AQA

General Certificate of Secondary Education
Higher Tier
June 2013

Physics
Unit Physics P3

PH3HP

H

Thursday 23 May 2013   9.00 am to 10.00 am

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

Time allowed
- 1 hour

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 (a) 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.

PH3HP

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

1 (a) The diagram shows parts of the human eye.

Complete the missing labels.
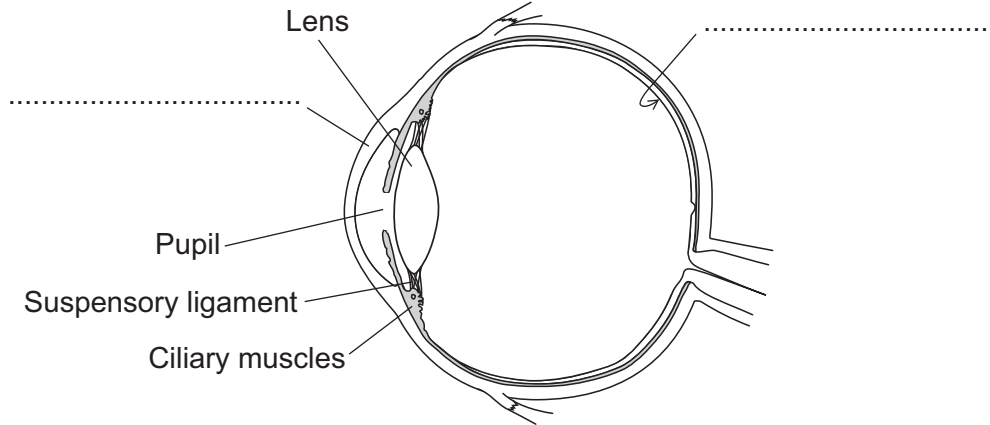
(2 marks)

1 (b) Each part of the human eye has a function.

Complete the table below.

Part of the human eye	Function of the part
....	Changes size to make sure the correct amount of light enters the eye.
Ciliary muscles	....
Lens	....

(3 marks)

1 (c) The human eye can focus on near objects. The closest distance the eye can bring into sharp focus is called the near point.

A student measured the near point of four people of different ages. The table shows her data.

Age of human in years	Near point in millimetres
10	200
25	250
40	400
55	700

What can you conclude from the data in the table above?

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(2 marks)

1 (d) Suggest how the data obtained by the student could be improved.

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(1 mark)

1 (e) Spectacles are worn to correct vision. One of the lenses in a pair of spectacles has a focal length of 40 centimetres.

Calculate the power of the lens.

Use the correct equation from the Physics Equations Sheet.

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Power of lens = ... dioptres

(2 marks)

10

Turn over ▶

2   An event involved paddling a homemade raft down a fast-flowing river. The rafts were made using empty barrels.

Below are the designs of two rafts.
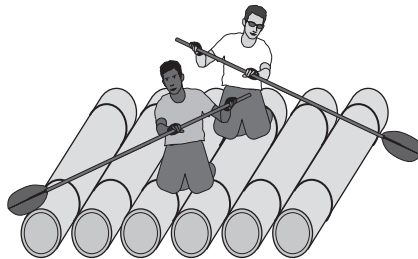
Design **A**   Design **B**
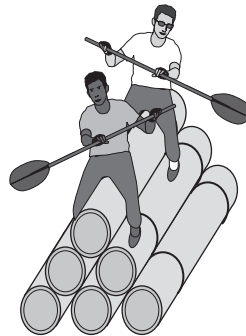
2 (a)   Compare the stability of the two raft designs. Give reasons for your answer.

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(2 marks)

2 (b) A camera was used to take photographs of the rafts. The camera contains a convex (converging) lens.

