

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
Higher Tier
January 2013

Physics
Unit Physics P3

PHY3H
H

Wednesday 30 January 2013 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.



J A N 1 3 P H Y 3 H 0 1

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

1 (a) Explain what ultrasound is.

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.....

(2 marks)

1 (b) Ultrasound is used for pre-natal scanning. This is much safer than using X-rays. However, doctors were only sure ultrasound was safe after experiments on mice.

Do you think the ultrasound experiments on mice were justified?

Explain your answer.

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.....
.....

(2 marks)

1 (c) Explain what scientists should do if they find evidence that ultrasound may be harmful to human health.

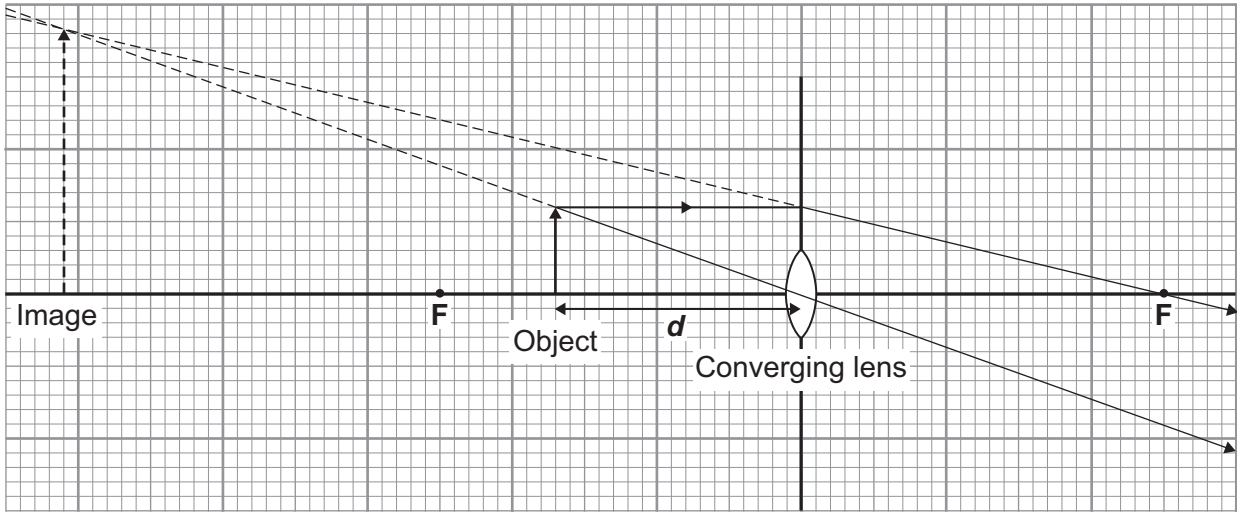
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(2 marks)

6



- 2 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.



- 2 (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)

- 2 (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)

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

.....

.....
(1 mark)

Question 2 continues on the next page

Turn over ►



- 2 (b)** The student now uses a different converging lens. He places the object between the lens and the 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.
His friend's conclusion is wrong.

- 2 (b) (i)** Explain using data from the table why his friend's conclusion is wrong.

.....

.....

.....

.....

(2 marks)

- 2 (b) (ii)** Write a correct conclusion.

.....

.....

(1 mark)



2 (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

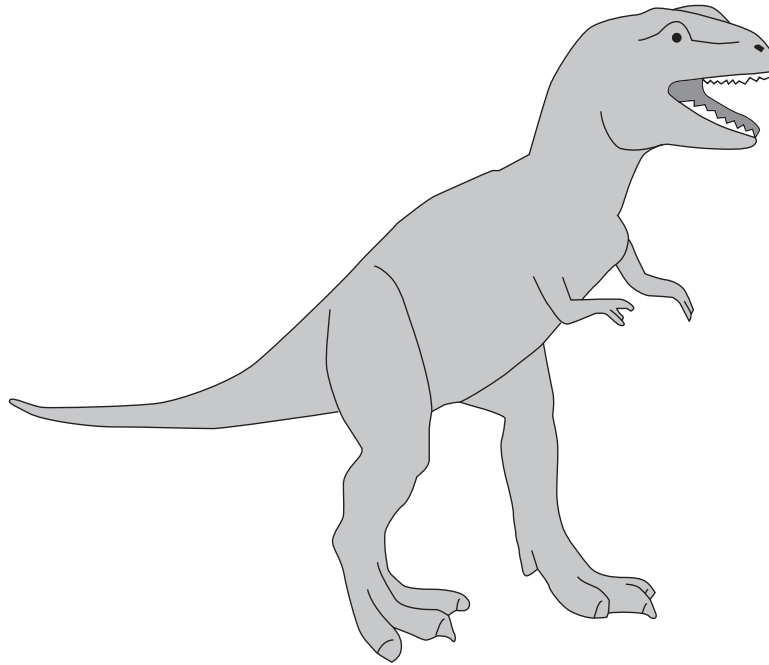
Turn over for the next question

Turn over ►



3 The drawing shows a plastic toy which can stand on its feet.

3 (a) (i) Draw an **X** on the diagram so that the centre of the **X** marks the likely position of the centre of mass of the toy.



