

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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



General Certificate of Secondary Education  
Higher Tier  
January 2010

# Physics

# PHY3H

Unit Physics P3

# H

Written Paper

Wednesday 20 January 2010 9.00 am to 9.45 am

**For this paper you must have:**

- a ruler.

You may use a calculator.

### Time allowed

- 45 minutes

### Instructions

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

### Information

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

### Advice

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



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

G/K46769 6/6/6/6

# PHY3H

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

- 1 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

- 1 (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)

- 1 (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)



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

.....  
(1 mark)

- 1 (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)

- 1 (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)

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

<b>circular</b>	<b>direction</b>	<b>friction</b>	<b>gravitational</b>	<b>speed</b>	<b>universal</b>
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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)

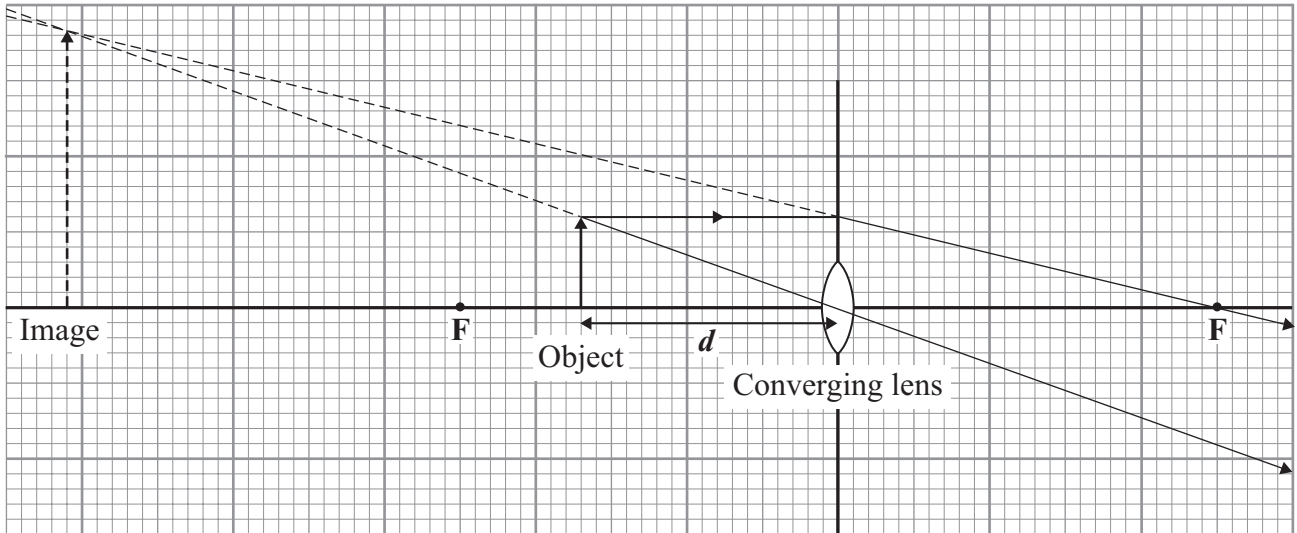
7
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Turn over ►



- 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 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.

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

.....

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.....

.....

(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
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**Turn over for the next question**

**Turn over ►**



3 (a) Explain what an ultrasound wave is.

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(2 marks)

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

One method is to put the jewellery in a bath of cleaning fluid which contains an electronic oscillator. The electronic oscillator generates ultrasound waves in the cleaning fluid.

Suggest how these waves clean the jewellery.

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.....  
.....

(2 marks)

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

Explain whether or not you think that these experiments were justified.

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.....  
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(2 marks)

6





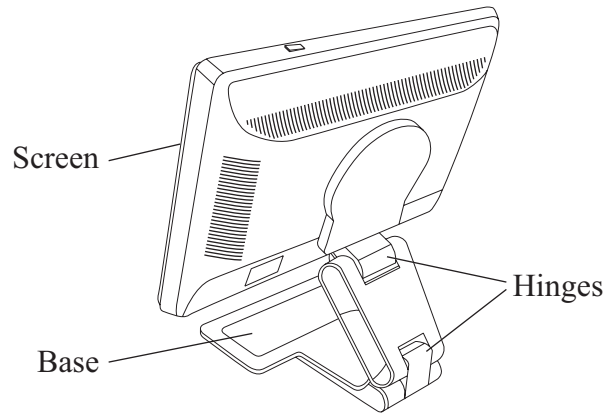
**Turn over for the next question**

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**

**Turn over ▶**



4 The diagram shows a back view of a computer monitor.



4 (a) In normal use, the monitor is *stable*.