Complete the ray diagram to show how the lens produces an image of the object.
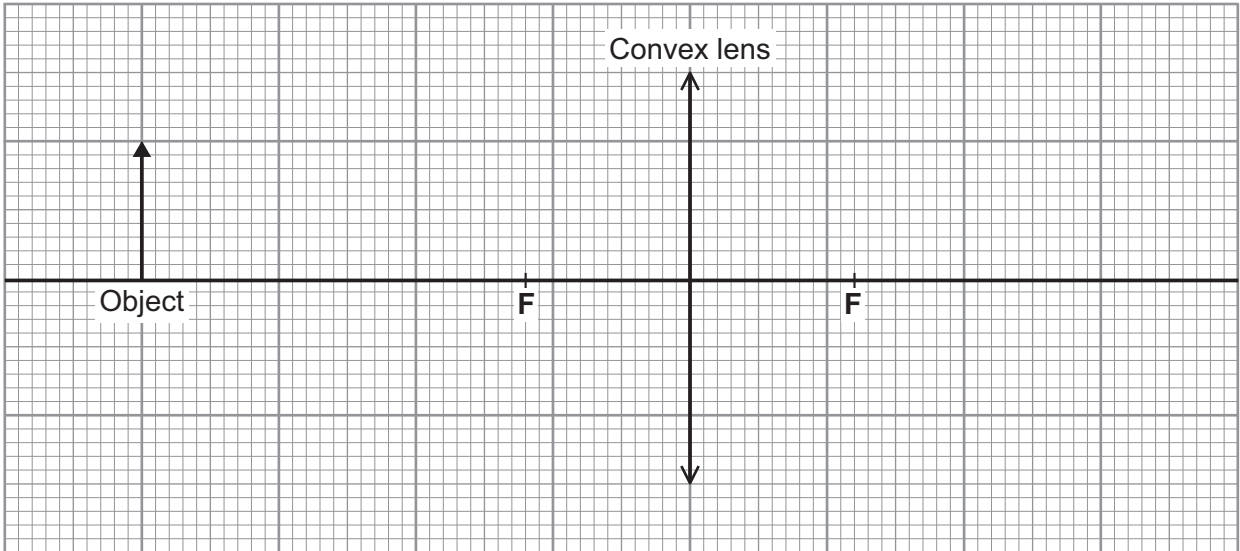
F = Principal focus

(4 marks)

2 (c) State **two** words to describe the nature of the image produced by the lens in the camera.

1 ....

2 ....

(2 marks)

8

Turn over for the next question

Turn over ▶

3 Ultrasound and X-rays are waves used in hospitals to create images of the inside of the human body. To produce the images below, the waves must enter the human body.

Ultrasound scan of an unborn child

X-ray of a broken bone

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

Describe the features of ultrasound and X-rays, and what happens to each type of wave after it has entered the human body.

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(6 marks)

3 (b) It would **not** be safe to use X-rays to produce an image of an unborn child.

Explain why.

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(2 marks)

3 (c) Ultrasound can be used for medical treatments as well as for imaging.

Give **one** use of ultrasound for medical treatment.

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(1 mark)

9

Turn over for the next question

Turn over ▶

4 Mountain bike riders use brakes to slow down.
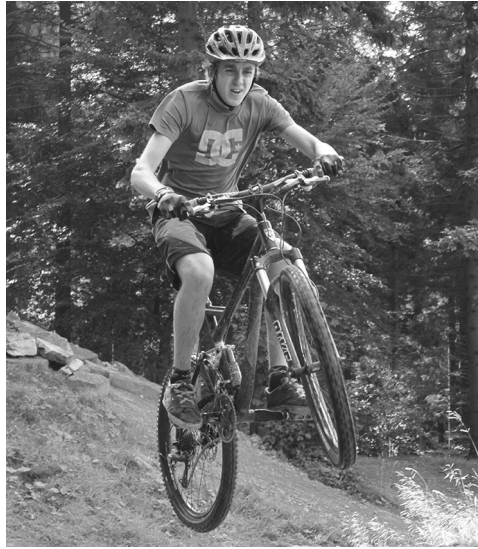
Some mountain bikes have hydraulic brakes.