(1 mark)

3 (a) (ii) Explain the reason for your choice in part **(a) (i)**.

.....
.....

(1 mark)

3 (b) Suggest **two** ways in which the design of the toy could be altered to make the toy more stable.

1

.....

2

.....

(2 marks)

4



4 Read this statement from a website.

Immediately after the 'big bang', at the start of the Universe, there were only atoms of the element hydrogen (H).

Now there are over one hundred elements. Scientists think that all the elements on Earth are also present throughout the Universe.

4 (a) Explain how atoms of the element (He) are formed in a star.

.....

.....

.....

.....

(2 marks)

4 (b) Explain how atoms of very heavy elements, such as gold (Au), were formed.

.....

.....

.....

.....

(2 marks)

4 (c) Scientists have only examined a tiny fraction of the Universe.

What is the basis for scientists thinking that the elements found on Earth are present throughout the Universe?

.....

.....

(1 mark)

5

Turn over ►



5 (a) In the National Grid, very large step-up transformers link power stations to the transmission cables.

A transformer used for this purpose has 800 turns on its primary coil and 12 800 turns on its secondary coil. The p.d. (potential difference) across its primary coil is 25 kV.

Use the equation in the box to calculate the p.d. across its secondary coil.

$\frac{\text{p.d. across primary}}{\text{p.d. across secondary}} = \frac{\text{number of turns on primary}}{\text{number of turns on secondary}}$

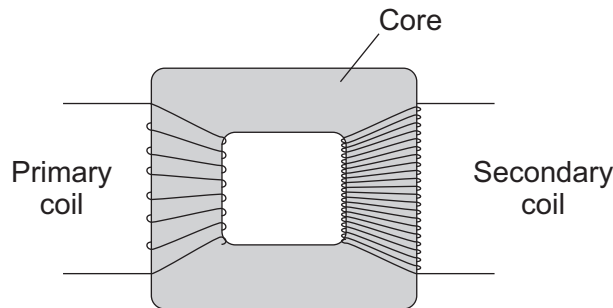
Show clearly how you work out your answer.

.....

.....

p.d. across secondary coil = volts
(2 marks)

5 (b) The diagram shows the structure of a transformer.



5 (b) (i) The primary and secondary coils of a transformer are made of insulated wire.

Why is this insulation necessary?

.....

.....

(1 mark)

5 (b) (ii) Why is the core made of iron?

.....

.....

(1 mark)



5 (b) (iii) Explain how the transformer works.

.....
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.....

(3 marks)

5 (c) Before 1926, large towns had their own local power stations. After 1926, these power stations were connected to form the National Grid.

Give **two** advantages of having a National Grid system.

1

.....

2

.....

(2 marks)

