CCEA GCSE SCIENCE: SINGLE AWARD (MODULAR)

SCIENCE



EXAM QUESTION PACK

MODULE 5 HIGHER TIER GSC52 PAPERS

STEMUP

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Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2011–2012

Science: Single Award (Modular)

Electricity, Waves and Communication

Module 5

Higher Tier

[GSC52]

GSC52

THURSDAY 24 MAY 2012, MORNING

TIME

45 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all six** questions.

INFORMATION FOR CANDIDATES

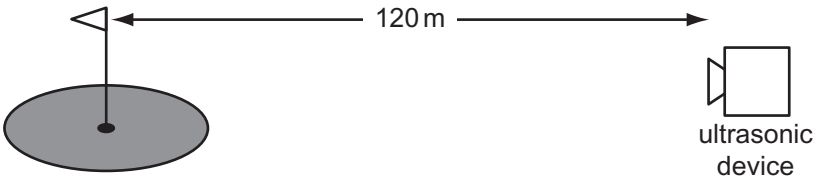
The total mark for this paper is 45.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
Total Marks	

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Examiner Only	
Marks	Remark

1 The diagram below shows how a golfer can use an ultrasonic (ultrasound) device to measure the distance to the flag.



(a) The device shows a distance of 120 m and the return time for the signal was 0.8 s.

Use the equation:

$$\textbf{speed} = \frac{\textbf{distance}}{\textbf{time}}$$

to calculate the speed of sound in air.

(Show your working out.)

Answer _____ m/s [3]

(b) (i) Explain fully what is meant by the term 'ultrasound'.

_____

_____

_____ [2]

(ii) Apart from measuring distance give another use of ultrasound.

_____ [1]

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(c) Ultrasound is a longitudinal wave and light is an example of the other type of wave.

(i) Name this other **type** of wave.

_____ [1]

(ii) State **one** feature both light and sound waves have in common.

_____ [1]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

2 The table below shows the cost per unit of generating electricity from some energy sources available in the UK.

Energy source	Building cost/p	Fuel cost/p	Running cost/p	Decommissioning cost/p	Total cost/p
Coal	1.1	1.5	0.3	0.1	3.0
Gas	0.4	2.5	0.5	0.1	3.5
Nuclear	1.5	0.5	0.5	2.5	5.0
Wind	4.2	none	0.9	0.2	5.3
Tidal	4.9	none	1.7	0.2	

(a) Calculate the total cost per unit of using **tidal** energy.

Answer _____ p [1]

(b) Use the information in the table to state two differences between the costs of using renewable sources compared to using non-renewable sources for electricity generation.

1. _____

_____

2. _____

_____ [2]

Nuclear power has the most expensive decommissioning cost.

(c) Describe fully what happens during decommissioning and suggest **one** reason why it is so expensive.

_____

_____

_____

_____

_____ [3]

(d) Apart from cost give **one** disadvantage of using tidal energy.

_____

_____ [1]

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(Questions continue overleaf)

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Marks	Remark

3 The picture below shows a dynamo connected to a bicycle wheel and lamp.

"Picture of a dynamo"

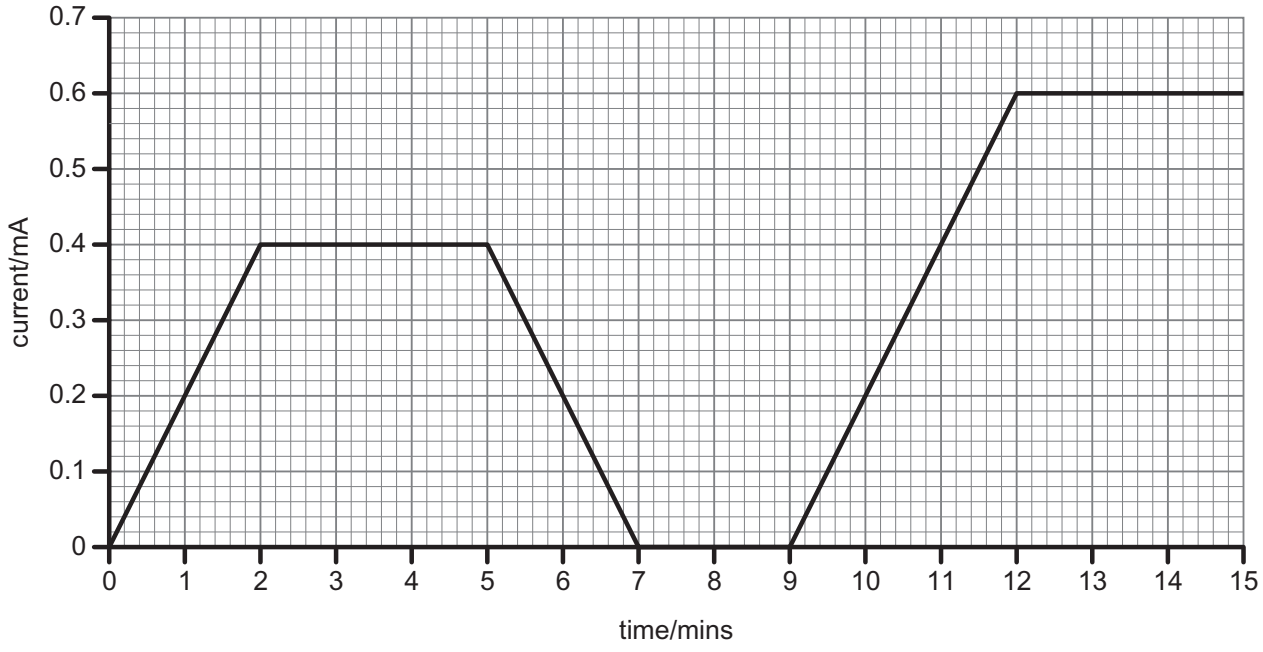
(a) A dynamo is a small generator. Describe fully what happens inside the dynamo to generate the electricity.

_____

_____

_____ [2]

(b) The graph below shows how much current is flowing from the dynamo to the lamp during a 15 minute cycle ride.



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(i) How much current is being produced at 6 minutes?

_____ mA [1]

(ii) Between which times would you suggest the bicycle is moving fastest?
Explain your answer.

Times _____ and _____

Explanation _____

_____ [2]

(iii) Suggest a reason why dynamo powered lamps are considered less safe than battery powered lamps.

_____

_____ [1]

(c) A 6 V battery is used to supply a 2.4 W bulb.

Use the equation:

$$\textbf{current} = \frac{\textbf{power}}{\textbf{voltage}}$$

to calculate the current flowing from the battery to the bulb.

(Show your working out.)

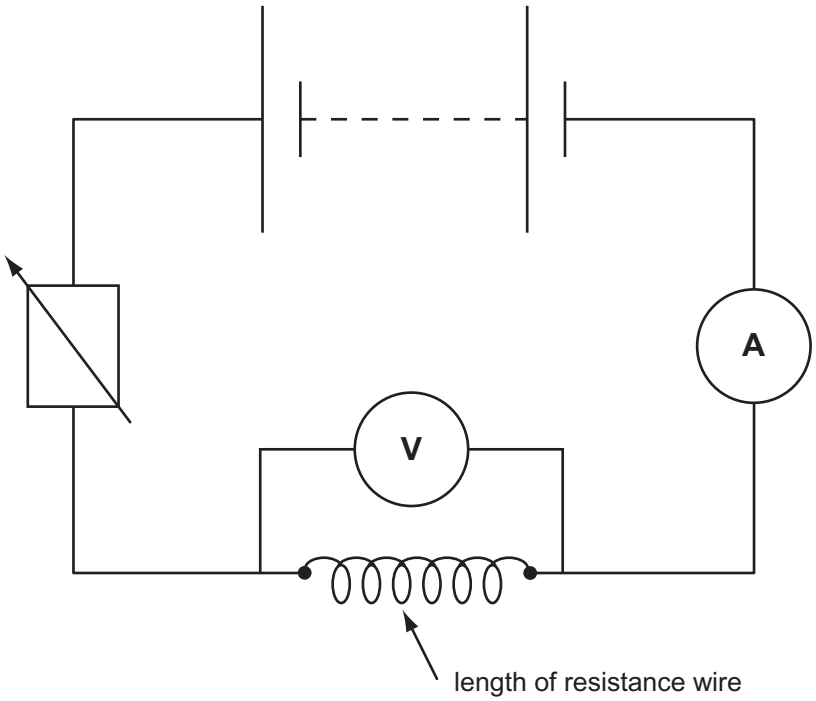
Answer _____ A [2]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

4 The circuit below was set up to measure the resistance of a length of wire.



(a) How can the current through the resistance wire be changed without changing the batteries?

_____

_____ [1]

(b) **(i)** Draw an arrow on the diagram to show the direction of conventional current flow. [1]

(ii) Explain fully the difference between conventional current flow and how the current actually flows around the circuit.

_____

_____

_____ [2]

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(c) When different lengths of wire were put into the circuit the following results were found.

Length/cm	Current/A	Resistance/ohms
25	2.00	1.5
50	1.58	1.9
75	1.25	2.4
100	1.03	2.9
125	0.91	3.3

(i) State **two** trends shown by the results in the table.

_____

_____

_____

_____ [2]

(ii) Apart from length, name another property of a wire which affects resistance.

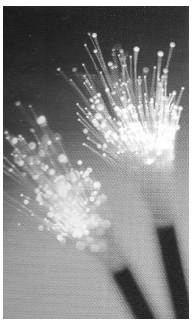
_____ [1]

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Marks	Remark

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5 The picture below shows two bundles of optical fibres.



© Science Photo Library / Lawrence Lawry

(a) Total internal reflection allows light to pass along optical fibres. Explain fully how total internal reflection is achieved inside optical fibres.

_____

_____

_____ [2]

(b) **(i)** Suggest two reasons why optical fibres are replacing copper wire in telephone communications.

1. _____

_____ [1]

2. _____

_____ [1]

(ii) Apart from communications give another use for optical fibres.

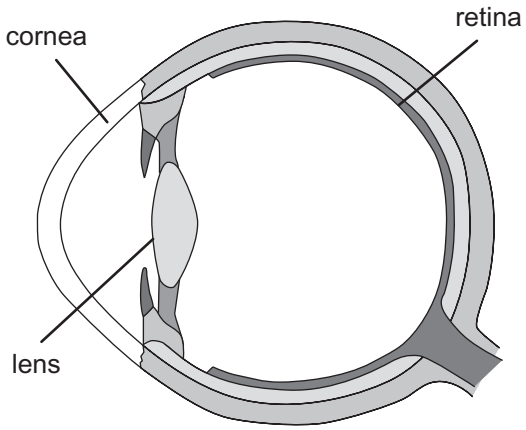
_____ [1]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

6 The diagram below shows the human eye.



© CCEA GCSE Single Award in Science Foundation Tier byA G McFarland, C Murphy & J Napier, page 114, published by Hodder Education, 2009. ISBN 978 0340 974728. 'Reproduced by permission of Hodder Education'.

(a) Use the diagram and your knowledge to explain fully what happens to parallel rays of light as they pass through the eye.

_____

_____

_____

_____

_____ [3]

(b) Short sight and astigmatism are two common eyesight problems.

(i) Describe fully the cause and effect of short sight.

_____

_____

_____

_____

_____ [3]

(ii) Name the type of lens required to correct short sight.

_____ [1]

(iii) What is the cause of astigmatism?

_____

_____ [1]

(iv) Suggest how an optician could test for astigmatism.

_____

_____

_____

_____ [2]

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Marks	Remark

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Rewarding Learning

General Certificate of Secondary Education
2011–2012

Science: Single Award (Modular)

Electricity, Waves and Communication
Module 5
Higher Tier

[GSC52]

THURSDAY 24 MAY 2012
9.15 am–10.00 am

MARK SCHEME

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			AVAILABLE MARKS
1	**(a)**	120/0.8 [1] 240/0.8 or 120/0.4 [2] 300 [3] [3]	
	(b)	**(i)** (sound with a) frequency [1] too high for humans to hear/above 20 kHz [1] [2]	
		(ii) scanning/fish finding/map sea bed/cleaning delicate equipment/ lithotripsy [1]	
	(c)	**(i)** transverse [1]	
		(ii) (caused by) vibrations/carry energy [1]	8
2	**(a)**	6.8 p [1]	
	(b)	renewables cost more to build/have cheaper fuel costs cost more to run/total cost is more (any 2 = 1 mark each) [2]	
	(c)	power station is shut down/waste removed site restored to former state (any 2 = 1 mark each) expensive to get rid of waste/no radiation leaks waste is radioactive for a long time/concrete over [3]	
	(d)	ruins habitats/eyesore/ugly/inhibits shipping lanes [1]	7
3	**(a)**	magnet + coil of wire [1] movement [1] [2]	
	(b)	**(i)** 0.2 A [1]	
		(ii) 12–15 mins [1] faster = more current [1] [2]	
		(iii) no movement = no current/no light/battery power/always on [1]	
	(c)	2.4/6 [1] 0.4 A [2] [2]	8

			AVAILABLE MARKS
4	**(a)** change the variable resistor/change length of wire [1]		
	(b) **(i)** direction from +ve to −ve [1]		
	(ii) actual is in opposite direction/from −ve to +ve [1] actual is flow of electrons [1] electrons are negatively charged [1] (any 2 = 1 mark each) [2]		
	(c) **(i)** as length increases, current decreases [1] as length increases, resistance increases [1] as current decreases, resistance increases [1] (any 2 = 1 mark each) [2]		
	(ii) width/type of material/temperature [1]		7
5	**(a)** angle of incidence [1] is greater than the critical angle [1] [2]		
	(b) **(i)** carry more information [1] more secure [1] less prone to interference [1] faster signals [1] no energy loss [1] doesn't need boosted as often (any 2 = 1 mark each) [2]		
	(ii) reflectors/endoscopes/xmas tree lights/keyhole surgery [1]		5
6	**(a)** light is refracted/bent by the cornea [1] light is refracted/bent by the lens [1] most refraction occurs at the cornea [1] light is focussed on the retina [1] (any 3 = 1 mark each) [3]		
	(b) **(i)** lens too strong [1]/too thick/too converging rays focussed in front of retina [1] far objects appear blurry/only close objects are clear [1] [3]		
	(ii) concave/diverging [1]		
	(iii) uneven curvature of cornea [1]		
	(iv) series of crossed lines or diagram [1] some lines appear thicker/more blurry [1] [2]		10
		Total	**45**

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Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2011–2012

Science: Single Award (Modular)

Electricity, Waves and Communication
Module 5

Higher Tier

[GSC52]

GSC52

WEDNESDAY 29 FEBRUARY 2012
9.30 am–10.15 am

TIME

45 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all six** questions.