Pivot

Brake lever

Force from rider's hand

F

Handle bar

Cross-sectional area of master piston = $5.6 \times 10^{-5}\,\text{m}^2$

Liquid

Cross-sectional area of slave piston = $14.4 \times 10^{-5}\,\text{m}^2$

Brake pad

Wheel axle

Spinning brake disc
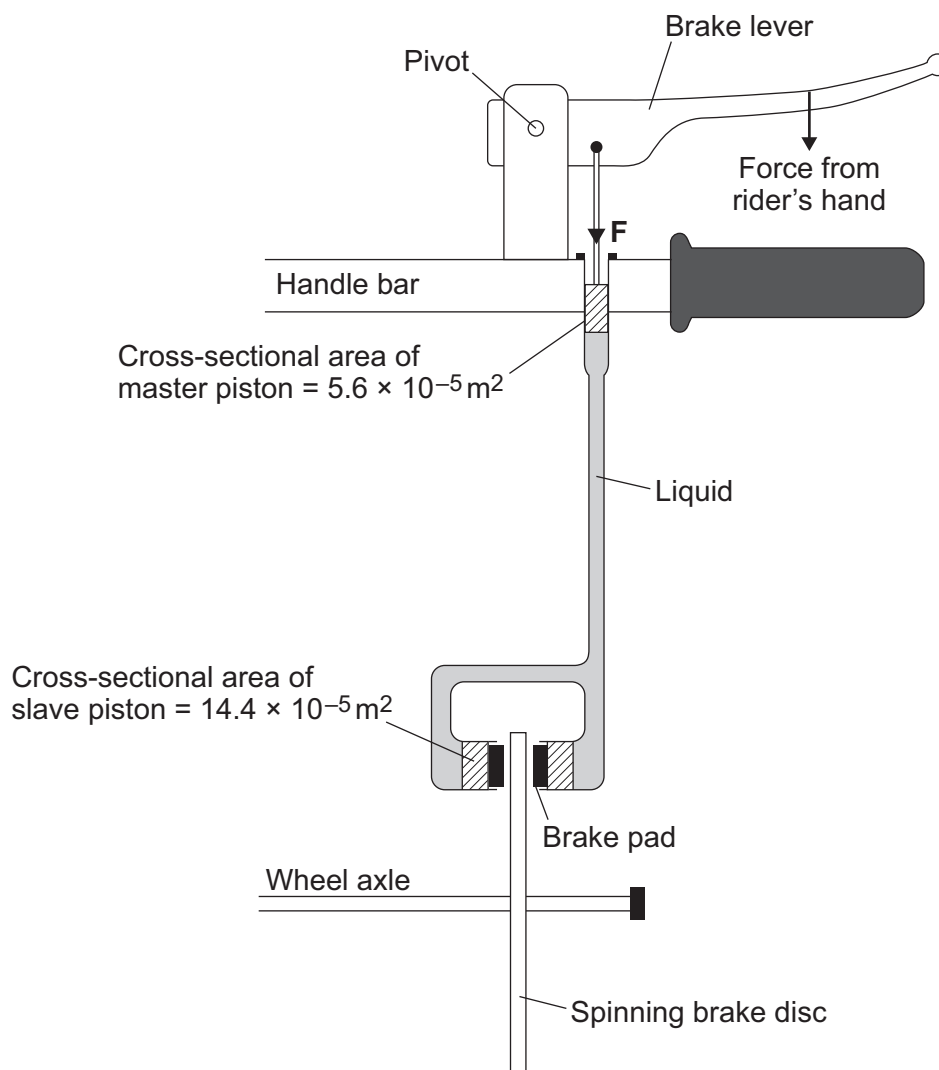
4 (a) What property of a liquid enables a hydraulic brake system to work?

....

(1 mark)

4 (b) When the rider's hand pulls on the brake lever, the master piston applies a pressure of 1.5×10^6 pascals to the liquid.

