AQA GCSE PHYSICS (4403)

PHYSICS



EXAM QUESTION PACK

UNIT P3 FOUNDATION TIER PH3FP PAPERS

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AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

GCSE PHYSICS

F

Foundation Tier Unit Physics P3

Friday 17 June 2016 Morning Time allowed: 1 hour

Materials

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

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 8(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.

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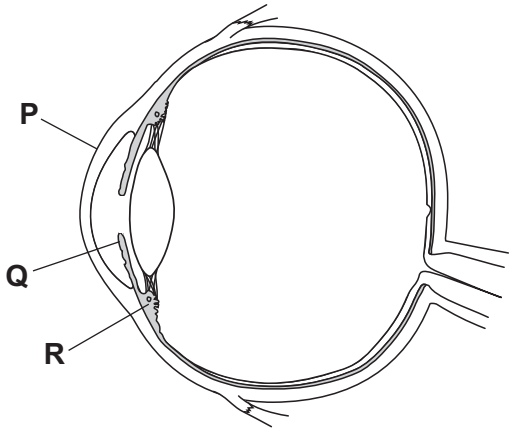
Do not write outside the box

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

1 **Figure 1** is a diagram of a human eye.

Three of the parts of the eye are labelled **P**, **Q** and **R**.

Figure 1



1 (a) Draw **one** line from each box, **P**, **Q** and **R**, to the correct part of the eye.

[3 marks]

Label	Part of the eye
P	Ciliary muscles
Q	Cornea
R	Iris
	Retina

1 (b) What is the function of the pupil?

[1 mark]

_____

_____

Do not write outside the box

1 (c) As people get older, the near point of their vision changes.

What does 'the near point' mean?

[1 mark]

Tick (✓) **one** box.

The closest distance to the eye that an object can be clearly seen ☐

The distance between the front and back of the eyeball ☐

The focal length of the lens in the eye ☐

1 (d) How does the eye change in order to focus on objects at different distances?

[1 mark]

Tick (✓) **one** box.

The distance between the lens and the retina changes ☐

The eyeball changes shape ☐

The lens changes shape ☐

1 (e) In laser eye surgery, the cornea is reshaped to help improve a person's vision.

Complete the following sentence.

[1 mark]

Surgeons use the _____ transferred by the light from a laser to cut and reshape the cornea.

1 (f) Lasers were tested on animals before they were used in surgery on people.

Suggest why some people disagree with testing lasers on animals.

[1 mark]

_____

_____

8

Do not write outside the box

2 **Figure 2** shows an X-ray of an arm with a broken bone.

Figure 2



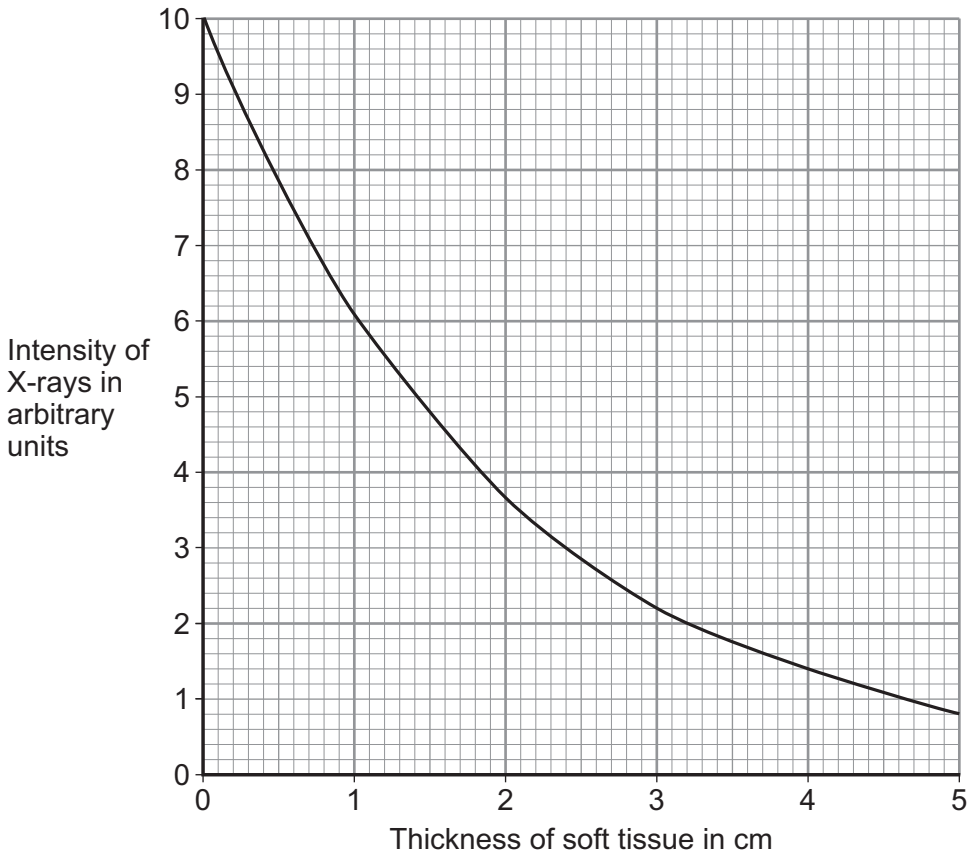
2 (a) Complete the following sentence.

[1 mark]

X-rays are part of the _____ spectrum.

2 (b) **Figure 3** shows how the intensity of the X-rays changes as they pass through soft tissue and reach a detector.

Figure 3



Do not write outside the box

2 (b) (i) Use **Figure 3** to determine the intensity of X-rays reaching the detector for a 3 cm thickness of soft tissue.

[1 mark]

Intensity of X-rays = _____ arbitrary units

2 (b) (ii) Describe how the thickness of soft tissue affects the intensity of the X-rays.

[2 marks]

_____

_____

_____

_____

2 (b) (iii) The data in **Figure 3** are shown as a line graph and not as a bar chart.

Choose the reason why.

[1 mark]

Tick (✓) **one** box.

Both variables are categoric ☐

Both variables are continuous ☐

One variable is continuous and one is categoric ☐

2 (c) What happens to X-rays when they enter a bone?

[1 mark]

_____

_____

Question 2 continues on the next page

Do not write outside the box

2 (d) How are images formed electronically in a modern X-ray machine?

[1 mark]

Tick (✓) **one** box.

With a charge-coupled device (CCD) ☐

With an oscilloscope ☐

With photographic film ☐

2 (e) Radiographers who take X-ray photographs may be exposed to X-rays.

2 (e) (i) X-rays can increase the risk of the radiographer getting cancer.

Why can X-rays increase the risk of getting cancer?

[1 mark]

Tick (✓) **one** box.

X-rays travel at the speed of light ☐

X-rays can travel through a vacuum ☐

X-rays are ionising ☐

2 (e) (ii) What should the radiographer do to reduce the risk from X-rays?

[1 mark]

_____

_____

9

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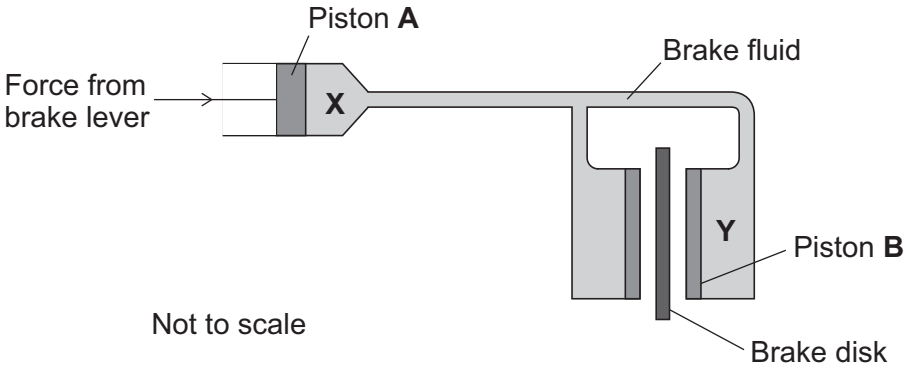
Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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3 **Figure 4** is a simplified diagram of a hydraulic brake system.

Figure 4



3 (a) Which is the correct statement about the pressure at **X** and the pressure at **Y**?

[1 mark]

Tick (✓) **one** box.

The pressure at **X** is greater than at **Y** ☐

The pressure at **X** is the same as at **Y** ☐

The pressure at **X** is less than at **Y** ☐

3 (b) Piston **B** is larger than piston **A**.

How will this affect the size of the force on piston **B**?

Use the correct answer from the box to complete the sentence.

[1 mark]

smaller than	**the same as**	**larger than**

The force on piston **B** will be _____ the force on piston **A**.

Do not write outside the box

3 (c) (i) A force of 24 N acts on piston **A**. The cross-sectional area of piston **A** is 8 mm^2.

Calculate the pressure in N/mm^2 at position **X**.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

Pressure = _____ N/mm^2

3 (c) (ii) The unit N/mm^2 is not often used to measure pressure.

Which unit is usually used to measure pressure?

[1 mark]

Tick (✓) **one** box.

newton ☐

pascal ☐

watt ☐

3 (d) The liquid used in the hydraulic brake system freezes at –30 °C.

Suggest **one** effect a temperature below –30 °C would have on the brake system.

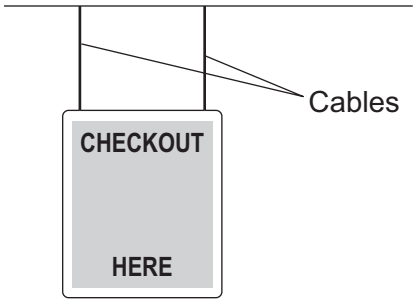
[1 mark]

6

Do not write outside the box

4 A sign hangs from the ceiling using two cables, as shown in **Figure 5**.

Figure 5



4 (a) On **Figure 5**, mark the centre of mass of the sign using an X.

[1 mark]

4 (b) Use the correct answer from the box to complete the sentence.

[1 mark]

concentrated	**greatest**	**pivoted**

The centre of mass of an object is the point where the mass appears

to be _____ .

4 (c) A breeze made the sign swing forwards and backwards like a pendulum.
The frequency of oscillations of the sign was 2 hertz.

Calculate the periodic time for the sign.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

_____

_____

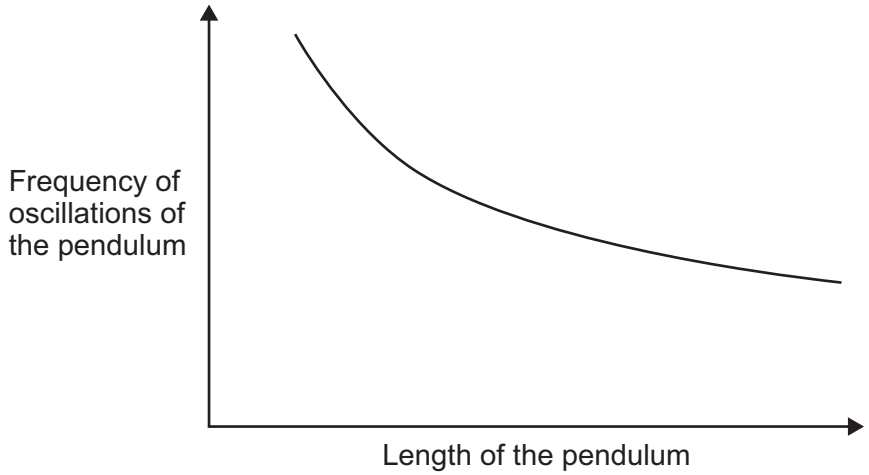
_____

Periodic time = _____ seconds

Do not write outside the box

4 (d) **Figure 6** is a sketch graph showing how the frequency of the oscillations of a pendulum changes as the length of the pendulum is increased.

Figure 6



Give **one** way the sign could be made to swing with a lower frequency.
Use **only** the information in the sketch graph.

[1 mark]

_____

_____

5

Turn over for the next question

Do not write outside the box

5 (a) Ultrasound is sound above the maximum frequency that humans can hear.

What is the maximum frequency that most humans can hear?

[1 mark]

Tick (✓) **one** box.

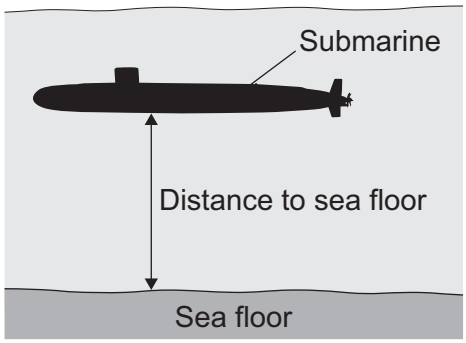
20 Hz ☐

2000 Hz ☐

20 000 Hz ☐

5 (b) **Figure 7** shows a submerged submarine.

Figure 7



Not to scale

The submarine sends a pulse of ultrasound to the sea floor.
The pulse takes 0.25 seconds to travel from the submarine to the sea floor.

The speed of sound in water is 1600 m/s.

Calculate the distance from the submarine to the sea floor.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

Distance = _____ m

Do not write outside the box

5 (c) The ultrasound is reflected from the sea floor back to the submarine.
Use the correct answer from the box to complete the sentence.

[1 mark]

half	the same as	twice

The total distance the ultrasound pulse travelled is _____ the distance to the sea floor.

5 (d) The submarine moves through the sea and every few seconds sends a pulse of ultrasound to check the distance to the sea floor.

Table 1 shows the time taken for five ultrasound pulses to travel from the submarine to the sea floor and back to the submarine.

Table 1

Pulse number	Time for pulse to return in seconds
1	0.50
2	0.45
3	0.38
4	0.40
5	0.48

Describe how the distance from the submarine to the sea floor changed over these five pulses.

[2 marks]

_____

_____

_____

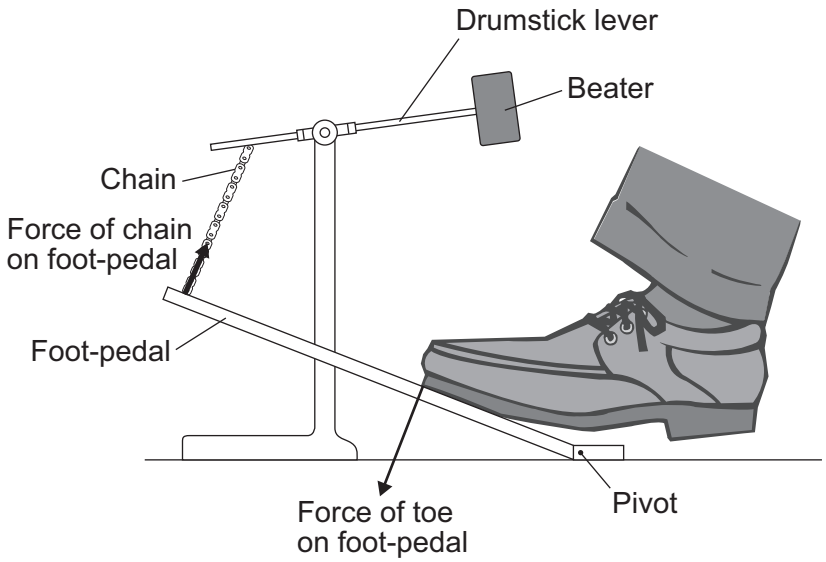
_____

6

Do not write outside the box

6 A drum is hit by a beater attached to a drumstick lever. The drumstick lever is attached to a foot-pedal by a chain, as shown in **Figure 8**.

Figure 8



6 (a) State how the size of the force of the chain on the foot-pedal compares with the size of the force of the toe on the foot-pedal.

[1 mark]

_____

_____

6 (b) The foot-pedal is pushed halfway down and held stationary.

The force of the toe and the force of the chain each create a moment which acts on the foot-pedal.

Compare the size and direction of the moments of the toe and the chain.

[1 mark]

Tick (✓) **one** box.

Size	**Direction**	**Tick (✓)**
The moments are equal	same	
The moments are equal	opposite	
The moment of the force of the toe is greater	same	

Do not write outside the box

6 (c) How can the drummer create a greater moment about the pivot without increasing the force he applies?

[1 mark]

_____

_____

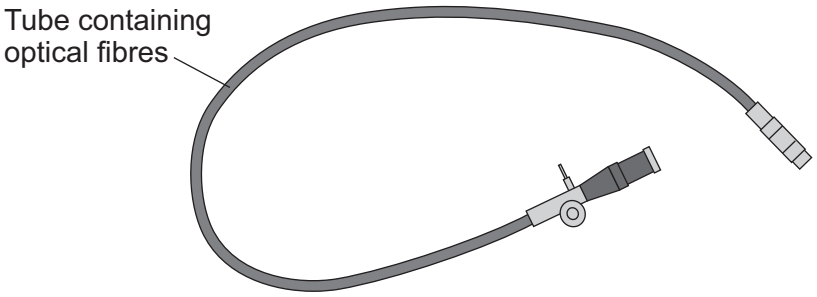
3

Turn over for the next question

Do not write outside the box

7 An endoscope is a piece of equipment used by doctors. An endoscope contains optical fibres. **Figure 9** shows an endoscope.

Figure 9



7 (a) State what a doctor would use an endoscope for.

[1 mark]

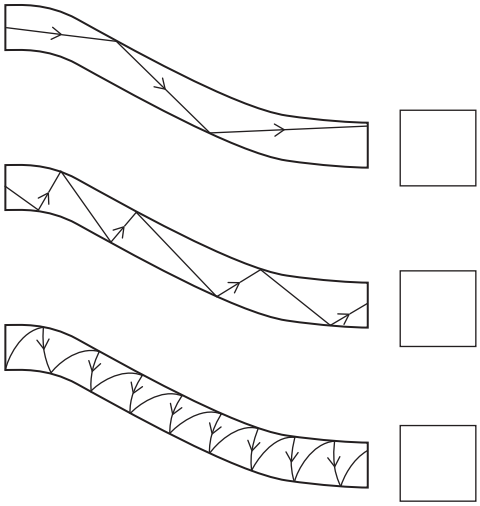
_____

_____

7 (b) Which **one** of the following diagrams correctly shows how a ray of light travels through an optical fibre?

[1 mark]

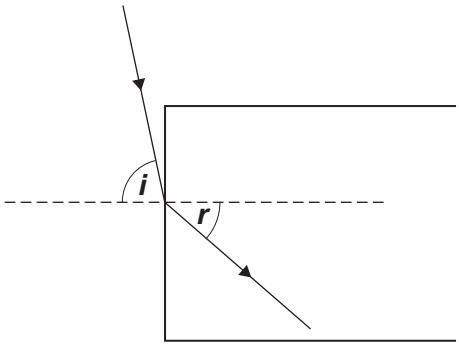
Tick (✓) **one** box.



Do not write outside the box

7 (c) **Figure 10** shows a ray of light entering an optical fibre.

Figure 10



The angle of incidence ***i*** is 78°
The angle of refraction ***r*** is 40°

Calculate the refractive index of the optical fibre.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

Refractive index = _____

5

Turn over for the next question

Do not write outside the box

8 (a) Electromagnets are often used at recycling centres to separate some types of metals from other materials.

Give **one** reason why an electromagnet would be used rather than a permanent magnet.

[1 mark]

_____

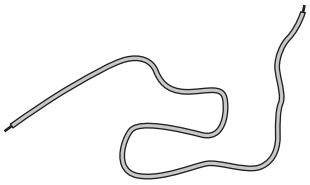
_____

8 (b) **In this question you will gain marks for using good English, organising information clearly and using scientific words correctly.**

Some students want to build an electromagnet.

The students have the equipment shown in **Figure 11**.