INFORMATION FOR CANDIDATES

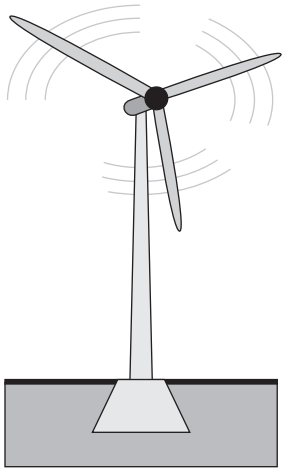
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Marks	Remark

1 Below is a diagram of a wind turbine.



The following investigation was carried out to find out how much electricity it produced.

- The wind turbine was used to charge a battery overnight.
- The next morning the battery was used to light a bulb and the time it stayed lit until it was completely out was timed.
- This was repeated every night for a week.
- The results are recorded below.

Day	**Mon**	**Tues**	**Wed**	**Thurs**	**Fri**	**Sat**	**Sun**
Time bulb stayed lit /mins.	45	50	2	25	60	35	42

(a) (i) What is measured in this investigation to show the amount of electricity produced by the wind turbine?

_____ [1]

(ii) Explain how timing the bulb until it is completely out ensures that the investigation is a fair test (valid).

_____

_____ [1]

(iii) Apart from timing the bulb until it is completely out, state **two** other things that need to be done to ensure that the results are valid.

_____

_____

_____ [2]

(iv) It is difficult to know exactly when the bulb is completely out.

Suggest how this will affect the results.

_____

_____ [1]

(b) Wind is classified as a renewable energy source.

(i) Name another renewable energy source.

_____ [1]

(ii) Explain fully why developing alternative renewable energy sources is becoming more important for the environment.

_____

_____

_____

_____

_____ [3]

Examiner Only	
Marks	Remark

2 The picture below shows a race being started using a starting pistol.

There is a large brick wall at the side of the running track.

"Image of runners starting a race with a brick wall in the background".

Each time the pistol is fired an echo is heard a short time later.

(a) Suggest why the runners will see the smoke from the pistol before they hear the sound.

_____

_____ [1]

(b) Explain fully why the runners will hear an echo.

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

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(c) The wall is 50 m behind the starter and the echo is heard 0.3 s after the pistol is fired.

Use the equation:

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

to calculate the speed of sound in air.
Show your working out.

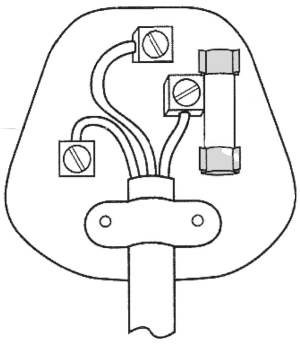
Answer _____ m/s [3]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

3 **(a)** The diagram below shows a 3-pin plug.



(i) Explain fully how the fuse protects any appliance attached to the plug.

_____

_____ [2]

(ii) Give one other safety feature of the 3-pin plug and explain how it protects the user from electric shock.

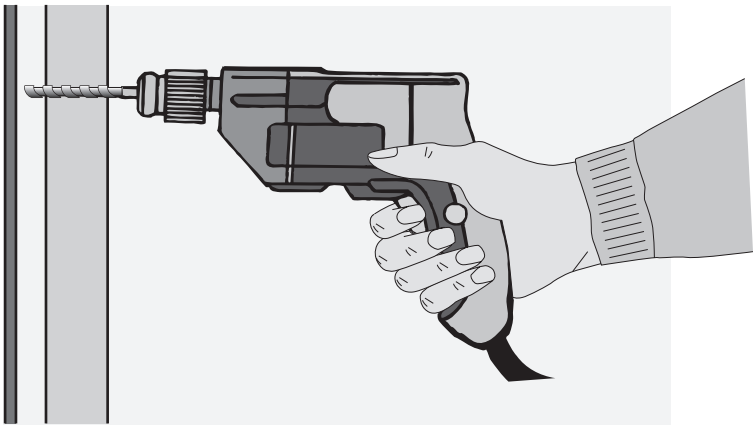
_____

_____

_____ [2]

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(b) The picture below shows a double insulated drill.



© GCSE Single Award Science for CCEA by T Laverty, J Napier & R White, page 199, published by Hodder Murray, 2006. ISBN 978 0340926000. 'Reproduced by permission of Hodder Education'.

(i) Name the wire that is not required in the plug for this drill.

_____ [1]

(ii) Explain fully how double insulation protects the user from electric shock.

_____

_____

_____ [2]

(c) In modern houses the fuses have been replaced with RCCB's (residual current circuit breakers).

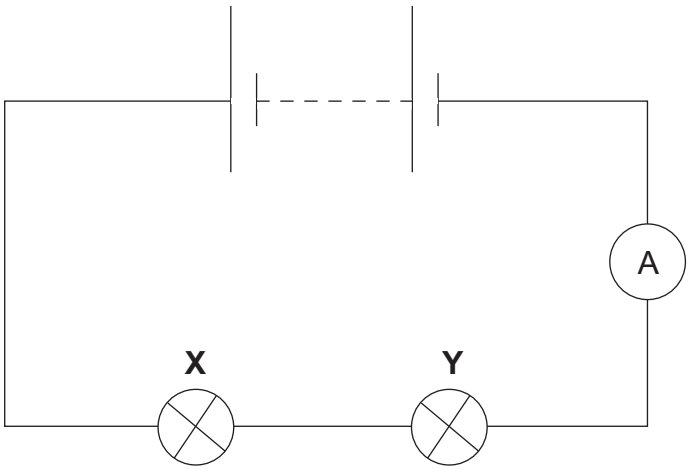
State one reason why RCCB's are considered to be better than fuses.

_____ [1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

4 **(a)** The circuit diagram below shows two identical bulbs each with a resistance of 4 Ω.



(i) The ammeter reading is 2 A.

Use the equation:

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

to calculate the voltage across bulb X.

Answer _____V [2]

(ii) What is the total voltage supplied by the power supply?

Answer _____V [1]

(iii) If bulbs **X** and **Y** are now connected in parallel with the same power supply, what will be the voltage across each bulb?

Answer _____V [1]

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(b) Suggest and explain why it is safer to have car headlights connected in parallel.

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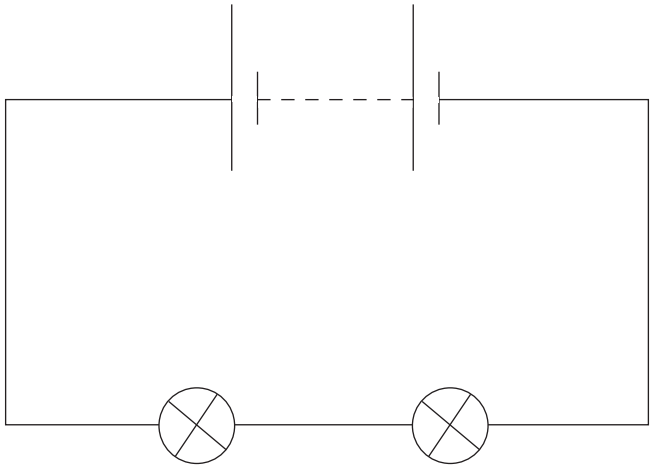
Marks	Remark

_____

_____

_____ [2]

(c) **(i)** Show, using an arrow, the direction of conventional current flow on the circuit diagram below.



[1]

(ii) Explain fully why the current actually flows in the opposite direction.

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

5 **(a)** The following article about wireless networking fears appeared in a newspaper.

Wireless networking (Wi-fi) fears are "unproven"

Wi-fi technology uses electromagnetic radiation to communicate between routers and laptops.

More and more schools are now installing wireless networks but some people have reported suffering from ill-health as a result.

The BBC's Panorama programme employed a scientist to measure electromagnetic radiation levels. He measured radiation levels, once, 100 m from a mobile phone mast and 1 m from a school laptop computer.

The scientist reported that measurements of radiation levels near the laptop were three times higher than those 100 m from the phone mast, although they were still 600 times less than the government's safety limits.

Other scientists have criticised the findings, saying they are 'unscientific'.

Adapted from: "Wi-fi health fears are 'unproven' ", 21 May 2007 © BBC News @bbc.co.uk 2012

(i) Give two reasons why these results are described as *'unscientific'*.

_____

_____

_____

_____ [2]

(ii) The report states that *"some people have reported suffering from ill-health as a result."*

Name a health risk associated with the radiation from mobile phones.

_____ [1]

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(b) The electromagnetic spectrum of waves is shown in the table below.

Gamma rays	X-rays	Ultraviolet light	Visible light	Infra red	Micro waves	Radio waves

(i) State one feature all electromagnetic waves have in common.

_____ [1]

(ii) Explain fully why gamma rays are much more dangerous than ultraviolet.

_____

_____

_____ [2]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

6 The picture below shows a combined microwave oven and traditional grill.



© Argos UK Plc

(a) (i) Explain fully the microwave heating effect in terms of energy absorption and molecular behaviour.

_____

_____

_____

_____ [3]

(ii) Suggest why food is more likely to be burnt when using a traditional grill.

_____

_____ [1]

(b) This combined microwave oven and grill has a power rating of 900 W.

Use the equation:

$$\text{cost} = \text{power} \times \text{time} \times \text{cost per unit}$$

to calculate the cost of using this appliance 30 mins per day for a week given that the cost of each unit of electricity is 21p.

Cost _____ p [3]

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Rewarding Learning

General Certificate of Secondary Education
2011–2012

Science: Single Award (Modular)

Electricity, Waves and Communication
Module 5

Higher Tier

[GSC52]

WEDNESDAY 29 FEBRUARY 2012
9.30 am–10.15 am

MARK SCHEME

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					AVAILABLE MARKS
1	**(a)**	**(i)**	timing how long the bulb stays lit/or implied	[1]	
		(ii)	all the electricity is used up/or implied	[1]	
		(iii)	charged for 12 hours/same time same bulb/same battery/same wind turbine (*any* 2 = 1 mark each)	[2]	
		(iv)	results will be inaccurate	[1]	
	(b)	**(i)**	solar/hydroelectric/wave/geothermal/tidal	[1]	
		(ii)	fossil fuels non-renewable/will run out [1] less carbon dioxide/less air pollution/less acid rain less greenhouse gases [1] less greenhouse effect/less global warming [1]	[3]	9
2	**(a)**		light travels faster than sound	[1]	
	(b)		sound bounces off/reflects [1] hard surfaces/brick wall [1]	[2]	
	(c)		50/0.3 [1] 50/0.15 or 100/0.3 [2] 333 [3]	[3]	6
3	**(a)**	**(i)**	prevents too much current/electricity flowing [1] melting and breaking/gap in circuit [1]	[2]	
		(ii)	plastic cover/earth wire [1] plastic is an insulator/ carries current to ground/not through user (appropriate explanation) [1]	[2]	
	(b)	**(i)**	earth wire	[1]	
		(ii)	no metal parts exposed [1] covered with plastic [1] plastic cover is an insulator [1]	[2]	
	(c)		don't need to be replaced/react faster/more sensitive	[1]	8

					AVAILABLE MARKS
4	**(a)**	**(i)**	4 × 2 [1] 8 v	[2]	
		(ii)	16 v/c.m if double part (i)	[1]	
		(iii)	16 v/c.m if same as part (ii)	[1]	
	(b)		If one light goes out, the others stay lit [1] Driver still has light/can see where going [1]	[2]	
	(c)	**(i)**	arrow from positive to negative/anti clockwise	[1]	
		(ii)	actual is flow of electrons [1] electrons have −ve charge [1]	[2]	9
5	**(a)**	**(i)**	only 1 set of measurements [1] unrelated distances [1] unfair comparison of laptop + mast [1] (*any* 2 = 1 mark each)	[2]	
		(ii)	tumour/cancer	[1]	
	(b)	**(i)**	all transverse waves/travel at same speed/ travel at speed of light/can travel through a vacuum	[1]	
		(ii)	higher frequency [1] carry more energy/more penetrating [1]	[2]	6
6	**(a)**	**(i)**	waves absorbed by water molecules [1] molecules vibrate [1] faster [1] more friction produces heat [1] (any three from above)	[3]	
		(ii)	grill cooks from outside in/microwave cooks from inside out	[1]	
	(b)		900 W – 0.9 Kw [1] 30 mins – 0.5 hr [1] × 7 × 21 [1] (*any* 2 = 1 mark each) 66p [3]	[3]	7
				Total	**45**

Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2011–2012

Science: Single Award (Modular)

Electricity, Waves and Communication
Module 5

Higher Tier

[GSC52]

MONDAY 14 NOVEMBER 2011
1.30 pm–2.15 pm

GSC52

TIME

45 minutes.

INSTRUCTIONS TO CANDIDATES

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Write your answers in the spaces provided in this question paper.
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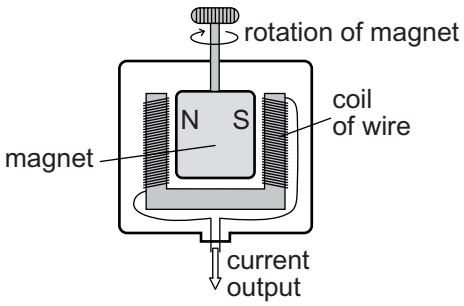
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Examiner Only	
Marks	Remark

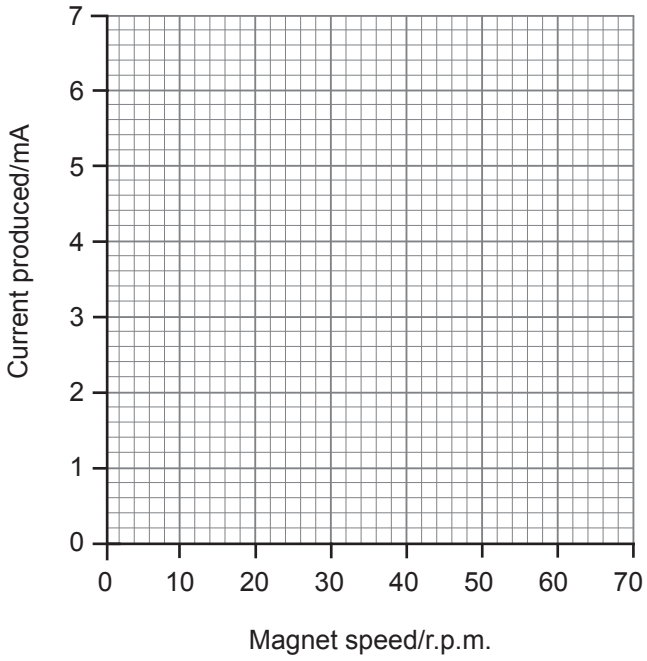
1 An investigation was carried out using a bicycle dynamo to find how the amount of current produced depends on the speed of rotation of a magnet.



The investigation results are given below.

Magnet speed/r.p.m.	Current produced/mA
0	0
20	2.2
30	3.4
40	4.4
50	5
60	5
70	5

(a) Plot the points and draw a line graph on the grid below.



[3]

(b) (i) State fully the conclusion that can be drawn from these results.

Examiner Only

Marks	Remark

_____

_____ [2]

(ii) Suggest the effect on the amount of current produced if:

- a weaker magnet is used.

_____ [1]

- more coils of wire are used.

_____ [1]

(c) Forty years ago bicycles were fitted with dynamo powered lights similar to the one used in this investigation.

Suggest and explain why battery powered lights replaced dynamo powered lights.

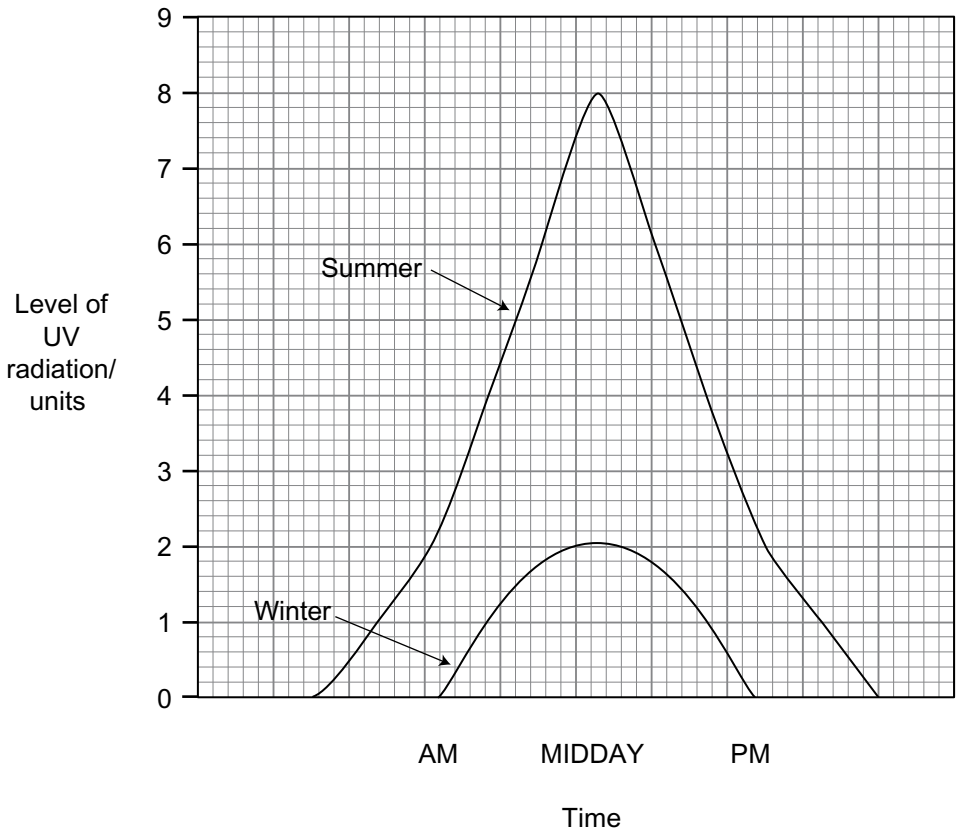
_____

_____

_____ [2]

Examiner Only	
Marks	Remark

2 The graph below shows how the level of ultraviolet (UV) radiation changed during typical summer and winter days.
Skin needs protection above 3 units of UV.



(a) Use the information to suggest why sunscreen (sun protection) sales are greater in summer.

_____

_____ [1]

(b) UV radiation is just one part of the electromagnetic spectrum and all electromagnetic waves are transverse waves.

Examiner Only

Marks	Remark

(i) Describe fully the movement of the particles in a transverse wave.

_____

_____

_____ [2]

(ii) Apart from being transverse waves state **two** features that all electromagnetic waves have in common.

_____

_____

_____ [2]

(iii) Apart from transverse waves name another type of wave.

_____ [1]

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Examiner Only	
Marks	Remark

3 The device shown below can be used to measure the length of a room.



© Digiflex Ltd

It produces ultrasound waves and times how long it takes the wave to travel to a wall and back again.

(a) Describe fully why we cannot hear the waves produced by this measuring device.

_____

_____

_____ [2]

(b) A signal takes 0.04 s to travel from one wall of a room to another wall and back. The speed of sound in air is 330 m/s.

Use the equation:

$$\text{distance} = \text{speed} \times \text{time}$$

to calculate the distance between these two walls.

Distance _____ m [3]

Examiner Only	
Marks	Remark

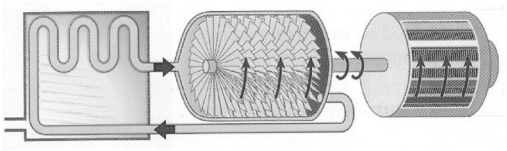
(c) Ultrasound and X-rays are both used for scanning the human body. Explain fully why ultrasound is used to scan pregnant women rather than X-rays.

_____

_____

_____ [2]

4 The diagram below shows some component parts of a fossil fuel power station.



boiler turbine generator

© CCEA GCSE Single Award in Science Foundation Tier by A McFarland, C Murphy & J Napier, published by Hodder Education, 2009. ISBN 9780340974728 Reproduced by permission of Hodder Education.

(a) Describe fully the main energy change that takes place within each named component part.

_____

_____

_____ [3]

(b) Some people suggest that any new power stations should be nuclear rather than fossil fuel power stations.

Describe fully the environmental advantages of this suggestion.

_____

_____

_____ [2]

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Examiner Only	
Marks	Remark

5 The picture below shows a volume control switch found on an electric guitar. The switch controls how much current flows to the amplifier producing the sound.



© Tone Deaf Music

(a) (i) Use your knowledge of variable resistors to explain how the current going to an amplifier is controlled by the length of wire inside this component.

_____

_____

_____ [3]

(ii) Apart from length of wire give **two** other factors that affect the resistance.

_____

_____ [2]

(b) Calculate the current flowing to a 30 W amplifier connected to the 230 V mains.

Use the equation:

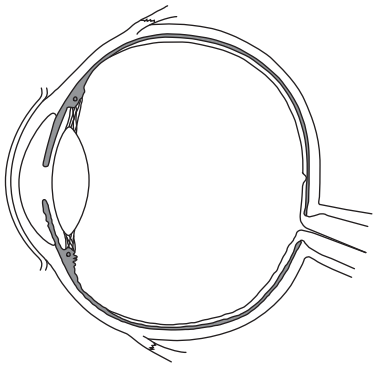
$$\text{power} = \text{voltage} \times \text{current}$$

Current _____ A [2]

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Examiner Only	
Marks	Remark

6 The diagram below shows the human eye.



Two common eyesight problems are long sight and astigmatism.

(a) (i) Describe the cause and explain fully the effect of long sight.

_____

_____

_____

_____ [3]

(ii) Explain fully how long sight can be corrected.

_____

_____

_____

_____ [3]

(b) (i) What is the cause of astigmatism?

_____ [1]

(ii) Suggest how an optician might check for astigmatism.

_____

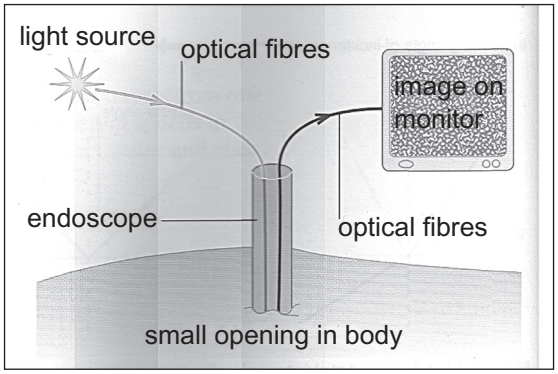
_____

_____ [2]

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Examiner Only	
Marks	Remark

(c) The diagram below shows an endoscope being used in keyhole surgery. Endoscopes use optical fibres.



© GCSE Single Award Science for CCEA by T Laverty, J Napier & R White, published by Hodder Education, 2006. ISBN 9780340926000. Reproduced by permission of Hodder Education.

Describe fully how optical fibres transmit light.

_____

_____

_____ [2]

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Rewarding Learning

General Certificate of Secondary Education
2011–2012

Science: Single Award (Modular)

Electricity, Waves and Communication

Module 5

Higher Tier

[GSC52]

MONDAY 14 NOVEMBER
1.30 pm–2.15 pm

MARK SCHEME

STEMUP.CO.UK

			AVAILABLE MARKS
1	**(a)**	all points correct [2] 6/5 points correct [1] correct line [1] [3]	
	(b)	**(i)** *increasing magnet speed* gives more current [1] up to a maximum current [1] [2]	
		(ii) 1. less current [1] 2. more current [1]	
	(c)	produce light even when stopped/go fast for bright light/ slow will be dim light [1] safer [1] or implied [2]	9
2	**(a)**	In summer UV level is above 3 or implied [1]	
	(b)	**(i)** particles vibrate at right angles/particles move up and down [1] [2] to the direction of wave travel [1]	
		(ii) Any **two** from: all carry energy/can travel through a vacuum/same speed in vacuum/speed of light [2]	
		(iii) longitudinal [1]	6
3	**(a)**	frequency [1] above 20 khz/too high to be heard by human ear [1] [2]	
	(b)	330 × 0.04 [1] 330 × 0.02 [2] 6.6 [3] [3]	
	(c)	safer [1] or implied less damage to cells/less risk of cancer [1] [2]	7
4	**(a)**	chemical to heat [1] heat to kinetic [1] kinetic to electric [1] **not** electricity [3]	
	(b)	less carbon dioxide/greenhouse gases/air pollution/less fossil fuels used [1] less greenhouse effect/global warming [1] [2]	5
5	**(a)**	**(i)** volume control turned from 10 to 0 = more resistance wire [1] more wire = higher resistance [1] higher resistance = less current [1] } Any **two** from longer wire = less current [3]	
		(ii) type of material [1] width of wire [1] [2]	
	(b)	30/230 [1] 0.13 [2] [2]	7

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					AVAILABLE MARKS
6	**(a)**	**(i)**	Cause = lens too weak/thin/eyeball too short [1] Effect = light not converged enough [1] Focused behind retina [1] Close objects blurry/far objects clear [1] } Any **two** from	[3]	
		(ii)	convex lens [1] converge light more [1] clear image formed on retina light focused on retina } [1]	[3]	
	(b)	**(i)**	uneven curvature of cornea	[1]	
		(ii)	crossed lines [1] some appear thicker [1]	[2]	
	(c)		Above critical angle/42° [1] TIR occurs [1]	[2]	11
				Total	**45**

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Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2010–2011

Science: Single Award (Modular)

Electricity, Waves and Communication

Module 5

Higher Tier

[GSC52]

GSC52

FRIDAY 20 MAY 2011, MORNING

TIME

45 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all six** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 45.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
Total Marks	

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Examiner Only	
Marks	Remark

1 The picture below shows a wave produced on a slinky spring.



(a) (i) Name the type of wave shown.

_____ [1]

(ii) Waves are caused by vibrations. In what direction do the vibrations occur as this wave travels from left to right?

Choose from:

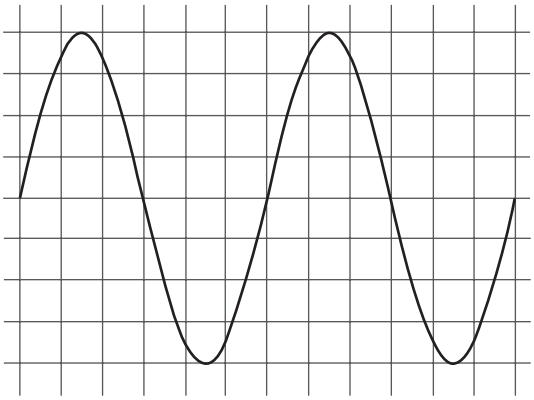
The vibrations are in the same direction as the wave

The vibrations are at right angles to the direction of the wave

The vibrations are in the opposite direction to the wave

_____ [1]

(b) The diagram below represents a sound wave.



1 square = 1 cm

(i) What is the amplitude of the wave shown above?

_____ [1]

(ii) What is the wavelength of the wave shown above?

_____ [1]

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Examiner Only	
Marks	Remark

(c) The picture below shows two pupils experimenting to find the speed of sound in air.



(i) Describe a method that pupils could use.

_____

_____

_____

_____

_____ [3]

(ii) How can the pupils ensure that their results are:

accurate? _____

_____ [1]

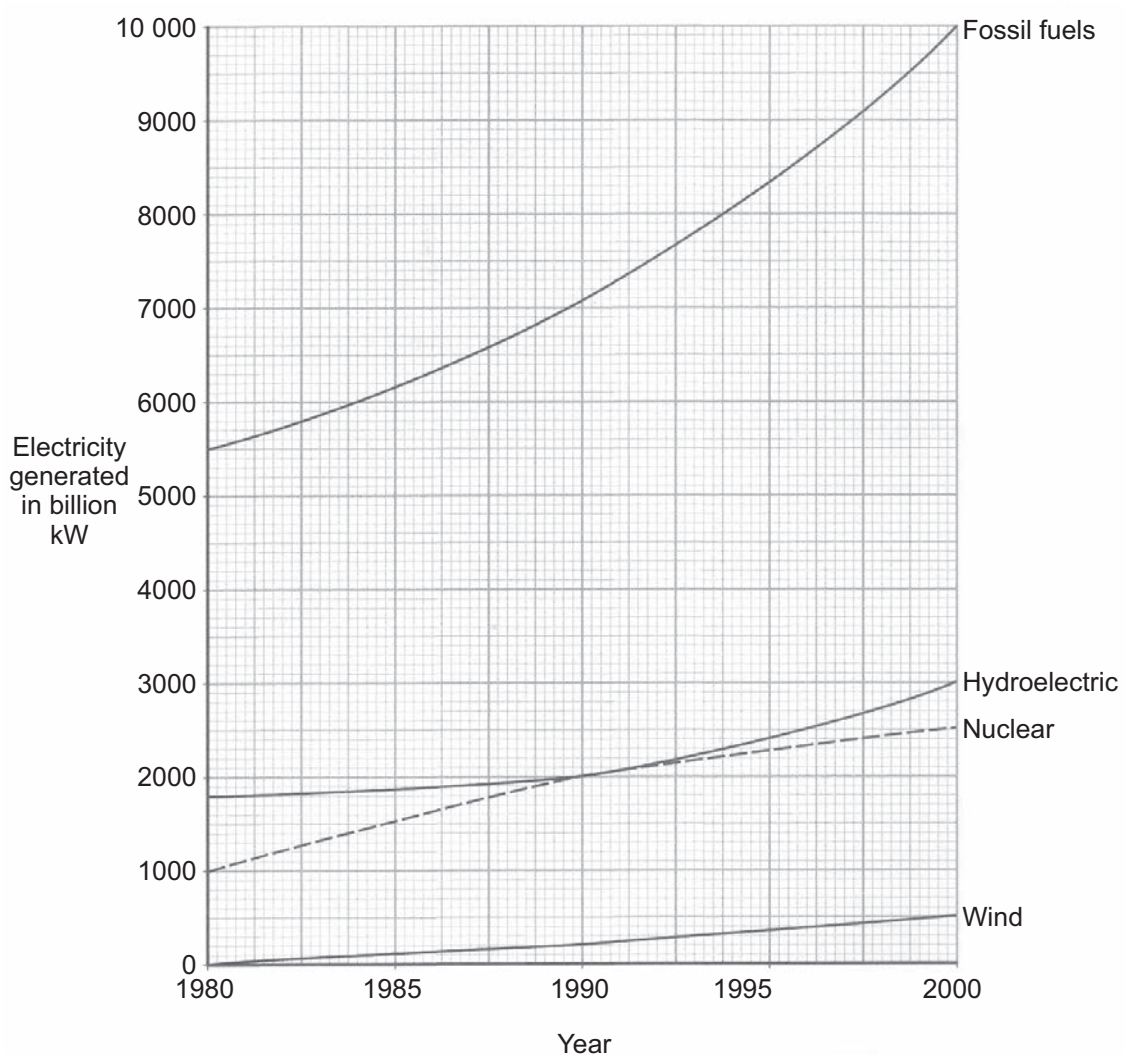
reliable? _____

_____ [1]

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Examiner Only	
Marks	Remark

2 The graph below shows how much electricity was generated worldwide from four different energy sources between 1980 and 2000.



(a) Calculate the increase in generation from fossil fuels during this 20 year period.

_____ billion kW [1]

(b) Suggest **two** reasons why the increase in the use of renewables has not been as dramatic as with fossil fuels. (Your answer must state which renewable source you are referring to.)

_____

_____

_____ [2]

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(c) In the year 2030 the amount of electricity generated from nuclear power is expected to be 5 times what it was in 2000.

Examiner Only	
Marks	Remark

(i) Calculate how much electricity could be generated from nuclear power in 2030.

_____ billion kW [1]

(ii) Explain fully why using nuclear power instead of fossil fuels is better for the environment.

_____

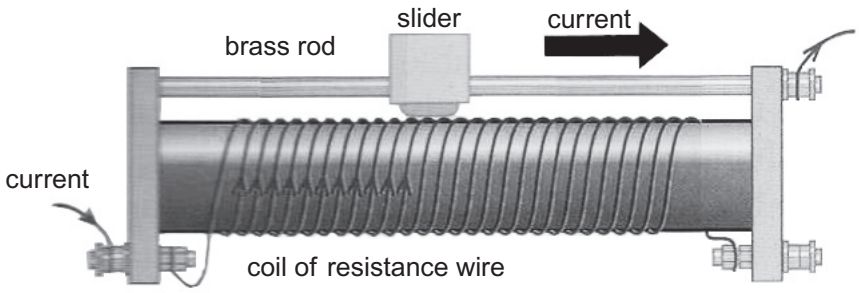
_____

_____ [2]

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Examiner Only	
Marks	Remark

3 The diagram below shows a variable resistor.



© GCSE Single Award Science for CCEA by T Laverty, J Napier & R White, published by Hodder Murray, 2006. ISBN 978 0340926000. Reproduced by permission of Hodder Education.

(a) Describe fully how the variable resistor works to change the current flowing in a circuit.

_____

_____

_____ [2]

(b) Name **one** other factor, apart from length, that would affect the resistance of a piece of wire.

_____ [1]

(c) Suggest **one** everyday use for a variable resistor.

_____ [1]

(d) State the unit of resistance.

_____ [1]

Examiner Only	
Marks	Remark

4 The picture below shows a dental surgery. The dentist can use ultrasound to clean teeth.



© *iStockphoto / Thinkstock*

(a) Explain fully what ultrasound is.

_____

_____ [2]

(b) The dentist also uses X-rays to take pictures of teeth and jaw bones.

(i) Name a possible harmful effect of using X-rays.

_____ [1]

(ii) Explain why the dentist leaves the room while the patient is having an X-ray but yet it is safe enough for the patient to remain.

_____

_____ [1]

(c) Gamma rays can be used to sterilise dental equipment.

State what makes gamma rays the most dangerous type of electromagnetic wave.

_____ [1]

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Examiner Only	
Marks	Remark

5 The picture below shows a mobile phone charger.



© iStockphoto / Thinkstock

(a) To fully charge a phone the charger must be connected to the 230 V mains for 45 mins and the current flowing is 0.7 A.

The cost of each unit (kWhr) of electricity is 18p.

Use the equations:

power = voltage × current

and

electrical cost = power × time × cost per unit

to calculate the cost of charging a phone.

Cost = _____ pence [4]

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(b) Mobile phones can use digital or analogue signals.

(i) Describe the difference between analogue and digital signals.

_____

_____

_____ [2]

(ii) Give **two** reasons why digital signals are better than analogue signals.

_____

_____

_____ [2]

(c) Microwaves are used in cooking. Explain fully how microwaves produce heat to cook food.

_____

_____

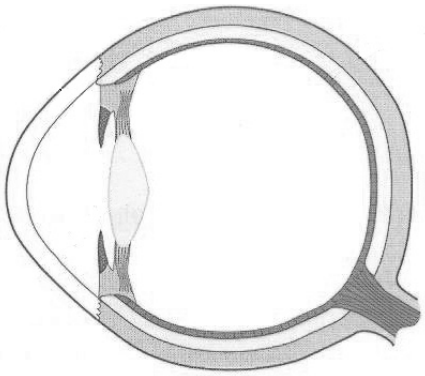
_____

_____ [3]

Examiner Only	
Marks	Remark

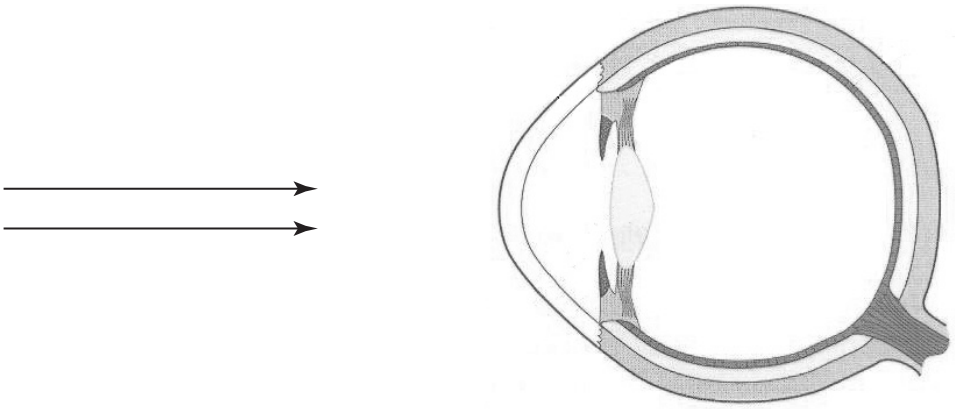
Examiner Only	
Marks	Remark

6 The diagram below shows the human eye.



(a) Label the lens, cornea and retina on the diagram. [2]

(b) Complete the diagram below to show how short sight can be corrected by inserting the correct type of lens and continuing the rays of light. [3]



(c) **(i)** Describe the cause of astigmatism and its effect.

_____

_____

_____ [2]

(ii) Suggest how an optician would test for astigmatism.

_____

_____

_____ [2]

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Rewarding Learning

General Certificate of Secondary Education
2010–2011

Science: Single Award (Modular)

Electricity, Waves and Communication

Module 5

Higher Tier

[GSC52]

FRIDAY 20 MAY 2011, MORNING

MARK SCHEME

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					AVAILABLE MARKS
1	**(a)**	**(i)**	transverse	[1]	
		(ii)	The vibrations are at right angles to the direction of the wave.	[1]	
	(b)	**(i)**	4 cm	[1]	
		(ii)	6 cm	[1]	
	(c)	**(i)**	see – hear [1] appropriate timing [1] large distance [1] formula [1] } any 3	[3]	
		(ii)	accurate: ensure time started when blocks banged/stopwatch increased distances = [1] reliable: repeat/average = [1]	[2]	9
2	**(a)**		4500	[1]	
	(b)		wind; less electricity produced; amount of land; intermittent/unreliable hydroelectric – lack of sites; cost/flooding	[2]	
	(c)	**(i)**	12 500	[1]	
		(ii)	less greenhouse gases/carbon dioxide/air pollution less global warming (any 2 = 1 mark each) *or* less sulphur dioxide/carbon dioxide [1] less acid rain [1]	[2]	6
3	**(a)**		longer wire = higher resistance or opposite = [1] higher resistance = less current or opposite = [1]	[2]	
	(b)		thickness/material	[1]	
	(c)		dimmer switch/volume control/cooker (ring switch)/thermostats/ toaster	[1]	
	(d)		ohm/symbol	[1]	5
4	**(a)**		very *high* frequency/too *high* for humans = [1] above 20 kHz = [1]	[2]	
	(b)	**(i)**	cancer/tumour	[1]	
		(ii)	more exposure	[1]	
	(c)		highest frequency	[1]	5

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				AVAILABLE MARKS
5	**(a)**	230 × 0.7 = 161 = [1] changing W to kW = [1] changing mins to hours = [1] 0.161 × 0.75 x 18 = [3] 2 pence/2.2p/2.17p	[4]	
	(b)	**(i)** analogue varies continuously = [1] digital = on/off = [1]	[2]	
		(ii) less interference; easily processed by computers clearer signals	[2]	
	(c)	microwaves absorbed [1]/by water molecules [1] water molecules vibrate [1]/faster [1] friction [1] (any 3 = [1] each)	[3]	11
6	**(a)**	all correct = [2] 2/1 correct = [1]	[2]	
	(b)	concave lens = [1] divergence at lens = [1] convergence at cornea/lens and focus on retina = [1]	[3]	
	(c)	**(i)** uneven curve on cornea = [1] focus sharper *in some directions* = [1]	[2]	
		(ii) series of crossed lines or diagram = [1] some directions more blurry = [1]	[2]	9
			Total	**45**

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Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2010–2011

Science: Single Award (Modular)

Electricity, Waves and Communication Module 5

Higher Tier

[GSC52]

GSC52

THURSDAY 24 FEBRUARY 2011, MORNING

TIME

45 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all six** questions.

INFORMATION FOR CANDIDATES

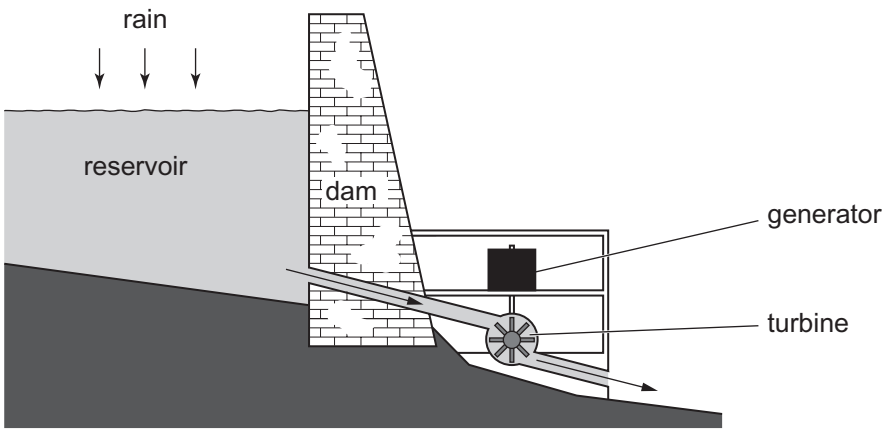
The total mark for this paper is 45.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
Total Marks	

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Examiner Only	
Marks	Remark

1 The diagram below shows a hydroelectric power station.



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(a) (i) Hydroelectric power is a renewable energy source.

Use the diagram and your knowledge to explain fully why hydroelectric power is a renewable energy source.

_____

_____

_____ [2]

(ii) Suggest **one** reason why hydroelectric power stations are usually built in mountainous areas.

_____ [1]

(iii) Name **two** other renewable energy sources.

_____ and _____ [1]

(b) Describe and explain **one** environmental disadvantage of using hydroelectric power stations.

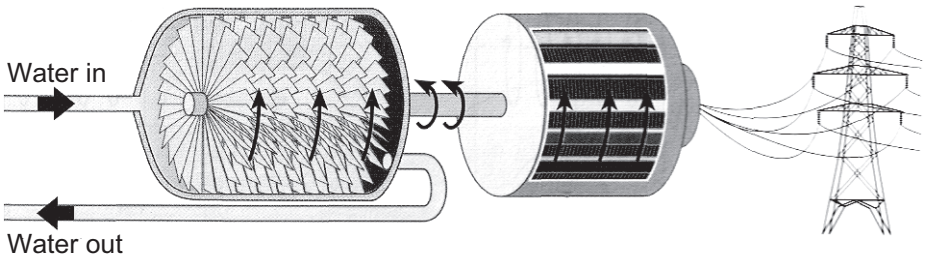
_____

_____

_____ [2]

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(c) The diagram below shows the operation of a turbine and generator.



© GCSE Single Award Science for CCEA by T Laverty, J Napier & R White, page 204, published by Hodder Education, 2006, ISBN 9780340926000. "Reproduced by permission of Hodder Education".

Explain fully how the turbine and generator produce electricity.

_____

_____

_____

_____ [3]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

2 **(a)** The pictures below show a bathroom and a bedroom.



© George Doyle/Stockbyte/Thinkstock



© istockphoto/Thinkstock

Suggest why your voice will sound more powerful in the bathroom rather than the bedroom.

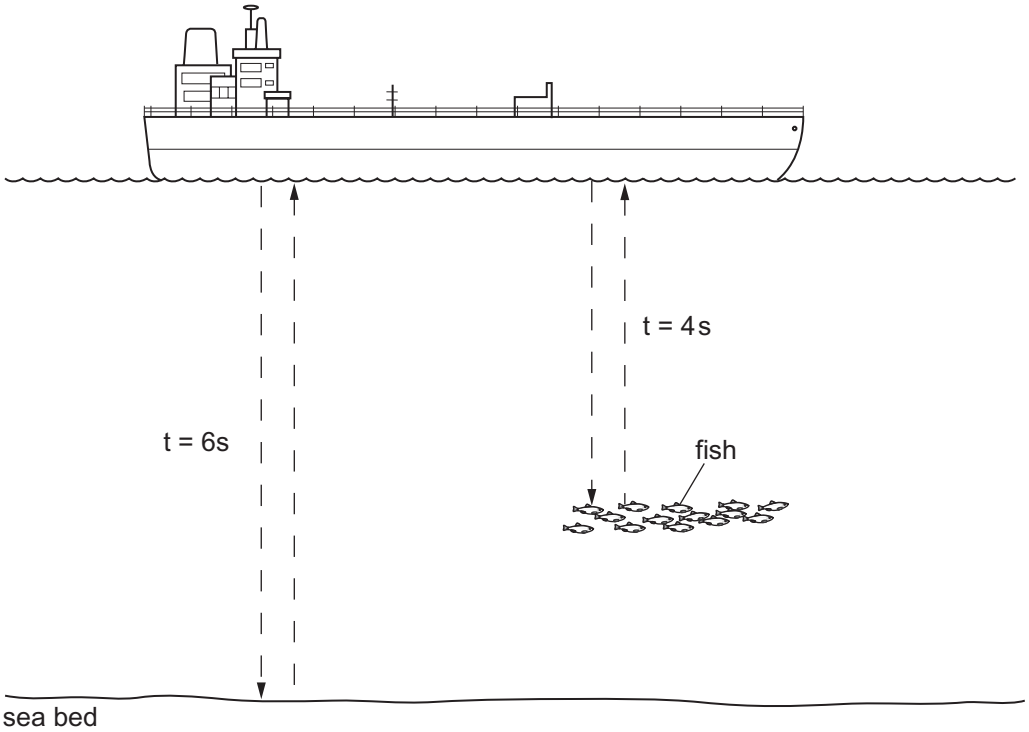
_____

_____

_____

_____ [3]

(b) Ultrasound can be used for both depth measurement and locating fish as shown in the diagram below.



The times shown on the diagram are the **return times** for the ultrasound and the speed of sound in water is 1500 m/s.

Use the equation:

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

to calculate the height of the fish above the sea bed.

Answer _____ m [4]

Examiner Only	
Marks	Remark

STEMUP.CO.UK

Examiner Only	
Marks	Remark

3 A microfilter adapter allows both a computer and a telephone to be connected into one phone line currently made of copper.

These copper phone lines are now being replaced with fibre optic cables.

(a) Describe and explain **one** advantage of using fibre optic cables.

_____

_____

_____ [2]

(b) Information can be sent using either digital or analogue signals.

(i) Describe each type of signal.

_____

_____

_____

_____ [2]

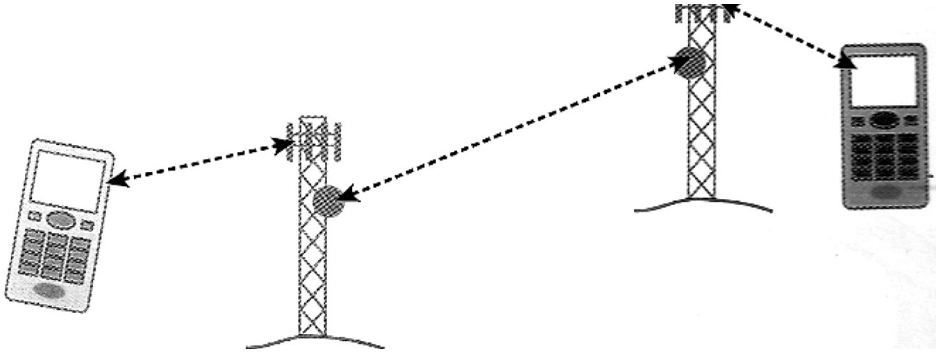
(ii) Give **one** advantage of using digital signals.

_____

_____ [1]

Examiner Only	
Marks	Remark

(c) The diagram below shows how information can be sent between two mobile phones.



© CCEA GCSE Single Award Science Foundation Tier by A McFarland, C Murphy & J Napier, page 113, published by Hodder Education, 2009. ISBN 9780340974728. "Reproduced by permission of Hodder Education

(i) Name the type of electromagnetic wave that travels between the mast and phone.

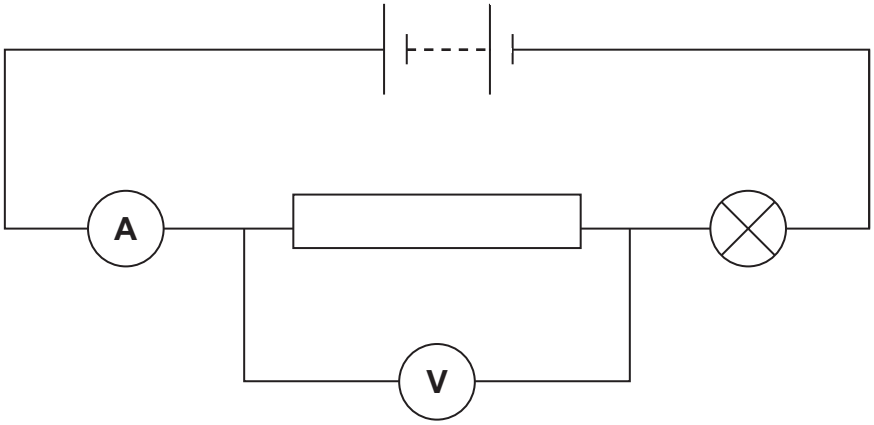
_____ [1]

(ii) What name is given to the area around a mast?

_____ [1]

Examiner Only	
Marks	Remark

4 The circuit below was set up to investigate how the resistance of a wire depends on the length.



Pupils placed a variety of lengths of wire in the circuit. Their results are recorded in the table.

Length/m	Voltage/V	Current/A	Resistance/ ohms
0.5	4	2.0	2.0
1.0	4	0.9	4.5
1.5	4	0.6	6.5
2.0	4	0.4	9.0
2.5	4		11.5

(a) Use the following equation:

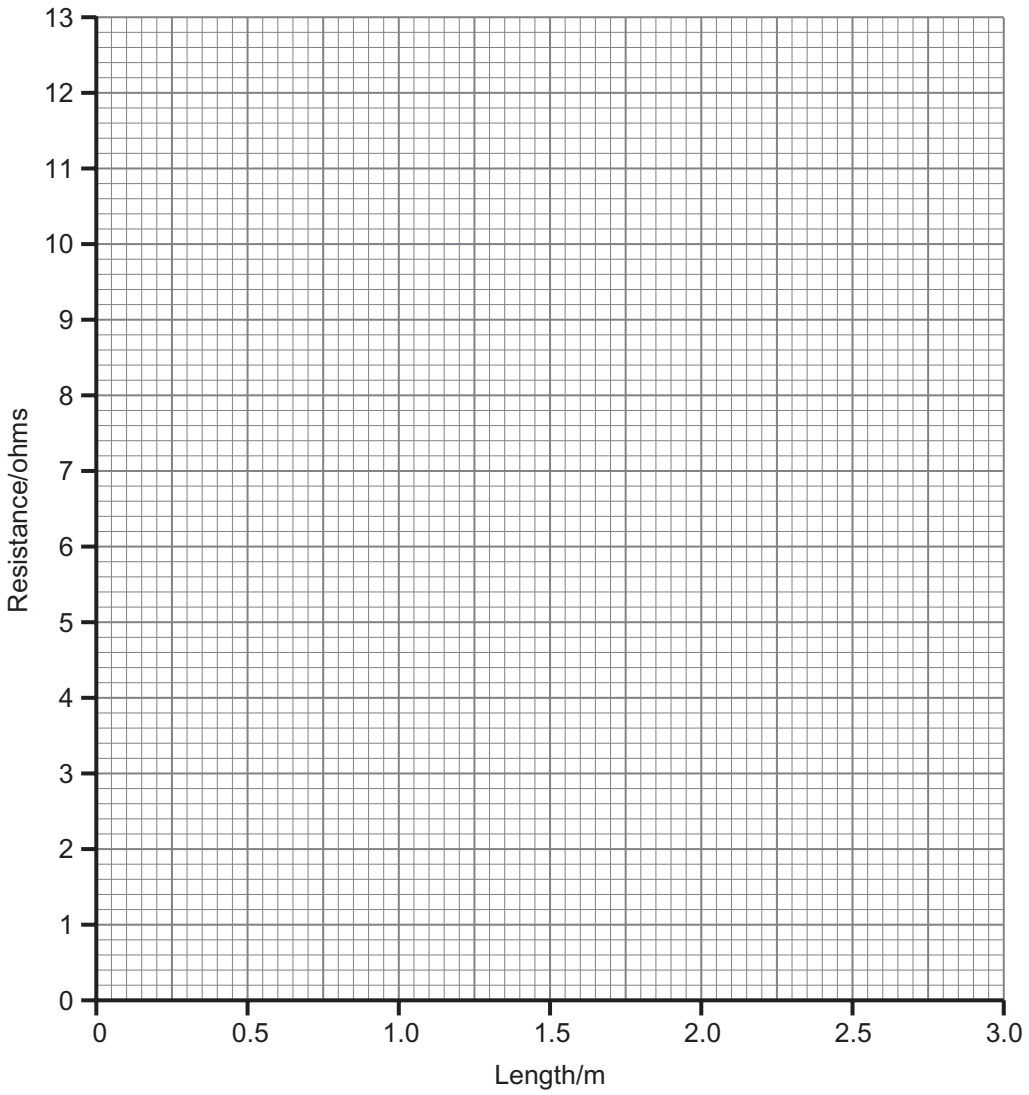
$$\text{Resistance} = \frac{\text{Voltage}}{\text{Current}}$$

to calculate the current flowing through the 2.5 m length.
Show your working out.

_____ A [2]

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(b) Draw a line graph for resistance against length on the grid below.



[3]

(c) Apart from voltage, give two other factors that must be kept the same during this investigation to make the test fair.

1. _____

2. _____ [2]

(d) State the trend shown by the results of this investigation.

_____

_____ [1]

(e) How could the pupils have achieved more reliable results?

_____

_____ [1]

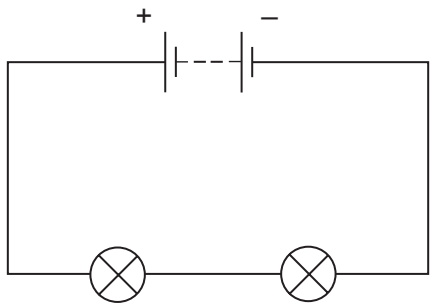
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

5 The diagram below shows two identical bulbs connected in series.



(a) (i) Draw an arrow on the diagram to show the direction of conventional current flow. [1]

(ii) Use your knowledge of atomic structure to describe and explain the difference between conventional and actual current flow.

_____

_____

_____

_____ [3]

(b) Use the meter readings below to calculate the cost of electricity used by a household.

Electricity costs 15p per unit.

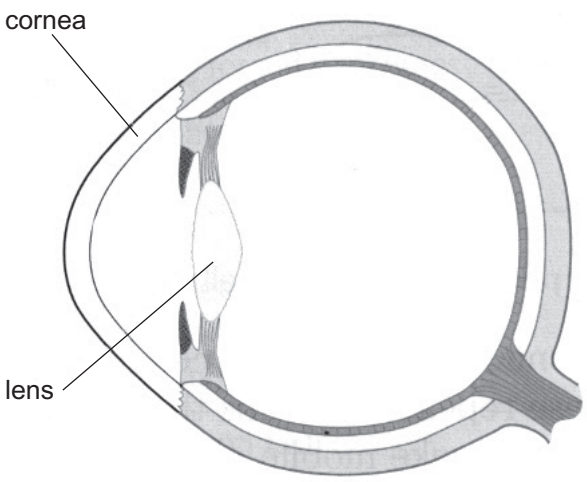
4 0 9 4 8	3 9 6 6 6
present reading	previous reading

Cost = _____ [2]

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Examiner Only	
Marks	Remark

6 **(a)** The diagram below shows the human eye.



© GCSE Single Award Science for CCEA by T Laverty, J Napier & R White, page 224, published by Hodder Education, 2006. ISBN 978330926000. "Reproduced by permission of Hodder Education".

(i) Name the type of lens found in the eye.

_____ [1]

(ii) Describe fully what will happen to parallel rays of light as they pass through this type of lens.

_____

_____

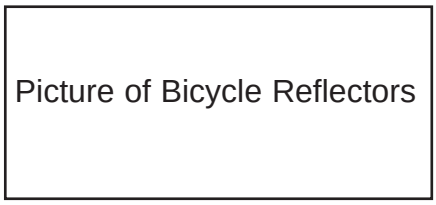
_____ [2]

(iii) A common eyesight problem is caused when the lens is too weak. Name this eyesight problem.

_____ [1]

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(b) The picture below shows bicycle reflectors.



Explain fully, in terms of total internal reflection, how these bicycle reflectors work.

_____

_____

_____

_____ [3]

Examiner Only	
Marks	Remark

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Rewarding Learning

General Certificate of Secondary Education
2010–2011

Science: Single Award (Modular)

Electricity, Waves and Communication
Module 5

Higher Tier

[GSC52]

THURSDAY 24 FEBRUARY 2011, MORNING

MARK SCHEME

STEMUP.CO.UK

					AVAILABLE MARKS
1	**(a)**	**(i)**	will not run out; refilled by rain; always be rain [2]		
		(ii)	more rain in mountains; better faster fall for water; v-shaped valley [1]		
		(iii)	wind/waves/solar/sun/biomass (any **two**) [1]		
	(b)		flooding; damages habitats [2]		
	(c)		water in turns the blades of turbine [1] a magnet [1] turns inside a coil of wire [1] (any **three** = [1] each) [3]		9
2	**(a)**		hard surfaces in bathroom/soft in bedroom = [1] reflectors absorbers = [1] echoes = [1] [3]		
	(b)		6 − 4 = 2 s [1] 1500 = d/2 d = 1500 × 2 } [2] 1500 × 4 } divide time or speed by 2 [1] d = 1500 m = [4] [4]		7
3	**(a)**		supply broadband/faster computer/faster internet/more data carried/ less data lost/less boosting required/light travels faster than electricity/ faster signal [2]		
	(b)	**(i)**	digital is series of on/offs or 1's and 0's = [1] analogue varies continuously = [1] [2]		
		(ii)	less prone to interference/processed by computers/better quality [1]		
	(c)	**(i)**	microwaves [1]		
		(ii)	cell [1]		7

			AVAILABLE MARKS
4	**(a)**	4/11.5 = [1] 0.347/0.3 = [2] 0.35 [2]	
	(b)	5 points correct = [2], 4/3 points = [1] correct line = [1] [3]	
	(c)	type/thickness of wire/temperature (any **two**) [2]	
	(d)	increased length = increased resistance = lower current (any **one**) [1]	
	(e)	repeat/average [1]	9
5	**(a)**	**(i)** conventional from +ve to −ve = [1] [1]	
		(ii) opposite direction = [1] (−ve to +ve) flow of electrons = [1] electrons −ve charge = [1] [3]	
	(b)	1282 units = [1] 19230 pence or £192.30 = [1] (need units) [2]	6
6	**(a)**	**(i)** convex/converging [1]	
		(ii) refracted/bent [1] inwards/converge together/meet focus on retina [1] [2]	
		(iii) long sight [1]	
	(b)	light enters reflector at/above critical angle [1] critical angle = angle at which TIR occurs/42 degrees for glass [1] = angle at which refraction doesn't occur [1] = angle below which refraction occurs [1] with TIR no refraction occurs [1] (any **three** = [1] each) [3]	7
		Total	**45**

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Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2010 – 2011

Science: Single Award (Modular)

Electricity, Waves and Communication

Module 5

Higher Tier

[GSC52]

GSC52

THURSDAY 11 NOVEMBER 2010, AFTERNOON

TIME

45 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper .
Answer **all six** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 45.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	

Total Marks	

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Examiner Only	
Marks	Remark

1 In an experiment on hearing, different frequencies were played to 20 teenagers and 20 pensioners. The number who could hear each frequency was recorded.
The results are shown in the table below.

Frequency (kHz)	Number who could hear each frequency	
	Teenagers	Pensioners
12	20	20
14	20	18
16	20	15
18	20	12
20	20	0
22	0	0

(a) (i) Describe fully what the information in the table tells us about hearing in teenagers.

_____

_____

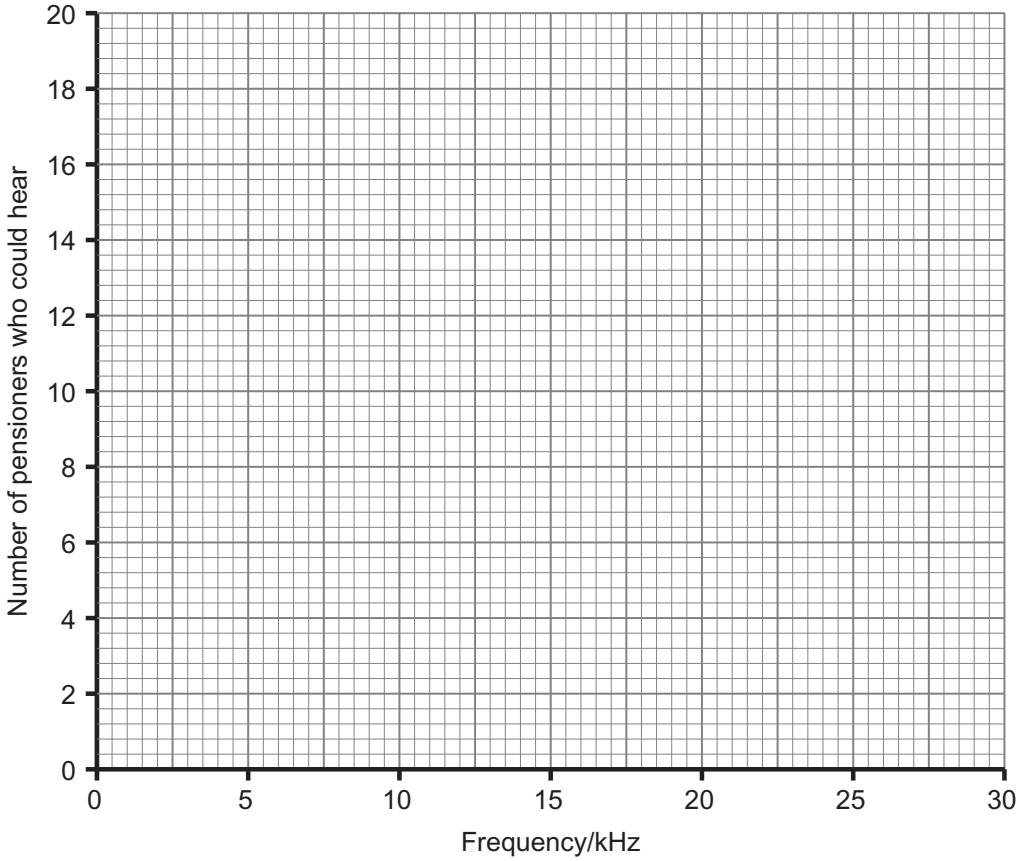
_____ [2]

(ii) What name is given to sounds above 20 kHz?

_____ [1]

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(b) Plot a line graph below for the **pensioners'** results.



[3]

(c) **(i)** Describe fully a conclusion that can be drawn about our ability to hear different frequencies as we get older.

_____

_____

_____ [2]

(ii) How could the accuracy of these results be improved?

_____ [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

2 **(a)** A charity wanted to build a water pump in a remote desert area of Africa. They had the choice of a petrol generated or solar powered pump. Explain fully why they considered the solar powered pump the better choice.

_____

_____

_____

_____

_____ [3]

(b) The water pump has a power rating of 1 kW and a voltage of 250 V. Calculate the current flowing in the lead connecting the water pump to the generator.

Use the equation:

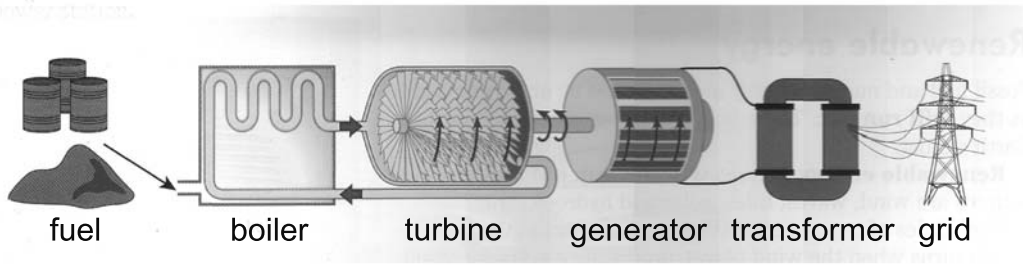
$$\text{Current} = \frac{\text{Power}}{\text{Voltage}}$$

Answer _____ A [3]

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Examiner Only	
Marks	Remark

3 **(a)** The diagram below outlines the component parts of a fossil fuel power station.



© CCEA GCSE Science Single Award Foundation Tier by J Napier, A Macfarland & C Murphy, published by Hodder Education. Reproduced by permission of Hodder Education.

(i) Describe fully how electricity is made inside the generator.

_____

_____

_____ [2]

(ii) Suggest how the amount of electricity produced by the generator can be increased.

_____

_____ [1]

(iii) State the energy changes that occur in the:

Boiler _____ → _____ [1]

Turbine _____ → _____ [1]

(b) Nuclear power can also be used to generate electricity. A major disadvantage is the eventual cost of decommissioning (shutting down and making the plant safe).
Explain fully why decommissioning is so expensive.

_____

_____

_____

_____

_____ [3]

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Examiner Only	
Marks	Remark

4 Mobile phones send digital signals using electromagnetic waves.



© Roger Scruton

(a) (i) Describe the main features of analogue and digital signals.

Analogue _____ [1]

Digital _____ [1]

(ii) Name a type of electromagnetic wave used in mobile phone communications.

_____ [1]

(b) The table below gives the SAR rating (Specific Absorption Rate) of 5 popular mobile phones.

Model	SAR (W/kg)
A	0.94
B	0.53
C	1.18
D	0.52
E	1

SAR (specific absorption rate) is a measurement of how much electromagnetic radiation is absorbed by body tissue whilst using a mobile phone. The higher the SAR the more radiation is absorbed. The maximum recommended level in the UK is 2 W/kg but experts warn that children are twice as sensitive to radiation as adults.

Use the information given to answer the following questions.

Examiner Only	
Marks	Remark

(i) Which phone (A, B, C, D or E) would be the safest purchase? Explain your choice.

Choice _____

Explanation _____

_____ [1]

(ii) Explain fully why model C should not be used by children.

_____

_____

_____ [2]

(c) Apart from considering SAR values suggest two other ways that mobile phone users can reduce their exposure to electromagnetic radiation.

_____

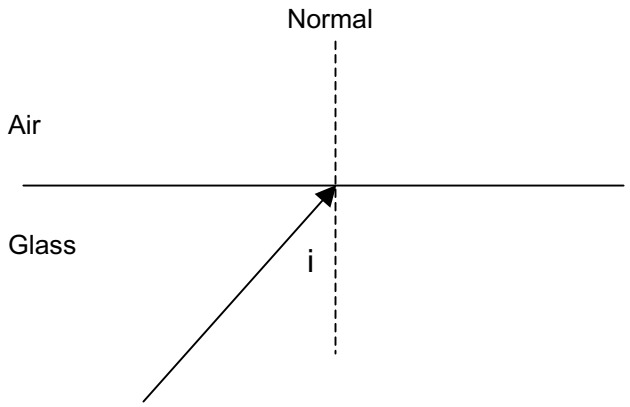
_____

_____ [2]

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Examiner Only	
Marks	Remark

5 During an experiment rays of light were incident onto a glass-air boundary as shown in the diagram below.



(a) Describe fully what happens to a ray of light at the following angles of incidence (i):

(i) 40° (less than the critical angle)

_____

_____ [2]

(ii) 42° (critical angle)

_____

_____ [2]

(iii) 44° (greater than the critical angle)

_____

_____ [2]

(b) Optical fibres have replaced copper as communication cables because they can carry more information.
Explain fully the reason for this choice.

_____

_____

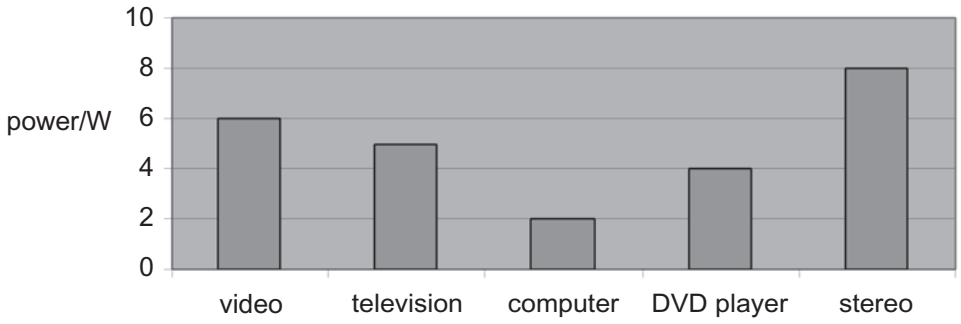
_____

_____ [2]

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Examiner Only	
Marks	Remark

6 The bar chart below shows how much electrical power appliances use when left on Standby.



(a) Calculate the cost of leaving the video and DVD player on Standby for 1 month (300 hours).
Each unit of electricity costs 18p per kWhr.

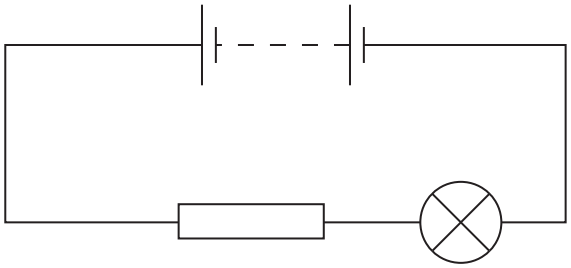
Use the equation:

Total cost = power × time × cost per unit

Answer _____ p [3]

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(b) Explain the difference between actual and conventional current flow. You may use the diagram to help your answer.



_____

_____

_____

_____

_____ [3]

Examiner Only	
Marks	Remark

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Rewarding Learning

General Certificate of Secondary Education
2010–2011

Science: Single Award (Modular)

Electricity, Waves and Communication

Module 5

Higher Tier

[GSC52]

THURSDAY 11 NOVEMBER 2010, AFTERNOON

MARK SCHEME

STEMUP.CO.UK

					AVAILABLE MARKS
1	(a)	(i)	teenagers hear all frequencies/teenagers hear higher frequencies/as frequency increases, numbers stay the same/ teenagers can hear higher frequency sounds than pensioners [1] none can hear 22 kHz [1]	[2]	
		(ii)	ultrasound	[1]	
	(b)		6 points correct [2] 5/4 points [1] [1] for correct line	[3]	
	(c)	(i)	as we get older we can hear less well/unable to detect high frequency sounds/hearing decreases/hearing deteriorates [1] can't hear above 18 kHz [1]	[2]	
		(ii)	repeat/average/more people/more frequencies	[1]	9
2	(a)		no cost of buying fuel/no cost for transporting fuel solar is renewable (will not run out) less air pollution/carbon dioxide/global warming } maximum [2] less greenhouse effect	[3]	
	(b)		1 kW = 1000 W [1] $\frac{1}{250}$ [1] 1000/250 [2] 4 [3]	[3]	6
3	(a)	(i)	magnet + coil of wire [1] movement [1]	[2]	
		(ii)	faster movement **or** stronger magnet **or** more coils	[1]	
		(iii)	Boiler = chemical → heat/thermal Turbine = heat/thermal → kinetic/movement	[1] [1]	
	(b)		removing radioactive waste/waste remains radioactive for long time returning site to its former state/difficult to store waste/expensive to store waste causes cancer/waste is dangerous/waste is toxic Any **three**, [1] each **not** nuclear is radioactive	[3]	8

					AVAILABLE MARKS
4	**(a)**	**(i)**	digital are series of on/off pulses (1's and 0's) [1] analogue vary continuously [1] **or** appropriate diagrams	[2]	
		(ii)	microwave/infrared	[1]	
	(b)	**(i)**	D as emits less radiation/lowest SAR rate	[1]	
		(ii)	highest SAR value [1]/most radiation SAR value is above children's recommended level [1]	[2]	
	(c)		shorter calls/speakerphone/text instead of calling use phone outside/hold phone further away Any **two**, [1] each	[2]	8
5	**(a)**	**(i)**	40 = refraction/bending [1] away from normal/to the right [1]	[2]	
		(ii)	42 = refraction/bending [1] At 90 degrees right angles/along edge of block [1]	[2]	
		(iii)	TIR = [2] reflection [1]	[2]	
	(b)		costs less/less cable required/more secure/less interference Signal needs less boosting/faster Any **two**, [1] each	[2]	8
6	**(a)**		DVD video = 10 watts [1] 6 + 4 = 10 [1]	converting 10 W to 0.01 kW [1] 0.010 × 300 × 18 [2] 10 × 300 × 18 [2] 54p [3]	
	(b)		conventional = from +ve to –ve (**or** arrow on diagram) actual = from –ve to +ve (**or** arrow on diagram) or opposite Actual = flow of electrons electrons = –ve charge Any **three**, [1] each	[3]	6
				Total	**45**

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Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2009–2010

Science: Single Award (Modular)

Electricity, Waves and Communication

Module 5

Higher Tier

[GSC52]

GSC52

THURSDAY 20 MAY 2010, AFTERNOON

TIME

45 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all six** questions.

INFORMATION FOR CANDIDATES

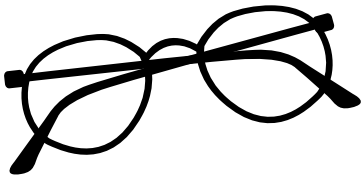
The total mark for this paper is 45.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
Total Marks	

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Examiner Only	
Marks	Remark

1 The spectacles shown in the picture below contain convex (converging) lenses.



(a) (i) Describe fully what a convex lens does to parallel rays of light.

_____

_____

_____ [2]

(ii) Name the other type of lens.

_____ [1]

(b) The spectacles above are used to correct long sight.

Describe fully the cause of long sight and its effect on vision.

_____

_____

_____

_____ [3]

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(Questions continue overleaf)

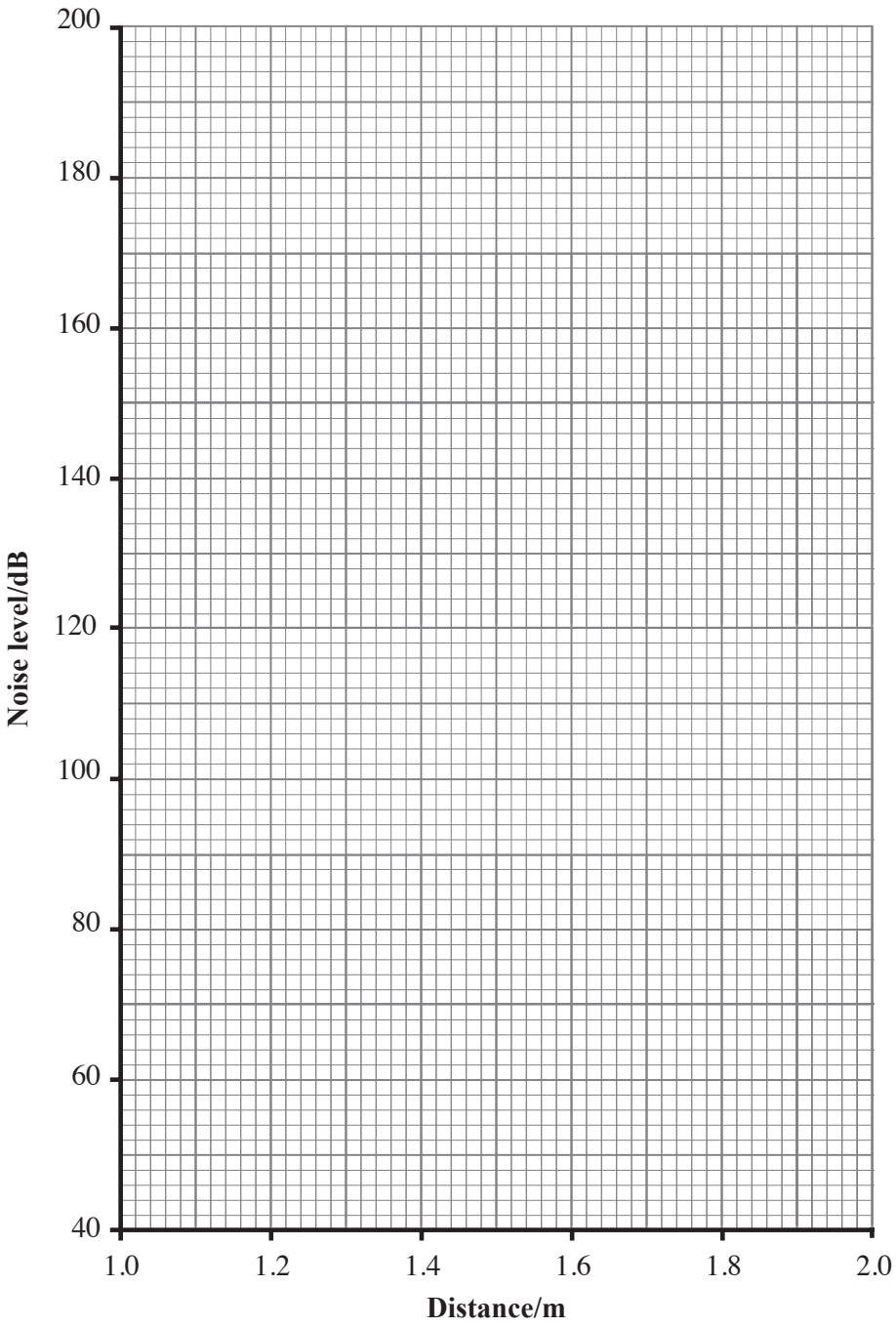
STEMUP.CO.UK

2 The table below gives noise levels in a concert at different distances from the loudspeakers.

Distance/m	Noise level/dB
1.0	180
1.2	125
1.4	92
1.6	70
1.8	56

(a) (i) Plot these points on the grid below and draw a smooth curve.

[3]



Examiner Only

Marks	Remark

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(ii) State the conclusion that can be drawn from these results.

_____

_____ [1]

(iii) Use the graph to find the distance from the loudspeaker that gives a noise level of 80 dB.

Answer _____ m [1]

(iv) Sounds above 100 dB cause hearing damage. Use the graph to find the minimum distance that safety barriers should be placed at a concert.

Answer _____ m [1]

(b) The walls of modern concert halls are lined with soft material. Explain fully why this is done.

_____

_____

_____ [2]

(c) Humans can hear sounds with a frequency between 20Hz and 20kHz. What is the name given to sound with a frequency higher than 20kHz?

_____ [1]

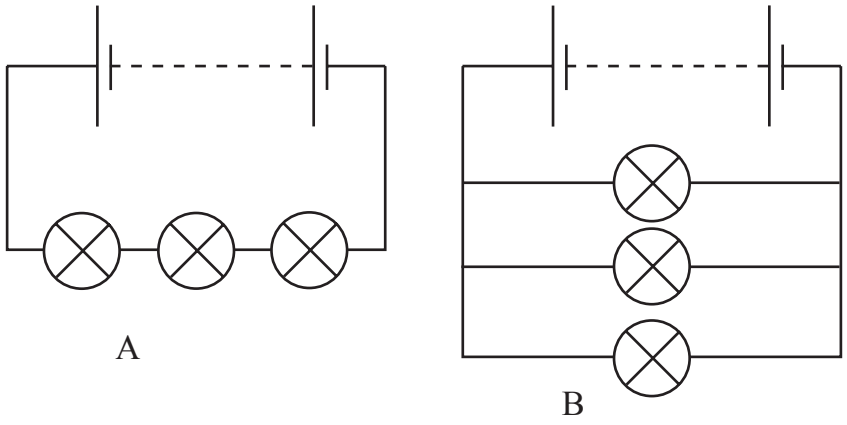
Examiner Only

Marks	Remark

STEMUP.CO.UK

Examiner Only	
Marks	Remark

3 The circuit diagrams below show different ways of connecting three identical bulbs into a circuit.



(a) (i) What is the name given to describe how the bulbs are connected in each circuit?

A _____ [1]

B _____ [1]

(ii) Explain fully why the bulbs in circuit A will be dimmer than those in circuit B.

_____

_____

_____

_____ [3]

(b) Give **one** reason why it is better to have house lighting circuits connected as shown in circuit B rather than circuit A.

_____

_____ [1]

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(c) **(i)** In an experiment the voltage was found to be 9 V and the current 1.5 A.

Use the equation :

voltage = current × resistance

to calculate resistance.

Answer _____ [2]

(ii) Name the unit of resistance.

_____ [1]

Examiner Only

Marks	Remark

STEMUP.CO.UK

4 The table below shows the electrical power ratings for a washing machine at various temperatures.

Temperature/°C	Power/W
30	350
40	650
50	900
60	1200

(a) Describe the relationship between temperature and power.

_____

_____ [1]

(b) (i) Calculate how many units of electricity are consumed during a 50°C wash cycle that lasts for 2 hours.

Use the equation:

units of electricity (energy) = power × time

Answer _____ [3]

(ii) What name is given to these units of electrical consumption?

_____ [1]

Examiner Only

Marks	Remark

STEMUP.CO.UK

5 In a recent advertising campaign targeted at mobile phone users the advice given was:

Examiner Only	
Marks	Remark

"Texting is safer than talking"

(a) Use your knowledge of mobile phone signals to suggest why, on health grounds, this is good advice.

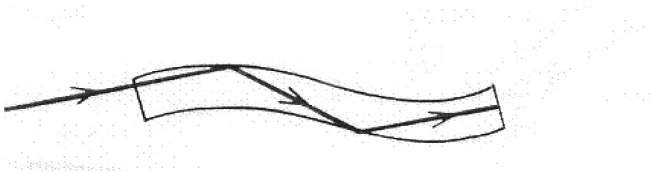
_____

_____

_____

_____ [3]

(b) Broadband internet signals can be transmitted through optical fibres as shown in the diagram below.



(i) Using the information given and your knowledge, explain why optical fibres are particularly effective for transmitting internet signals over long distances.

_____

_____

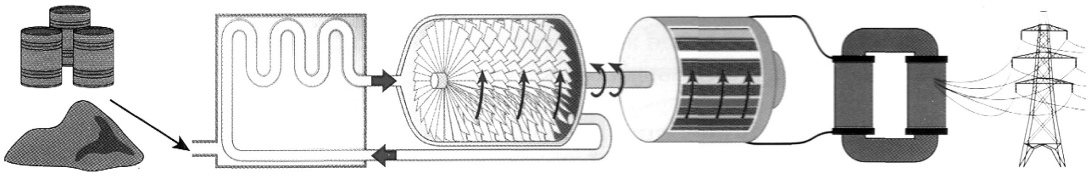
_____ [2]

(ii) Name a type of electromagnetic wave that is used in optic fibre communications.

_____ [1]

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6 The diagram below shows the components of a fossil fuel power station.



fuel boiler turbine generator transformer grid

© GCSE Single Award Science for CCEA By T Lavery, J Napier & R White, page 204, published by Hodder Murray, 2006 ISBN 0340 926007 'Reproduced with permission'

(a) Describe fully the energy changes that occur within the power station.

_____

_____

_____

_____

_____ [3

Examiner Only	
Marks	Remark

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(b) The table below compares the use of different energy sources to produce electricity.

Energy source	Carbon dioxide produced per kWh/g*	Construction cost/£ millions	Generating cost per kWh/pence	Output power/MW
Coal	1000	600	2.6	1800
Wind	4	1.4	3.3	3
Nuclear	5	1500	3.5	900
Hydroelectric	20	140	3.5	54

* includes during construction

Examiner Only	
Marks	Remark

Use the information in the table and your knowledge to answer the following questions.

(i) How could someone justify the building of more coal power stations rather than nuclear power stations?

_____

_____

_____

_____

_____ [4]

(ii) Carbon dioxide causes global warming. Explain fully why using the wind to produce 54 MW of electricity will have a greater effect on global warming than producing the same amount of power using hydroelectric.

_____

_____

_____

_____ [2]

(iii) Tidal energy is another source for generating electricity. Suggest why there are so few tidal generators being used in N. Ireland.

_____ [1]

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GCSE

Science: Single Award (Modular)

End of Module Tests

May 2010

Mark Schemes

Issued: October 2010

Rewarding Learning

General Certificate of Secondary Education
2009 – 2010

Science: Single Award (Modular)

Electricity, Waves and Communication
Module 5
Higher Tier

[GSC52]

THURSDAY 20 MAY 2010, AFTERNOON

MARK SCHEME

STEMUP.CO.UK

					AVAILABLE MARKS
1	**(a)**	**(i)**	bending / refraction [1] Inwards / together [1] Focus [1]	[2]	
		(ii)	concave / diverging	[1]	
	(b)		Can't see near things clearly or Can only see far things clearly [1] lens [1] weak / thin [1] Light focused behind retina [1] (**not** image formed behind retina) Eyeball too short	[3]	6
2	**(a)**	**(i)**	all 5 points [2] 4/3 [1] [1] for smooth curve No tolerance on points	[3]	
		(ii)	noise levels decrease with distance	[1]	
		(iii)	from graph 1.46 → 1.54	[1]	
		(iv)	from graph 1.32 → 1.38	[1]	
	(b)		Acts as sponge / absorb sound [1] prevents echoes / reverberation [1] or converse	[2]	
	(c)		Ultrasound / ultrasonic	[1]	9
3	**(a)**	**(i)**	A = series [1] B = parallel [1]	[2]	
		(ii)	Each bulb less current [1] Because less voltage [1] Because voltage shared [1] Bigger resistance	[3]	
	(b)		one bulb out, rest stay lit or number of lights switched on has no effect lights are brighter / independent switching of lights	[1]	
	(c)	**(i)**	$9 = 1.5 \times r$ or 9/1.5 [1] 6 [2]	[2]	
		(ii)	ohms / Ω	[1]	9

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				AVAILABLE MARKS
4	**(a)**	higher temperatures = more power or converse	[1]	
	(b)	**(i)** 900 / 1000 (W – kW) [1] 0.9 × 2 [2] 900 × 2 = [1] 1.8 [3]	[3]	
		(ii) kilowatt hours (kWh / kWhr)	[1]	5
5	**(a)**	microwaves [1] cancer / tumours [1] phone calls = longer time = higher dose [1] or converse or implied distance is less with calls = higher dose [1] or converse or implied (any **three** for [1] each)	[3]	
	(b)	**(i)** TIR [1] less loss of signal / stronger signal at end / light travels faster / less boosting required / carry more information [1] (any **two** = [1] each)	[2]	
		(ii) (visible) light or infra red	[1]	6
6	**(a)**	chemical – heat [1] heat – kinetic [1] movement / kinetic – electrical [1] name **three** types = [1]	[3]	
	(b)	**(i)** nuclear problems with waste [1] / radiation leak / cancer [1] (2/3) reference to cost of unit [1] greater output [1] cheaper coal has cheaper **generating** cost [1] by 0.9p [1] cheaper coal has cheaper **construction** cost [1] by £900 million [1] 2 out of 3	[4]	
		(ii) 18 wind turbines required [1] wind total = 72 (grams) / wind higher by 52 (grams) [1]	[2]	
		(iii) damages habitats / lack of suitable sites / big rivers – implied	[1]	10
			Total	**45**

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GCSE

Science: Single Award (Modular)

March 2010

Mark Schemes

Issued: May 2010

Rewarding Learning

General Certificate of Secondary Education
2009 – 2010

Science: Single Award (Modular)

Electricity, Waves and Communication

Module 5

Higher Tier

[GSC52]

THURSDAY 25 FEBRUARY 2010, MORNING

MARK SCHEME

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				AVAILABLE MARKS
1	**(a)**	it shrinks = 1 mark / lessens / decreases **not** loudness / gets worse / lower we can't hear high pitch (frequencies) = 2 marks or implied	[2]	
	(b)	**(i)** 1500 × 4 = 1 mark 1500 × 2 = 2 marks 3000m = 3 marks **not** 6000	[3]	
		(ii) (sound / echo returns) = 1 mark quicker = 2 marks decrease in depth = 1 mark	[2]	7
2	**(a)**	all points correct = 2 marks 6/5/4 points correct = 1 mark Correct line of best fit = 1 mark	[3]	
	(b)	power output increases with speed = 1 mark Up to a maximum = 1 mark	[2]	
	(c)	less acid rain / less air pollution / less carbon dioxide / less greenhouse gases **not** fossil fuels Less global warming (any 2 = 1 mark each) / less SO_2 or NO_2	[2]	
	(d)	will run out / can't be replaced/limited **not** can't be used again	[1]	8
3	**(a)**	**(i)** convex / converging	[1]	
		(ii) converges / bends / refracts light = 1 mark form image / focus on the retina = 1 mark	[2]	
	(b)	**(i)** too converging/too long/too strong/too thick; image focusses in front of the retina	[1]	
		(ii) see close objects clearly / far objects blurry	[1]	
		(iii) glasses have concave / diverging lens = 1 mark light rays are spread out = 1 mark come to a focus image on the retina = 1 mark	[3]	8

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				AVAILABLE MARKS
4	**(a)**	more wire in circuit = 1 mark Resistance increases = 1 mark Current decreases / ammeter reading falls = 1 mark Bulb gets dimmer = 1 mark (any 3 = 1 mark each)	[3]	
	(b)	**(i)** 6V	[1]	
		60 or c.m.	[1]	
		(ii) ohms (or symbol)	[1]	
	(c)	**(i)** melts / heats up = 1 mark breaks / blows =1 mark	[2]	
		(ii) stops electricity or current flowing / breaks (gap) circuit / prevents high current / limits current	[1]	9
5	**(a)**	**(i)** light is refracted / bent; away from the normal	[2]	
		(ii) total internal; reflection	[2]	
		(iii) critical angle	[1]	
	(b)	(visible) light/infrared	[1]	6
6	**(a)**	conventional flows from +ve to –ve / converse = 1 mark Actual = flow of electrons = 1 mark Electrons are negatively charged =1 mark	[3]	
	(b)	power = 240 × 6 = 1440 = 1 1440 W = 1.44 Kw = 1 15mins = 0.25 hrs = 1 1.44 × 0.25 × 8 = 3 marks 2.9p / 2.88pence (3p) = 4 marks	[4]	7
			Total	**45**

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