Using information from the diagram, calculate the force **F** exerted on the liquid by the master piston.

Use the correct equation from the Physics Equations Sheet.

....

....

....

....

Force **F** = ... N

(2 marks)

4 (c) The pressure in the liquid applies a force to move each slave piston.

How does the size of this force compare to the force **F** applied by the master piston?

....

....

Give a reason for your answer.

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....
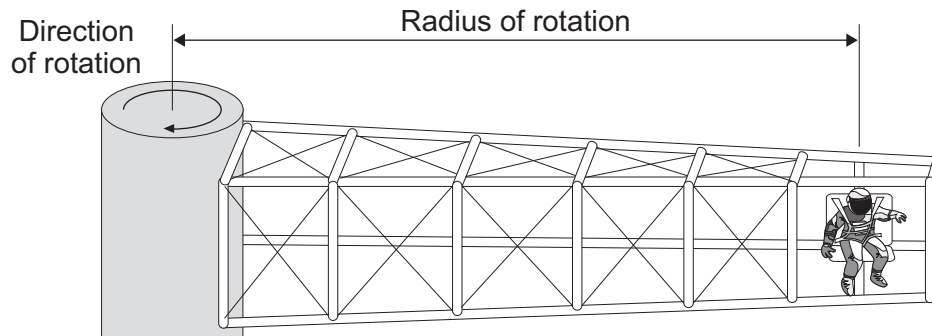
(2 marks)

5

Turn over for the next question

Turn over ▶

5 The diagram shows a 'G-machine'. The G-machine is used in astronaut training.

The G-machine moves the astronaut in a horizontal circle.

5 (a) When the G-machine is rotating at constant speed, the astronaut is accelerating.

State the name and direction of the force causing the astronaut to accelerate.

Name of force ....

Direction of force ....

....
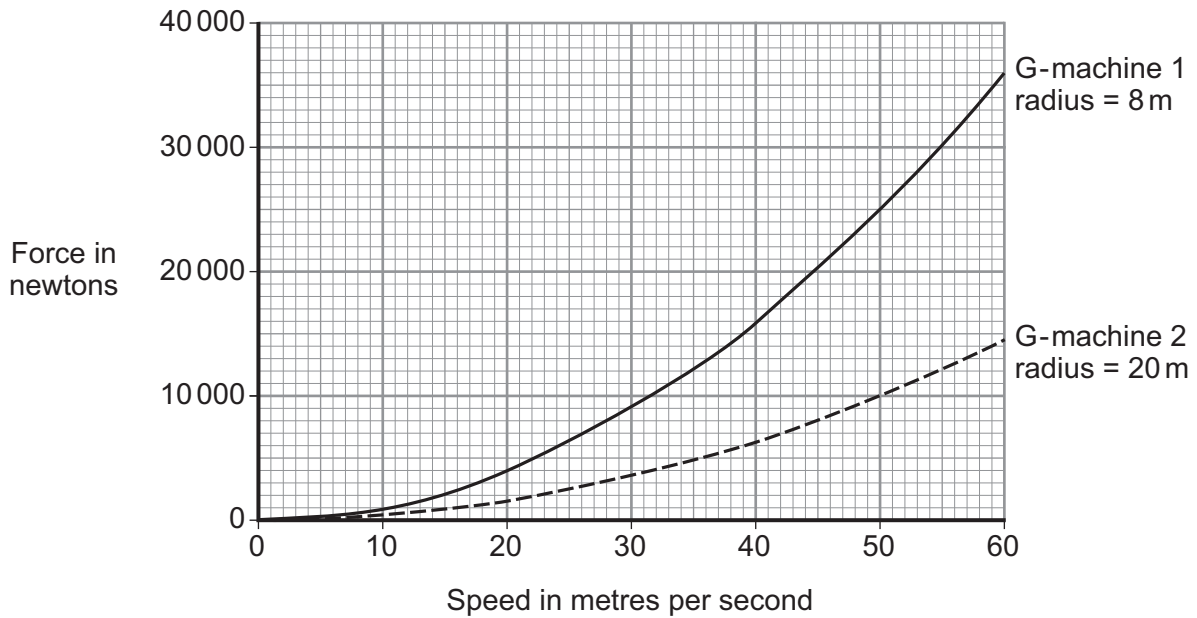
(2 marks)

5 (b)   The force causing the astronaut to move in a circle is measured.

