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
June 2015

Further Additional Science

Unit 3 Physics P3

FAS3HP

H

Wednesday 20 May 2015 1.30 pm to 2.30 pm

For this paper you must have:
- a ruler
- a calculator
- the Physics Equations Sheet (enclosed).

Time allowed
- 1 hour

A

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 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 3(b) should be answered in continuous prose.
  In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

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

There are no questions printed on this page

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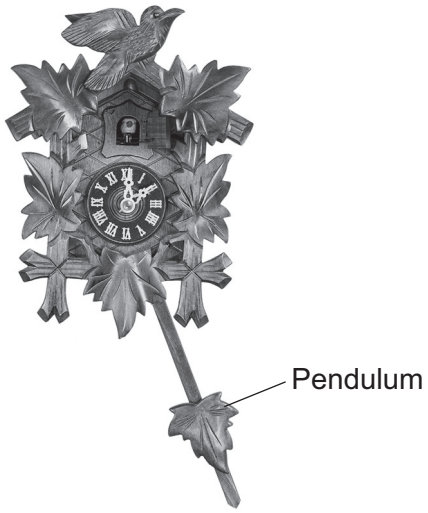
ANSWER IN THE SPACES PROVIDED

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

1 The clock shown in **Figure 1** uses a pendulum to keep time.

Figure 1



1 (a) The pendulum has a frequency of 0.80 Hz.

Calculate the periodic time of the pendulum.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

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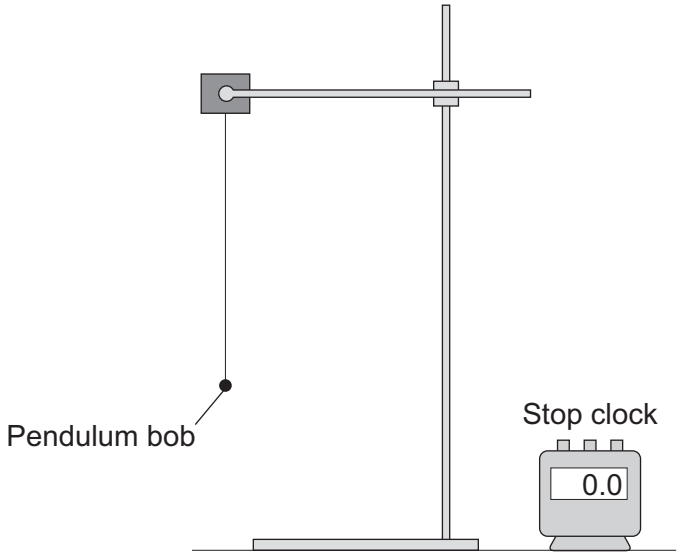
Periodic time = ... seconds

Question 1 continues on the next page

1 (b) A student investigated the factors affecting the oscillation of a pendulum. The student set up a pendulum as shown in **Figure 2**.

Figure 2



The student investigated how many complete oscillations the pendulum made for different lengths of the pendulum and different masses of the pendulum bob.

The results are shown in **Table 1**.

Table 1

Length of the pendulum in millimetres	Mass of the pendulum bob in grams	Number of complete oscillations made by the pendulum in 20 seconds
200	100	22
200	200	22
400	100	15
400	200	15
600	50	13
600	100	13

1 (b) (i) State **two** conclusions that the student should make from the results shown in **Table 1**.

[2 marks]

1 .....

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2 .....

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1 (b) (ii) The student wants to be more certain that her conclusions are correct.

Suggest **two** ways in which the investigation could be improved.

[2 marks]

1 .....

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2 .....

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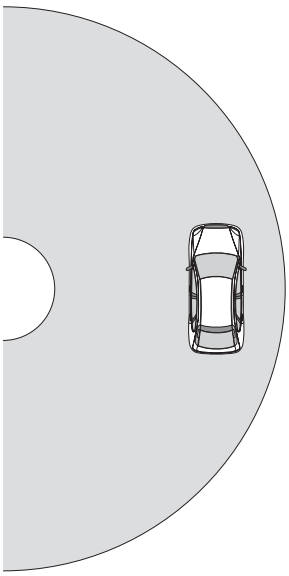
6

Turn over for the next question

2 (a) **Figure 3** shows a car travelling around a bend in the road. The car is travelling at a constant speed.

Figure 3



There is a centripetal force acting on the car.

2 (a) (i) Draw an arrow on **Figure 3** to show the direction of the centripetal force that is acting on the car.

[1 mark]

2 (a) (ii) The centripetal force acting on the car in **Figure 3** causes it to accelerate.

What changes as the car accelerates?

[1 mark]

Tick (✓) **one** box.

Direction ☐

Kinetic energy ☐

Mass ☐

2 (a) (iii) State **two** factors that affect the size of the centripetal force acting on the car.

[2 marks]

1 .....

2 .....

2 (b) **Figure 4** shows a racing car.

Figure 4

The racing car should not roll over when racing.

State **two** features of the car that make it difficult for the car to roll over.

[2 marks]

1 .....

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2 .....

.....

6

Turn over for the next question

3 (a) Complete the following sentences.

[2 marks]

Ultrasound waves have a minimum frequency

of ..... hertz.

The wavelength of an X-ray is about the same as

the diameter of ..... .

3 (b) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Figure 5 shows one medical use of ultrasound and one medical use of X-rays.

Figure 5

Compare the medical uses of ultrasound and X-rays.

Your answer should include the risks, if any, and precautions, if any, associated with the use of ultrasound and X-rays.

[6 marks]

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Extra space .....

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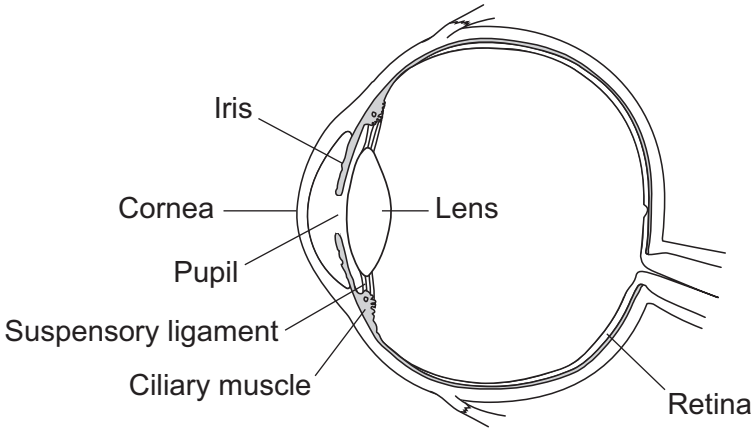
8

Turn over for the next question

4 **Figure 6** shows a diagram of a human eye.

Figure 6



The human eye adapts to focus light so that a clear image is formed on the retina.

4 (a) (i) Describe how the eye adapts to view objects that are far away. Refer to the relevant parts labelled in **Figure 6**.

[3 marks]

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4 (a) (ii) Describe how the eye adapts to view objects in bright light. Refer to the relevant parts labelled in **Figure 6**.

[2 marks]

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4 (b) **Figure 7** shows the view that two students have from the back of a classroom.

Figure 7

4 (b) (i) One of the students is able to see the whiteboard clearly from the back of the classroom.

In the student's eye, the distance between the retina and the cornea is 20 mm.

Calculate the power of the student's eye.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

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Power of the student's eye = ... dioptres

Question 4 continues on the next page

4 (b) (ii) The second student is short-sighted and cannot see the whiteboard clearly without wearing glasses.

The student's eye is unable to focus clearly without the help of the glasses.

Explain why.

[2 marks]

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4 (b) (iii) What conclusion can be made about the lenses in the glasses that the second student wears?

[1 mark]

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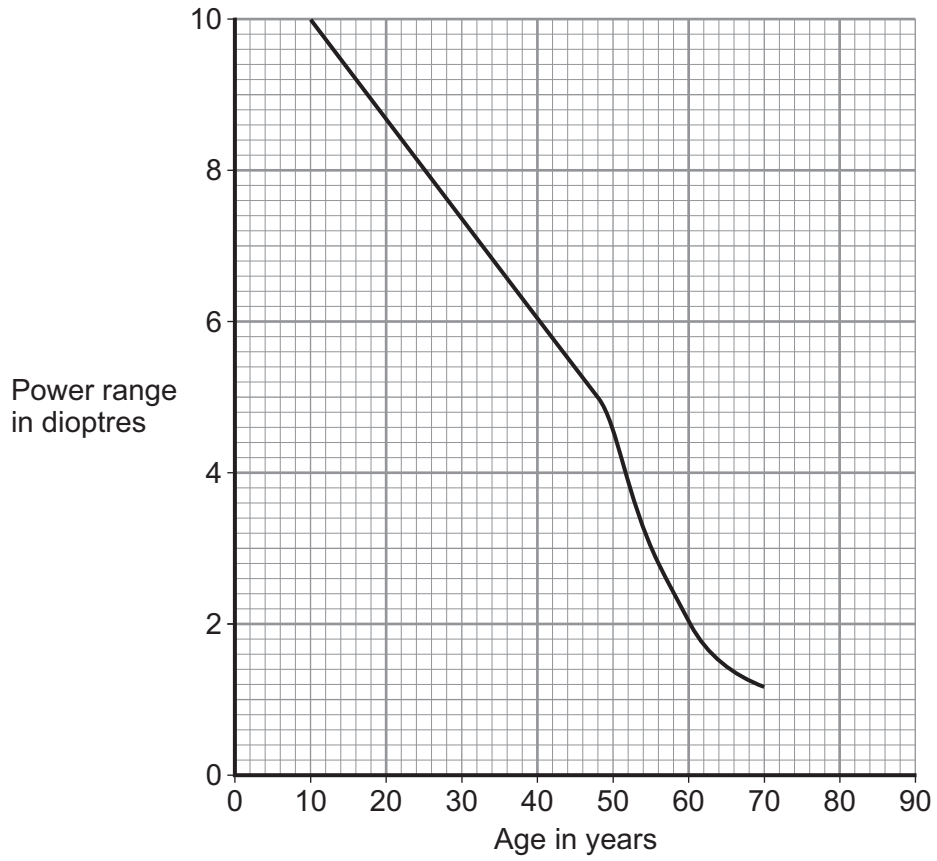
4 (c) The 'power range' of an eye lens is the difference between the maximum and minimum power of the lens.

Figure 8 shows how the power range of an eye lens changes with age.

Figure 8



4 (c) (i) Use **Figure 8** to suggest the power range of the eye lens for a 90-year-old person.

[1 mark]

Power range = ... dioptres

4 (c) (ii) Use **Figure 8** to explain why people are more likely to need glasses for reading as they get older.

[2 marks]

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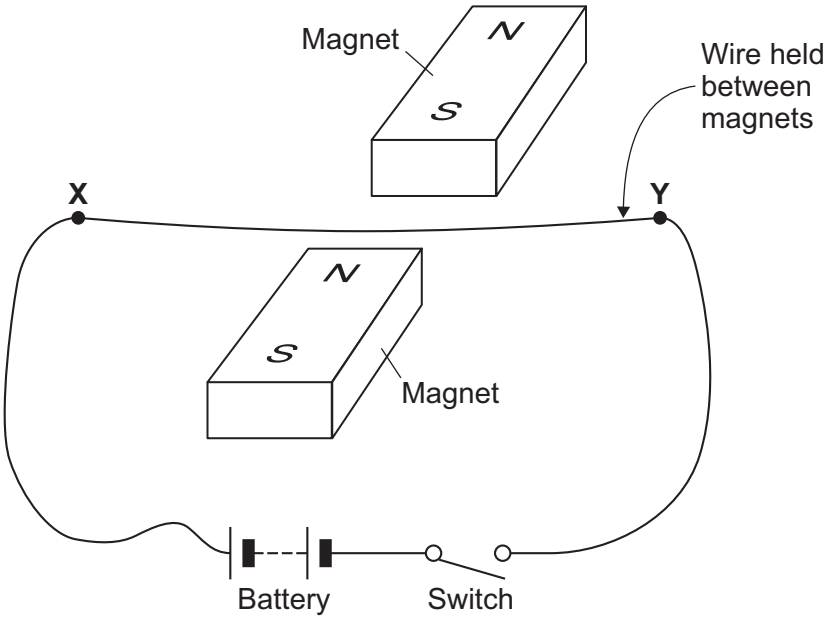
14

5 **Figure 9** shows apparatus set up by a student.

Figure 9



Closing the switch creates a force that acts on the wire **XY**.

5 (a) (i) Explain why a force acts on the wire **XY** when the switch is closed.

[3 marks]

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5 (a) (ii) The force causes the wire **XY** to move.
Draw an arrow on **Figure 9** to show the direction in which the wire **XY** will move.

[1 mark]

5 (a) (iii) State the effect that this experiment demonstrates.

[1 mark]

.....

5 (b) The student replaced the battery with a low frequency alternating current (a.c.) power supply.

The student closed the switch.

5 (b) (i) Describe the movement of the wire.

[1 mark]

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

[1 mark]

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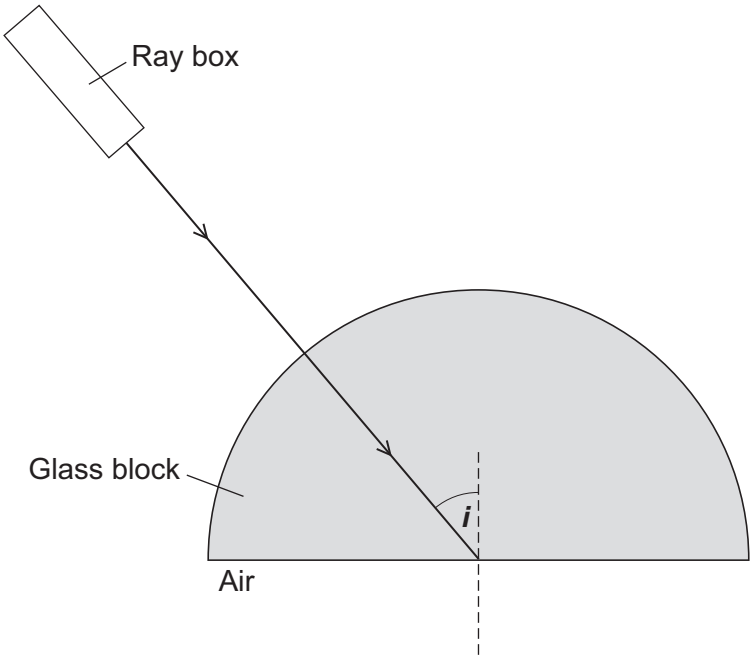
7

Turn over for the next question

6 **Figure 10** shows a ray of light travelling through a semicircular glass block. The angle of incidence is labelled ***i***.

Figure 10



6 (a) (i) The angle of incidence ***i*** equals the critical angle for the glass.

Complete **Figure 10** to show what happens to the ray of light at the glass-to-air boundary.

[1 mark]

6 (a) (ii) The critical angle for the glass is 41°.

Calculate the refractive index of the glass.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

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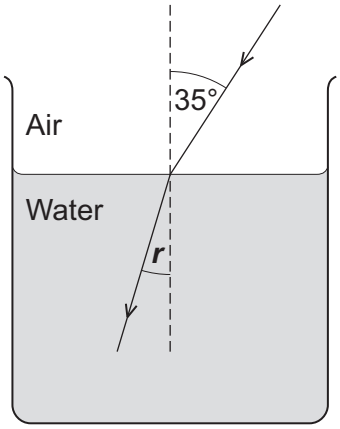
Refractive index = ...

6 (b) **Figure 11** shows what happens to a ray of light as it meets the boundary between air and water.

Figure 11



Not to scale

The refractive index of the water is 1.3

Calculate the angle of refraction ***r***.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

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Angle of refraction = ... degrees

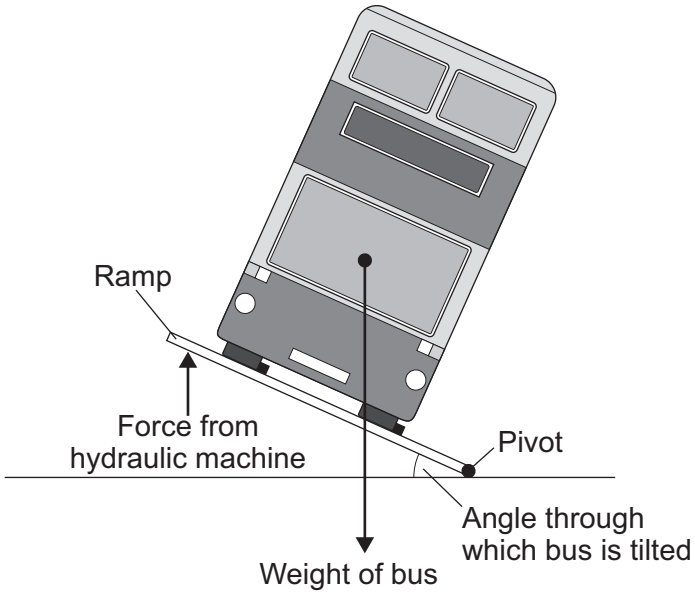
6

Turn over for the next question

7 Before a new bus can be used on the roads, it must pass a stability test. **Figure 12** shows how the bus is tested.

Figure 12

Front view



7 (a) (i) The bus will topple over if the ramp is tilted at too great an angle.

Explain why.

[2 marks]

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7 (a) (ii) The bus is tested to angles of tilt far greater than it would experience in normal use.

Suggest **two** reasons why.

[2 marks]

1 .....

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2 .....

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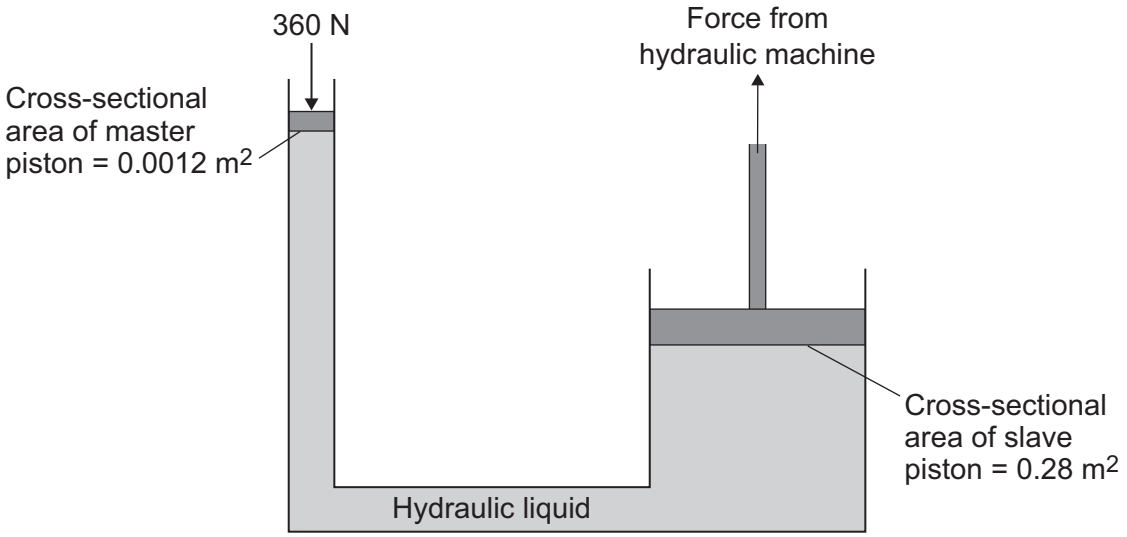
7 (b) **Figure 13** shows the hydraulic machine that is used to make the ramp tilt.

Figure 13



The pressure applied to the hydraulic liquid at the master piston is the same as the pressure applied by the hydraulic liquid to the slave piston.

7 (b) (i) State the property of the liquid that keeps the pressure at both pistons the same.

[1 mark]

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7 (b) (ii) A 360 N force acts on the master piston.

Use information from **Figure 13** to calculate the force applied by the hydraulic liquid to the slave piston.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

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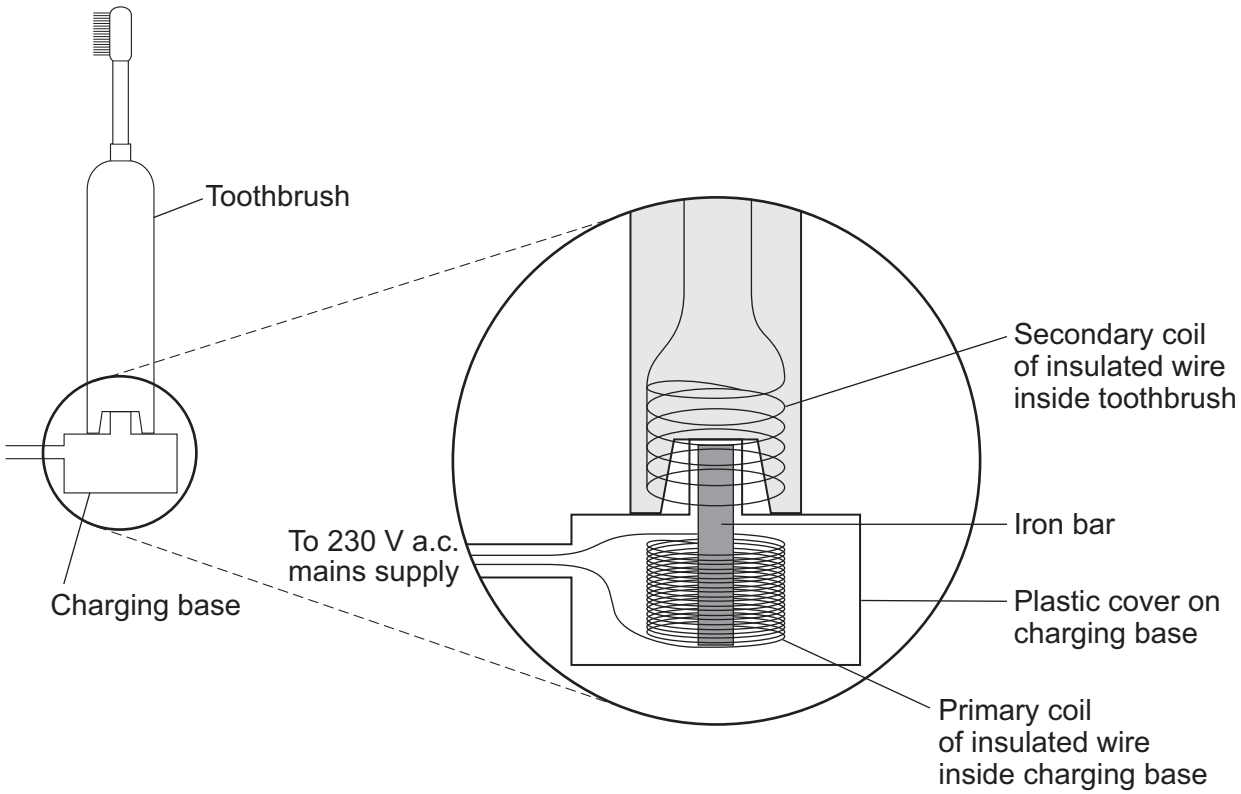
Force = ... N

8

8 An electric toothbrush is charged by standing it on a separate charging base. **Figure 14** shows the inside of the electric toothbrush and the charging base.

Figure 14



8 (a) An alternating potential difference (p.d.) across the coil in the charging base creates an alternating current in the coil inside the toothbrush.

Explain how.

[3 marks]

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8 (b) When the toothbrush is being charged, the p.d. across the primary coil in the charging base is 230 V.

The charging p.d. across the secondary coil in the toothbrush is 7.2 V.

The primary coil in the charging base has 575 turns of wire on its coil.

Calculate the number of turns on the secondary coil inside the toothbrush.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

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Number of turns on the secondary coil = ...

5

END OF QUESTIONS

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