4 (a) (i) Explain the meaning, in the above sentence, of the word *stable*.

.....

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(2 marks)

4 (a) (ii) State the relationship between the total clockwise moment and the total anticlockwise moment about any axis of the monitor when it is stable.

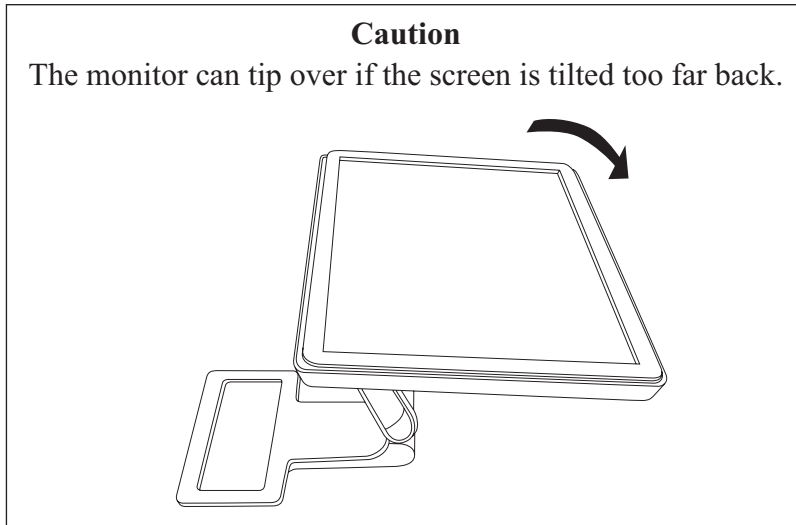
.....

.....

(1 mark)



- 4 (b) The instruction booklet explains that the screen can be tilted. It also includes a warning.



Explain why the monitor will tip over if the screen is tilted too far back.

Include the words *centre of mass*, *weight* and *moment* in your explanation.

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(3 marks)

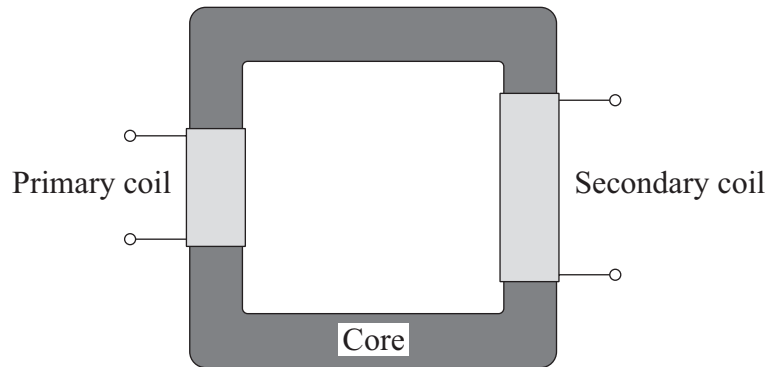
6

**Turn over for the next question**

**Turn over ►**



- 5 (a) The diagram shows the basic structure of a step-up transformer.



- 5 (a) (i) What is the core made of?

.....  
(1 mark)

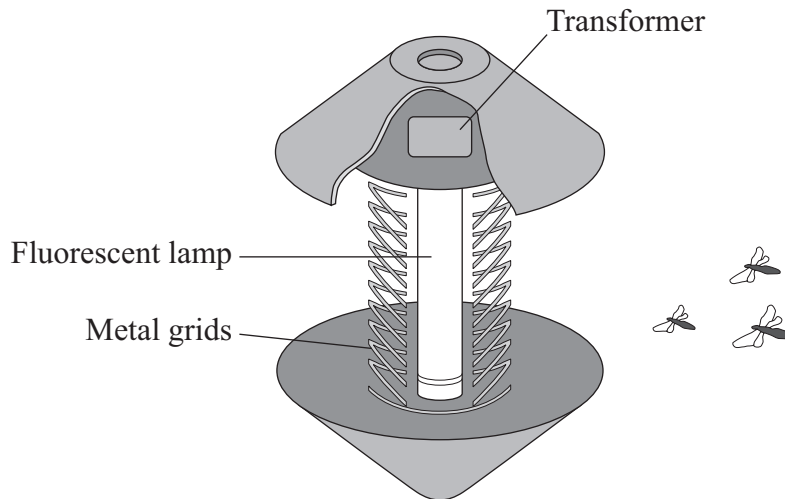
- 5 (a) (ii) Explain how an alternating input produces an alternating output.

.....  
.....  
.....  
.....  
.....  
.....  
.....  
(3 marks)



- 5 (b) Fly killers are used in kitchens and food stores because flying insects carry diseases which cause food poisoning.

The diagram shows the inside of one design. Insects are attracted to a fluorescent lamp. The metal grids have a high potential difference (p.d.) between them. The insects are killed as they fly between the grids.



A transformer is used in the fly killer. There is a p.d. of 230 V across the primary coil. There are 300 turns of wire on the primary coil and 4000 turns on the secondary coil.

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

$\frac{\text{p.d. across primary}}{\text{p.d. across secondary}} = \frac{\text{number of turns on primary}}{\text{number of turns on secondary}}$
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Show clearly how you work out your answer.

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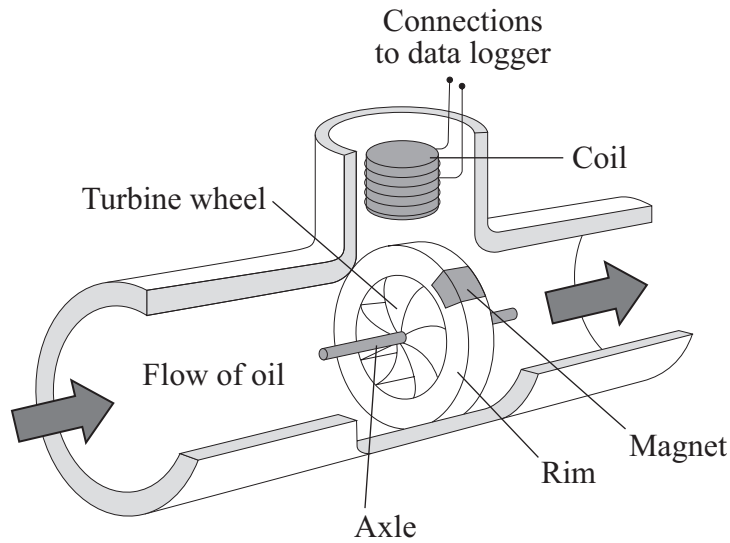
Potential difference = ..... V  
(3 marks)

7
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Turn over ▶



- 6 The diagram shows the inside of an oil pipeline and a student's design for a meter to measure the flow of oil.



As oil flows through the pipeline, the oil rotates a turbine wheel. Above the turbine wheel is a coil of wire connected to a data logger. There is a magnet in the rim of the turbine wheel. The turbine wheel spins and this induces a varying potential difference (p.d.) across the ends of the coil. This varying p.d. is recorded by the data logger.

- 6 (a) Complete the sentence by writing in the space.

The faster the oil flows through the pipeline, the .....  
the maximum p.d. across the coil.

(1 mark)

- 6 (b) Explain why a varying p.d. is induced across the coil even when the rate of flow of oil remains constant.

.....

.....

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.....

(3 marks)



6 (c) Suggest **two** changes to the design of the meter which would increase the maximum p.d. across the coil for the same flow of oil.

Change 1 .....

.....

Change 2 .....

.....

(2 marks)

<b>6</b>

**Turn over for the next question**

**Turn over ▶**



7 (a) Our star, the Sun, is stable.

Explain what the conditions need to be for a star to remain stable.

.....

.....

.....

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(2 marks)

7 (b) Shortly after the ‘big bang’, hydrogen was the only element in the Universe.

Explain how the other elements came to be formed.

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(3 marks)

5

**END OF QUESTIONS**