The graph shows how the speed of the astronaut affects the force causing the astronaut to move in a circle for two different G-machines.

The radius of rotation of the astronaut is different for each G-machine.

5 (b) (i)   State **three** conclusions that can be made from the graph.

1 ....

....

2 ....

....

3 ....

....

(3 marks)

5 (b) (ii)   The speed of rotation of G-machine 1 is increased from 20 m/s to 40 m/s.

Determine the change in force on the astronaut.
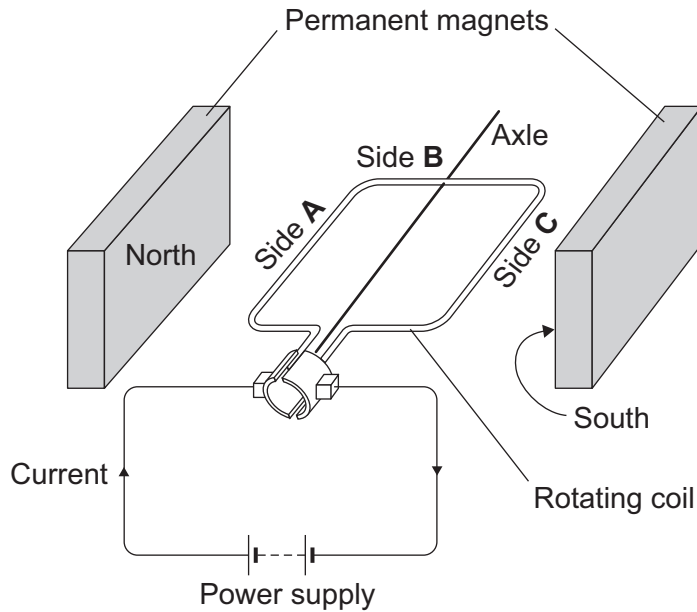
....

Change in force = ... N

(1 mark)

Turn over ▶

5 (c) Each G-machine is rotated by an electric motor. The diagram shows a simple electric motor.

Permanent magnets

Axle

Side **B**

Side **A**

Side **C**

North

South

Current

Rotating coil

Power supply

5 (c) (i) A current flows through the coil of the motor.

Explain why side **A** of the coil experiences a force.

....

....

....

....

(2 marks)

5 (c) (ii) Draw arrows on the diagram to show the direction of the forces acting on side **A** of the coil and side **C** of the coil.

(1 mark)

5 (c) (iii) When horizontal, side **B** experiences no force.

Give the reason why.

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(1 mark)

5 (d) While a G-machine is rotating, the operators want to increase its speed.

What can the operators do to make the G-machine rotate faster?

....

....

(1 mark)

5 (e) The exploration of space has cost a lot of money.

Do you think spending lots of money on space exploration has been a good thing?

Draw a ring around your answer.

Yes **No**

Give a reason for your answer.

