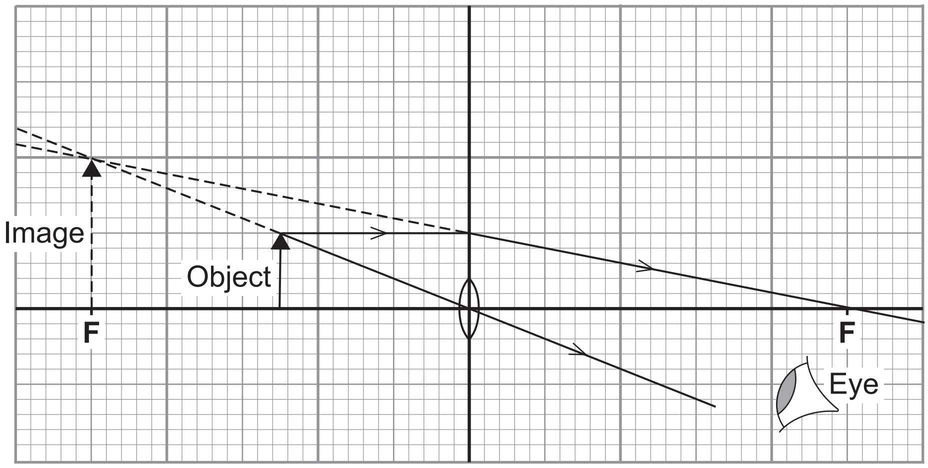
The .... sends pulses of ultrasound into the leg. When the ultrasound meets the ligament, some is reflected back to the .... The reflected pulses are converted by a .... into an image that can be seen on the screen.

(2 marks)

6

Turn over for the next question

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.

....

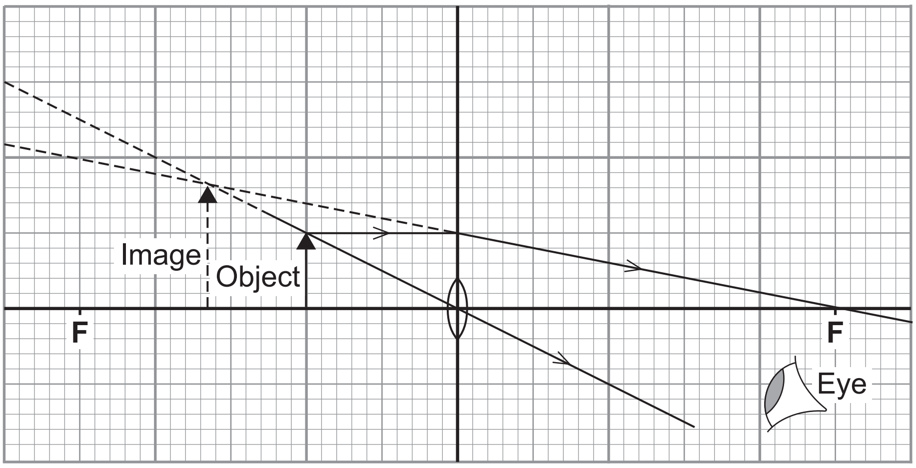
....

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.

increases
does not change
decreases

(1 mark)

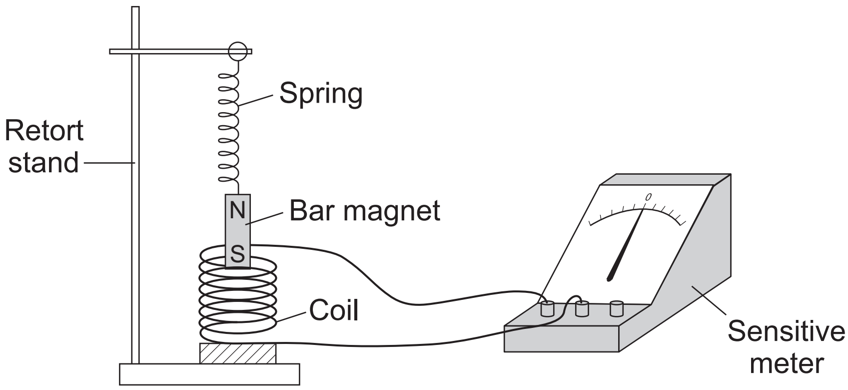
4

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.