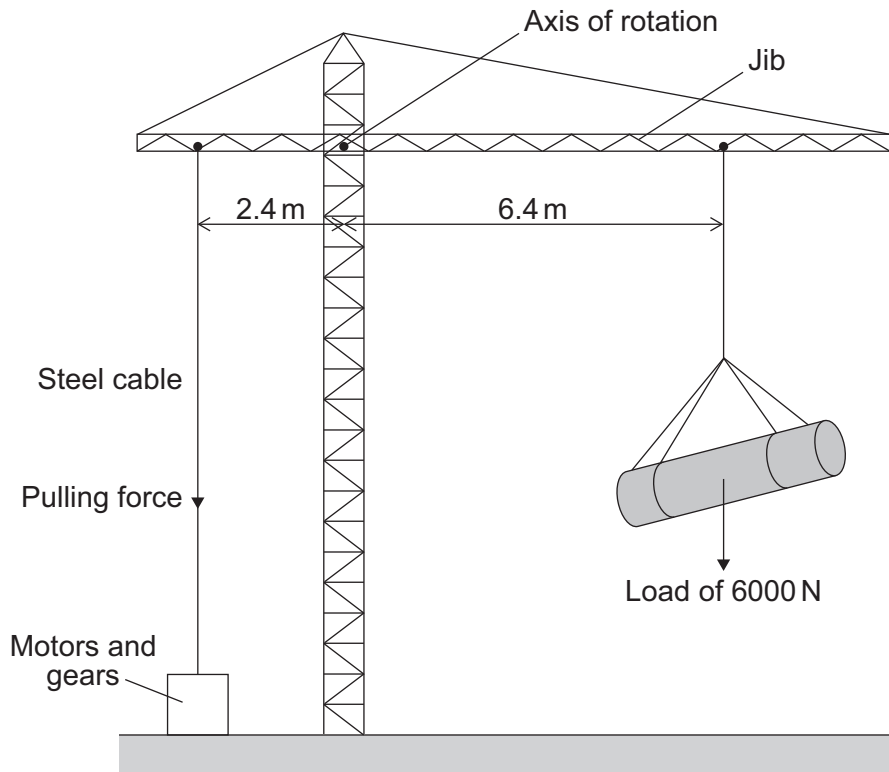
9

Turn over for the next question

Turn over ►



6 The diagram shows a design for a crane. The crane is controlled by a computer.



The purpose of the motors and gears is to change the pulling force in the steel cable. This is done so that the jib stays horizontal whatever the size of the load or the position of the load.

Use the equation in the box to answer questions (a) and (b).

$\text{moment} = \text{force} \times \text{perpendicular distance from the line of action of the force to the axis of rotation}$
--

6 (a) Calculate the moment caused by the load in the position shown in the diagram.

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

.....

.....

Moment = (3 marks)



6 (b) Calculate the pulling force that is needed in the steel cable to keep the jib horizontal.
Show clearly how you work out your answer.

.....
.....

Pulling force = N
(2 marks)

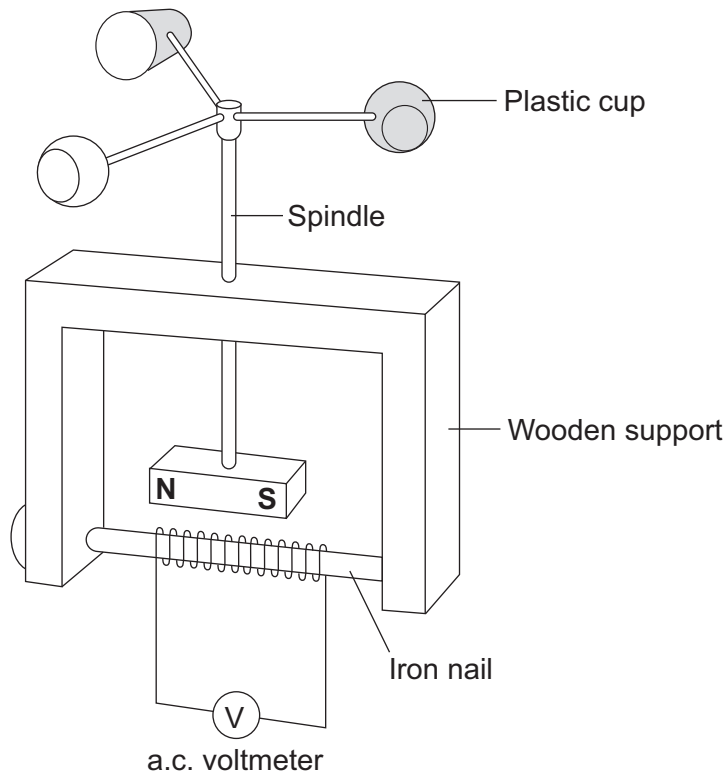
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Turn over for the next question

Turn over ►



7 The diagram shows a student's design for a simple wind speed gauge.



7 (a) Explain why the wind causes the a.c. voltmeter to give a reading. The explanation has been started for you.

The wind causes the plastic cups to turn.

.....

.....

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.....

.....

.....

(3 marks)

7 (b) The gauge is not sensitive enough to measure light winds. Suggest **one** way that the design can be modified to make the gauge more sensitive.

.....

.....

(1 mark)

4



8 The London Eye is one of the largest observation wheels in the world.



The passengers ride in capsules. Each capsule moves in a circular path and accelerates.

8 (a) Explain how the wheel can move at a steady speed and the capsules accelerate at the same time.

.....
.....
.....

(2 marks)

8 (b) In which direction is the resultant force on each capsule?

.....

(1 mark)

8 (c) The designers of the London Eye had to consider **three** factors which affect the resultant force described in part (b).

Two factors that increase the resultant force are:

- an increase in the speed of rotation
- an increase in the total mass of the wheel, the capsules and the passengers.

Name the other factor that affects the resultant force and state what effect it has on the resultant force.

.....
.....

(1 mark)

END OF QUESTIONS

4



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