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....
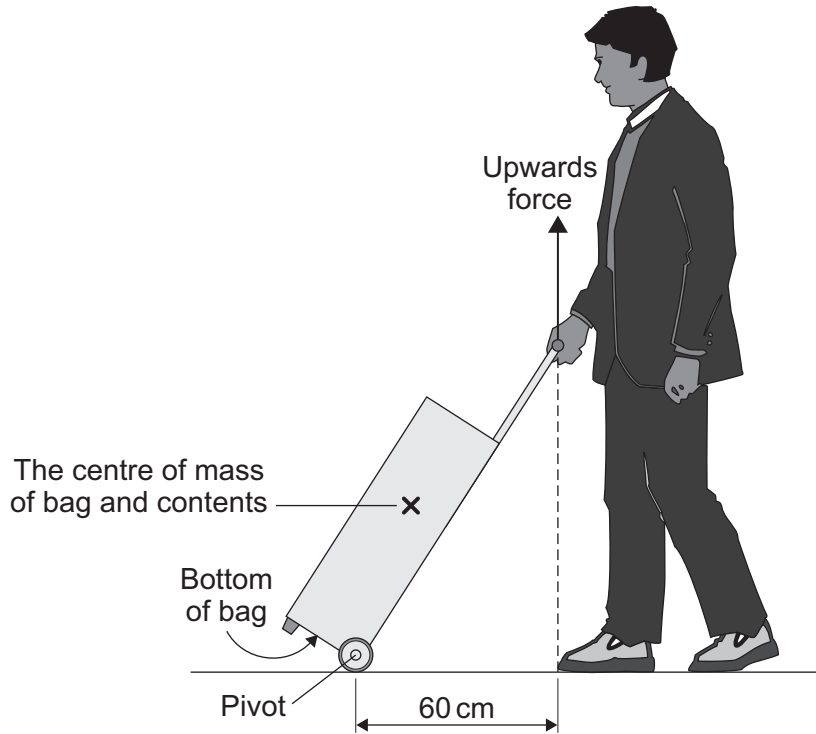
(1 mark)

12

Turn over for the next question

Turn over ▶

6 The diagram shows a man standing in an airport queue with his wheeled bag.

Upwards force

The centre of mass of bag and contents

Bottom of bag

Pivot

60 cm

6 (a) The man applies an upward force to the handle of his bag to stop the bag from falling. The moment of this force about the pivot is 36 Nm.

Calculate the upward force the man applies to the handle of his bag.

Use the correct equation from the Physics Equations Sheet.

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....

Force = ... N

(2 marks)

6 (b) When the man lets go of the bag handle, the bag falls and hits the floor.

Explain why.

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(2 marks)

6 (c) During his holiday the man visits the Foucault Pendulum in Paris, France.
The pendulum makes 10 complete swings every 160 seconds.

Calculate the frequency of the pendulum and give the unit.

Use the correct equation from the Physics Equations Sheet.

....

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....

Frequency = ...

(3 marks)

7

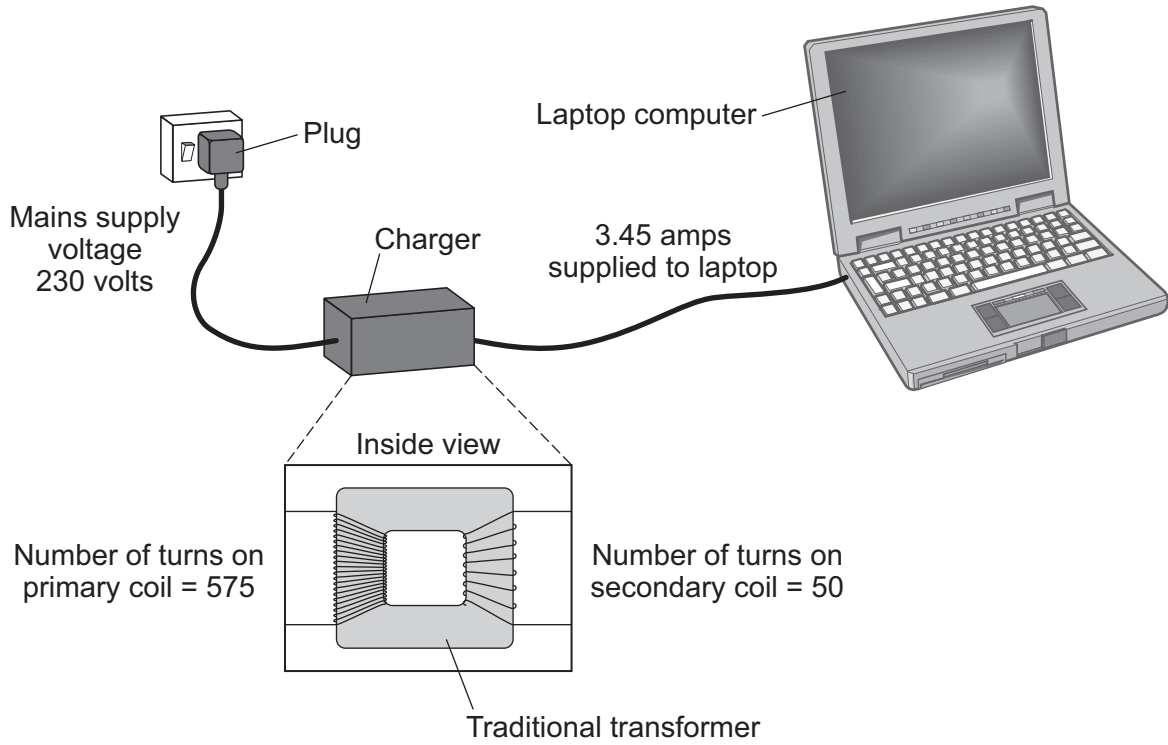**Turn over for the next question**

7 Batteries inside laptop computers are charged using laptop chargers. The laptop charger contains a traditional transformer.

Plug

Laptop computer

Mains supply voltage 230 volts

Charger

3.45 amps supplied to laptop

Inside view

Number of turns on primary coil = 575

Number of turns on secondary coil = 50

Traditional transformer

7 (a) The alternating current flowing through the primary coil of the transformer creates an alternating current in the secondary coil.

Explain how.

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(3 marks)

7 (b) (i) Use information from the diagram to calculate the potential difference the charger supplies to the laptop.

Use the correct equation from the Physics Equations Sheet.

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Potential difference = ... V

(2 marks)

7 (b) (ii) Calculate the current in the primary coil of the transformer when the laptop is being charged.

Assume the transformer is 100% efficient.

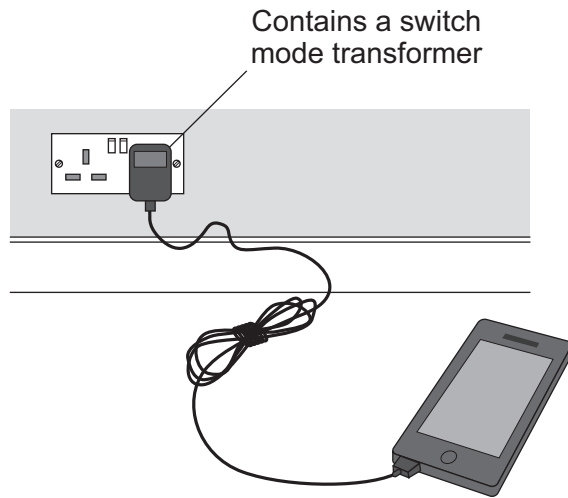Use the correct equation from the Physics Equations Sheet.

....

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....

....

Current = ... A

(2 marks)

Question 7 continues on the next page

Turn over ▶

7 (c)   Switch mode transformers can be used in mobile phone chargers.

Contains a switch
mode transformer

Switch mode transformers and traditional transformers can both use the UK mains supply.

The switch mode transformer is smaller and lighter than the traditional transformer used in the laptop charger.

Give **one** other advantage of the switch mode transformer.

....

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(1 mark)

7 (d)   Laptop batteries and mobile phone batteries can only be recharged a limited number of times. After this, the batteries cannot store enough charge to be useful. Scientists are developing new batteries that can be recharged many more times than existing batteries.

Suggest **one** other advantage of developing these new batteries.

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(1 mark)

9

END OF QUESTIONS

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