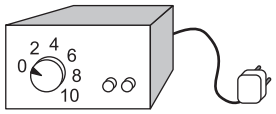
Figure 11



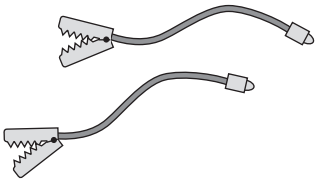
Insulated wire



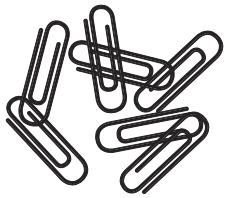
Iron nail



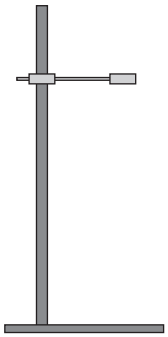
Power supply



Connecting leads



Steel paperclips



Wooden clamp and stand

Do not write outside the box

Describe how the students could build an electromagnet. Include in your answer how the students should vary and test the strength of their electromagnet.

[6 marks]

Extra space

7

Turn over for the next question

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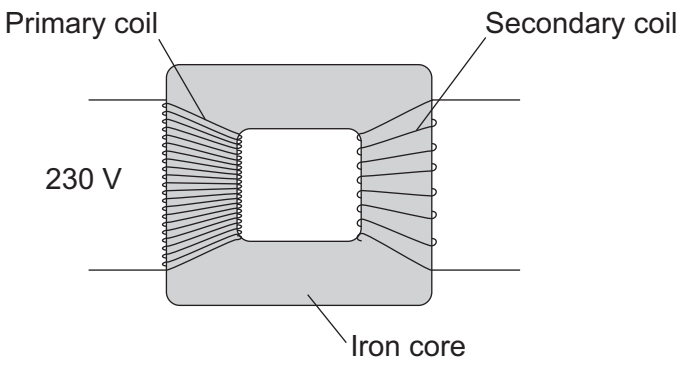
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ANSWER IN THE SPACES PROVIDED

Do not write outside the box

9 **Figure 12** shows the structure of a traditional transformer.

Figure 12



9 (a) There is an alternating current in the primary coil of the transformer.

State what is produced in the iron core.

[2 marks]

_____

_____

9 (b) A transformer has only **one** turn of wire on the secondary coil.
The potential difference across the secondary coil is 11.5 V
The potential difference across the primary coil is 230 V

Calculate the number of turns on the primary coil.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

_____

_____

_____

_____

Number of turns on the primary coil = _____

Question 9 continues on the next page

Do not write outside the box

9 (c) In most transformers, the power output is less than the power input.

State why.

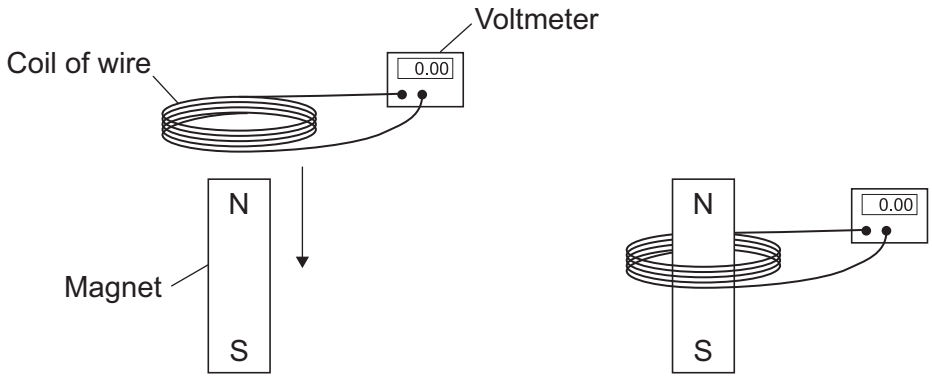
[1 mark]

_____

_____

9 (d) Two students investigated how magnets can be used to produce a potential difference. The students held a coil of wire above a magnet. The students quickly lowered the coil so that the magnet was inside the coil, as shown in **Figure 13**.

Figure 13



The students recorded the maximum potential difference for coils with different numbers of turns of wire. The results are shown in **Table 2**.

Table 2

Number of turns of wire in the coil	Maximum potential difference in volts	
	Results from student 1	Results from student 2
5	0.09	0.08
10	0.20	0.15
15	0.31	0.25
20	0.39	0.33
25	0.51	0.39

Do not write outside the box

9 (d) (i) State the resolution of the voltmeter.

Give **one** reason why the resolution of the voltmeter is suitable for this investigation.

[2 marks]

Resolution _____

Reason _____

_____

9 (d) (ii) The two students used exactly the same equipment to carry out their investigations. Both students recorded their results correctly.

Give the reason why student 2 got different results from student 1.

[1 mark]

_____

_____

9 (d) (iii) The students decided that even though the results were different, there was no need to repeat the investigation.

How do the results show that the investigation is reproducible?

[1 mark]

_____

_____

9 (d) (iv) State the name of the process which causes the potential difference to be produced in this investigation.

[1 mark]

_____

9 (e) A transformer has been developed that can be used with many different devices.

Suggest **one** advantage of having a transformer that can be used with many different devices.

[1 mark]

_____

_____

11

END OF QUESTIONS

There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED

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GCSE

Physics

PH3FP

Mark scheme

4403

June 2016

Version/Stage: 1.0 Final Mark Scheme

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Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Mark Scheme

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of errors / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column or by each stage of a longer calculation.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Accept / allow

Accept is used to indicate an equivalent answer to that given on the left-hand side of the mark scheme. Allow is used to denote lower-level responses that just gain credit.

3.9 Ignore / Insufficient / Do <u>not</u> allow

Ignore of insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

4. Quality of Communication and levels marking

In Question **8(b)** students are required to produce extended written material in English, and will be assessed on the quality of their communication as well as the standard of the scientific response.

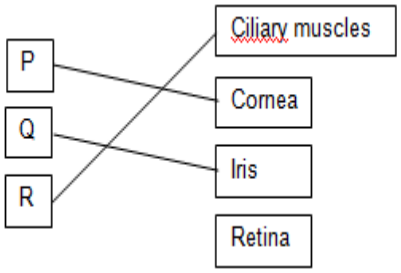
Students will be required to:
- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: basic
- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: clear
- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: detailed
- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)	P – Cornea Q – Iris R – Ciliary muscles		1 1 1	AO1 3.1.4a
1(b)	to let light into the eye	accept control the amount of light entering the eye	1	AO1 3.1.4a
1(c)	The closest distance to the eye that an object can be clearly seen		1	AO1 3.1.4c
1(d)	The lens changes shape		1	AO1 3.1.4e
1(e)	energy	accept heat	1	AO1 3.1.5c
1(f)	(because they think that) the results for animals may be different to those for humans **or** (because they think that) the animals could be harmed	accept disagreements on ethical, moral or religious grounds	1	AO3 3.1.5c
Total			8	

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	electromagnetic	accept e.m.	1	AO1 3.1.1a
2(b)(i)	2.2 (arbitrary units)	allow an answer between 2.1 and 2.3	1	AO2 3.1.1a
2(b)(ii)	the thicker the tissue the lower the intensity the relationship is not linear	accept more intensity is needed to pass through thicker tissue accept the line is not straight allow for **1** mark it still goes through with thicker tissue **or** intensity does not reach zero **or** at 5cm X rays still pass through	1 1	AO2 3.1.1a
2(b)(iii)	Both variables are continuous		1	AO3 3.1.1a
2(c)	(they are) absorbed	accept (they are) stopped	1	AO1 3.1.1a
2(d)	With a charge-coupled device (CCD).		1	AO1 3.1.1b
2(e)(i)	X-rays are ionising		1	AO1 3.1.1a
2(e)(ii)	stand behind a (protective) screen	accept leave the room accept wear a lead apron	1	AO1 3.1.1c
Total			9	

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)	The pressure at X is the same as at Y		1	AO1 3.2.3a
3(b)	larger than		1	AO1 3.2.3b
3(c)(i)	3 (N/mm^2)	accept 3 000 000 Pa (correct unit must be given) allow **1** mark for correct substitution, ie $\frac{24}{8}$ provided no subsequent step	2	AO2 3.2.3c
3(c)(ii)	pascal		1	AO1 3.2.3c
3(d)	the brakes would not work	allow the vehicle (car/bike etc) would not stop accept they would freeze solid **or** seize up	1	AO3 3.2.3
Total			6	

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)	X marked in the centre of the sign	 Check position by eye	1	AO1 3.2.1c
4(b)	concentrated		1	AO 1 3.2.1a
4(c)	0.5 (s)	allow **1** mark for correct substitution ie $\frac{1}{2}$ provided no subsequent step	2	AO2 3.2.1d
4(d)	make the cables longer	accept pendulum / sign for cables	1	AO3 3.2.1e
Total			5	

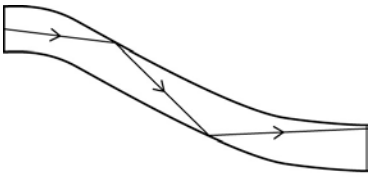
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Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	20 000 Hz		1	AO1 3.1.2a
5(b)	400 (m)	allow **1** mark for correct substitution ie 1600 × 0.25 provided no subsequent steps shown an answer of 200 (m) gains **1** mark	2	AO2 3.1.2c
5(c)	twice		1	AO1 3.1.2b
5(d)	From pulse 1 to pulse 3 the distance (to the sea floor) decreased then (after pulse 3) the distance (to the sea floor) increased	accept the sea got shallower **or** the submarine went deeper for the distance decreased accept the sea got deeper **or** the submarine rose for the distance increased An answer of the distance decreased then increased gains **1** mark	1 1	AO3 3.1.2b
Total			6	

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)	(force on the chain is) smaller (than the force of the toe)		1	AO2 3.2.2e
6(b)	Tick in middle box The moments are equal and opposite		1	AO1 3.2.2c
6(c)	move the toe (up the pedal) away from the pivot		1	AO2 3.2.2e
Total			3	

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(a)	to see inside the body or internal imaging	accept looking at an internal organ, e.g. stomach, appendix allow keyhole surgery	1	AO1 3.1.5b
7(b)	top diagram ticked 		1	AO1 3.1.5a
7(c)	1.5(2)	An answer that rounds to 1.5 gains **3** marks allow **2** marks for $\frac{0.978}{0.643}$ allow **1** mark for correct substitution $n = \frac{\sin(78)}{\sin(40)}$	3	AO2 3.1.3c
Total			5	

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
8(a)	an electromagnet can be switched off **or** an electromagnet is stronger	accept a permanent magnet cannot be switched off accept control the strength	1	AO1 P3.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
8(b)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.		6	AO1 AO2 P3.3.1a P3.3.1c

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant / correct content	there is a basic description of how to make an electromagnet **or** there is a basic description of how the strength of the electromagnet can be varied **or** there is a basic description of how the electromagnet can be tested	there is a description of how the electromagnet is made **and either** there is a description of how the strength of the electromagnet can be varied **or** there is a description of how the electromagnet can be tested	there is a description of how the electromagnet is made **and** there is a description of how the strength of the electromagnet can be varied **and** there is a description of how the strength of the electromagnet can be tested

Question 8 continues on the next page . . .

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examples of the points made in the response	extra information	
Details of how to make an electromagnet • wrap the wire around the nail • connect the wire to the power supply (with connecting leads and croc clips) • switch on the power supply	accept a current should be sent along the wire	
Details of how to vary the strength of the electromagnet • change the number of turns (on the coil) • change the current (through the coil) • change the separation of the turns	allow change the potential difference (across the coil) accept wrap the coil more tightly	
Details of how to test the electromagnet • suspend paperclips from the electromagnet • the more paperclips suspended, the stronger the electromagnet is • clamp the electromagnet at different distances from the paperclip(s) • the further the distance from which paperclips can be attracted the stronger the electromagnet is • test before and after making alterations to change the strength • compare the results from before and after making alterations • use de-magnetised paper clips	accept count the number of paperclips with different current **or** p.d. **or** no. of turns **or** core and see if the number changes/increases	

Total			7

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
9(a)	a magnetic field that is alternating / changing	accept electromagnetic field heat is insufficient	1 1	AO1 3.3.2d
9(b)	20	allow **1** mark for correct substitution, ie $\frac{230}{11.5}$ provided no subsequent step	2	AO2 3.3.2g
9(c)	(most) transformers are not 100% efficient	allow energy / power is lost to the surroundings allow energy / power is lost as heat / sound power is lost is insufficient	1	AO1 3.3.2h
9(d)(i)	0.01 (V) because there is a change in p.d. each time (the number of turns changes)	 allow because all the results (to 2 decimal places) are different accept if results were to 1 decimal place, there might not be a difference	1 1	AO3 3.3.2a 3.3.2b
9(d)(ii)	student 2 moved the coil more slowly (than student 1)	accept student 2 moved the coil at a different speed to student 1 do not accept student 2 moved the coil faster (than student 1)	1	AO3 3.3.2a 3.3.2b
9(d)(iii)	both sets of results show the same pattern	accept trend for pattern results are similar is insufficient results follow a pattern is insufficient	1	AO3 3.3.2a 3.3.2b

Question 9 continues on the next page . . .

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
9(d)(iv)	(electromagnetic) induction	accept it is induced do not accept electric / magnetic induction	1	AO1 3.3.2a
9(e)	any **one** from: • more economical / cheaper for the consumer • easier/cheaper to replace if broken/lost • since fewer transformers need to be made less resources are used	allow more convenient allow in case one gets lost allow fewer plug sockets are needed allow fewer transformers are needed environmentally friendly is insufficient	1	AO3 3.3.2
Total			11	

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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	
9	
TOTAL	

AQA

General Certificate of Secondary Education
Foundation Tier
June 2015

Physics
Unit Physics P3

PH3FP

F

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 9(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.

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

1 (a) Use the correct answer from the box to complete the sentence.

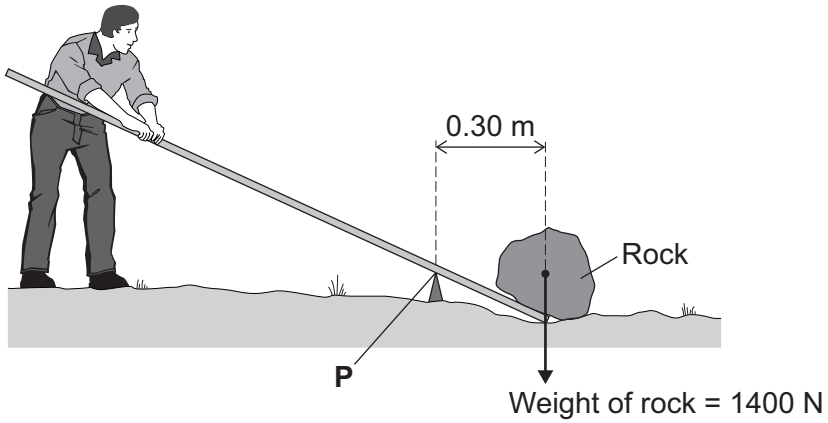
[1 mark]

balancing	stretching	turning

A moment is the ..... effect of a force.

1 (b) **Figure 1** shows how a lever can be used to lift a heavy rock.

Figure 1



Calculate the moment of the weight of the rock about point **P**.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

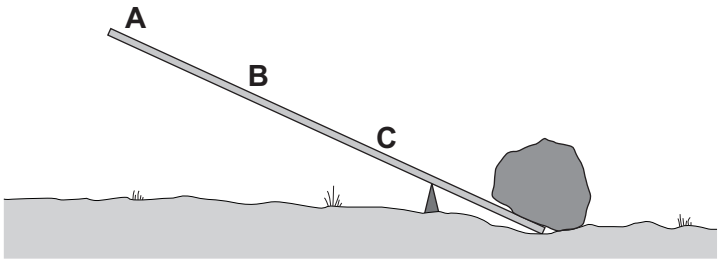
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Moment = ... newton metres

Do not write outside the box

1 (c) **Figure 2** shows three positions on the lever, **A**, **B** and **C**, where the person could have applied a force to lift the rock.

Figure 2



Which position, **A**, **B** or **C**, needs the smallest force to lift the rock?

Draw a ring around the correct answer.

[2 marks]

A **B** **C**

Give the reason for your answer.

.....

.....

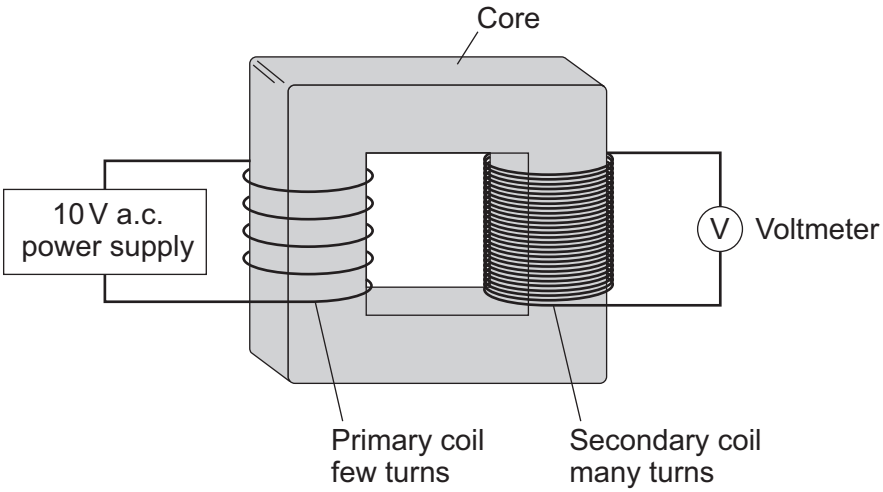
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Turn over for the next question

Do not write outside the box

2 **Figure 3** shows a traditional transformer.

Figure 3



2 (a) (i) Which metal should the core of the transformer be made from?

[1 mark]

Tick (✓) **one** box.

aluminium ☐

copper ☐

iron ☐

2 (a) (ii) What would the reading be on the voltmeter shown in **Figure 3**?

Draw a ring around the correct answer.

[2 marks]

2 V **10 V** **50 V**

Give the reason for your answer.

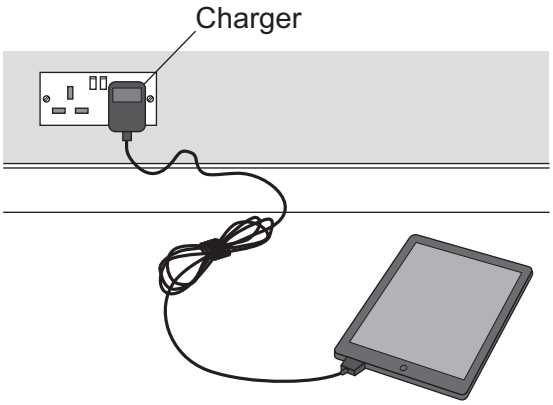
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2 (b) **Figure 4** shows a tablet computer and its charger.

Figure 4



The charger contains a switch mode transformer.

2 (b) (i) Use the correct answer from the box to complete the sentence.

[1 mark]

200	**1000**	**20 000**

Switch mode transformers operate at frequencies

from 50 kHz to ..... kHz.

2 (b) (ii) Give **one** advantage of a switch mode transformer over a traditional transformer.

[1 mark]

.....

.....

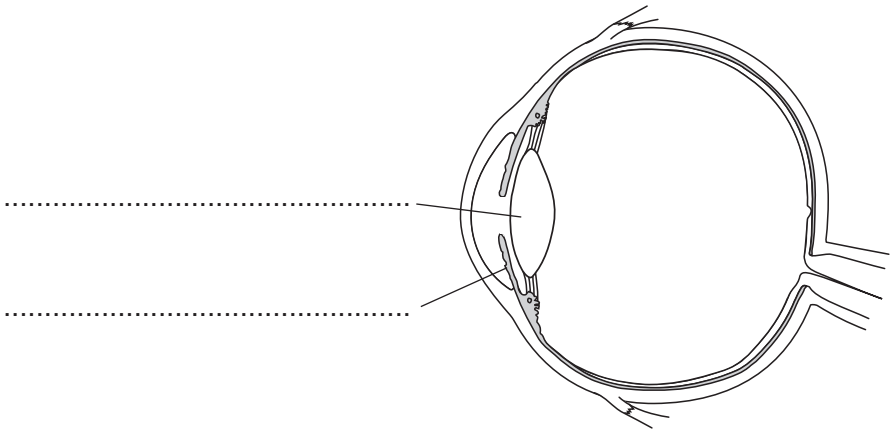
5

Turn over for the next question

Do not write outside the box

3 **Figure 5** shows a diagram of a human eye.

Figure 5



3 (a) Use words from the box to label **Figure 5**.

[2 marks]

Cornea	**Iris**	**Lens**	**Pupil**

3 (b) Draw **one** line from each part of the eye to its correct function.

[2 marks]

Part of the eye	**Function**
Cornea	Changes light into electrical signals
Retina	Changes the direction of light entering the eye
	Changes the shape of the lens

Do not write outside the box

3 (c) Some people wear contact lenses to help them to see clearly.

A contact lens has a focal length of 0.2 metres.

Calculate the power of this contact lens.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

Power of the contact lens = ... dioptres

3 (d) Eye lens replacement is a surgical procedure that can help some people to see clearly.

In this procedure, the surgeon removes the eye lens and replaces it with an artificial lens.

Which statement gives the correct reason for carrying out the procedure?

[1 mark]

Tick (✓) **one** box.

The potential benefit of the procedure is greater than the risk. ☐

The procedure involves a recent medical development. ☐

The surgical procedure is totally safe. ☐

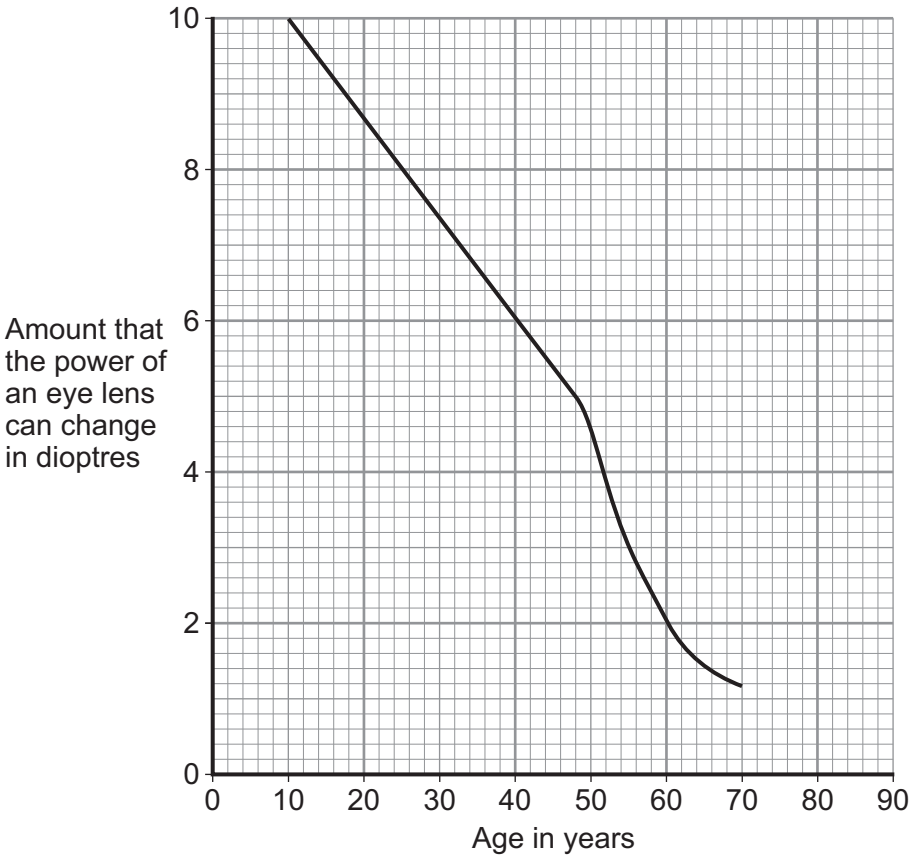
Question 3 continues on the next page

Do not write outside the box

3 (e) When a human eye changes focus from a distant object to a close object, the power of the eye lens changes.

Figure 6 shows how the amount that the power of an eye lens can change depends on age.

Figure 6



3 (e) (i) A person is 40 years old.

State the amount that the power of this person's eye lens is able to change.

[1 mark]

Change in power = ... dioptres

3 (e) (ii) Give **one** conclusion that can be made from **Figure 6**.

[1 mark]

.....

.....

Do not write outside the box

3 (e) (iii) Use **Figure 6** to estimate the amount that the power of the eye lens of an 80-year-old person is able to change.

[1 mark]

Tick (✓) **one** box.

2 dioptres ☐

1 dioptre ☐

0 dioptres ☐

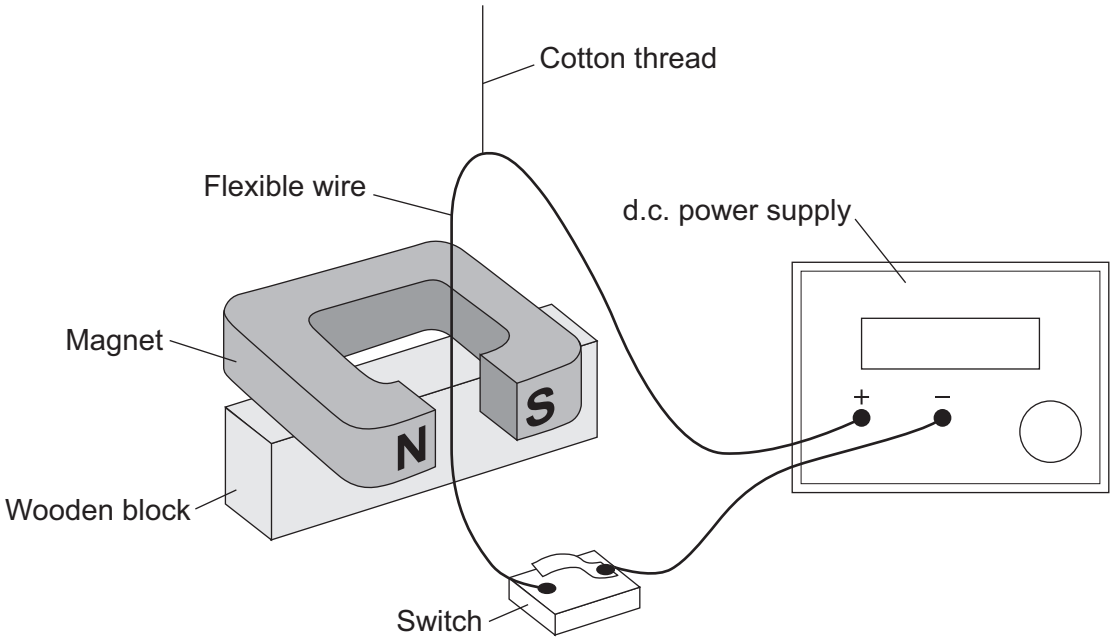
10

Turn over for the next question

Do not write outside the box

4 **Figure 7** shows a demonstration carried out by a teacher.

Figure 7



When the switch is closed, there is a current of 2 A through the wire. The wire experiences a force and moves.

4 (a) Use the correct word from the box to complete the sentence.

[1 mark]

generator	**motor**	**transformer**

The demonstration shows the ..... effect.

4 (b) State **two** changes that the teacher could make to the demonstration, each of which would increase the force on the wire. The teacher does not touch the wire.

[2 marks]

1 .....

.....

2 .....

.....

Do not write outside the box

4 (c) State **one** change that the teacher could make to the demonstration to change the direction of the force on the wire.

[1 mark]

.....

.....

4 (d) With the switch closed, the teacher changes the position of the wire so that the force on the wire is zero.

What is the position of the wire?

[1 mark]

Tick (✓) **one** box.

The wire is at 90° to the direction of the magnetic field. ☐

The wire is at 45° to the direction of the magnetic field. ☐

The wire is parallel to the direction of the magnetic field. ☐

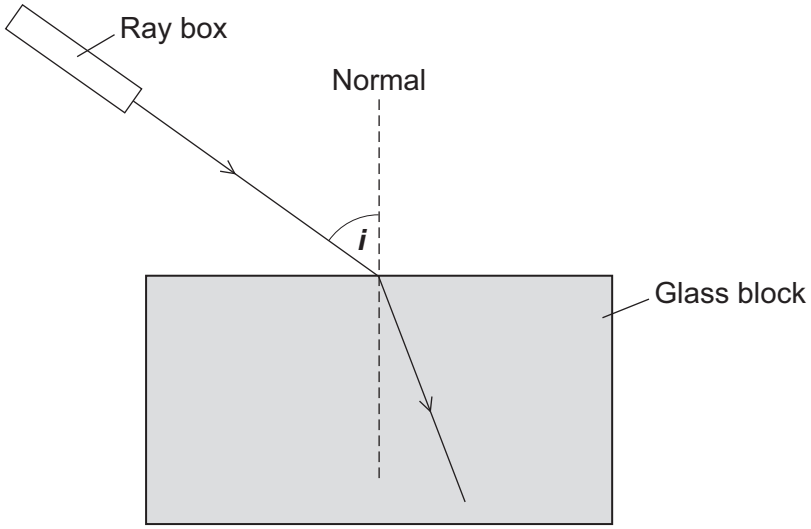
5

Turn over for the next question

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5 (a) **Figure 8** shows a ray of light entering a glass block.

Figure 8



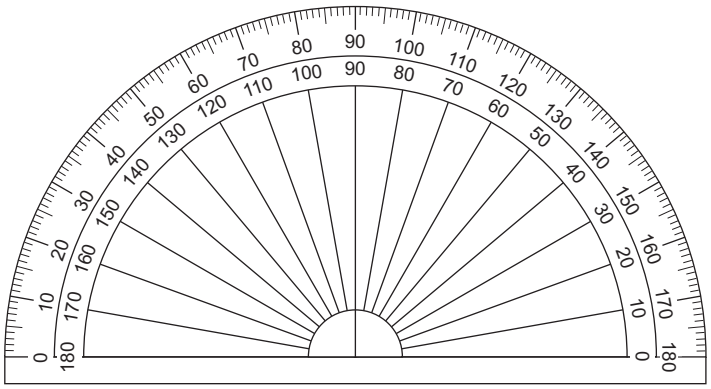
5 (a) (i) The angle of incidence in **Figure 8** is labelled with the letter ***i***.

On **Figure 8**, use the letter ***r*** to label the angle of refraction.

[1 mark]

5 (a) (ii) **Figure 9** shows the protractor used to measure angles ***i*** and ***r***.

Figure 9



What is the resolution of the protractor?

[1 mark]

Tick (✓) **one** box.

1 degree ☐ 5 degrees ☐ 10 degrees ☐

Do not write outside the box

5 (a) (iii) **Table 1** shows calculated values for angle ***i*** and angle ***r*** from an investigation.

Table 1

Calculated values
sin ***i*** = 0.80
sin ***r*** = 0.50

Use the values from **Table 1** to calculate the refractive index of the glass.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

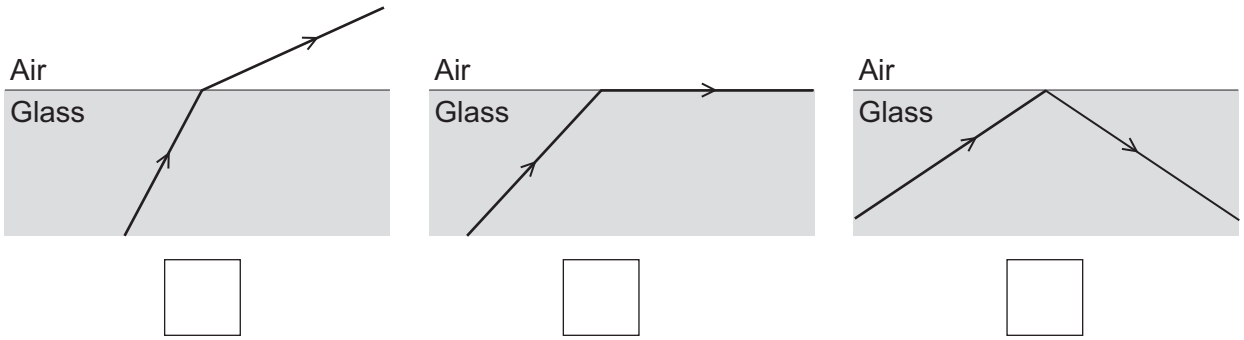
Refractive index = ...

5 (b) The diagrams below show a ray of light moving through glass.

Which diagram correctly shows what happens when the ray of light strikes the surface of the glass at the critical angle?

[1 mark]

Tick (✓) **one** box.



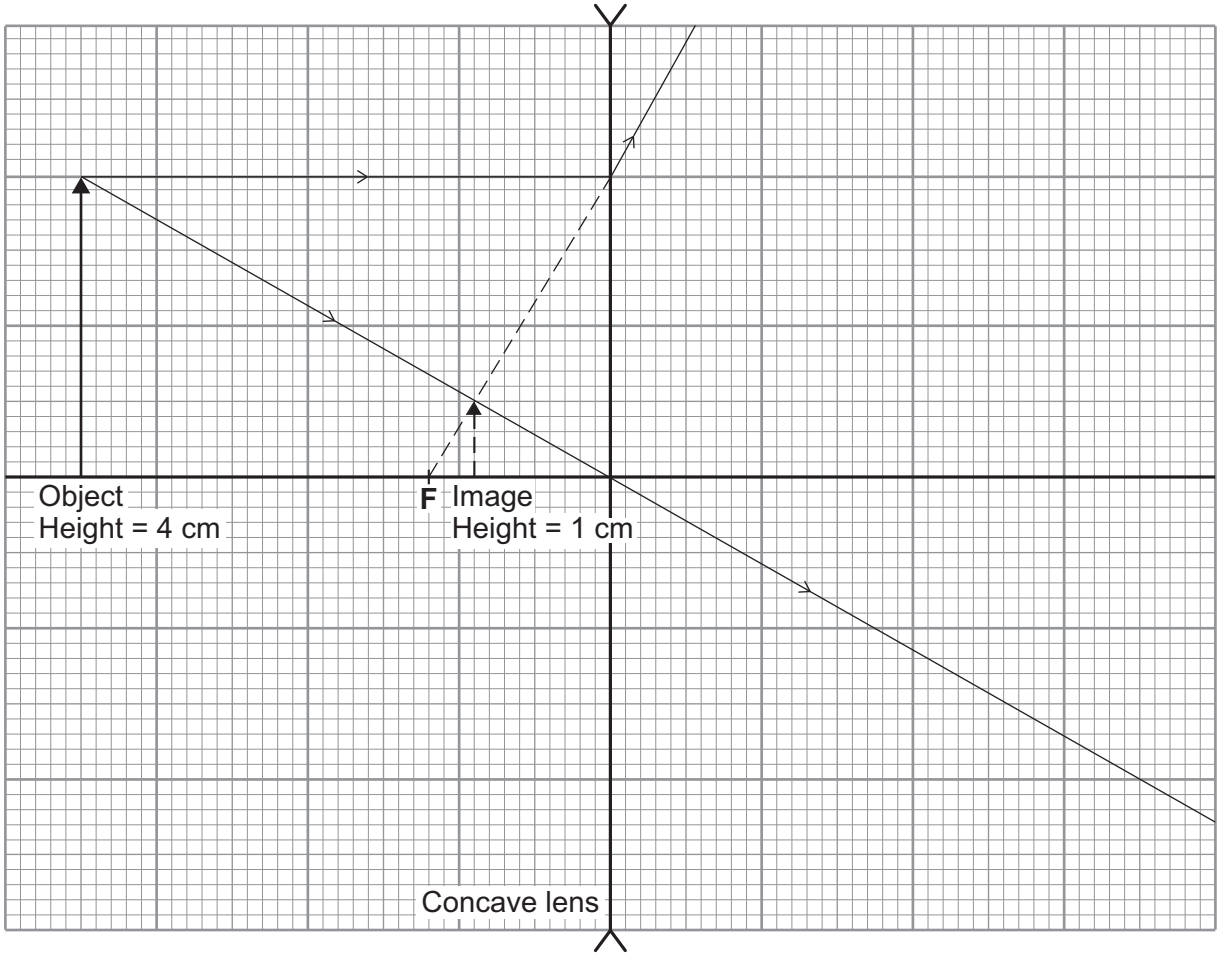
Question 5 continues on the next page

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5 (c) A concave (diverging) lens is fitted into a door to make a security spyhole.

Figure 10 shows how this lens produces an image.

Figure 10



5 (c) (i) State **one** word to describe the nature of the image in **Figure 10**.

[1 mark]

.....

Do not write outside the box

5 (c) (ii) Use data from **Figure 10** to calculate the magnification of the image.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Magnification = ...

5 (c) (iii) What is another use for a concave lens?

[1 mark]

Tick (✓) **one** box.

A magnifying glass ☐

Correcting short sight ☐

To focus an image in a camera ☐

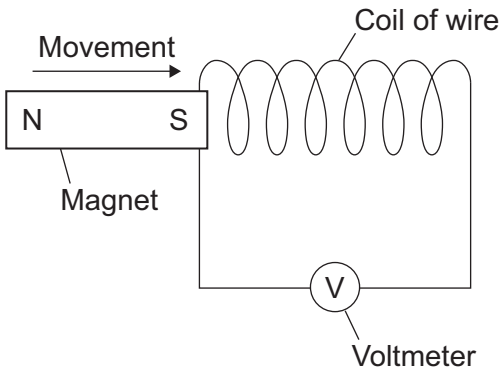
9

Turn over for the next question

Do not write outside the box

6 **Figure 11** shows a magnet moving into a coil of wire. This movement causes a reading on the voltmeter.

Figure 11



6 (a) Use the correct word from the box to complete the sentence.

[1 mark]

generated	**induced**	**produced**

Moving the magnet into the coil of wire causes a reading on the voltmeter because a potential difference is ..... across the ends of the wire.

6 (b) A student investigated how the number of turns on the coil of wire affects the maximum voltmeter reading. The student changed the number of turns on the coil of wire, then moved the magnet into the coil. The student recorded the maximum voltmeter reading.

To obtain valid data, suggest **two** variables that the student should control in this investigation.

[2 marks]

1 .....

.....

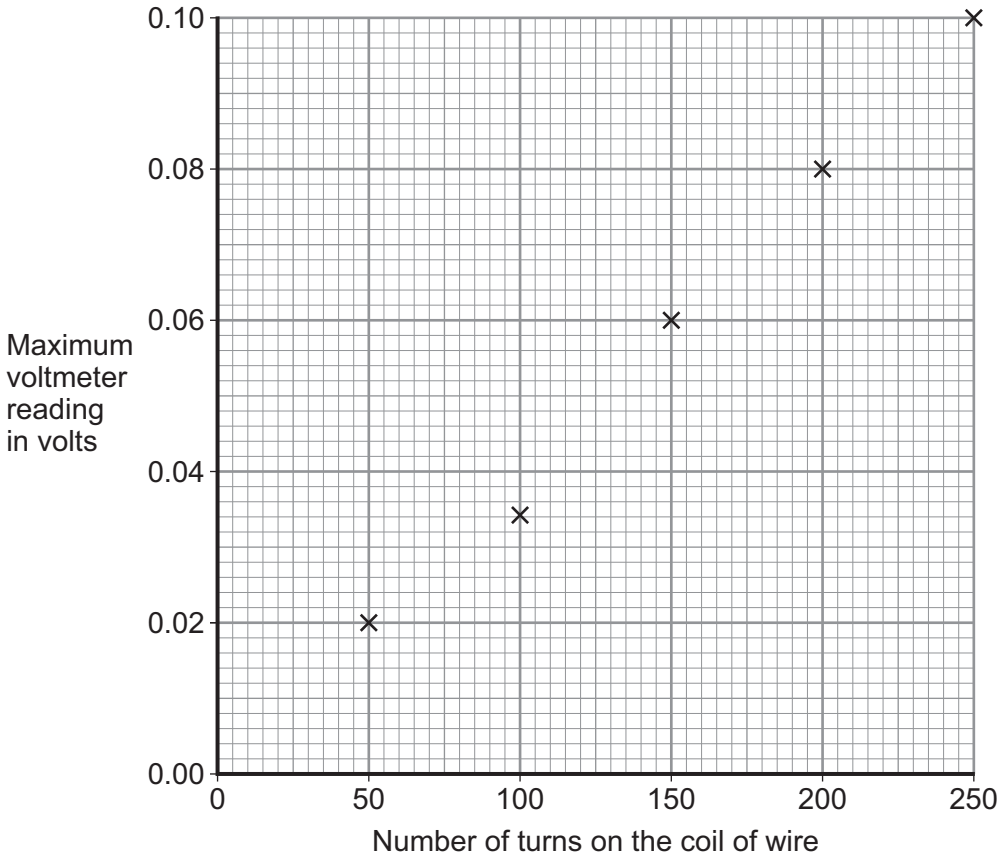
2 .....

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6 (c) The student's results are shown in **Figure 12**.

Figure 12



6 (c) (i) One of the results is anomalous.
Suggest a reason for the anomalous result.

[1 mark]

.....

6 (c) (ii) Draw a line of best fit on **Figure 12**.

[1 mark]

6 (d) A data-logger can automatically record and store data.

It may have been better for the student to have used a data-logger in his investigation rather than a voltmeter.

Suggest **one** reason why.

[1 mark]

.....

.....

6

Turn over ▶

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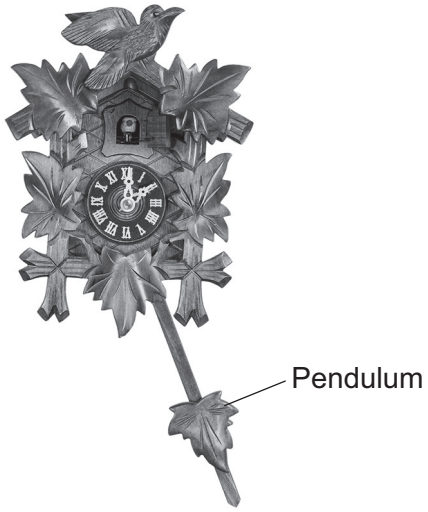
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ANSWER IN THE SPACES PROVIDED

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7 The clock shown in **Figure 13** uses a pendulum to keep time.

Figure 13



7 (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]

.....

.....

.....

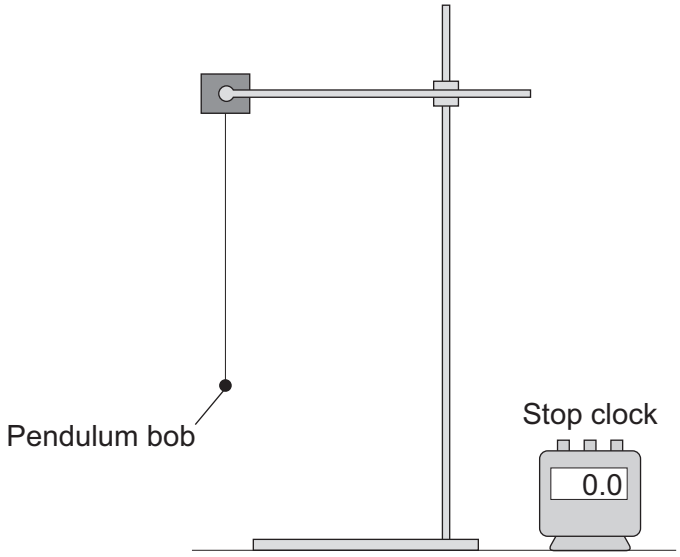
Periodic time = ... seconds

Question 7 continues on the next page

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7 (b) A student investigated the factors affecting the oscillation of a pendulum. The student set up a pendulum as shown in **Figure 14**.

Figure 14



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 2**.

Table 2

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

Do not write outside the box

7 (b) (i) State **two** conclusions that the student should make from the results shown in **Table 2**.

[2 marks]

1 .....

.....

2 .....

.....

7 (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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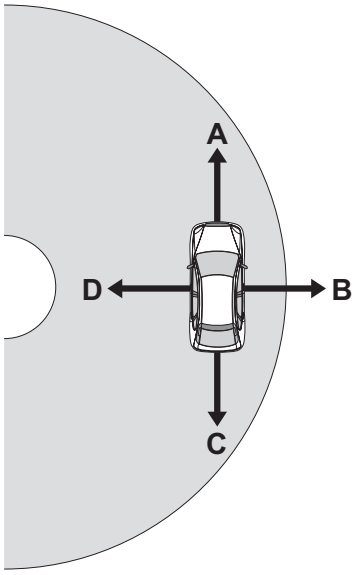
6

Turn over for the next question

Do not write outside the box

8 (a) **Figure 15** shows a car travelling around a bend in the road. The car is travelling at a constant speed.

Figure 15



There is a resultant force acting on the car. This resultant force is called the centripetal force.

8 (a) (i) In which direction, **A**, **B**, **C** or **D**, does the centripetal force act on the car?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

8 (a) (ii) State the name of the force that provides the centripetal force.

[1 mark]

.....

Do not write outside the box

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

[2 marks]

1 .....

2 .....

8 (b) **Figure 16** shows a racing car.

Figure 16



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 .....

.....

2 .....

.....

6

Turn over for the next question

Do not write outside the box

9 (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 ..... .

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

Figure 17 shows one medical use of ultrasound and one medical use of X-rays.

Figure 17





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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8

END OF QUESTIONS

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ANSWER IN THE SPACES PROVIDED

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AQA

GCSE

Physics

PH3FP

Mark scheme

4403

June 2015

Version/Stage: 1.0 Final

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Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

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Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; e.g. allow smooth / free movement.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of error / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

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Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column or by each stage of a longer calculation.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Ignore / Insufficient / Do <u>not</u> allow

Ignore or insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

Quality of Written Communication and levels marking

In Question 9(b) candidates are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Candidates will be required to:

- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: basic

- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: clear

- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: detailed

- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

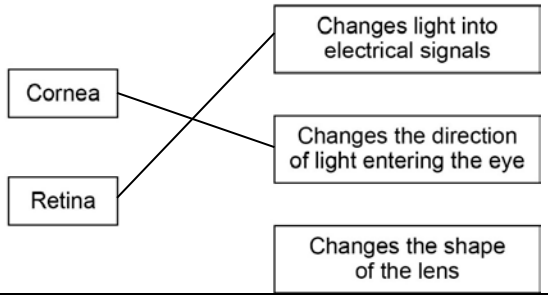
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Question	Answers	Extra information	Mark	AO / Spec. ref.
1(a)	turning		1	AO1 P3.2.2a
1(b)	420	allow **1** mark for correct substitution, ie 1400 x 0.30 provided no subsequent step shown	2	AO2 P3.2.2b, e
1(c)	**A** any **one** correct reason: the force is furthest away (from the pivot)	reason only scores if A is chosen accept distance (from the pivot) is the greatest accept it is further away (from the pivot) accept furthest away from the rock	1 1	AO1 AO2 P3.2.3b, e
Total			5	

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Question	Answers	Extra information	Mark	AO / Spec. ref.
2(a)(i)	Iron		1	AO1 P3.3.2c
2(a)(ii)	50 there are more turns on the secondary coil (than the primary coil)	ignore references to current reason only scores if 50 chosen accept it is a step-up transformer not more coils	1 1	AO1 AO2 P3.3.2g P3.3.2e
2(b)(i)	200		1	AO1 P3.3.2i
2(b)(ii)	any **one** from: • Lighter • smaller • use very little power / current (when switched on with no load /phone attached)	accept more efficient. do not accept uses no power/current a disadvantage of a traditional transformer is insufficient on its own	1	AO1 P3.3.2j &k
Total			5	

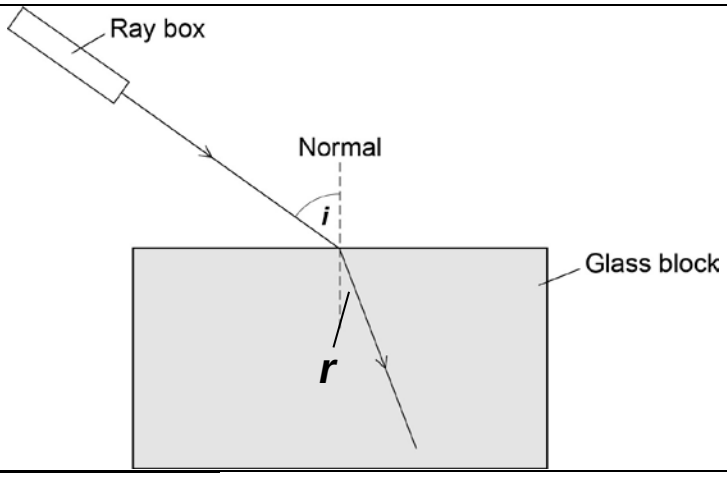
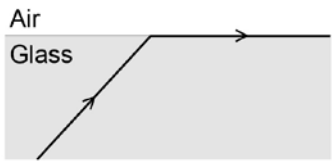
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Question	Answers	Extra information	Mark	AO / Spec. ref.
3(a)	lens iris	correct order only	1 1	AO1 P3.1.4a
3(b)	**Part of the eye** / **Function**  	allow **1** mark for each correct line if more than one line drawn from any part box then all of those lines are wrong	2	AO1 P3.1.4a
3(c)	5	allow **1** mark for correct substitution, ie 1 / 0.2 provided no subsequent step shown	2	AO2 P3.1.4e
3(d)	The potential benefit of the procedure is greater than the risk.		1	AO3 SaLoSE
3(e)(i)	6(.0)		1	AO2 P3.1.4
3(e)(ii)	increasing age decreases the ability of the lens to change power	accept as you get older, the change in (lens) power gets less	1	AO3 P3.1.4
3(e)(iii)	1 dioptre		1	AO3 P3.1.4
Total			10	

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Question	Answers	Extra information	Mark	AO / Spec. ref.
4(a)	motor		1	AO1 P3.3.1b
4(b)	increase the strength of the magnetic field	accept use a stronger magnet use a larger / bigger magnet is insufficient do **not** accept move magnets closer	1	AO1 P3.3.1c
	increase the (size of the) current	accept use a current greater than 2 (A) accept increase the p.d./voltage (of the power supply) increase the power supply is insufficient	1	
4(c)	any **one** from: • (reverse the) direction of the current	accept swap the wires at the power supply connections swap the wires around is insufficient	1	AO1 P3.3.1e
	• (change the) direction of the magnetic field	accept turn the magnet around do **not** accept use an a.c. supply		
4(d)	The wire is parallel to the direction of the magnetic field.		1	AO1 P3.3.1d
Total			5	

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Question	Answers	Extra information	Mark	AO / Spec. ref.
5(a)(i)			1	AO1 P3.1.3c
5(a)(ii)	1 degree		1	AO3 P3.1.3c
5(a)(iii)	1.6	allow **1** mark for correct substitution, ie 0.80 / 0.5 provided no subsequent step shown working showing 1.59(9…..) scores zero	2	AO2 P3.1.3c
5(b)	2nd diagram ticked  ✓		1	AO1 P3.1.5a
5(c)(i)	any **one** correct description: • upright • virtual • diminished	treat multiple words as a list	1	AO1 P3.1.3d

Question 5 continued . . .

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Question	Answers	Extra information	Mark	AO / Spec. ref.
5(c)(ii)	0.25	allow **1** mark for correct substitution, ie 1 / 4 or 5/20 provided no subsequent step shown ignore any unit	2	AO2 P3.1.3i
5(c)(iii)	Correcting short sight		1	AO1 P3.1.4b
Total			9	

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Question	Answers	Extra information	Mark	AO / Spec. ref.
6(a)	induced		1	AO1 P3.3.2b
6(b)	any **two** from: • use the same (strength) magnet • the speed that the magnet is moved • the area of the turns • the magnetic pole being moved towards the coil (of wire)	same size magnet is insufficient accept movement of the magnet same type/length of wire is insufficient use the same voltmeter is insufficient	2	AO3 P3.3.2b
6(c)(i)	voltmeter misread **or** number of turns miscounted	result misread is insufficient human error is insufficient allow the magnet was moved at a (slightly) different speed (into the coil) than for the other readings allow spacing between the turns had changed	1	AO2 P3.3.2
6(c)(ii)	line of best fit passing through all points except (100, 0.034)	line does not need to go back to origin	1	AO3 P3.3.2
6(d)	any **one** from: • can re-check data / readings • can take more readings (in a given time) • easier to identify maximum value	accept can go back to data can store data is insufficient automatically records data is insufficient accept is more accurate accept eliminates human error	1	AO3 P3.3.2b
Total			6	

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Question	Answers	Extra information	Mark	AO / Spec. ref.
7(a)	1.25	accept 1.3 for **2** marks allow **1** mark for correct substitution ie $\frac{1}{0.8}$ provided no subsequent step shown	2	AO2 P3.2.1d
7(b)(i)	increasing the length (of the pendulum) decreases the number of oscillations / swings made (in 20 seconds)	accept increasing the length (of the pendulum) increases the time (of 1 oscillation / swing) accept increasing the length (of the pendulum) decreases the speed/frequency (of 1 oscillation / swing) answers must refer to the effect of increasing/decreasing length ignore references to time being proportional to length	1	AO3 P3.2.1e
	changing the mass (of the pendulum bob) does not change the number of oscillations / swings made (in 20 seconds)	accept changing the mass does not change the time/speed/frequency/results accept weight for mass	1	

Question 7 continues on the next page . . .

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Question	Answers	Extra information	Mark	AO / Spec. ref.
7(b)(ii)	any **two** suitable improvements: • measure (the number of swings) over a wider range of (pendulum) lengths • measure (the number of swings) over a wider range of (bob) masses • measure the number of swings made over a greater period of time • repeat each measurement & calculate mean / average (number of oscillations in 20 seconds) • measure (the total number of swings &) the fraction of swings made • start the swings at the same height	accept repeat measurements & discard anomalous measurements repeat measurements is insufficient use a computer / datalogger to make measurement (of number of oscillations) is insufficient measuring time period is insufficient using a stop clock with greater resolution is insufficient	2	AO3 P3.2.1
Total			6	

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Question	Answers	Extra information	Mark	AO / Spec. ref.
8(a)(i)	D		1	AO2 P3.2.4b
8(a)(ii)	friction		1	AO1 P3.2.4b
8(a)(iii)	any **two** from: • the speed / velocity • the radius of the bend • the mass (of the car)	 the radius is insufficient accept curvature of the road size of the bend is insufficient accept distance of car from centre (of bend) accept weight for mass	2	AO1 P3.2.4c
8(b)	the car has a wide base the car has a low centre of mass / gravity	accept any description of a wide base e.g. the wheels are far apart accept wide wheel base do **not** accept long wheel base a large surface area is insufficient wide tyre(s) is insufficient accept any description of low centre of mass e.g. mass is close to the ground a down force is insufficient	1 1	AO2 P3.2
Total			6	

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Question	Answers	Extra information	Mark	AO / Spec. ref.
9(a)	20,000	accept 20 kilo **or** 20 k **or** 20 001	1	AO1 P3.1.2a
	an atom		1	AO1 P3.1.1a

Question 9 continues on the next page . . .

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
9(b)			6	AO1 P3.1 P3.1.1c

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 4 and apply a 'best-fit' approach to the marking.

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
no relevant content	At least one relevant statement is given for either type of wave	**either** a use, risk and precaution is given for one type of wave **or** A medical use is given for both types of wave **plus** a risk or precaution for one type of wave	At least one medical use is given for both types of wave linked to the risks and any precautions necessary

examples of the points made in the response	extra information
<u>Medical use of X-rays</u> Any one from: • Detecting bone fractures • Detecting dental problems • Killing cancer cells • CT scanning	Ignore details about how X-rays/ultrasound work accept any specific use of X-rays, eg • detecting heart/lung disorders (with chest X-rays) • mammograms / breast cancer detection • detecting stones / bowel disease (with abdominal X-rays)
<u>Risks with X-rays</u> X-rays pose a risk / danger / hazard	accept are harmful
X-rays cause ionisation / damage to cells **or** mutate cells / cause mutations / increase chances of mutations **or** turn cells cancerous / produce abnormal growths / produce rapidly growing cells **or** kill cells	accept a description of what ionising is instead of cell, any of these words can be used: DNA / genes / chromosomes / nucleus accept (may) cause cancer

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Operator precautions with X-rays The X-ray operator should go behind a (metal / glass) screen / leave the room when making an X-ray / wear a lead lined apron	accept appropriate precautions for the patient e.g. limit the total exposure/dose (in one year) wear a radiation badge is insufficient	
Medical use of ultrasound Any one from: • Pre-natal scanning • Imaging (a named body part). • removal / destruction of kidney / gall stones • removing plaque from teeth • repair of damaged tissue / muscle	cleaning teeth is insufficient accept examples of repair, eg alleviating bruising, repair scar damage, ligament / tendon damage, joint inflammation accept physiotherapy accept curing prostate cancer **or** killing prostate cancer cells	
Risks with ultrasound Ultrasound poses no risk / danger / hazard (to the user / patient). Ultrasound is not ionising **or** Ultrasound does not damage (human) cells	accept ultrasound is safer than using X-rays	
Precautions with ultrasound The operator needs to take no precautions when making an ultrasound scan.	this can be assumed if it is stated that ultrasound is harmless or it is safer than using x-rays or it is non-ionising	

Total		**8**

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
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7	
8	
9	
TOTAL	

AQA

General Certificate of Secondary Education
Foundation Tier
June 2014

Physics
Unit Physics P3

PH3FP

F

Monday 19 May 2014 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 9(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.

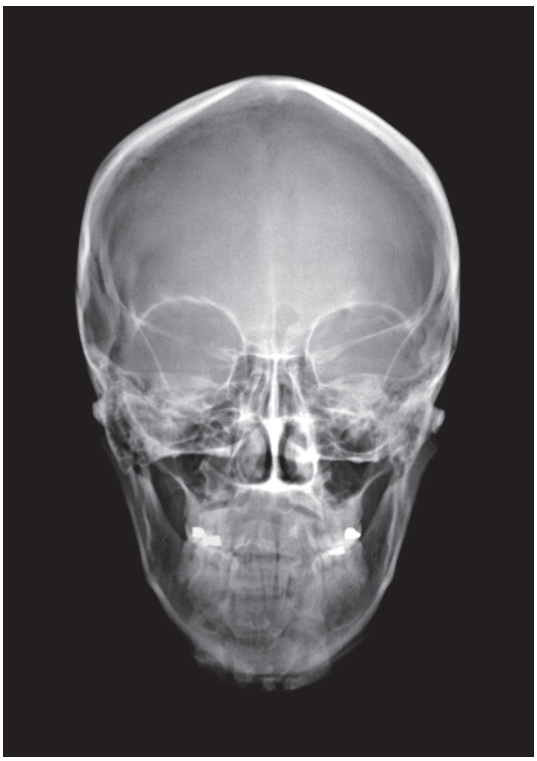
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Do not write outside the box

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

1 **Figure 1** shows an X-ray image of a human skull.

Figure 1



1 (a) Use the correct answers from the box to complete the sentence.

[2 marks]

absorbs	**ionises**	**reflects**	**transmits**

When X-rays enter the human body, soft tissue ..... X-rays and bone ..... X-rays.

1 (b) Complete the following sentence.

[1 mark]

The X-rays affect photographic film in the same way that ..... does.

Do not write outside the box

1 (c) **Table 1** shows the total dose of X-rays received by the human body when different parts are X-rayed.

Table 1

Part of body X-rayed	Dose of X-rays received by human body in arbitrary units
Head	3
Chest	4
Pelvis	60

Calculate the number of head X-rays that are equal in dose to one pelvis X-ray.

[2 marks]

.....

.....

.....

Number of head X-rays = ...

1 (d) Which **one** of the following is another use of X-rays?

Tick (✓) **one** box.

[1 mark]

Cleaning stained teeth ☐

Killing cancer cells ☐

Scanning of unborn babies ☐

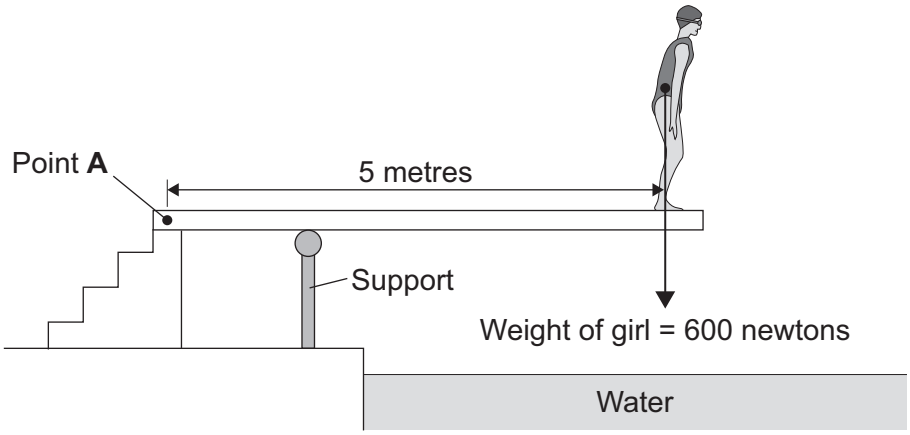
6

Turn over ▶

Do not write outside the box

2 **Figure 2** shows a girl standing on a diving board.

Figure 2



2 (a) Calculate the moment of the girl's weight about Point **A**.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

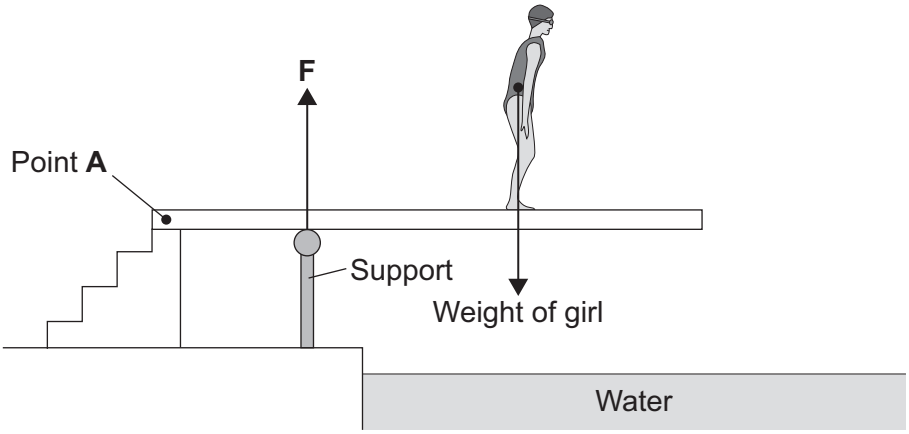
Moment = ... newton metres

Do not write outside the box

2 (b) **Figure 3** shows the girl standing at a different place on the diving board.

The support provides an upward force **F** to keep the diving board balanced.

Figure 3



Complete the following sentence.

[1 mark]

The diving board is not turning. The total clockwise moment is balanced

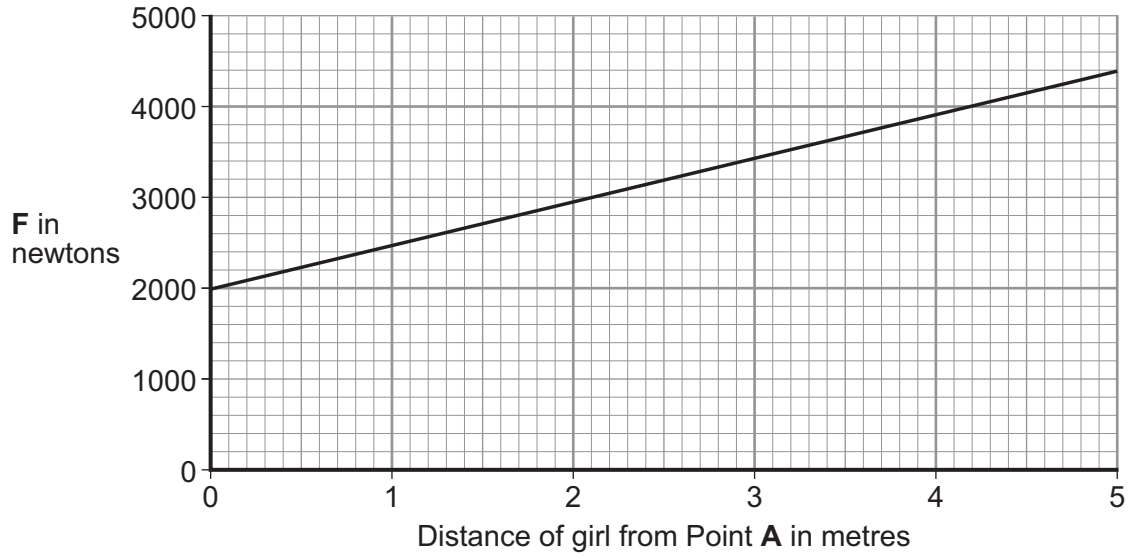
by the total ..... .

Question 2 continues on the next page

Do not write outside the box

2 (c) **Figure 4** shows how the upward force **F** varies with the distance of the girl from Point **A**.

Figure 4



2 (c) (i) Use **Figure 4** to determine the upward force **F** when the girl is standing at a distance of 3 metres from point **A**.

[1 mark]

Upward force **F** = ... newtons

2 (c) (ii) What conclusion should be made from **Figure 4**?

[1 mark]

.....

.....

.....

5

Do not write outside the box

3 (a) Digital cameras and human eyes both form images.

Complete **Table 2** by putting a tick in the correct column(s) to show if the parts are found in the digital camera or in the human eye or in both.

The first part has been completed for you.

[3 marks]

Table 2

Part	In a digital camera	In the human eye
Cornea		✓
Lens		
Pupil		
Charge-coupled device (CCD)		

Question 3 continues on the next page

Do not write outside the box

3 (b) Some humans are short-sighted.

Complete the following sentence.

[1 mark]

Short sight can be caused by the eyeball being too ..... .

3 (c) Spectacles can be worn to correct short sight.

Table 3 gives information about three different lenses that can be used in spectacles.

Table 3

	Lens feature		
	Material	**Mass in grams**	**Type**
Lens A	Plastic	5.0	Concave (diverging)
Lens B	Glass	6.0	Convex (converging)
Lens C	Glass	5.5	Convex (converging)

Which lens from **Table 3** would be used to correct short sight?

Draw a ring around the correct answer.

Lens A **Lens B** **Lens C**

Give the reason for your answer.

[2 marks]

.....

.....

Do not write outside the box

3 (d) Every lens has a focal length.

Which factor affects the focal length of a lens?

Tick (✓) **one** box.

[1 mark]

The colour of the lens ☐

The refractive index of the lens material ☐

The size of the object being viewed ☐

3 (e) A lens has a focal length of 0.25 metres.

Calculate the power of the lens.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Power of lens = ... dioptres

3 (f) Laser eye surgery can correct some types of eye defect.

Which of the following is another medical use for a laser?

Tick (✓) **one** box.

[1 mark]

Cauterising open blood vessels ☐

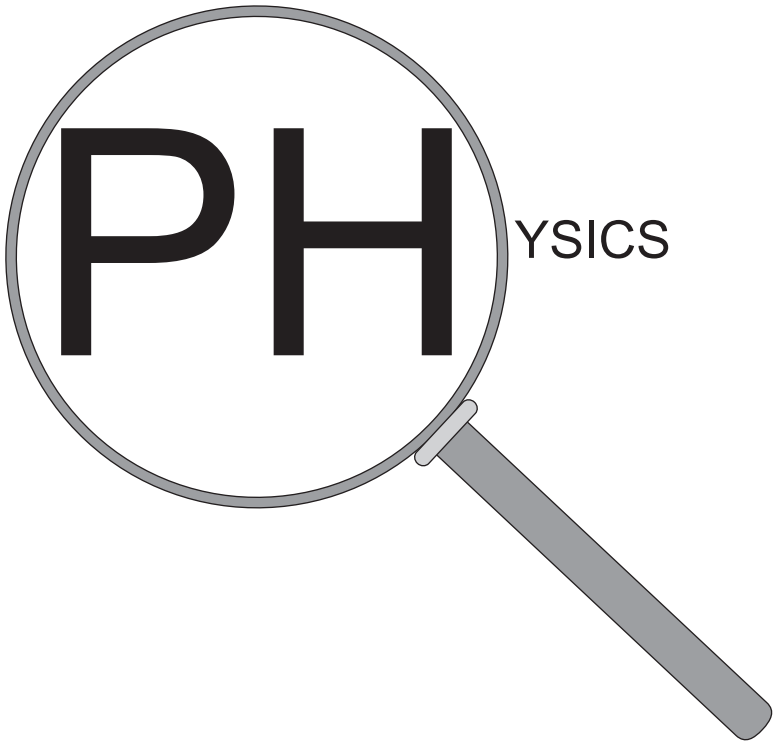
Detecting broken bones ☐

Imaging the lungs ☐

Do not write outside the box

3 (g) **Figure 5** shows a convex lens being used as a magnifying glass.

Figure 5



Not to scale

An object of height 14 mm is viewed through a magnifying glass.

The image height is 70 mm.

Calculate the magnification produced by the lens in the magnifying glass.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Magnification = ...

12

Do not write outside the box

4 (a) Use the correct answer from the box to complete the sentence.

[1 mark]

concentrated	**stored**	**pivoted**

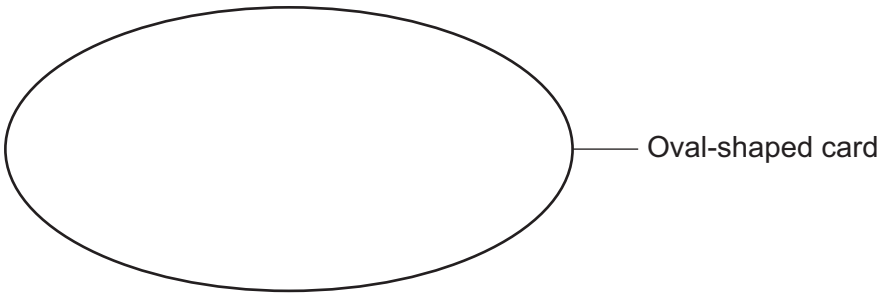
The centre of mass of an object is the point at which the mass of an object may be thought to be ..... .

4 (b) **Figure 6** shows an oval-shaped piece of card.

Draw an **X** on **Figure 6**, so that the centre of the **X** marks the centre of mass of the oval shape.

[1 mark]

Figure 6

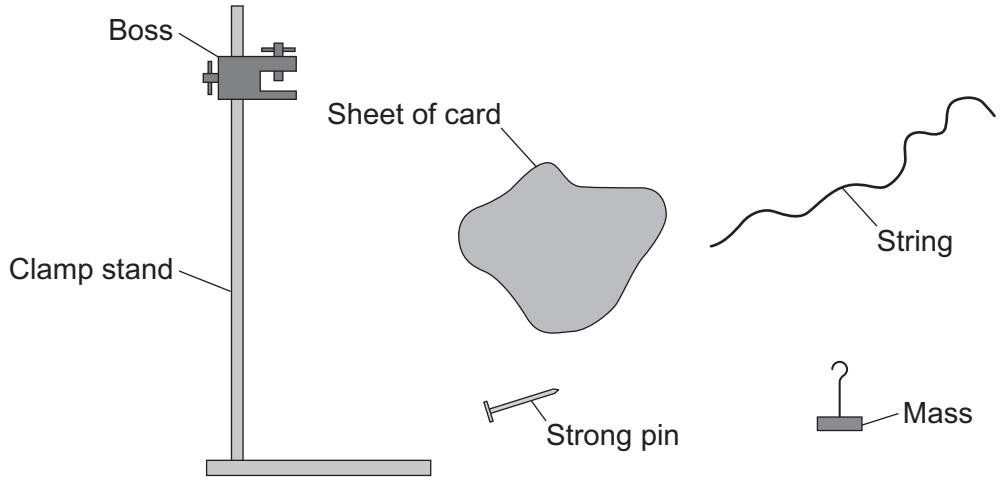


Question 4 continues on the next page

Do not write outside the box

4 (c) **Figure 7** shows some apparatus and a sheet of card.

Figure 7



The sentences describe how to find the centre of mass of the sheet of card.

The sentences are in the wrong order.

A Tie the mass to one end of the string and then hang the string from the pin.

B Repeat this using the other hole. The centre of mass is where the two lines cross on the card.

C Put the pin through one of the holes in the card and hold the pin in the boss.

D Draw a line on the card marking the position of the string.

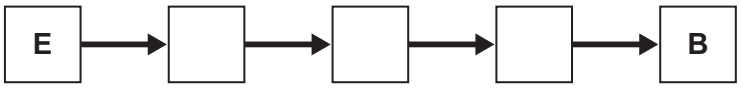
E Make two holes in the card, with each hole near to the edge of the card.

Put the sentences into the correct order to describe how to find the centre of mass of the card.

Start with **E** and end with **B**.

Write the correct order in these boxes.

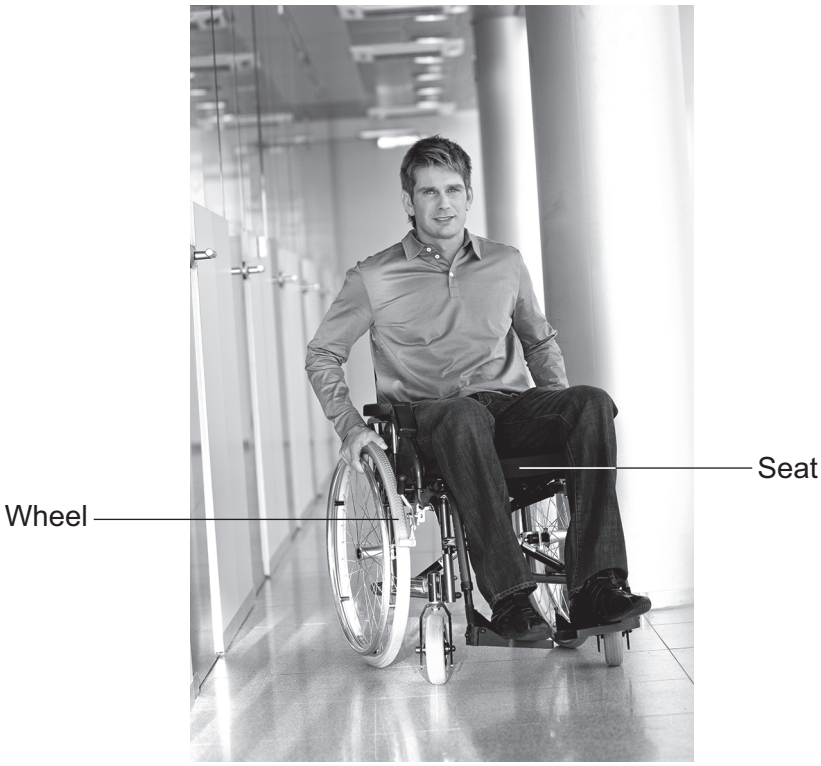
[2 marks]



Do not write outside the box

4 (d) **Figure 8** shows a person in a wheelchair.

Figure 8



Tipping the wheelchair at a large angle may cause it to become unstable and to topple over.

How could the design of this wheelchair be changed to make it less likely to be toppled over?

Tick (✓) **two** boxes.

[2 marks]

Lower the person's seating position ☐

Make the wheelchair from lighter materials ☐

Move the wheels further apart ☐

Use taller wheels ☐

6

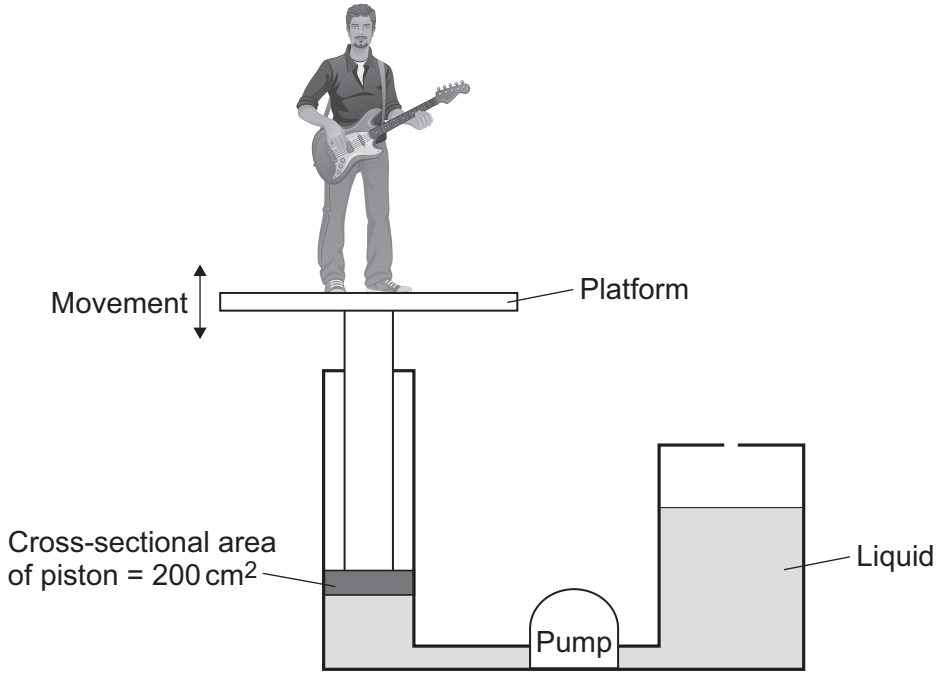
Turn over ▶

Do not write outside the box

5 Musicians sometimes perform on a moving platform.

Figure 9 shows the parts of the lifting machine used to move the platform up and down.

Figure 9



5 (a) What name is given to a system that uses liquids to transmit forces?

Draw a ring around the correct answer.

[1 mark]

electromagnetic **hydraulic** **ionising**

Do not write outside the box

5 (b) To move the platform upwards, the liquid must cause a force of 1800 N to act on the piston.

The cross-sectional area of the piston is 200 cm^2.

Calculate the pressure in the liquid, in N/cm^2, when the platform moves.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Pressure = ... N/cm^2

5 (c) A new development is to use oil from plants as the liquid in the machine.

Growing plants and extracting the oil requires **less energy** than producing the liquid usually used in the machine.

Draw a ring around the correct answer to complete the sentence.

[1 mark]

Using the oil from the plants gives | an environmental / an ethical / a social | advantage over the liquid usually used.

4

Turn over for the next question

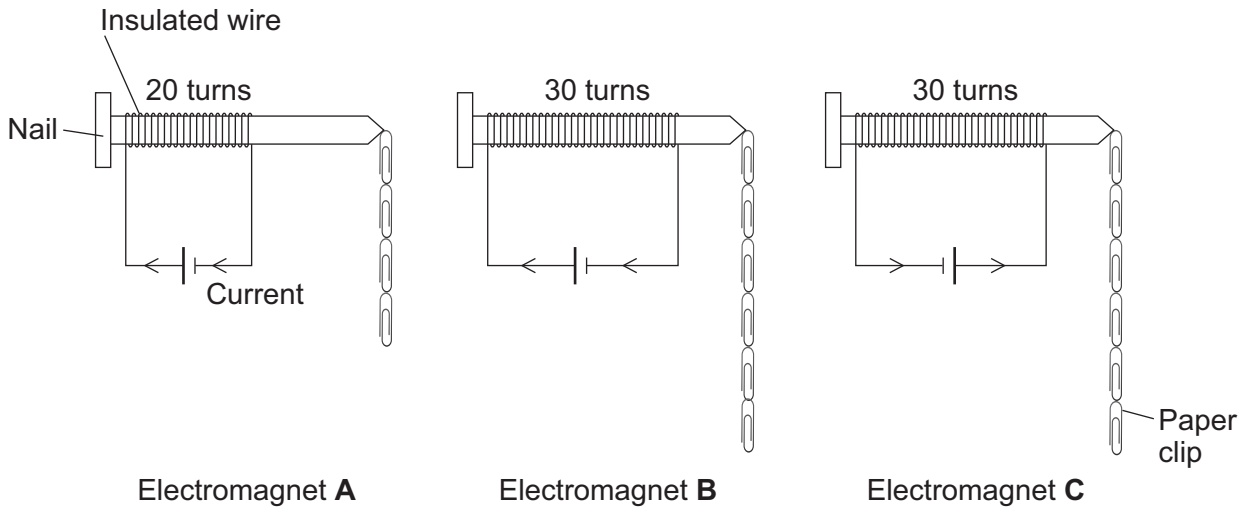
Do not write outside the box

6 A student is investigating the strength of electromagnets.

Figure 10 shows three electromagnets.

The student hung a line of paper clips from each electromagnet.

Figure 10



No more paper clips can be hung from the bottom of each line of paper clips.

6 (a) (i) Complete the conclusion that the student should make from this investigation.

[1 mark]

Increasing the number of turns of wire wrapped around the nail will .....

the strength of the electromagnet.

6 (a) (ii) Which **two** pairs of electromagnets should be compared to make this conclusion?

[1 mark]

Pair 1: Electromagnets ..... and .....

Pair 2: Electromagnets ..... and .....

6 (a) (iii) Suggest **two** variables that the student should control in this investigation.

[2 marks]

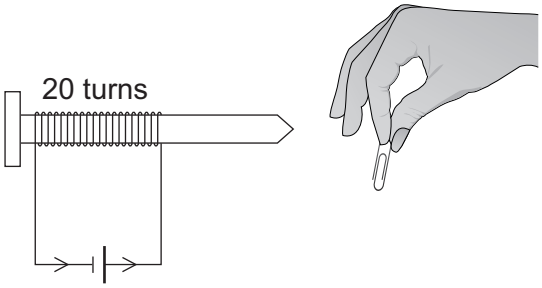
1 .....

2 .....

Do not write outside the box

6 (b) The cell in electromagnet **A** is swapped around to make the current flow in the opposite direction. This is shown in **Figure 11**.

Figure 11



What is the maximum number of paper clips that can now be hung in a line from this electromagnet?

Draw a ring around the correct answer.

[2 marks]

fewer than 4 **4** **more than 4**

Give **one** reason for your answer.

.....

.....

.....

6 (c) Electromagnet **A** is changed to have only 10 turns of wire wrapped around the nail.

Suggest the maximum number of paper clips that could be hung in a line from the end of this electromagnet.

[1 mark]

Maximum number of paper clips = ...

7

Do not write outside the box

7 (a) What is ultrasound?

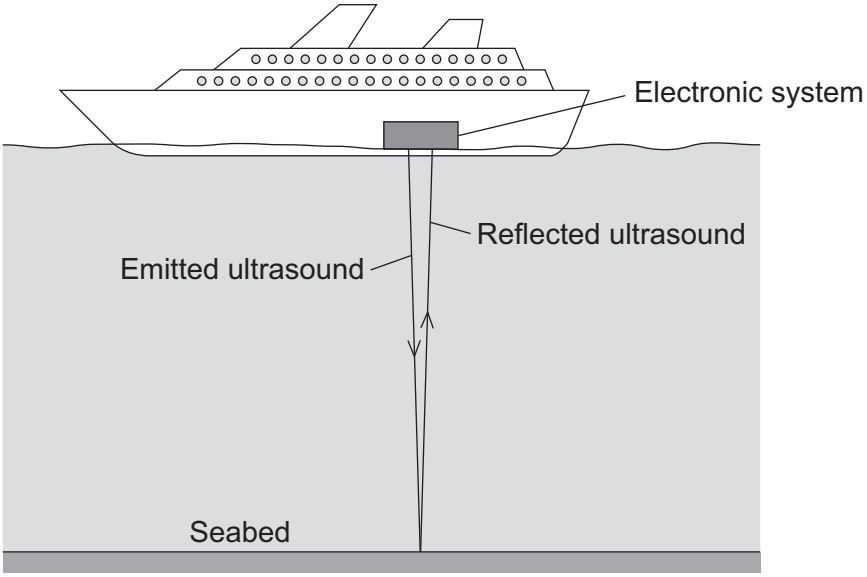
[1 mark]

.....

.....

7 (b) **Figure 12** shows how ultrasound is used to measure the depth of water below a ship.

Figure 12



A pulse of ultrasound is sent out from an electronic system on-board the ship.

It takes 0.80 seconds for the emitted ultrasound to be received back at the ship.

Calculate the depth of the water.

Speed of ultrasound in water = 1600 m/s

Use the correct equation from the Physics Equations Sheet.

[3 marks]

.....

.....

.....

.....

Depth of water = ... metres

Do not write outside the box

7 (c) Ultrasound can be used in medicine for scanning.

State **one** medical use of ultrasound scanning.

[1 mark]

.....

7 (d) Images of the inside of the human body can be made using a Computerised Tomography (CT) scanner. The CT scanner in **Figure 13** uses X-rays to produce these images.

Figure 13



State **one** advantage and **one** disadvantage of using a CT scanner, compared with ultrasound scanning, for forming images of the inside of the human body.

[2 marks]

Advantage of CT scanning .....

.....

.....

Disadvantage of CT scanning .....

.....

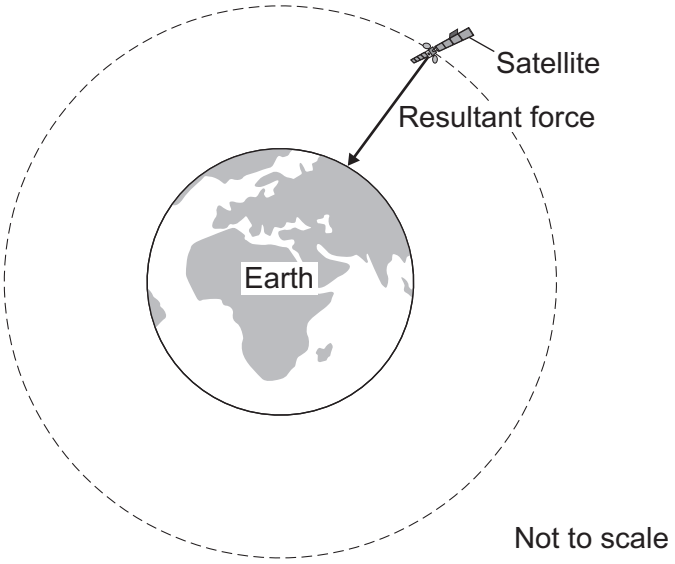
.....

7

Do not write outside the box

8 Man-made satellites can orbit the Earth, as shown in **Figure 14**.

Figure 14



The satellite experiences a resultant force directed towards the centre of the orbit.

The resultant force is called the centripetal force.

8 (a) What provides the centripetal force on the satellite?

[1 mark]

.....

8 (b) State **two** factors that determine the size of the centripetal force on the satellite.

[2 marks]

1 .....

2 .....

Do not write outside the box

8 (c) **Table 4** gives data for five different satellites orbiting the Earth.

Table 4

Satellite	Average height above Earth's surface in kilometres	Time taken to orbit Earth once in minutes	Mass of satellite in kilograms
A	370	93	419 000
B	697	99	280
C	827	103	630
D	5 900	228	400
E	35 800	1440	2 030

8 (c) (i) State the relationship, if any, between the height of the satellite above the Earth's surface and the time taken for the satellite to orbit the Earth once.

[1 mark]

.....

.....

8 (c) (ii) State the relationship, if any, between the time taken for the satellite to orbit the Earth once and the satellite's mass.

[1 mark]

.....

.....

Question 8 continues on the next page

Do not write outside the box

8 (d) Over 300 years ago, the famous scientist Isaac Newton proposed, with a 'thought experiment', the idea of satellites.

Newton suggested that if an object was fired at the right speed from the top of a high mountain, it would circle the Earth.

Why did many people accept Isaac Newton's idea as being possible?

Tick (✓) **one** box.

[1 mark]

Isaac Newton was a respected scientist who had made new discoveries before. ☐

Isaac Newton went to university. ☐

It was a new idea that nobody else had thought of before. ☐

6

Do not write outside the box

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

There are two types of traditional transformer; step-up and step-down.

Describe the similarities and differences between a step-up transformer and a step-down transformer.

You should include details of:

- construction, including materials used
- the effect the transformer has on the input potential difference (p.d.).

You should **not** draw a diagram.

[6 marks]

.....

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Extra space .....

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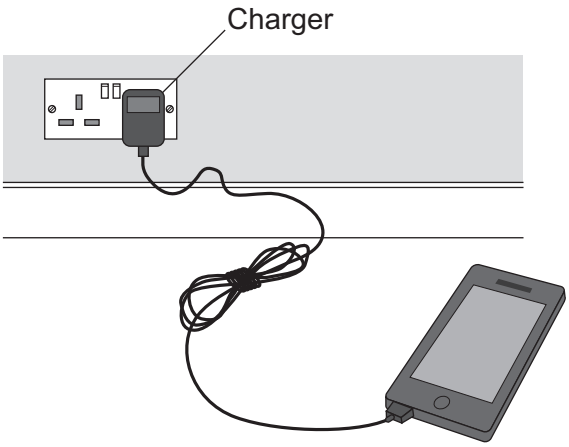
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Question 9 continues on the next page

Do not write outside the box

9 (b) **Figure 15** shows a mobile phone and charger.

Figure 15



Mobile phone chargers use a different type of transformer, which is smaller and lighter than a traditional transformer.

What name is given to the type of transformer used in a mobile phone charger?

[1 mark]

.....

7

END OF QUESTIONS

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GCSE
PHYSICS

PH3FP

Mark scheme

4403

June 2014

Version: 1.0 Final

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Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; e.g. allow smooth / free movement.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of error / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

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Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column or by each stage of a longer calculation.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Ignore / Insufficient / Do <u>not</u> allow

Ignore or insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

Quality of Written Communication and levels marking

In Question 9(a) candidates are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Candidates will be required to:

- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: basic

- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: clear

- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: detailed

- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

Question	Answers	Extra information	Mark	AO spec ref
1(a)	transmits absorbs	correct order	1 1	AO1 3.1.1b
1(b)	light	allow ultra violet **or** UV **or** infrared **or** IR **or** gamma	1	AO1 3.1.1b
1(c)	20	allow **1** mark for correct working, ie $\frac{60}{3}$ provided no subsequent step	2	AO2 3.1.1b
1(d)	Killing cancer cells		1	AO1 3.1.1b
Total			**6**	

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Question	Answers	Extra information	Mark	AO spec ref
2(a)	3000	allow **1** mark for correct substitution, ie 600 × 5 provided no subsequent step	2	AO2 3.2.2b
2(b)	anticlockwise moment	must be both words	1	AO1 3.2.2c
2(c)(i)	3400	allow 3.4 kilo (newtons)	1	AO2 3.2.2c
2(c)(ii)	as the distance (of the girl from point A) increases, force F increases	allow gets bigger for increases force is (directly) proportional to distance will negate any correct response	1	AO3 4.5.3
Total			**5**	

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<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO
spec ref</th></tr>
<tr><td>3(a)</td><td>
<table>
<tr><td></td><td>Digital Camera</td><td>Eye</td></tr>
<tr><td>Cornea</td><td></td><td>✓</td></tr>
<tr><td>Lens</td><td>✓</td><td>✓</td></tr>
<tr><td>Pupil</td><td></td><td>✓</td></tr>
<tr><td>CCD</td><td>✓</td><td></td></tr>
</table>
</td><td>ignore shaded row
each correct row = 1 mark</td><td>3</td><td>AO1

3.1.4a, d</td></tr>
<tr><td>3(b)</td><td>long</td><td></td><td>1</td><td>AO1

3.1.4b</td></tr>
<tr><td>3(c)</td><td>lens A

it is a concave / diverging lens</td><td>

this mark is only gained if lens A is stated

any reference to lens material or mass of lens negates this mark

allow it will focus light onto the retina</td><td>1

1</td><td>AO1

3.1, 3.1.4b</td></tr>
<tr><td>3(d)</td><td>The refractive index of the lens material</td><td></td><td>1</td><td>AO1

3.1.4f</td></tr>
<tr><td>3(e)</td><td>4</td><td>ignore any signs

allow 1 mark for correct substitution, ie $\frac{1}{0.25}$ provided no subsequent step</td><td>2</td><td>AO2

3.1.4e</td></tr>
</table>

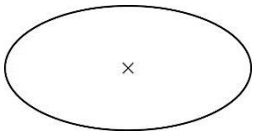
Question 3 continues on the next page . . .

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Question 3 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
3(f)	Cauterising open blood vessels		1	AO1 3.1.5f
3(g)	5	allow **1** mark for correct substitution, ie $\frac{70}{14}$ provided no subsequent step	2	AO2 3.1.3i
Total			**12**	

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Question	Answers	Extra information	Mark	AO spec ref
4(a)	concentrated		1	AO1 3.2.1a
4(b)		judge by eye	1	AO2 3.2.1c
4(c)	C A D	3 correct = **2** marks 1 or 2 correct = **1** mark	2	AO1 3.2.1a
4(d)	Lower the athlete's seating position Move the wheels further apart		1 1	AO2 3.2
Total			**6**	

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Question	Answers	Extra information	Mark	AO spec ref
5(a)	hydraulic		1	AO1 3.2.3
5(b)	9	allow **1** mark for a correct substitution, ie $\frac{1800}{200}$ provided no subsequent step	2	AO2 3.2.3c
5(c)	an environmental		1	AO3 SALoSE
Total			**4**	

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Question	Answers	Extra information	Mark	AO spec ref
6(a)(i)	increase		1	AO3 3.3.1a, 4.5.4
6(a)(ii)	A and B and B and C	both required for the mark either order	1	AO3 3.3.1a, 4.5.4
6(a)(iii)	any **two** from: • size of nail **or** nail material • current • (size of) paper clip • length of wire	 allow (same) nail allow (same) cell allow p.d. same amount of electricity is insufficient accept type/thickness of wire	2	AO3 4.1b
6(b)	4 B picks up the same number as C, so this electromagnet would pick up the same number as A **or** direction of current does not affect the strength of the electromagnet	 allow it has got the same number of turns as A	1 1	AO3 3.3.1a, 4.5.4
6(c)	2	allow 1 or 3	1	AO3 3.3.1a, 4.5.4
Total			**7**	

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Question	Answers	Extra information	Mark	AO spec ref
7(a)	(sound waves) which have a frequency higher than the upper limit of hearing for humans **or** a (sound) wave (of frequency) above 20 000 Hz	sound waves that cannot be heard is insufficient a wave of frequency 20 000 Hz is insufficient	1	AO1 3.1.2a
7(b)	640	an answer of 1280 gains **2** marks allow **2** marks for the correct substitution ie 1600 × 0.40 provided no subsequent step allow **2** marks for the substitution $\frac{1600 \times 0.80}{2}$ provided no subsequent step allow **1** mark for the substitution 1600 × 0.80 provided no subsequent step allow **1** mark for the identification that time (boat to bed) is 0.4	3	AO2 3.1.2c
7(c)	any **one** from: • pre-natal scanning / imaging • imaging of a named organ (that is not surrounded by bone), eg stomach, bladder, testicles • Doppler scanning blood flow	accept heart do **not** allow brain **or** lungs (either of these negates a correct answer)	1	AO1 3.1.2d

Question 7 continues on the next page . . .

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Question 7 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
7(d)	advantage any **one** from: • (images are) high quality or detailed or high resolution • (scan) produces a slice through the body • image can be viewed from any direction • an image can be made of <u>any</u> part (inside the body) • easier to diagnose **or** see a problem (on the image) disadvantage any **one** from: • (the X-rays used **or** scans) are <u>ionising</u> • mutate cells **or** cause mutations **or** increase chances of mutations • turn cells cancerous **or** produce abnormal growths **or** produce rapidly growing cells • kill cells • shielding is needed	clearer / better image is sufficient allow images are (always) 3D / 360° allow whole body can be scanned allow a description of what ionising is allow for cells: DNA / genes / chromosomes / nucleus / tissue damage cells is insufficient can be dangerous (to human health) unqualified, is insufficient	1 1	AO1 3.1
Total			**7**	

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Question	Answers	Extra information	Mark	AO spec ref
8(a)	gravitational attraction (between the satellite and the Earth)	allow gravity allow weight of the satellite	1	AO1 3.2.4b
8(b)	any **two** from: • mass of satellite • speed / velocity (of satellite) • radius of orbit / circle	allow height above the Earth radius / height alone is insufficient	2	AO1 3.2.4c
8(c)(i)	increasing the height (above the Earth's surface) increases the time (for one orbit)	allow a positive correlation allow as one gets bigger, the other gets bigger, or vice versa ignore they are directly proportional	1	AO3 4.5.3
8(c)(ii)	there is no relationship / correlation		1	AO3 4.5.3
8(d)	Isaac Newton was a respected scientist who had made new discoveries before		1	AO3 3.2.4, SALoSE
Total			**6**	

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<table>
<tr><td>Question

9(a)</td><td colspan="2">Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a ‘best-fit’ approach to the marking.</td><td>Mark

6</td><td>AO spec ref</td></tr>
<tr><td>0 marks</td><td>Level 1 (1–2 marks)</td><td>Level 2 (3–4 marks)</td><td colspan="2">Level 3 (5–6 marks)</td><td>AO1
3.3.2</td></tr>
<tr><td>No relevant / correct content.</td><td>Either
there is an attempt at a description of the construction of a transformer

or

a correct statement of the effect of one type of transformer on the input p.d.</td><td>There is a description of the construction of a transformer
and
a correct statement of the effect of one type of transformer on the input p.d.</td><td colspan="3">There is a clear description of the construction of a transformer
and
there is a correct description of how transformers affect the input p.d.</td></tr>
<tr><td colspan="3">details of construction:
a (laminated) core
core is made from a magnetic material / iron
2 coils
the coils are made from an electrical conductor / copper
the coils are covered in plastic / insulation
the coils are (usually) on opposite sides
step-up transformer has more turns on secondary coil than (its) primary (or vice versa)
step-down transformer has less turns on secondary coil than (its) primary (or vice versa)

effect on input p.d. :
step-up transformer, the output p.d. is greater (than the input p.d.)
step-down transformer, the output p.d. is lower (than the input p.d.)</td><td colspan="3">extra information

accept voltage for p.d.</td></tr>
</table>

Question 9 continues on the next page . . .

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Question 9 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
9(b)	switch mode (transformer)		1	AO1 3.3.2j
Total			**7**	

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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
June 2013

Physics

Unit Physics P3

PH3FP

F

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 8 (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.

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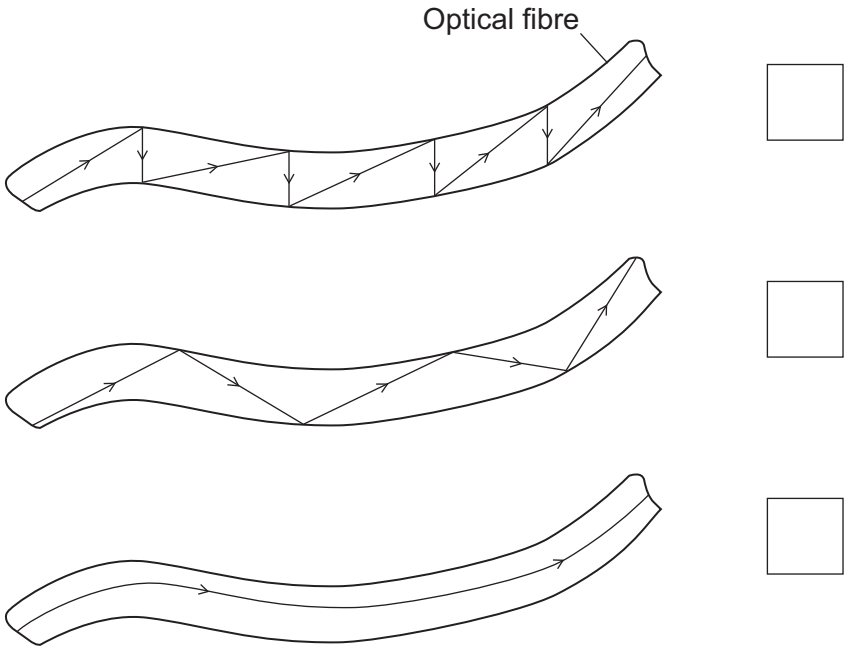
Do not write outside the box

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

1 (a) Visible light can be sent along optical fibres.

Which diagram correctly shows the path of light along an optical fibre?

Tick (✓) **one** box.



(1 mark)

1 (b) Complete the sentence to describe what happens to light as it travels through an optical fibre.

At the walls of the optical fibre, light undergoes total internal ..... .

(1 mark)

Do not write outside the box

1 (c) Which device passes light through optical fibres to produce images of the inside of the body?

Draw a ring around the correct answer.

endoscope **stethoscope** **X-ray machine**

(1 mark)

1 (d) Lasers are an energy source.

Which **one** of the following is a use for a laser?

Draw a ring around the correct answer.

CT scanning **digital camera** **eye surgery**

(1 mark)

4

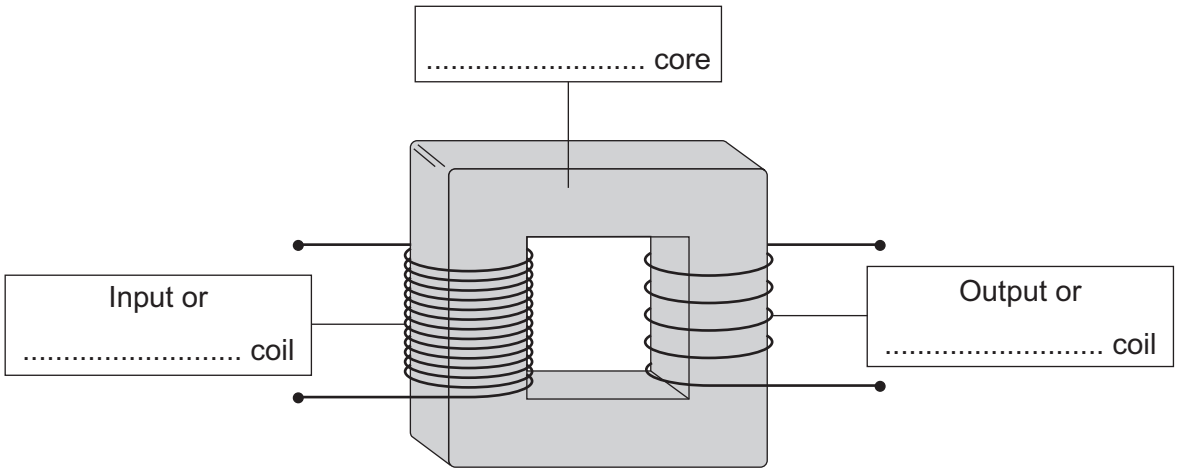
Turn over for the next question

Do not write outside the box

2 (a) The diagram shows the structure of a traditional transformer.

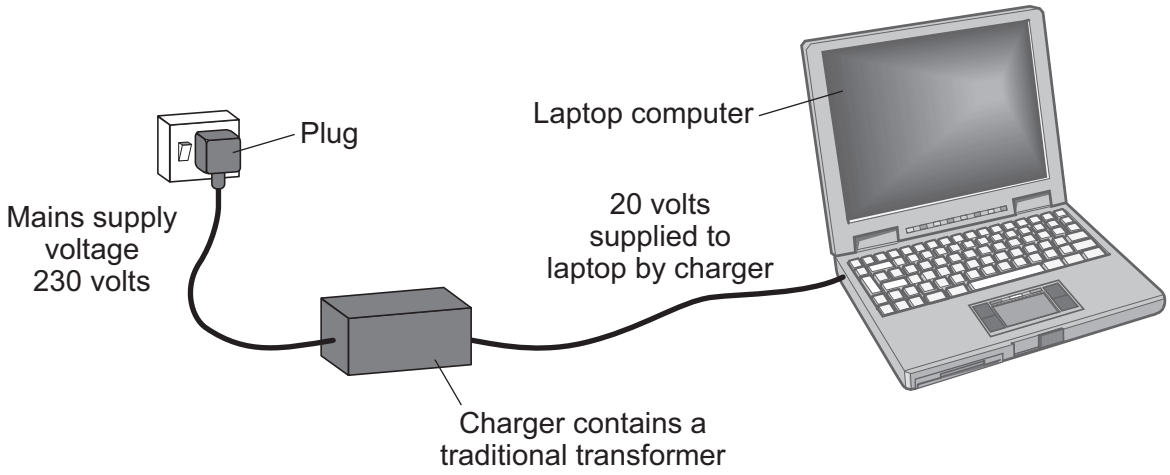
Use words from the box to label the diagram.

aluminium	**brass**	**iron**	**large**	**primary**	**secondary**



(3 marks)

2 (b) Batteries inside laptop computers are charged using laptop chargers. The laptop charger contains a traditional transformer.



Do not write outside the box

The laptop charger contains a step-down transformer.

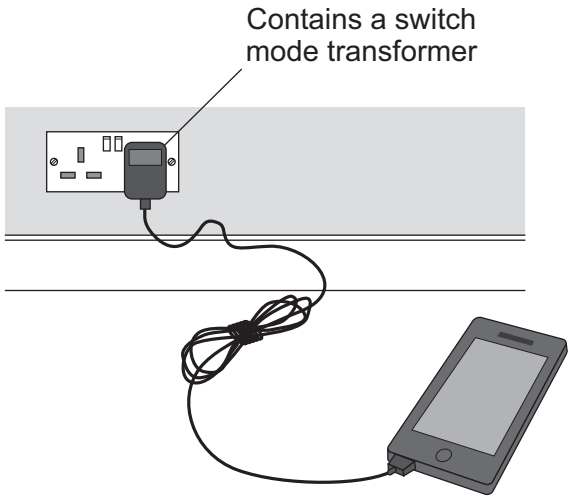
What does a step-down transformer do?

.....

.....

(1 mark)

2 (c) The transformer used in a modern mobile phone charger is a switch mode transformer. This is different to the traditional transformer used in the laptop charger.



Give **one** advantage of using a switch mode transformer, rather than a traditional transformer.

.....

.....

(1 mark)

2 (d) Laptop batteries and mobile phone batteries can only be recharged a limited number of times. When a battery cannot be recharged, it is better to recycle the battery than to throw it away.

Draw a ring around the correct answer to complete the sentence.

The batteries are recycled mainly due to

an environmental
a political
a social

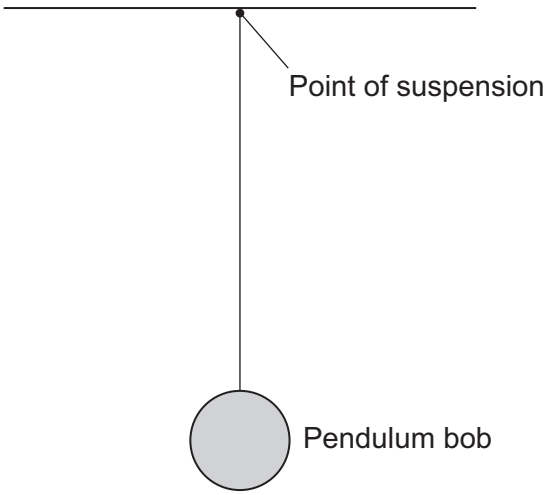
consideration.

(1 mark)

6

Do not write outside the box

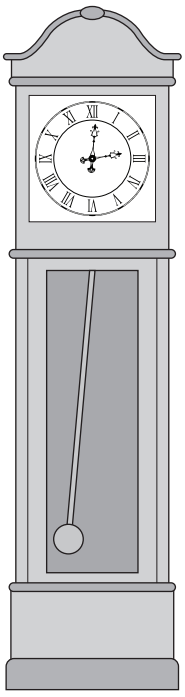
3 (a) The diagram shows a pendulum.



Draw an X on the diagram above, so that the centre of the **X** marks the centre of mass of the pendulum bob.

(1 mark)

3 (b) A large clock keeps time using the swing of a pendulum.



Do not write outside the box

3 (b) (i) The frequency of the swinging pendulum is 0.5 hertz.

Calculate the periodic time of the pendulum.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Periodic time = ... seconds

(2 marks)

3 (b) (ii) Calculate the number of complete swings the pendulum would make in 60 seconds.

Use your answer from part **(b)(i)** in your calculation.

.....

.....

.....

Number of swings in 60 seconds = ...

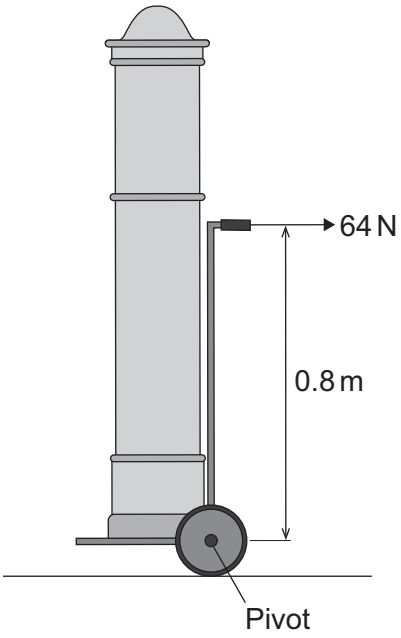
(2 marks)

Question 3 continues on the next page

Do not write outside the box

3 (c) The diagram shows a clock on a trolley.

The trolley is being used to move the clock.



Calculate the moment of the 64 N force about the pivot.

Use the correct equation from the Physics Equations Sheet.

.....

.....

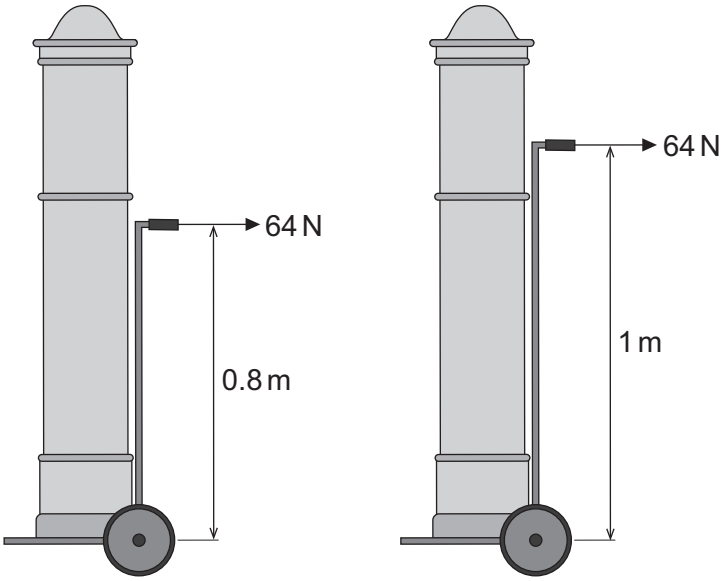
.....

Moment of the force = ... Nm

(2 marks)

Do not write outside the box

3 (d) The design of the trolley is now changed to make it taller.



How does making the trolley taller affect the moment produced by the 64 N force about the pivot?

.....

.....

(1 mark)

8

Turn over for the next question

Do not write outside the box

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



4 (a) (i) Which **two** factors would most affect the raft's stability?

Tick (✓) the **two** correct factors.

The cost of the raft ☐

The width of the base of the raft ☐

The position of the centre of mass of the raft ☐

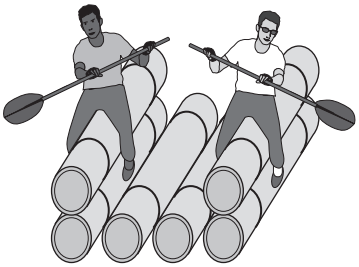
How streamlined the raft is ☐

(2 marks)

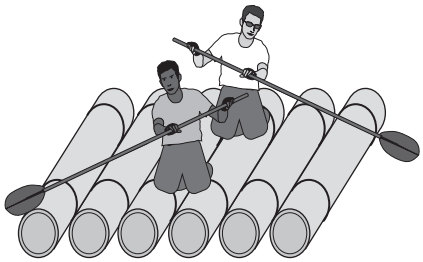
Do not write outside the box

4 (a) (ii) Here are three raft designs:

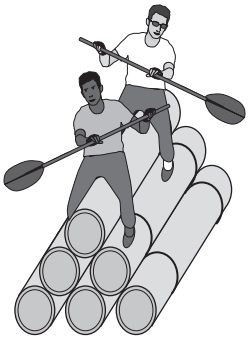
Design **A**



Design **B**



Design **C**



Which design of raft would be most stable?

Tick (✓) **one** box.

Design **A** ☐

Design **B** ☐

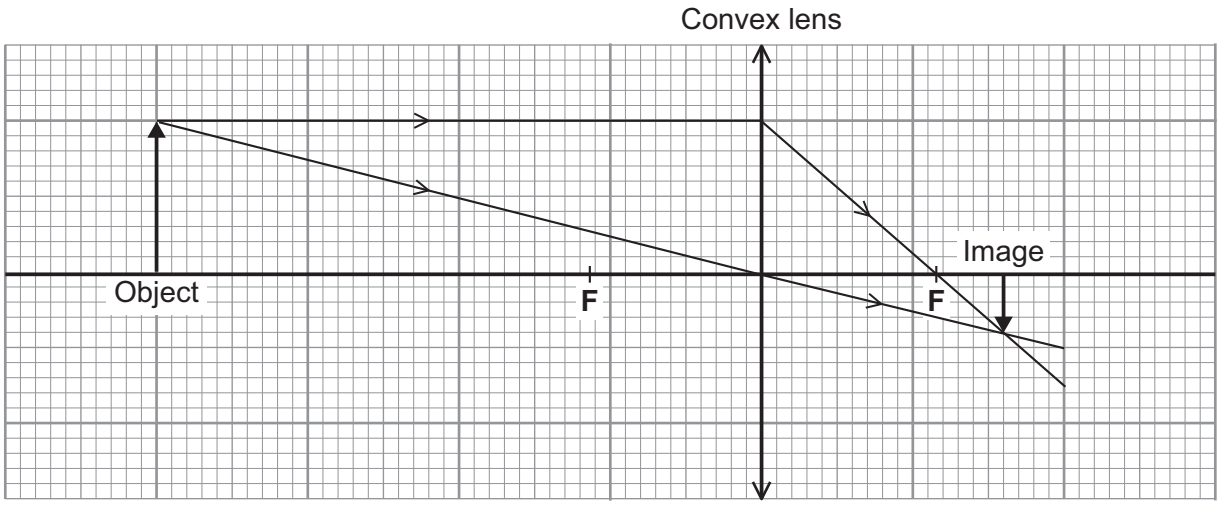
Design **C** ☐

(1 mark)

Question 4 continues on the next page

Do not write outside the box

4 (b) A camera was used to take photographs of the rafts. The camera contains a convex (converging) lens. The ray diagram shows how the lens produces an image.



F = Principal focus

4 (b) (i) Which **two** words from the list describe the nature of the image?

Draw a ring around each of the **two** correct answers.

upright **magnified** **inverted** **virtual** **real**

(2 marks)

4 (b) (ii) Use information from the ray diagram to calculate the magnification of the image.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Magnification = ...

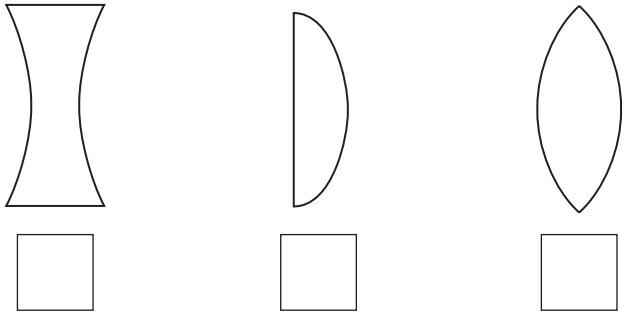
(2 marks)

Do not write outside the box

4 (c) A different type of lens is a concave (diverging) lens.

Which diagram shows a concave (diverging) lens?

Tick (✓) **one** box.



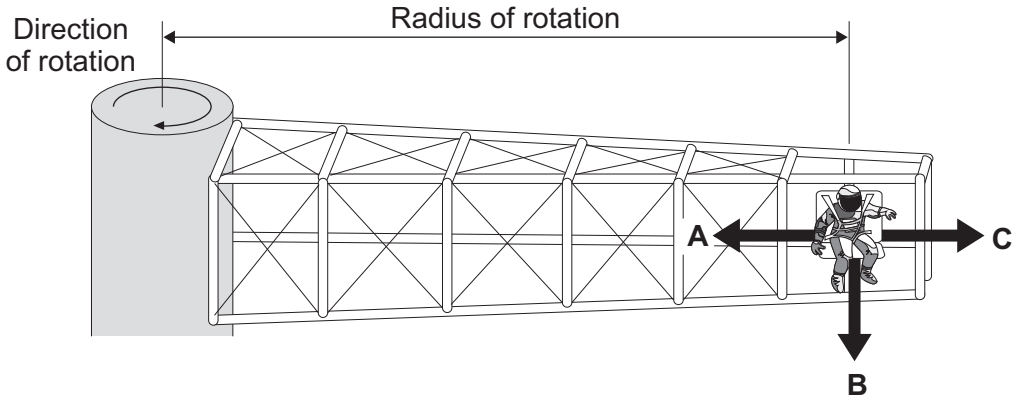
(1 mark)

8

Turn over for the next question

Do not write outside the box

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) In which direction, **A**, **B** or **C**, does the centripetal force on the astronaut act?

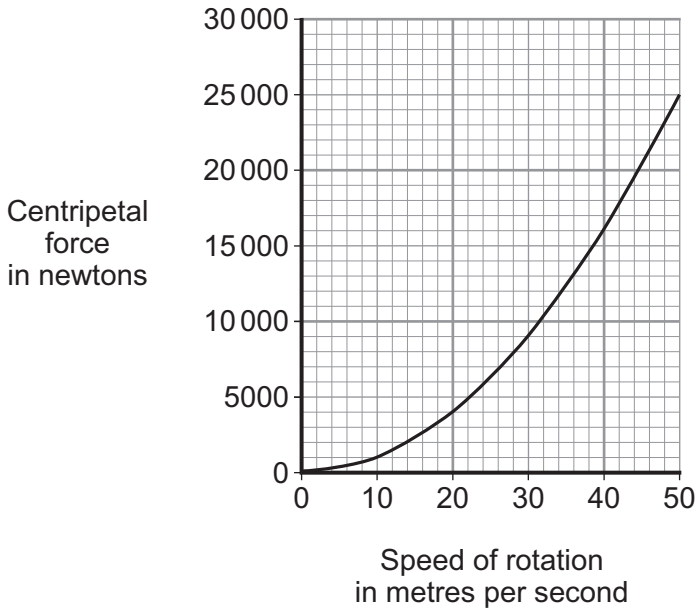
Write your answer in the box. ☐

(1 mark)

5 (b) The centripetal force on the astronaut is measured.

Graph X shows how the centripetal force is affected by the speed of rotation. The radius of rotation is kept the same.

Graph X



5 (b) (i) Use **Graph X** to determine the centripetal force on the astronaut when rotating at a speed of 30 metres per second.

Centripetal force = ... newtons

(1 mark)

Do not write outside the box

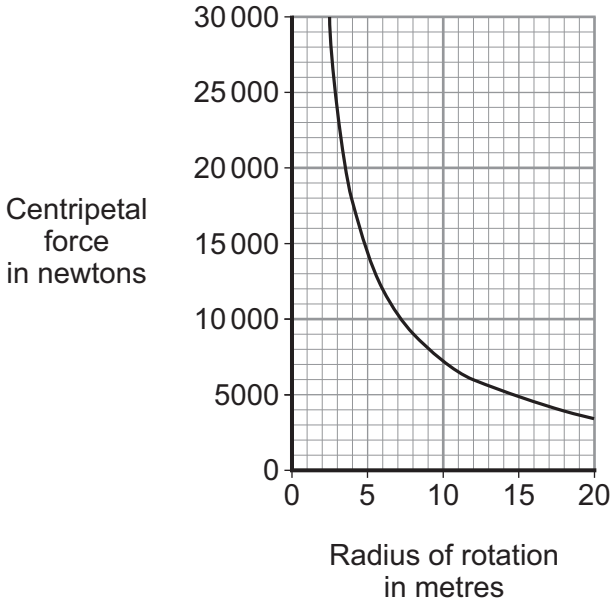
5 (b) (ii) Complete the following sentence to give the conclusion that can be made from **Graph X**.

Increasing the speed of rotation of a G-machine will ..... the centripetal force on the astronaut.

(1 mark)

5 (b) (iii) **Graph Y** shows how the centripetal force is affected by the radius of rotation, when the speed of rotation is kept the same.

Graph Y



Complete the following sentence to give the conclusion that can be made from **Graph Y**.

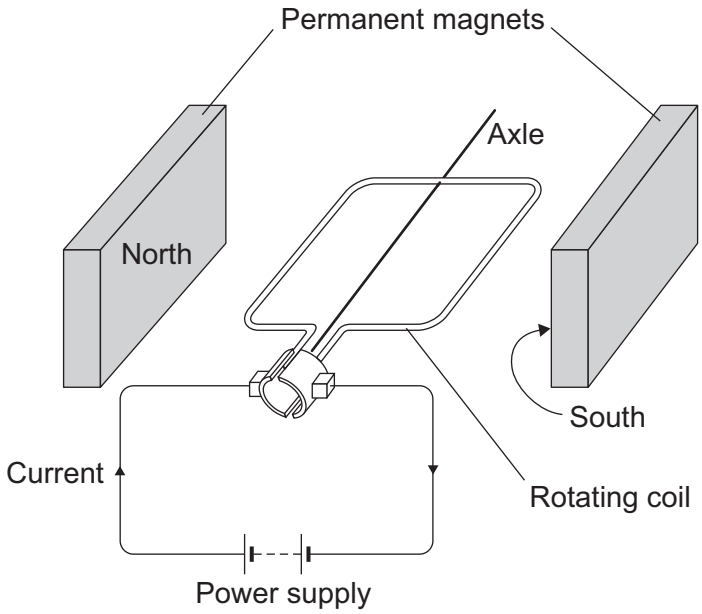
The greater the radius of rotation, the ..... the centripetal force on the astronaut.

(1 mark)

Question 5 continues on the next page

Do not write outside the box

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



The following statements explain how the motor creates a turning force. The statements are in the wrong order.

M – The magnetic field interacts with the magnetic field of the permanent magnets.

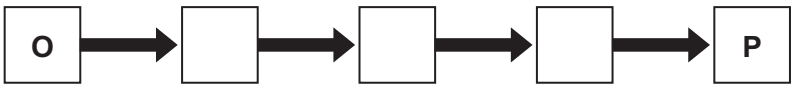
N – A magnetic field is created around the coil.

O – The power supply applies a potential difference across the coil.

P – This creates a force that makes the coil spin.

Q – A current flows through the coil.

Arrange the statements in the correct order. Two of them have been done for you.



(2 marks)

Do not write outside the box

5 (d) The electric motor produces a turning force.

Give **two** ways of increasing the turning force.

1 .....

.....

2 .....

.....

(2 marks)

5 (e) Draw a ring around the correct answer to complete the sentence.

It costs a lot of money to send astronauts into space.

This is

an economic
an environmental
a social

issue.

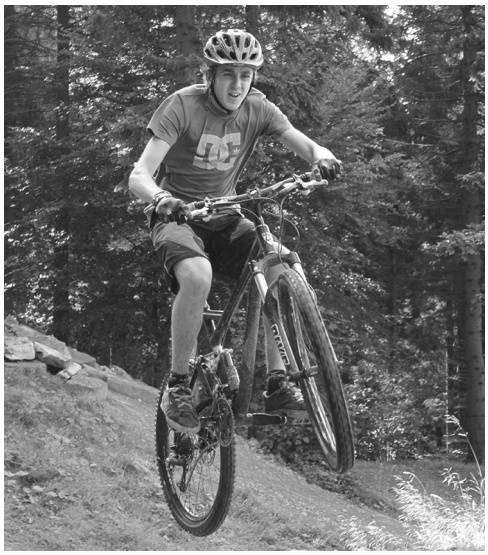
(1 mark)

9

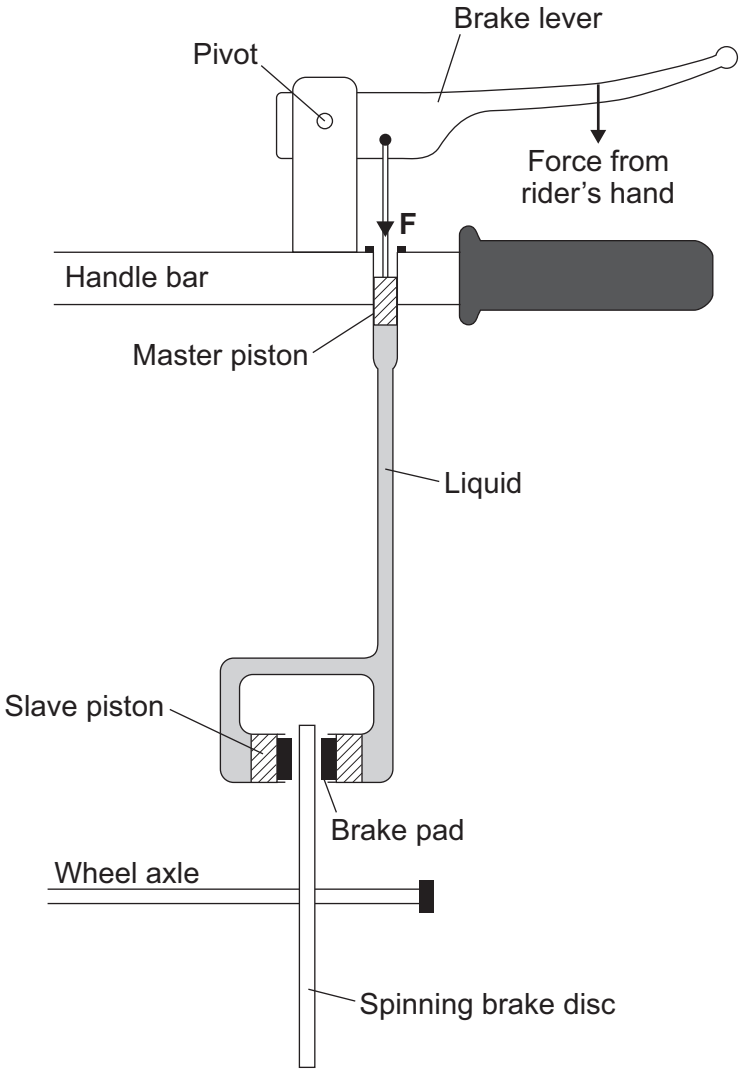
Turn over for the next question

Do not write outside the box

6 Mountain bike riders use brakes to slow down.



Some mountain bikes use liquid-filled pipes to transmit the force from the rider's hand on the brake lever to the brake pads. These brakes are called hydraulic brakes.



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Do not write outside the box

6 (a) Draw a ring around the correct answer to complete each sentence.

6 (a) (i) Liquids can be used to transmit the forces in a brake system,

because liquids

- are incompressible.
- can flow.
- take the shape of the container.

(1 mark)

6 (a) (ii) The pressure in the liquid is transmitted

- against force **F** only.
- downwards only.
- in all directions.

(1 mark)

6 (b) When the rider's hand pulls on the brake lever, the force **F** applied to the liquid by the master piston is 80 N. The cross-sectional area of this piston is 50 mm^2.

Calculate the pressure, in N/mm^2, exerted on the liquid by the master piston.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Pressure = ... N/mm^2

(2 marks)

6 (c) The unit N/mm^2 is **not** the usual unit of pressure.

Which unit is usually used when calculating pressure?

Draw a ring around the correct answer.

N Nm^2 Pa

(1 mark)

6 (d) The rider applies a larger force to the brake lever. How would this increase in force affect the pressure in the liquid?

.....

(1 mark)

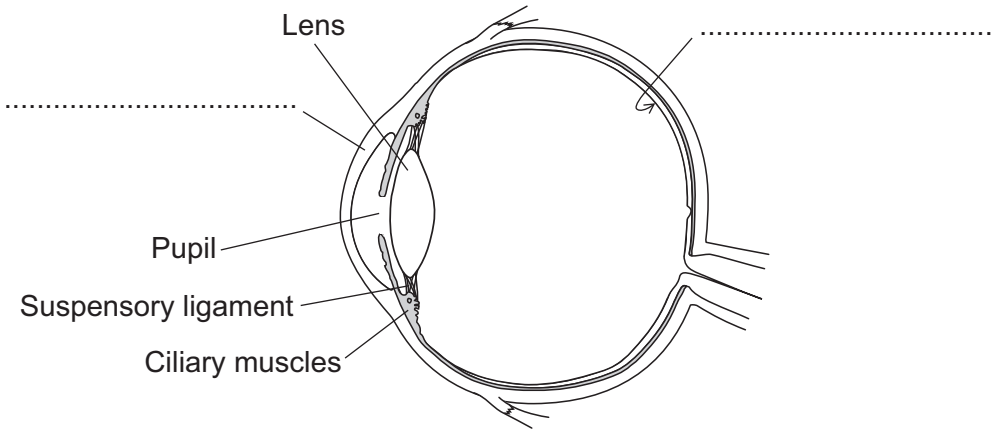
6

Turn over ▶

Do not write outside the box

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

Complete the missing labels.



(2 marks)

7 (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)

Do not write outside the box

7 (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?

.....

.....

.....

.....

(2 marks)

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

.....

.....

(1 mark)

7 (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.

.....

.....

.....

Power of lens = ... dioptres

(2 marks)

10

Do not write outside the box

8 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



8 (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)

Do not write outside the box

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

Explain why.

.....

.....

.....

.....

(2 marks)

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

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

.....

.....

(1 mark)

9

END OF QUESTIONS

Do not write outside the box

There are no questions printed on this page

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Question 6: Photograph of mountain biker © Tom Foxall
Question 8: Photograph of an unborn child © Thinkstock
Question 8: Photograph of a broken bone © Getty Images

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Version 1.0



General Certificate of Secondary Education
June 2013

Physics PH3FP

(Specification 4403)

Unit: Physics 3

Final

Mark Scheme

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for standardisation each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of error / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

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Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column or by each stage of a longer calculation.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Ignore / Insufficient / Do <u>not</u> allow

Ignore or insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

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Quality of Written Communication and levels marking

In Question 8(a) candidates are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Candidates will be required to:

- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: basic

- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: clear

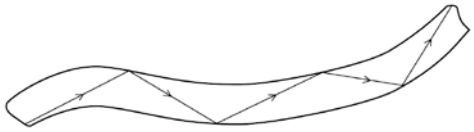
- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: detailed

- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

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Question 1

question	answers	extra information	mark
1(a)	middle box ticked 		1
1(b)	reflection	do **not** accept refraction	1
1(c)	endoscope		1
1(d)	eye surgery		1
Total			**4**

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Question 2

question	answers	extra information	mark
2(a)	iron primary secondary	correct positions only	1 1 1
2(b)	(it) decreases the p.d.	accept it would increase current accept voltage for p.d. the voltage goes from 230(V) to 20(V) is insufficient do **not** accept decreases current / energy / power do **not** accept decreases p.d. / voltage and current	1
2(c)	any **one** from: • lighter • smaller • use (very) little power / current / energy when switched on and no load / phone not connected • more efficient	accept it is easier to carry around accept no power / current / energy is drawn do **not** accept electricity for power / current / energy accept does not get as hot **or** less heat produced	1
2(d)	an environmental		1
Total			**6**

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Question 3

question	answers	extra information	mark
3(a)	centre of X drawn at centre of pendulum bob	judged by eye accept dot drawn at centre of circle	1
3(b)(i)	2	allow **1** mark for correct substitution, ie $\frac{1}{0.5}$ provided no subsequent step shown	2
3(b)(ii)	30 **or** 60 ÷ their (b)(i) correctly calculated	allow **1** mark for $\frac{60}{2}$ **or** $\frac{60}{\text{their (b)(i)}}$ **or** 0.5 × 60 provided no subsequent step shown	2
3(c)	51.2	allow **1** mark for correct substitution, ie 64 × 0.8 provided no subsequent step shown	2
3(d)	it increases (the moment)	must be comparative accept **1** mark for calculation of the moment = 64 (Nm)	1
Total			**8**

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Question 4

question	answers	extra information	mark
4(a)(i)	The width of the base of the raft The position of the centre of mass of the raft		1 1
4(a)(ii)	Design B		1
4(b)(i)	inverted real		1 1
4(b)(ii)	0.4	allow **1** mark for correct substitution, eg $\frac{8}{20}$ (in mm) **or** $\frac{0.8}{2}$ (in cm) **or** $\frac{0.008}{0.02}$ (in m) **or** $\frac{4}{10}$ (number of squares) ignore any units ignore negative sign	2
4(c)	this shape ticked: 		1
Total			**8**

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Question 5

question	answers	extra information	mark
5(a)	A		1
5(b)(i)	9000	an answer of 9 k(N) gains **1** mark	1
5(b)(ii)	increase	accept other comparative terms, eg give a bigger affect / change is insufficient	1
5(b)(iii)	smaller	accept other comparative terms, eg less	1
5(c)	Q N M	all three in correct boxes one statement in correct box gains **1** mark	2
5(d)	any **two** from: • increase the current / p.d. (supplied to the coil) • increase number of turns (on the coil) • increase the area (of the coil) • increase the (strength of the permanent) magnetic field	 accept reduce the resistance of the coil **or** increase cross sectional area of wire accept more cells / batteries **or** turn up the power supply increase power is insufficient accept increase the width of the coil increase width / size is insufficient accept move the magnets closer to the coil accept use stronger magnets do **not** accept use larger magnets	2
5(e)	an economic		1
Total			**9**

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Question 6

question	answers	extra information	mark
6(a)(i)	are incompressible		1
6(a)(ii)	in all directions		1
6(b)	1.6	allow **1** mark for correct substitution, ie $\frac{80}{50}$ provided no subsequent step shown an answer 0.032 gains **0** marks	2
6(c)	Pa		1
6(d)	increases		1
Total			**6**

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Question 7

question	answers	extra information	mark
7(a)	cornea (LHS gap)	must be in correct space	1
	retina (RHS gap)		1
7(b)	iris **or** pupil		1
	to change the shape / curvature (of the surface) of the lens	accept to make the lens thinner / fatter to contract and relax is insufficient	1
	to focus the light (from the object, onto the retina)	accept to refract / change direction of light accept rays for light accept to form / focus an image (on the retina) to focus is insufficient	1
7(c)	the older (a human), the longer the near point (or vice versa) **or** young people have the shortest near point (or vice versa)	answer must be in terms of near point (or a description of), eg become increasingly long sighted as you get older allow near point increases with age do **not** accept eye sight deteriorates as you get older answers must be comparative	1
	the (rate of) change of the near point increases as you get older (or vice versa)	accept near point increases most rapidly after 40 this statement alone gains **2** marks: the (rate of) increase of the near point gets greater as you get older	1

Question 7 continues on the next page . . .

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Question 7 continued . . .

question	answers	extra information	mark
7(d)	test / measure / use more people (to increase the range of ages) **or** test / measure / use more people with ages in between (those already measured)	accept test older / younger people accept increase sample size repeat the measurements (of the same people) is insufficient	1
7(e)	2.5	allow **1** mark for correct substitution and conversion to metres, ie $\frac{1}{0.4}$ provided no subsequent step shown an answer of 0.025 gains **1** mark	2
Total			**10**

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Question 8

question	answers	extra information	mark
8(a)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.		6

0 marks	**Level 1 (1–2 marks)**	**Level 2 (3–4 marks)**	**Level 3 (5–6 marks)**
No relevant / correct content.	There is a basic description of either wave **OR** What happens to either wave when they enter the body. However there is little other detail.	There is either: A clear description of BOTH waves **OR** A clear description as to what happens to BOTH waves inside the body **OR** A clear description of ONE of the waves with clear detail as to what happens to either wave inside the body.	There is a detailed description of BOTH of the waves **AND** A detailed description as to what happens to EITHER wave inside the body.

Question 8 continues on the next page . . .

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Question 8 continued . . .

Examples of the points made in the response:		
Description of an X-ray • X-rays are electromagnetic waves / part of the electromagnetic spectrum • X-rays are (very) high frequency (waves) • X-rays are (very) high energy (waves) • X-rays have a (very) short wavelength • Wavelength (of X-rays) is of a similar size to (the diameter of) an atom • X-rays are a transverse wave • X-rays are ionising radiation	do **not** allow a description of a property – eg X-rays travel through a vacuum / at the speed of light correct description acceptable – oscillations / vibrations are perpendicular (at 90°) to direction of energy transfer	
Description of ultrasound • ultrasound has a frequency above 20 000 (hertz) **OR** ultra sound is above 20 000 hertz • ultrasound is above / beyond the human (upper) limit (of hearing) • ultrasound is a longitudinal wave	accept ultrasound cannot be heard by humans correct description acceptable – oscillations / vibrations (of particles) are parallel (in same direction) to direction of energy transfer	
Statement(s) as to what happens to X-rays inside the human body: • X-rays are absorbed by bone • X-rays travel through / are transmitted by tissue / skin		
Statement as to what happens to ultrasound inside body: • ultrasound is (partially) reflected at / when it meets a boundary between two different media • travel at different speeds through different media		

Question 8 continues on the next page . . .

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Question 8 continued . . .

question	answers	extra information	mark
8(b)	(because the X-rays) are ionising	accept a description of what ionising is	1
	(they will) damage cells **or** mutate cells / cause mutations / increase chances of mutations **or** turn cells cancerous / produce abnormal growths / produce rapidly growing cells **or** kill cells	instead of cell, any of these words can be used: DNA / genes / chromosomes / nucleus do **not** accept they can be dangerous (to human health) do **not** accept damage to soft tissue	1
8(c)	any **one** from: • removal / destruction of kidney / gall stones		1
	• repair of damaged tissue / muscle	accept examples of repair, eg alleviating bruising, repair scar damage, ligament / tendon damage, joint inflammation accept physiotherapy accept curing prostate cancer **or** killing prostate cancer cells	
	• removing plaque from teeth	cleaning teeth is insufficient	
Total			**9**

UMS Conversion Calculator: www.aqa.org.uk/umsconversion

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