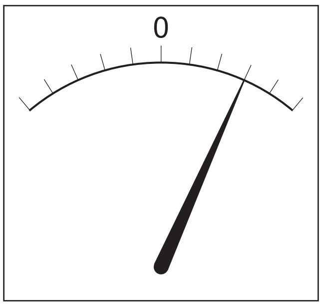
Diagram 1



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)

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.

....

....

....

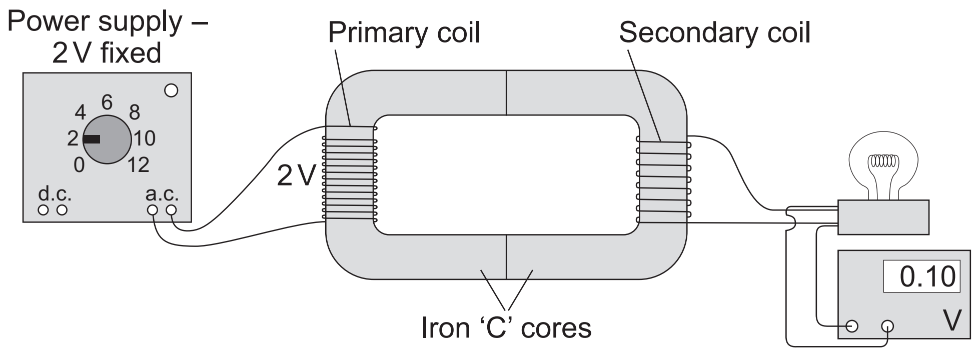
....

(2 marks)

6

Turn over for the next question

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.

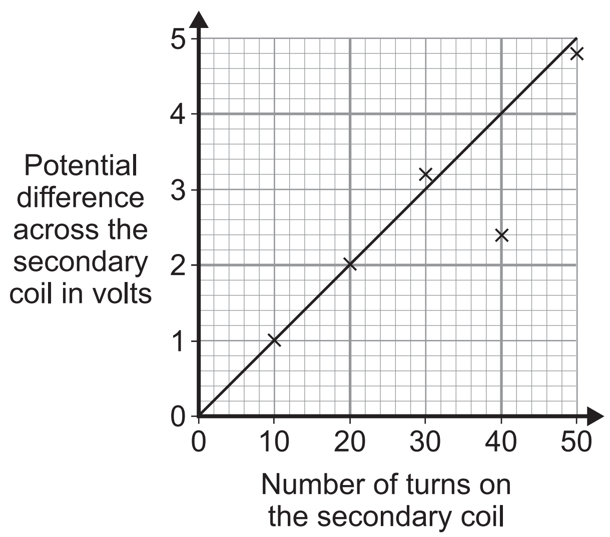
Why?

....

....

(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?

....

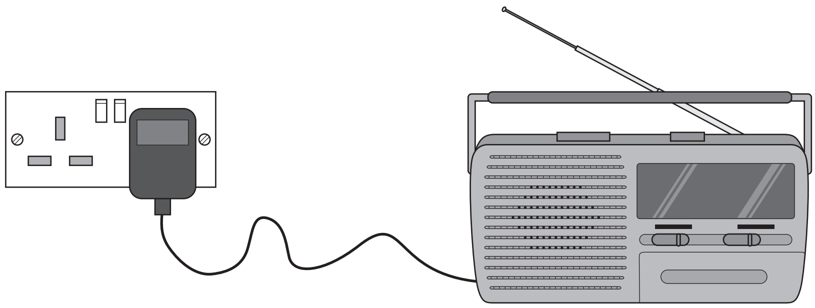
Give a reason for your answer.

....

....

(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

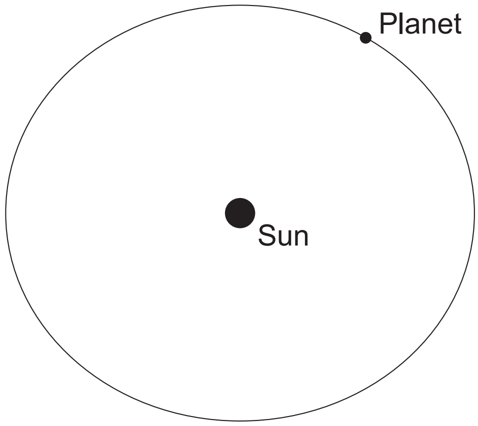
Turn over for the next question

Turn over ▶

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

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

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

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED