CCEA GCSE SCIENCE: SINGLE AWARD

SCIENCE



EXAM QUESTION PACK

UNIT 3 (PHYSICS) HIGHER TIER GSS32 PAPERS

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Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2016–2017

Science: Single Award

Unit 3 (Physics)
Higher Tier

GSS32

[GSS32]

FRIDAY 11 NOVEMBER 2016, AFTERNOON

TIME

1 hour 15 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 ten** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Questions **3(a)** and **6**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total Marks	

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Examiner Only	
Marks	Remark

1 **(a)** The table below shows the lowest and highest frequencies that some sea animals can hear.

Sea animal	Lowest frequency/ Hz	Highest frequency/ Hz
Porpoise	75	150 000
Beluga whale	1000	123 000
Dolphin	40 000	100 000
Seal	300	56 000

(i) Many sea animals can hear ultrasound. What is meant by the term 'ultrasound'?

_____

_____

_____ [2]

(ii) Name the sea animal which can **only** hear ultrasound.

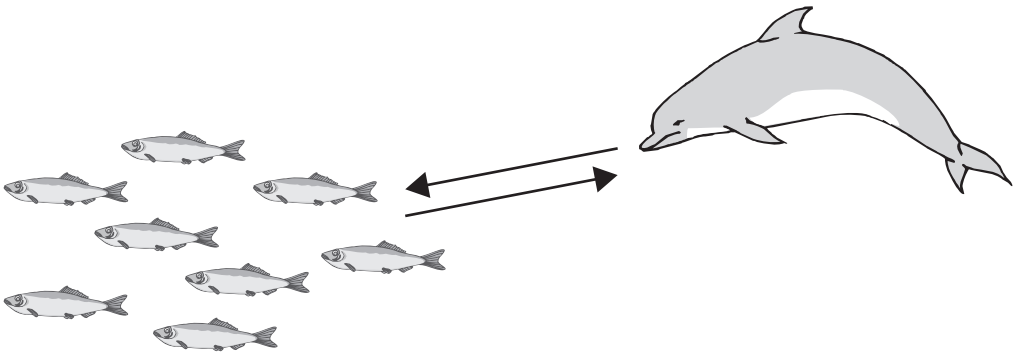
Answer _____ [1]

(iii) Name the sea animal which can hear the greatest range of frequencies.

Answer _____ [1]

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(b) The diagram below shows a dolphin using ultrasound to hunt fish.



Source: Principal Examiner

The dolphin sends out an ultrasound pulse and the echo returns 0.04 seconds later. Ultrasound travels at 1500 m/s in water.

Use the equation:

distance = speed × time

to calculate the distance between the dolphin and the fish.

(Show your working out.)

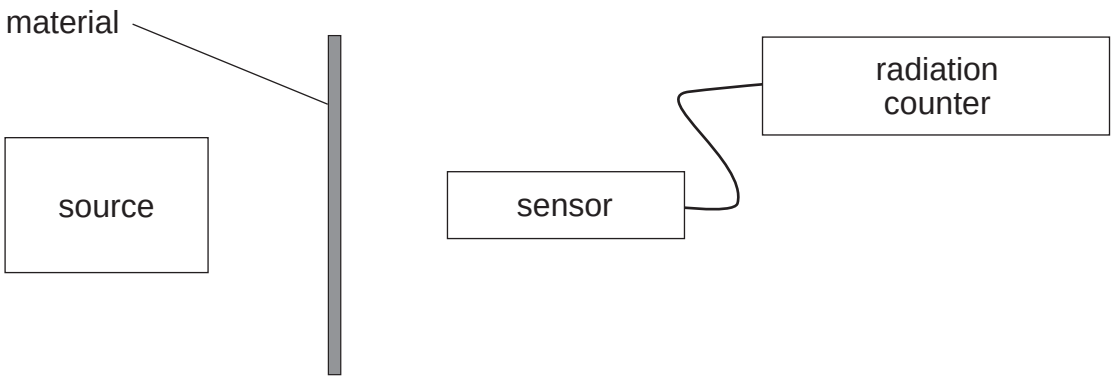
Answer _____ m [3]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

2 The apparatus below was used to investigate the type(s) of radiation emitted from a source.



The table below shows the results obtained when different materials were used.

Material	Radiation/cpm
None	1000
1 mm paper	800
5 mm aluminium	800
30 mm lead	15

(a) Name the **two** types of radiation produced by this source.
Explain your answer.

_____

_____

_____

_____

_____

_____ [3]

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(b) Radioactive tracers are used to examine organs inside the body. The tracer is put into the patient's body and followed by sensors outside the body.

The table below gives information about three isotopes of iodine that could be used as tracers.

Isotope	Radiation emitted	Half-life
Iodine-128	beta	25 minutes
Iodine-129	beta and gamma	25 000 000 years
Iodine-131	beta and gamma	8 days

(i) Explain fully what is meant by the term 'half-life'.

_____

_____

_____ [2]

(ii) Which isotope of iodine would be the best to use as a radioactive tracer? Explain your answer fully.

Isotope _____ [1]

Explanation _____

_____

_____

_____ [2]

(iii) Explain fully why some nuclei are radioactive.

_____

_____

_____

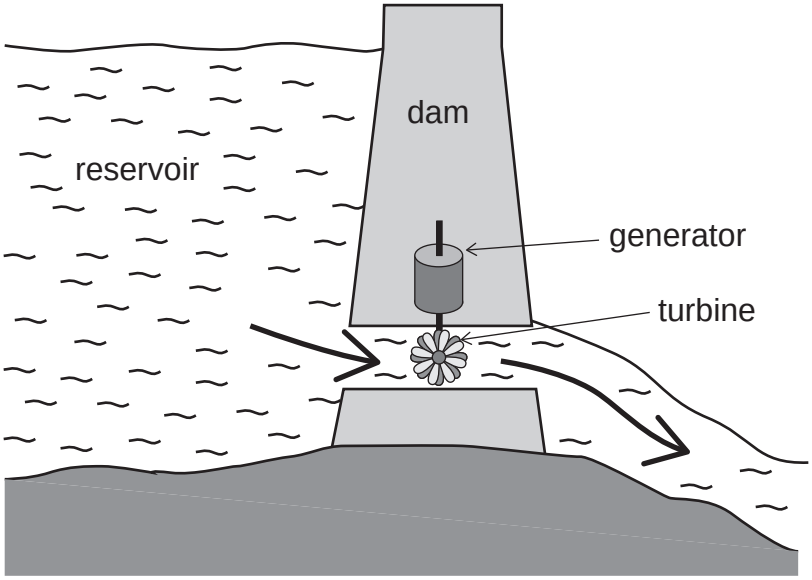
_____ [2]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

3 (a) The diagram below shows a hydroelectric power station.



Source: Principal Examiner

Explain how this power station produces electricity.

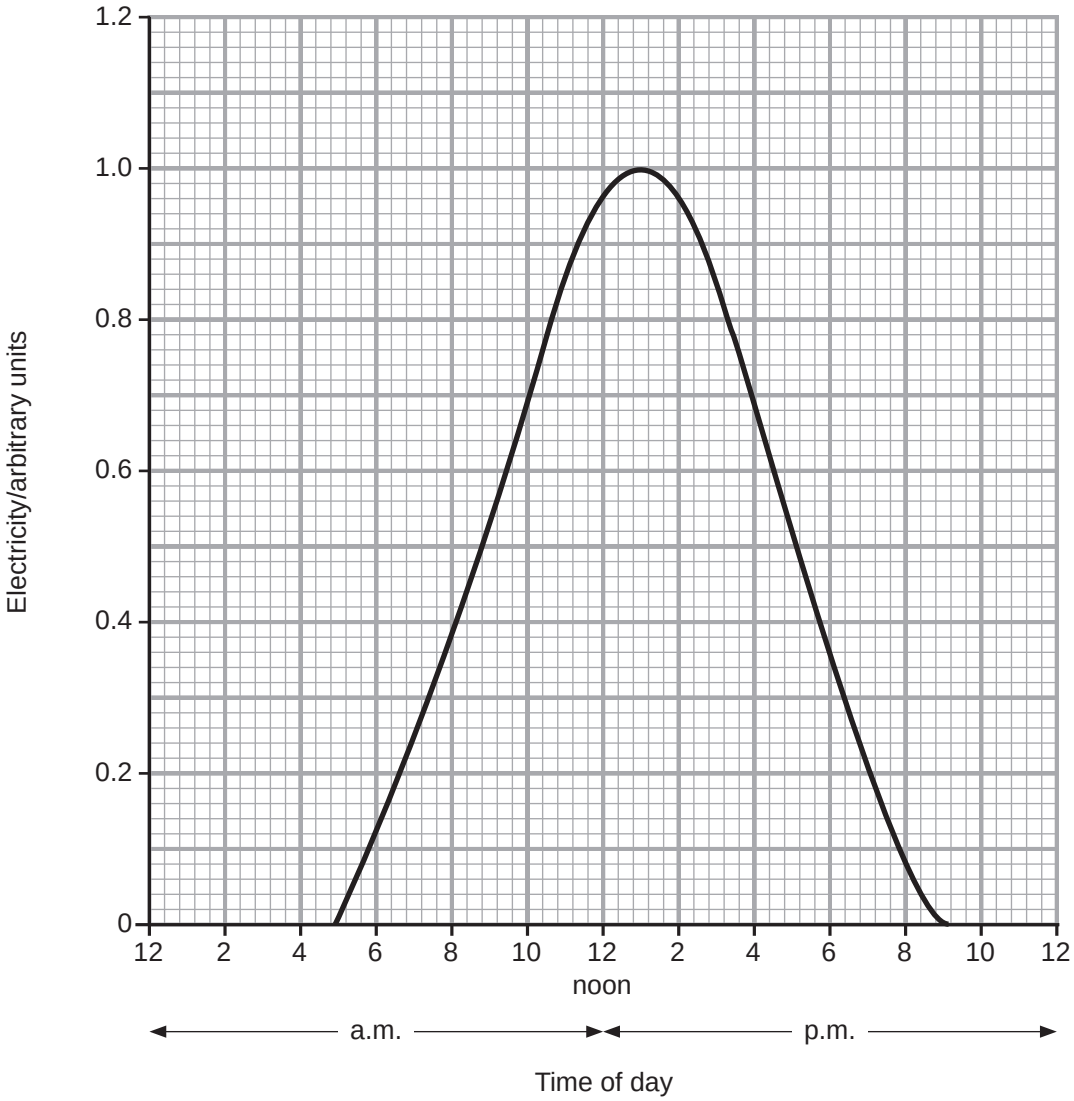
Your answer should include the **advantages** and **disadvantages** of using hydroelectric power compared to fossil fuels.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

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Solar cells can also be used to produce electricity. The graph below shows the amount of electricity produced by a solar cell over a 24 hour period in summer.



(b) On the same axes draw the curve you would expect for a 24 hour period in winter. [2]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

4 **(a)** The photograph below shows a 60 W filament bulb. This type of bulb is 15% efficient.



Source: Principal Examiner

What does the term 'efficiency' mean?

_____

_____

_____ [2]

(b) The table below gives information about three types of light bulb.

	CFL bulb	Filament bulb	LED spotlight
			
Power input/W	14	60	10
Cost to use for 2000 hours	£4.80	£20.40	£3.40
Average life/hours	10 000	1000	20 000
Cost to buy bulb	£2.60	£0.90	£10.00

Source: Principal Examiner

Which bulb would be cheapest to buy and use for 2000 hours?
Explain your answer.

_____

_____

_____

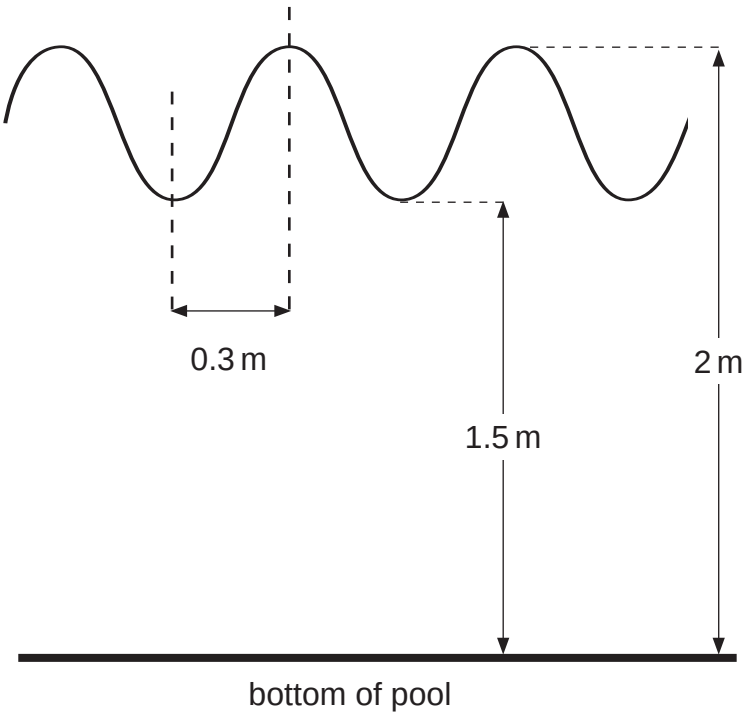
_____ [2]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

5 **(a)** The diagram below shows a wave produced by a wave machine at a swimming pool.



(i) Use information from the diagram to calculate:

1. the amplitude of the wave.

Answer _____ m

2. the wavelength of the wave.

Answer _____ m [2]

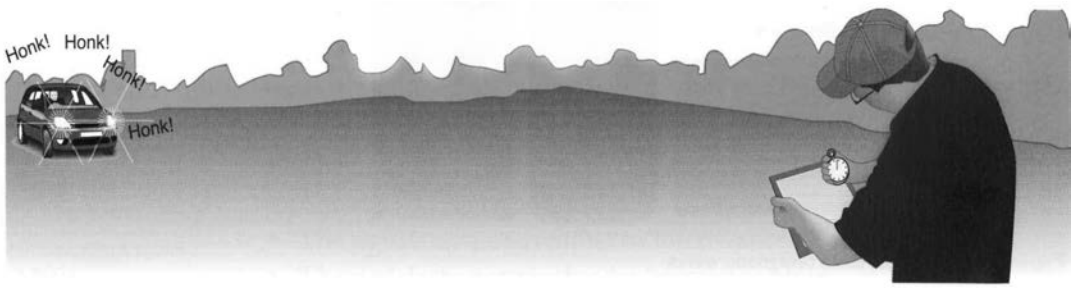
(ii) The equation below is used to describe a wave.

wave speed = frequency × wavelength

For a particular wave, the speed does not change but the wavelength increases. In what way, if at all, will the frequency change?

_____ [1]

(b) The diagram below shows two pupils using the flash-bang method to find the speed of sound in air.



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(i) Describe fully the flash-bang method.

_____

_____

_____

_____

_____

_____ [3]

The experiment was carried out three times and the results are shown below.

Time of the day	Speed/ m/s
morning	340
afternoon	335
evening	315

(ii) Calculate the average of these results.

Answer _____ m/s [1]

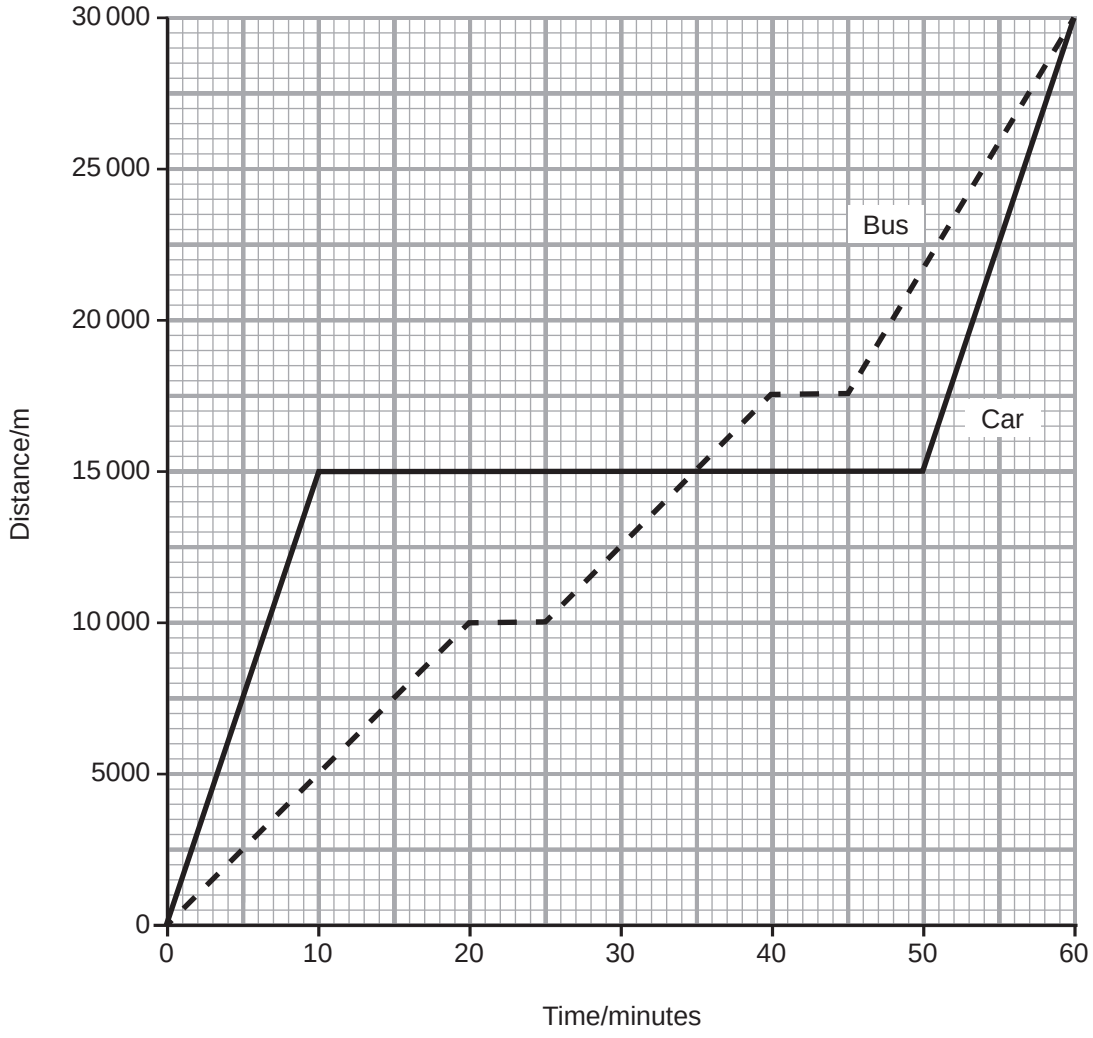
(iii) Apart from human error, suggest why all the results are different from each other.

_____ [1]

Examiner Only

Marks	Remark

6 The graph below shows a distance–time graph for a bus and a car.



Describe the movement of the car and compare it to the movement of the bus.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

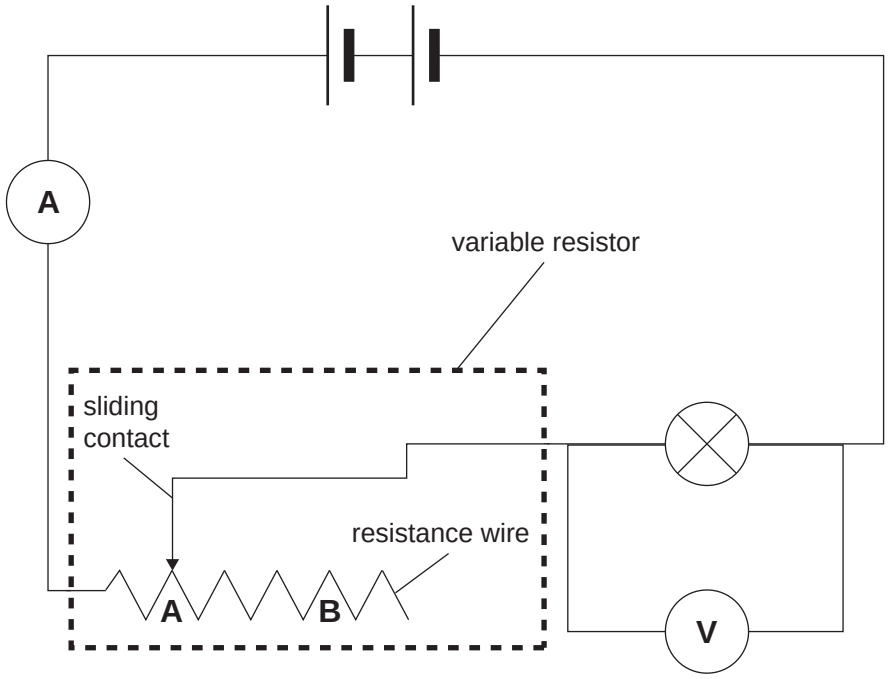
Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

[6]

Examiner Only	
Marks	Remark

7 **(a)** Keith set up the circuit below to measure the voltage across and the current through a bulb.



State **two** changes which will occur in the circuit as the sliding contact is moved from **A** to **B**.

1. _____

2. _____ [2]

(b) Suggest **one** use for a variable resistor in the home.

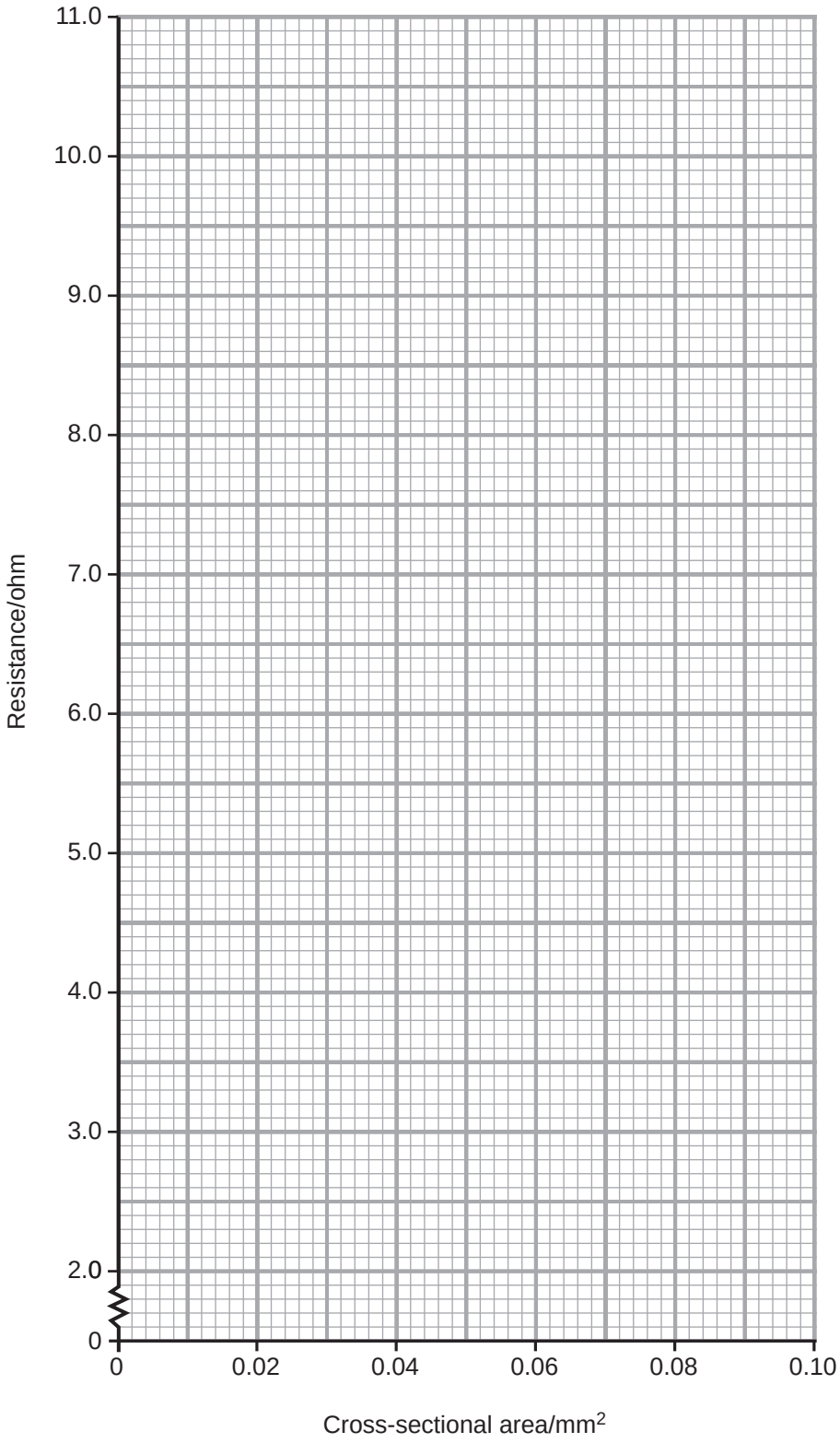
_____ [1]

(c) In an investigation, the cross-sectional area of resistance wire was changed and its resistance measured. The results are shown below.

Cross-sectional area/ mm^2	Resistance/ohm
0.02	10.9
0.04	5.5
0.05	4.4
0.07	3.1
0.10	2.0

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On the grid below, plot a line graph of these results.



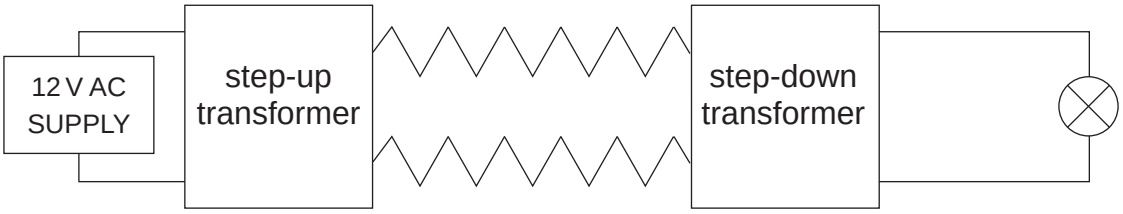
[3]

Examiner Only	
Marks	Remark

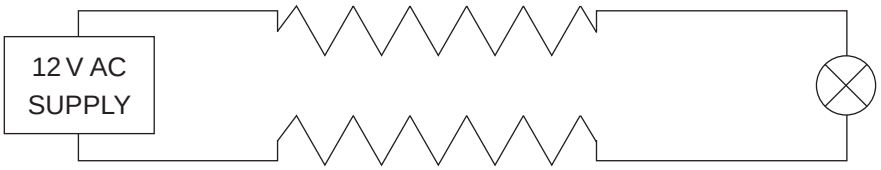
(d) Circuits **1** and **2**, shown below, were set up to show the role of transformers in the National Grid.

Examiner Only	
Marks	Remark

Circuit 1



Circuit 2



Explain fully why the bulb in **Circuit 1** is much brighter than the bulb in **Circuit 2**.

_____

_____

_____

_____ [2]

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(Questions continue overleaf)

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Examiner Only	
Marks	Remark

8 **(a)** The diagram below shows a car with a crumple zone.



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Crumple zones are designed to help reduce injuries to people inside the car during a crash.
The table below shows information about two cars during a crash.
Car **A** has a crumple zone and car **B** does not.

	Car A	**Car B**
Mass of the car/kg	1200	1200
Mass of the driver/kg	100	100
Force on the driver/N	1500	4500
Time taken to stop/s	1.2	0.4
Velocity before impact/ m/s	13	13

Use information from the table to explain how crumple zones reduce injury to a driver in a crash.

_____

_____

_____ [2]

(b) (i) Use information from the table and the equation below:

momentum = mass × velocity

to calculate the momentum of car **A** (including the driver) **before** the impact.

(Show your working out.)

Answer _____ [2]

(ii) What is the unit of momentum?

Answer _____ [1]

(iii) What is the momentum of car **A** 2 seconds after the impact? Explain your answer.

_____

_____

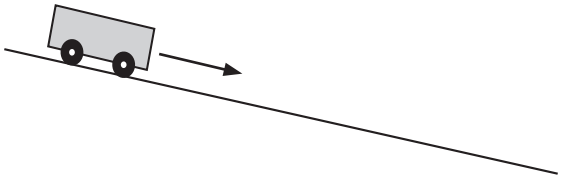
_____ [2]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

9 **(a)** The diagram below shows a trolley on a ramp. The instantaneous speed of the trolley was measured by sensors every second.



The results are shown below.

Sensor	Time/s	Distance/m	Speed/ m/s
A	0	0.00	0.00
B	1	0.05	0.10
C	2	0.20	0.20
D	3	0.45	0.30
E	4	0.80	0.40
F	5	1.25	0.50

(i) Explain fully, in terms of **forces**, the movement of the trolley down the ramp.

_____

_____

_____

_____

_____ [3]

(ii) Use the equation:

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

to calculate the average speed of the trolley between sensors **B** and **D**.

(Show your working out.)

Answer _____ m/s [2]

(iii) If the height of the ramp were increased, what effect, if any, would this have on the average speed?

_____ [1]

The table below shows four sets of forces.

	Set of forces
A	10 N → ← 5 N
B	10 N → 5 N →
C	5 N → ← 10 N
D	10 N → ← 10 N

(b) Which set (**A**, **B**, **C** or **D**) produces the largest resultant force?

Answer _____ [1]

(c) Car speed can be measured using instantaneous or average speed cameras. Suggest why average speed cameras may be more useful on a road outside a school.

_____

_____

_____ [2]

Examiner Only

Marks	Remark

Examiner Only

Marks	Remark

10 **(a)** The table below shows some data for five different satellites orbiting the Earth.

Satellite	Height above Earth's surface/ km	Time to orbit the Earth/hours	Mass/kg
Galileo	23 000	14	733
GPS	20 000	12	1630
GLONASS	19 000	11	750
Hubble	550	1.53	11 110
ISS	400	1.5	370 131

(i) State the trend shown by the information in the table.

_____

_____ [1]

(ii) The mass of the satellite does not affect its orbit time. Explain how the information in the table shows this.

_____

_____ [1]

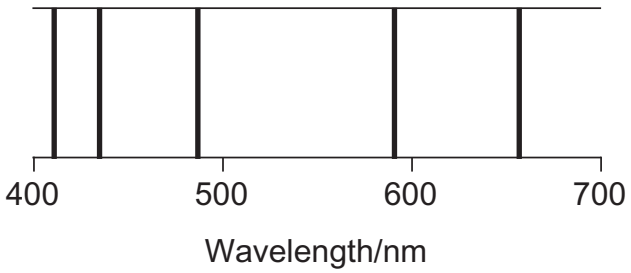
(b) As a star produces energy, its chemical composition changes. Name the chemical element which decreases. Explain why the amount of this element decreases over time.

_____

_____

_____ [2]

(c) A star gives out energy with a wide range of wavelengths but some gaps appear in its spectrum as dark lines.
Part of the spectrum of one star is shown below.



The gaps in the spectrum are caused when an element in the star absorbs the energy at that wavelength.
Identify the elements present in this star by putting ticks (✓) in the table below.

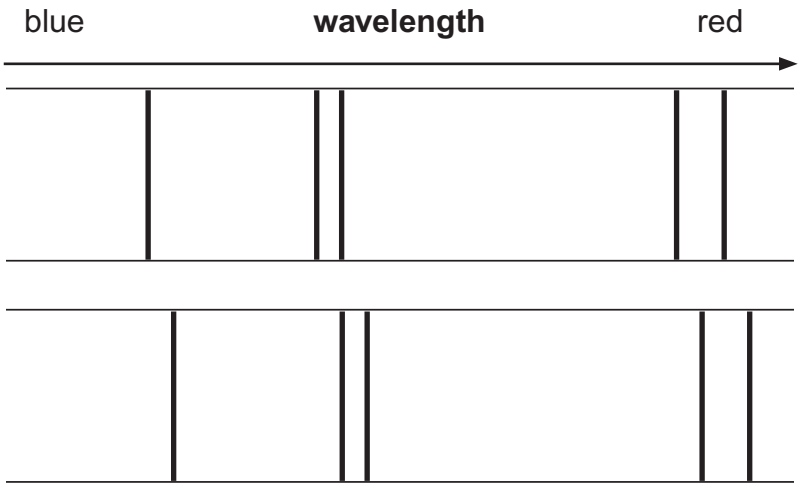
Element	Wavelength/nm	Element present (✓)
Helium	447, 502	
Sodium	590	
Hydrogen	410, 434, 486, 656	
Iron	431, 467, 496, 527	

[2]

Examiner Only

Marks	Remark

When astronomers examine the spectra from other galaxies they also show dark lines.



(d) Describe fully what astronomers can conclude about Galaxy **B** compared to Galaxy **A**.

_____

_____

_____ [2]

THIS IS THE END OF THE QUESTION PAPER

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Marks	Remark

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Rewarding Learning

General Certificate of Secondary Education
2016–2017

Science: Single Award

Unit 3 (Physics)

Higher Tier

[GSS32]

FRIDAY 11 NOVEMBER 2016, AFTERNOON

MARK SCHEME

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General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

					AVAILABLE MARKS
1	(a)	(i)	A sound with a frequency [1] above 20 kHz [1]	[2]	
		(ii)	Dolphin	[1]	
		(iii)	Porpoise	[1]	
	(b)		1500 × 0.04 [1] 1500 × 0.02 [1] 30 m [1]	[3]	7
2	(a)		Alpha and gamma [1] Any **two** from: • paper reduces the count so alpha radiation is present • aluminium has no effect on the count so beta radiation is absent • lead reduces the count so gamma radiation is present [2]	[3]	
	(b)	(i)	The time it takes [1] for the radioactivity to fall by half [1]	[2]	
		(ii)	Iodine-131 [1] It produces gamma rays [1] shortest half-life [1]	[3]	
		(iii)	The combination of protons and neutrons [1] is unstable [1]	[2]	10

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AVAILABLE MARKS

3 (a) Indicative content

- water flows to turn the turbine
- coil of wire and magnet (in generator)
- relative movement
- water is a renewable resource/coal is non-renewable
- it produces no carbon dioxide/air pollution
- saves fossil fuels/fossil fuels last longer/cheaper to run
- expensive to build
- floods habitats/uses land where people live

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe fully, in a logical sequence, how the hydroelectric power station works (using **at least six** of the above points). They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates use some appropriate specialist terms to partially describe, in a logical sequence, how the hydroelectric power station works (using **four or five** of the above points). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates describe how the hydroelectric power station works (using **one to three** of the above points). However these are not in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Response not worthy of credit.	[0]

[6]

(b) Graph has a lower maximum [1]
Starts later than 5 am and finishes before 9 pm [1] [2] 8

4 (a) How good the bulb is at transferring the total energy [1]
into useful energy [1] [2]

(b) CFL bulb [1]
it only costs £7.40 to use [1] [2] 4

	AVAILABLE MARKS

5 **(a)** **(i)** 0.25 m [1]
0.6 m [1] [2]

(ii) Frequency decreases [1]

(b) **(i)** Any **three** from:
- Place car and pupil a large (known) distance apart [1]
- car flashes lights and beeps horn **at the same time** [1]
- pupil starts the watch when he sees the lights, pupil stops the clock when he hears the horn. [1]
- use formula speed = distance ÷ time [3]

(ii) 330 m/s [1]

(iii) The wind [1] — 8

6 **Indicative content:**
- travels 15 000 m in 10 minutes
- at a steady speed
- stops once for 40 minutes
- then moves 15 000 m in 10 minutes
- the bus makes two stops/only stops for 10 mins
- both travel 30 000 m (in 60 minutes)
- at the same average speed
- any other valid comparison

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe fully, in a logical sequence, the motion of the bus and car (using **at least six** of the above points). They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates use some appropriate specialist terms to partially describe, in a logical sequence, the motion of the bus and car (using **four or five** of the above points). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates describe the motion of the bus and car (using **one to three** of the above points). However these are not in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Response not worthy of credit.	[0]

[6] — 6

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			AVAILABLE MARKS
7	**(a)**	Any **two** from: • bulb gets dimmer/cooler • voltage decreases • current decreases • resistance increases [2]	
	(b)	Dimmer switch/volume control [1]	
	(c)	All points correctly plotted [2] 4 points correctly plotted [1] line of best fit [1] [3]	
	(d)	Transformer increases the voltage/step-up transformer decreases current [1] less energy losses [1] [2]	8
8	**(a)**	They increase the time taken to stop [1] this reduces the force on the driver [1] [2]	
	(b) **(i)**	1300 × 13 [1] 16 900 [1] [2]	
	(ii)	kgm/s / Ns [1]	
	(iii)	0 kgm/s [1] its velocity is zero/stationary/stopped [1] [2]	7
9	**(a)** **(i)**	Friction is overcome by gravity [1] unbalanced force [1] trolley accelerates [1] [3]	
	(ii)	0.4 ÷ 2 [1] 0.2 [1] [2]	
	(iii)	The speed would increase. [1]	
	(b)	B [1]	
	(c)	Car travel within speed limit over a greater distance/time [1] reduces chance of a serious accident over a greater distance [1] [2]	9

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10 **(a)** **(i)** The greater the height, the longer it takes to orbit [1]

(ii) There is no correlation between the masses of the satellites and their orbit times [1]

(b) Hydrogen [1]
by nuclear fusion [1] [2]

(c)

Element	Wavelength/nm	Element present
Helium	447, 502	
Sodium	590	✓
Hydrogen	410, 434, 486, 656	✓
Iron	431, 467, 496	

[2]

(d) It is moving faster [1]
it is further away [1] [2]

Total

AVAILABLE MARKS

8

75

Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2015–2016

Science: Single Award

Unit 3 (Physics)

Higher Tier

[GSS32]

GSS32

WEDNESDAY 25 MAY 2016, AFTERNOON

TIME

1 hour 15 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in blue or black ink only. **Do not write with a gel pen.**
Answer **all ten** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Questions **4(a)** and **9**.

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1 **(a)** The advert below was used to discourage drink driving.



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(i) Suggest how drink driving could lead to a person losing his or her job.

_____

_____ [1]

(ii) Describe and explain how alcohol affects a driver's thinking distance.

_____

_____

_____ [2]

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(b) The table below shows how the braking distance and the thinking distance may be affected by the number of people in a car at different speeds.

Speed/ km/h	Braking distance/m		Thinking distance/m	
	car and driver only	car, driver and three passengers	car and driver only	car, driver and three passengers
30	5	7	6	6
45	12	14	8	8
60	21	23	11	11

(i) Explain what is meant by the term 'braking distance'.

_____

_____ [1]

(ii) In what way, if any, is braking distance affected by having passengers?

_____

_____ [1]

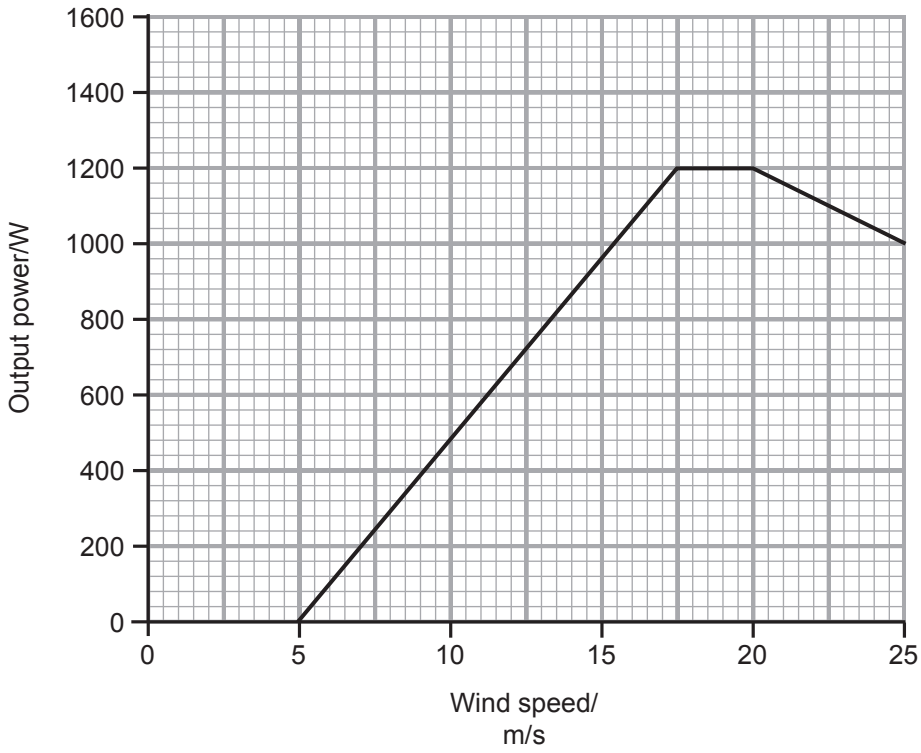
(iii) Calculate the **stopping** distance for a car with a driver and three passengers travelling at 30 km/h.

Answer _____ m [1]

[Turn over

STEMUP.CO.UK

2 **(a)** The graph below shows the output power produced by a wind turbine at different wind speeds.



(i) Describe fully the trend shown by the graph.

_____

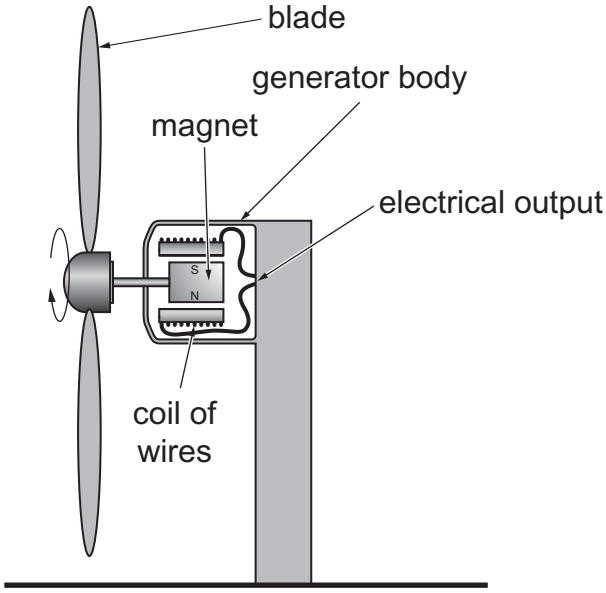
_____

_____

_____ [2]

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The diagram below shows a cross section through a wind turbine.



© Principal Examiner

(ii) Use the diagram and your knowledge to describe how electricity is produced by this turbine.

_____

_____

_____ [2]

(b) Give **one** environmental advantage and **one** environmental disadvantage of using wind turbines.

Advantage _____

_____

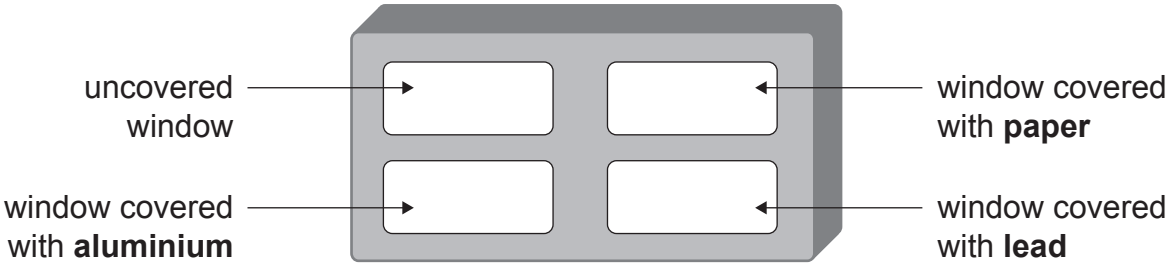
Disadvantage _____

_____ [2]

[Turn over

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3 **(a)** The diagram below shows a badge that is used to detect radiation.
The badge has four windows.



© Principal Examiner

Behind each window there is a film that is sensitive to radiation. This film changes colour from brown to white when exposed to radiation.

(i) Suggest the function of the uncovered window.

_____ [1]

(ii) How many windows will change from brown to white when exposed to **beta** radiation?

Answer _____ [1]

(b) Surgical equipment can be treated with radiation before it is used in hospital operations.
Suggest why this is necessary, naming the type of radiation used.

_____

_____

_____

_____

_____ [3]

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(c) The table below shows the results of an investigation into the activity of a radioactive isotope.

Day	Activity/cpm
1	100
2	73
3	50
4	37
5	25
6	18
7	15
8	15
9	15
10	15

Describe fully the trend shown by this information.

_____

_____

_____ [2]

[Turn over

STEMUP.CO.UK

4 **(a)** Describe fully the present day model of the Solar System and explain how it differs from the earlier model.

Your answer should include:

- the name of each model
- **two** differences between these models
- the names and positions of **two** planets

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

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(b) The Universe consists of millions of galaxies.

(i) What is a 'galaxy'?

_____

_____ [1]

(ii) Name the galaxy that includes planet Earth.

_____ [1]

[Turn over

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5 **(a)** Fuses are used in electrical circuits for safety.
Explain fully how a fuse works as a safety device.

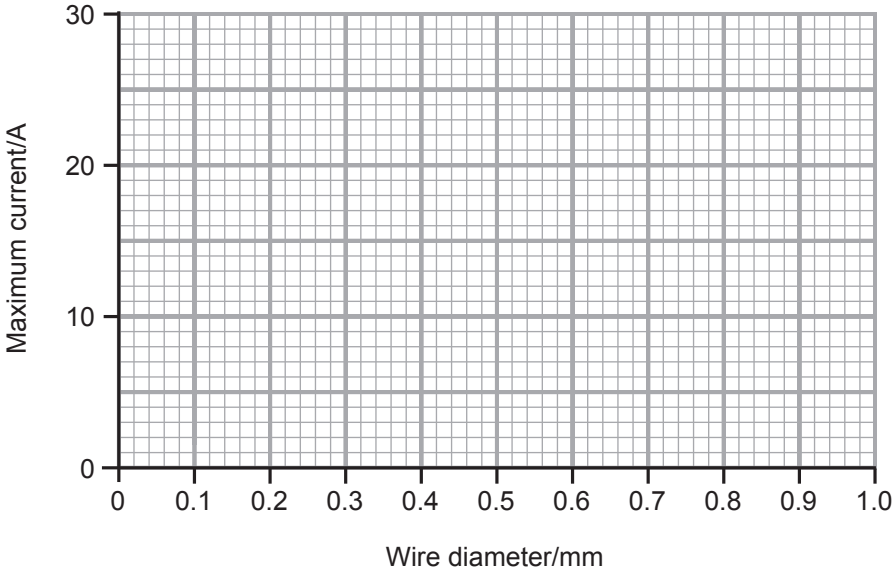
[3]

(b) The table below shows the maximum recommended current allowed to flow through different diameters of wire.

Wire diameter/mm	Maximum current/A
0.20	5
0.35	10
0.50	15
0.65	20
0.80	25
0.95	30

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(i) On the grid below, plot and draw a line graph of these results.



[3]

(ii) Use the graph to find the maximum current that a wire of diameter 0.4 mm should carry.

Answer _____ A [1]

(iii) Use the information and the equation:

power = voltage × current

to calculate the maximum power of an appliance connected to the 240 V mains through a 0.2 mm diameter wire.

(Show your working out.)

Answer _____ W [2]

[Turn over

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(c) The photograph below shows a consumer unit fitted with residual current circuit breakers (RCCBs).



© tentan / iStock / Thinkstock

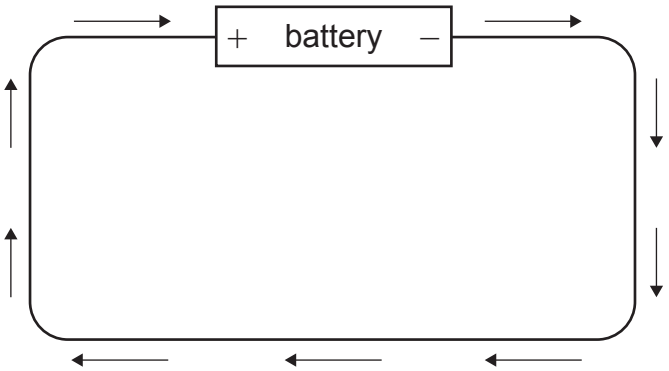
Suggest **one** reason why RCCBs have replaced fuses in consumer units.

_____

_____ [1]

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6 **(a)** The diagram below shows the actual direction that electrons flow in a circuit.



Use the diagram and your knowledge to explain fully how conventional current flows in a circuit.

_____

_____

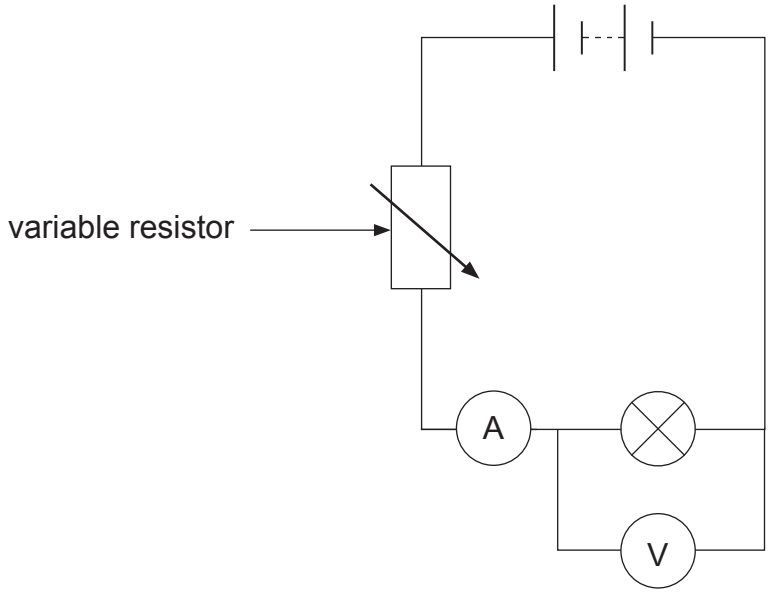
_____

_____ [2]

[Turn over

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(b) The circuit below was used to investigate the relationship between the current through a bulb and the voltage across it.



(i) Describe fully how the variable resistor controls the current flowing in a circuit.

_____

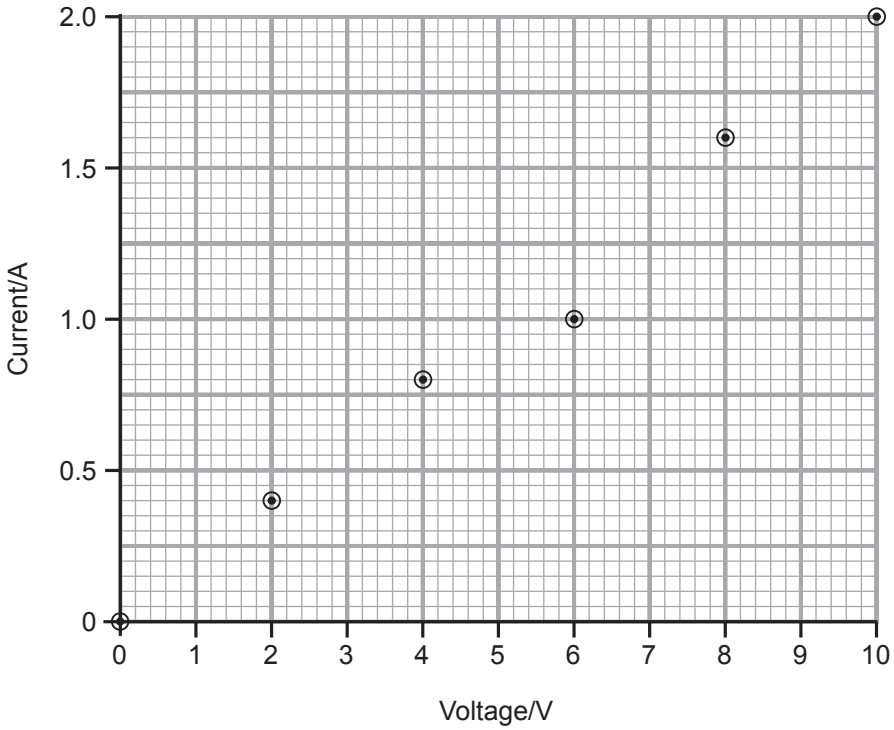
_____

_____

_____ [2]

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The graph below shows the results of the investigation but one of the points has been incorrectly plotted.



(ii) Draw a line of best fit on the graph. [1]

(iii) State the conclusion that can be drawn from this investigation.

_____

_____ [1]

(iv) Use the graph and the equation:

voltage = current × resistance

to calculate the resistance when the voltage is 8 V.

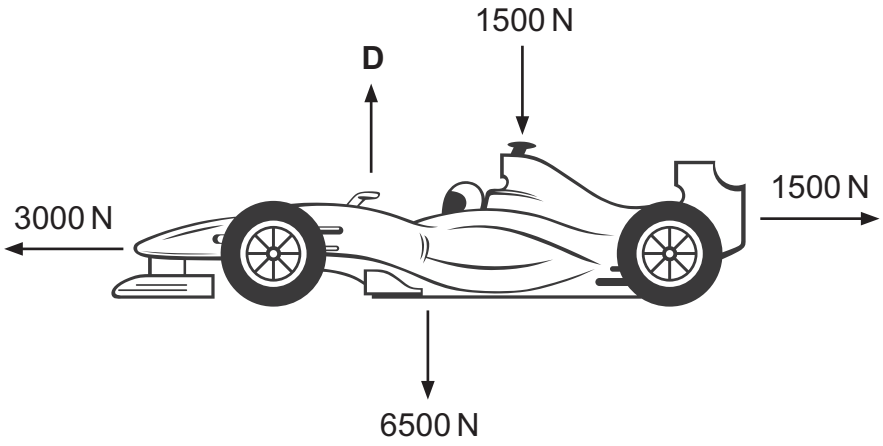
(Show your working out.)

Answer _____ ohms [2]

[Turn over

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7 **(a)** The diagram below shows the forces acting on a car that is moving forward.



© Kreatiw / iStock / Thinkstock

(i) The vertical forces on this moving car are balanced.
Calculate the size of the upward force labelled **D**.

(Show your working out.)

Answer _____ N [2]

(ii) Explain fully, in terms of the horizontal force, the motion of this car.

_____

_____

_____ [2]

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(b) In a collision, the force exerted on a driver depends on how long it takes the **driver** to come to a complete stop **inside the car**.

The table below shows the times from a car hitting an object to the driver coming to a complete stop and the forces that are exerted.

Time to come to a complete stop/s	Force exerted on the driver/N
0.2	12 000
0.4	6000
0.6	4000
0.8	3000
1.0	1000

In a collision a driver without a seat belt will come to a complete stop in a shorter time than a driver wearing a seat belt.

(i) Use the information to explain why wearing a seat belt is safer than not wearing one.

_____

_____

_____

_____ [2]

(ii) Another safety feature of a car is a crumple zone. Explain fully how a crumple zone acts as a safety feature in an accident.

_____

_____

_____

_____ [2]

[Turn over

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8 **(a)** Two ways to find the speed of sound are the echo method and the flash-bang method.

The steps given below are for the echo method.

1 find a wall to produce echoes
2 measure the distance to the wall
3 make a sound and start the stopwatch immediately
4 stop timing when echo is heard
5 record the time taken
6 repeat steps 3 to 5 twice more
7 calculate average time
8 divide average time by two
9 use the formula: speed = distance ÷ time

Using this information and your knowledge, answer the questions below.

(i) Describe **two** similarities between the echo method and the flash-bang method.

1. _____

_____

2. _____

_____ [2]

(ii) Describe **two** differences between these methods.

1. _____

_____

2. _____

_____ [2]

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(b) Sound is a longitudinal wave but microwaves are an example of a transverse wave.
Describe a transverse wave in terms of particle movement.

_____

_____

_____

_____ [2]

(c) The photograph below shows a microwave oven.



© Pupsik23 / iStock / Thinkstock

Explain fully how microwave ovens heat food.

_____

_____

_____

_____ [2]

[Turn over

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(d) The table below gives information about the electromagnetic spectrum.

Wave type	Wavelength/m	Energy/eV
radio waves	10^{3}	1.24×10^{-9}
microwaves	10^{-2}	1.24×10^{-4}
infrared	10^{-5}	1.24×10^{-1}
visible light	10^{-7}	1.24×10^{1}
ultraviolet	10^{-8}	1.24×10^{2}
X-rays	10^{-10}	1.24×10^{4}
gamma rays	10^{-12}	1.24×10^{6}

Use the information above and your knowledge to explain fully why X-rays are more dangerous than microwaves.

[2]

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9 Short sight is a common eye defect. Explain how and why short sight will affect someone's vision and how it is corrected.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

[Turn over

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10 (a) The table below shows how the number of cars sold, in different fuel type groups, has changed over a twenty year period in the UK.

Year \ Fuel type	Number of cars sold (× 1000)			
	Petrol	**Diesel**	**Modern Hybrid**	**Rechargeable electric (battery)**
1994	1920	147	0	0
1995	1950	189	0	0
1996	2005	218	0	0
1997	2040	244	0	0
1998	2060	269	0	0
1999	2103	293	0	0
2000	2123	315	0	0
2001	2164	346	0	0
2002	2184	391	0	0
2003	2180	440	0	0
2004	2195	501	0	0
2005	2180	560	0.8	0
2006	2147	608	1.6	0
2007	2126	666	3.2	0
2008	2090	716	4.7	0
2009	2049	764	6.1	0
2010	2008	820	8.2	0.15
2011	1950	876	10.2	0.26
2012	1916	939	12.5	0.41
2013	1870	1006	15.3	0.63
2014	1863	1073	18.8	1.62

Source: Principal Examiner

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Using **only** the information in the table, answer parts **(i)** and **(ii)** below.

(i) Of all the cars sold in 1994, what was the percentage that were either petrol or diesel?

Answer _____ % [1]

(ii) In which year did the total percentage of cars sold, that were either petrol or diesel, start to fall?

Answer _____ [1]

(b) Suggest **one** reason why people may not want to use a rechargeable electric powered car.

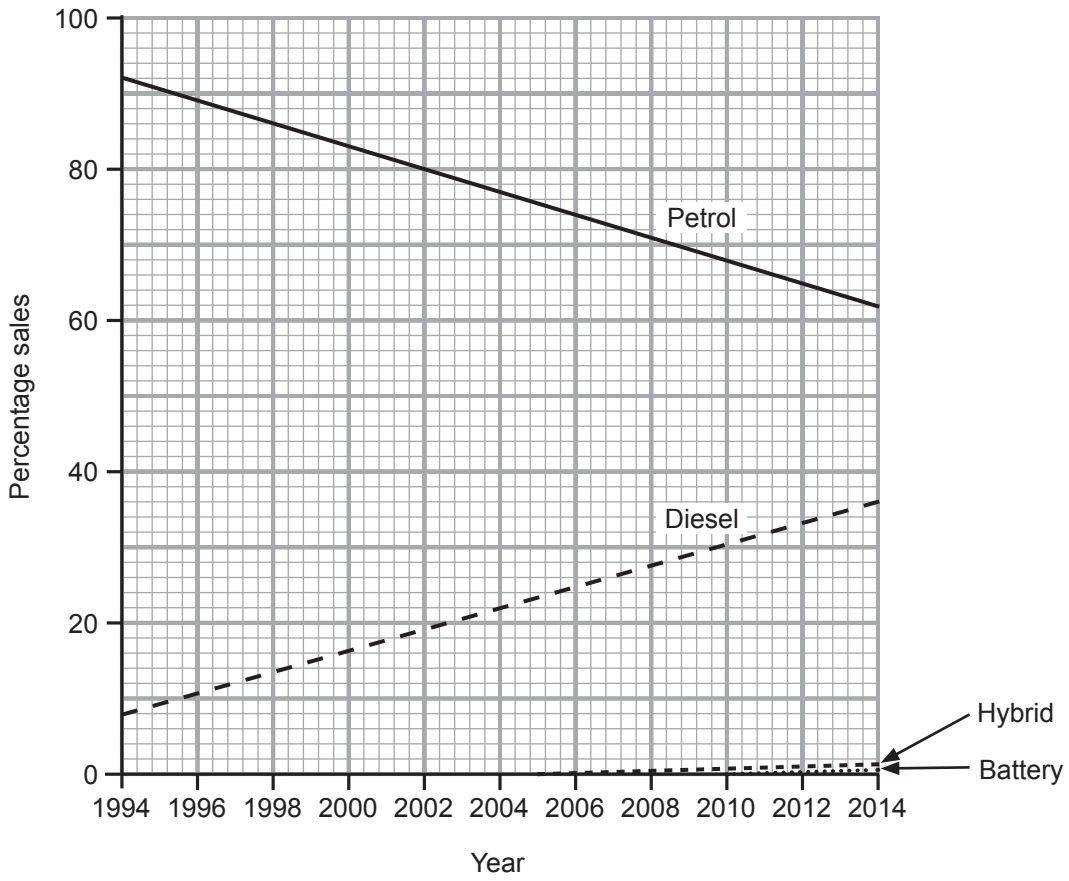
_____

_____ [1]

[Turn over

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(c) The graph below shows the trends in car sales using different fuel types over the same period.



Suggest which trend environmentalists would **not** like to see continue.
Explain your answer.

[3]

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Question Number	Marks
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Total Marks	

Examiner Number

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Rewarding Learning

General Certificate of Secondary Education
2015–2016

Science: Single Award

Unit 3 (Physics)

Higher Tier

[GSS32]

WEDNESDAY 25 MAY 2016, AFTERNOON

MARK SCHEME

STEMUP.CO.UK

General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

					AVAILABLE MARKS
1	**(a)**	**(i)**	Works as a driver [1]		
		(ii)	Increases [1] alcohol slows brain/reaction time increases [1] [2]		
	(b)	**(i)**	The distance covered from when brakes are first applied until the vehicle stops [1]		
		(ii)	Increases [1]		
		(iii)	13 m [1]		6
2	**(a)**	**(i)**	Any **two** from: • no output until **5 m/s** • increased output as wind increases from 5 up to 17.5 m/s/1200 W • levels off at **1200** between wind speeds of **17.5** or **20 m/s** • drops after 20 m/s [2]		
		(ii)	The blade moves the magnet [1] inside the coils of wire [1] [2]		
	(b)		Advantage – less fossil fuels used/less global warming/no air pollution [1] Disadvantage – unsightly/noise [1] [2]		6
3	**(a)**	**(i)**	For comparison/show (background) radiation [1]		
		(ii)	Two [1]		
	(b)		Gamma radiation [1] as could infect patients [1] kill microbes/sterilize [1] [3]		
	(c)		Activity falls time 7 [1] and then stays the same after day 7/15 CPM [2]		7

AVAILABLE MARKS

4 (a) Indicative content

- current model is heliocentric
- Sun in the centre
- planets orbit the Sun
- name and position of planets 1 Any
- name and position of planets 2 Any other
  geocentric is the previous model/old model
- Earth in centre in geocentric model/old model
- geocentric model had fewer planets/different order

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe fully the Solar System using **seven or eight** of the points above, in a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates use some appropriate specialist terms to describe the Solar System using **four to six** of the points above, in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates describe the Solar System using **one to three** of the above points. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and have made limited use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Response not worthy of credit.	[0]

[6]

(b) (i) A (huge) collection of stars/solar system**s** [1]

(ii) Milky Way [1] 8

5 (a) Current too high [1]
the (fuse) **wire** melts/breaks [1]
breaks circuit/incomplete circuit/stops flow [1] [3]

(b) (i) All points correct [2] (five points correct 1)
correct line [1] [3]

(ii) 11.5 [1]

(iii) 240 × 5 [1]
1200 [2] [2]

(c) Faster/can be reset/don't need replaced/no cost to reset [1] 10

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					AVAILABLE MARKS
6	**(a)**		Conventional current flows from positive to negative [1] High to low potential [1]	[2]	
	(b)	**(i)**	Any **two** from: • as length of wire increases, resistance increases • as resistance increases, current decreases	[2]	
		(ii)	Straight line of best fit (ignoring anomaly)	[1]	
		(iii)	As voltage increases, current increases (converse)	[1]	
		(iv)	8/1.6 [1] 5 [2]	[2]	8
7	**(a)**	**(i)**	6500 + 1500 [1] 8000 [2]	[2]	
		(ii)	Resultant forward force = (1500 N)/unbalanced forces [1] car is accelerating/increasing speed [1]	[2]	
	(b)	**(i)**	Less force exerted on driver [1] Longer time to stop [1]	[2]	
		(ii)	A zone in a car that collapses (slowly) [1] so absorbs energy [1]	[2]	8
8	**(a)**	**(i)**	Any **two** from: • both measure distance • both measure time • both repeat and **average** • both use formula	[2]	
		(ii)	Any **two** from: • echoes replaced by car/no reflection in flash-bang • involves sound and light • doesn't involve dividing by two	[2]	
	(b)		Vibrates [1] Moves: up and down/left right/back and forth/at right angles to the direction of travel [1]	[2]	
	(c)		Any **two** from: • microwaves penetrate food • water molecules (absorb microwaves) • vibrate **faster/more**	[2]	
	(d)		X-rays have more energy/converse [1] more energy means **more likely** to cause cancer/tumours/mutations [1]	[2]	10

9 Indicative content

- can see close objects clearly/focus
- distant objects appear blurry/not focus
- as lens is too strong/thick/eyeball too long
- light refracted too much
- focuses before the retina
- corrected by a concave/diverging lens
- spreads out light/diverge
- focus on retina

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe fully short sight and its correction using **more than six** of the points above, in a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates use some appropriate specialist terms to describe short sight and its correction using **four to six** of the points above, in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates describe short sight and/or its correction using **one to three** of the above points. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and have made limited use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Response not worthy of credit.	[0]

[6] — AVAILABLE MARKS: 6

10 (a) (i) 100 [1]

(ii) 2005 [1]

(b) Limited mileage/lack of recharge points/longer to recharge [1]

(c) **Increasing use** of diesel cars [1]
diesel is a fossil fuel [1]
amount of fossil fuels limited/contributes to global warming [1] [3] — AVAILABLE MARKS: 6

Total — AVAILABLE MARKS: **75**

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Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2015–2016

Science: Single Award

Unit 3 (Physics)
Higher Tier

GSS32

[GSS32]

FRIDAY 26 FEBRUARY 2016, MORNING

TIME

1 hour 15 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 nine** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Questions **3** and **8(c)**.

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

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Examiner Only	
Marks	Remark

1 **(a)** Describe fully how fossil fuels were formed.

_____

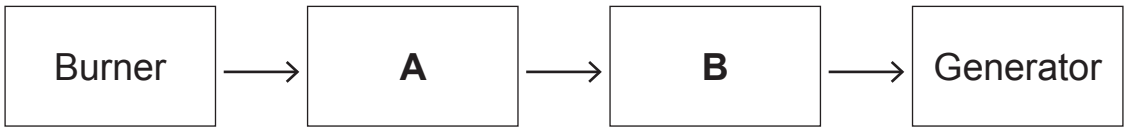
_____

_____

_____

_____ [3]

(b) Shown below are some parts of a fossil fuel power station.



(i) Name the parts **A** and **B** shown in the diagram above.

A _____

B _____ [2]

(ii) Explain fully how a generator produces electricity.

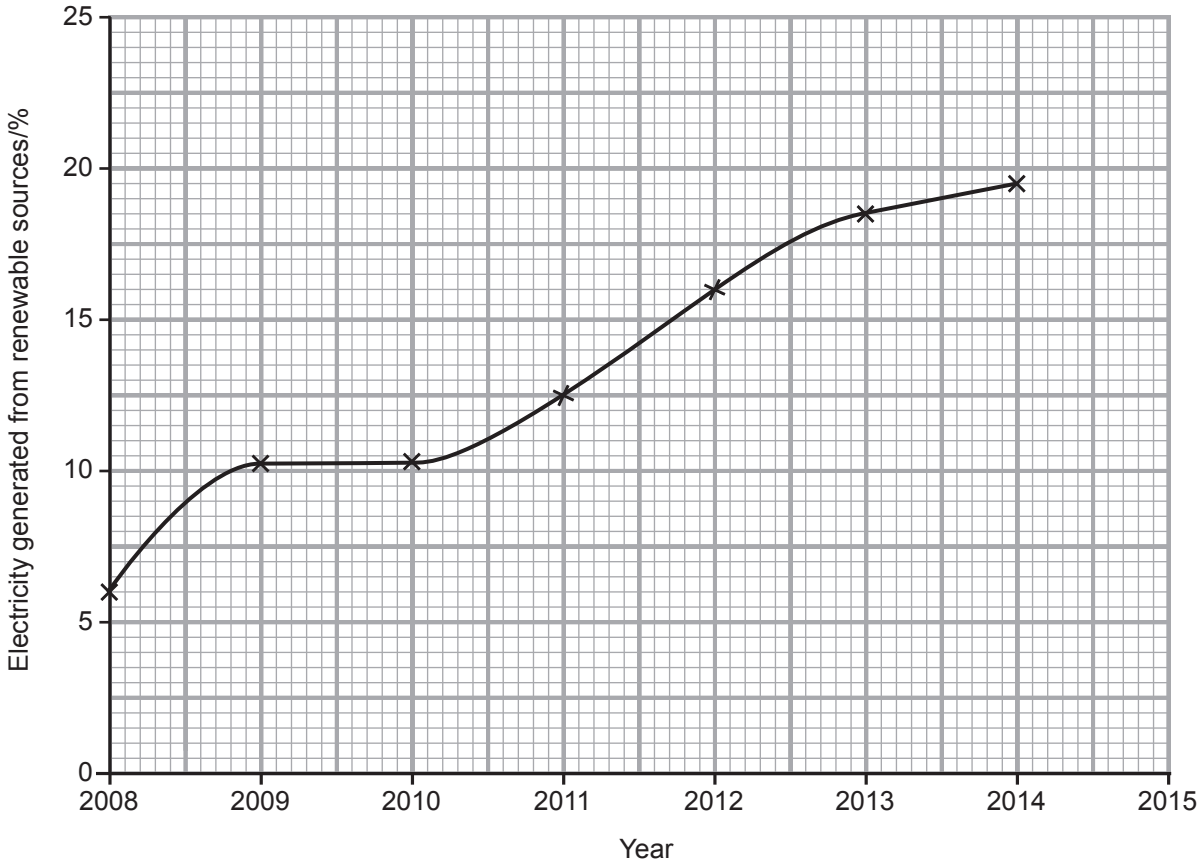
_____

_____

_____ [2]

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(c) The graph below shows the percentage of electricity generated in Northern Ireland using renewable sources in recent years.



(i) Use the graph to predict the percentage of electricity generated from renewable sources in 2015.

Answer _____ % [1]

(ii) Suggest why the Northern Ireland Assembly wants more electricity produced from renewable sources.

_____

_____ [1]

Examiner Only

Marks	Remark

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(d) The table below shows fuels which could be used to generate heat in a house.

Fuel	Fuel cost	Energy output/ kWh	Cost per kWh/p
wood pellets	£238 per tonne	4800/tonne	4.96
heating oil	49p per litre	10/litre	4.90
bottled gas	45p per litre	7.1/litre	6.30

Which fuel would be the best value for the householder to use? Explain your answer.

_____

_____

_____ [2]

Examiner Only

Marks	Remark

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(Questions continue overleaf)

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Examiner Only	
Marks	Remark

2 The half-life of carbon-14 can be used to estimate the age of an object made from wood.

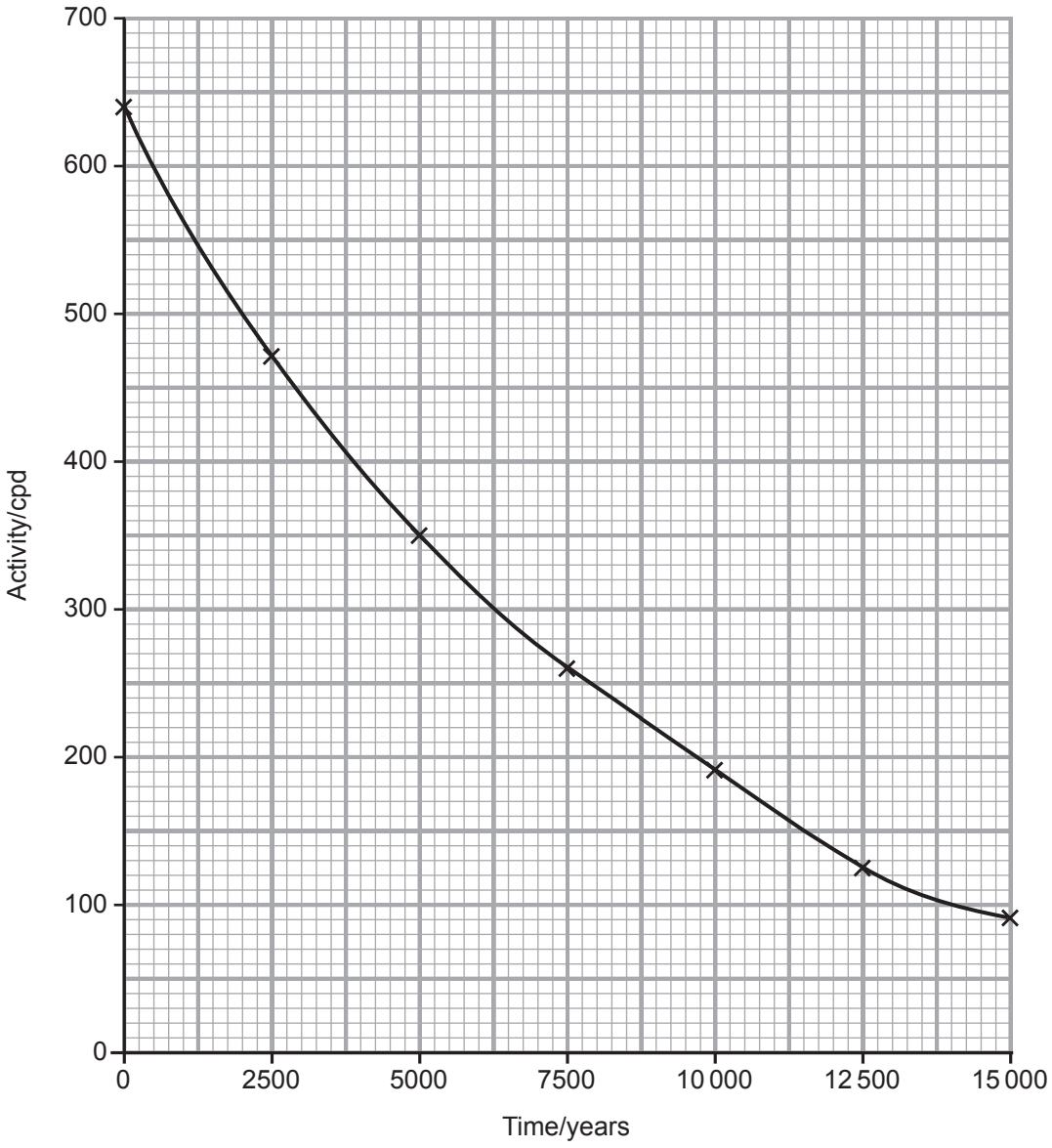
(a) What is meant by the term 'half-life'?

_____

_____

_____ [2]

The graph below shows how the activity of carbon-14 changes with time.



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(b) Use the graph to give the count rate of the carbon-14 after 7500 years.

Answer _____ cpd [1]

(c) **(i)** Brazil nuts contain radium-226 which has a half-life of 1600 years. What fraction of the radium-226 will be left after 3200 years?

Answer _____ [1]

(ii) The table below shows three isotopes of radium and the type(s) of radiation they emit.

Isotope	Radiation emitted
radium-224	alpha
radium-226	alpha, gamma
radium-228	beta

Describe the penetrating powers of these isotopes and how their radiation can be stopped.

_____

_____

_____

_____

_____ [3]

Examiner Only

Marks	Remark

3 Describe an investigation that will show how electrical resistance depends on the length of a piece of wire.

Your answer should include:

- the electrical circuit used;
- how to make the investigation valid (a fair test);
- what measurements would be taken, how they are used, and the conclusion you would expect.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

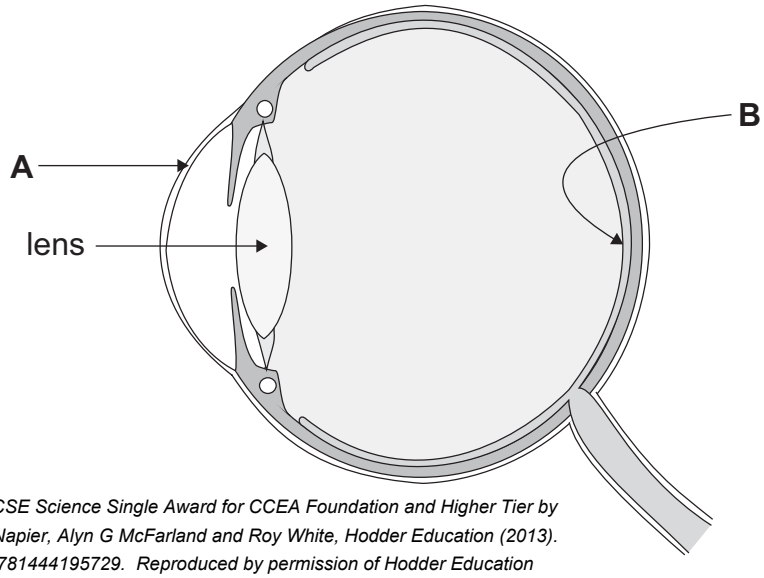
[6]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

4 The diagram below shows the eye.

(a) Name the parts labelled **A** and **B**.



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A _____

B _____ [2]

Long and short sight are eye defects that cause people difficulty in seeing objects clearly as shown in the table.

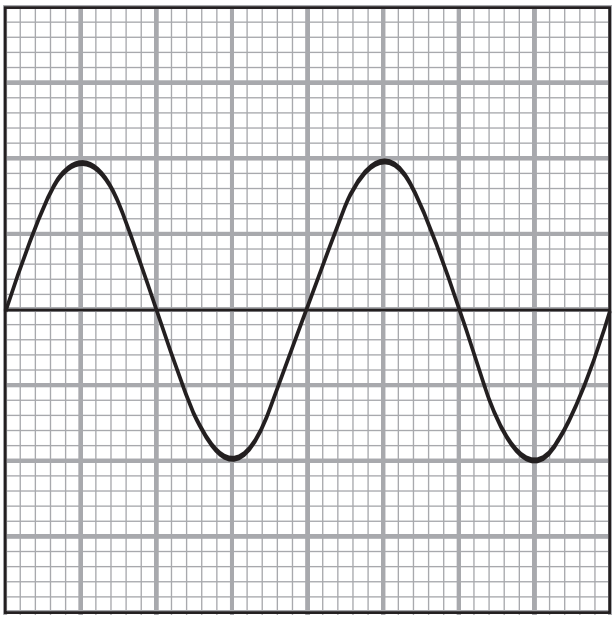
Person	Near object	Far object
A	blurry	clear
B	blurry	blurry
C	clear	blurry
D	clear	clear

(b) From the table above, which person **A**, **B**, **C** or **D** suffers from short sight?

Answer _____ [1]

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5 The diagram below shows a wave.



(a) On the same grid draw another wave with the same wavelength but double the amplitude of the one shown. [2]

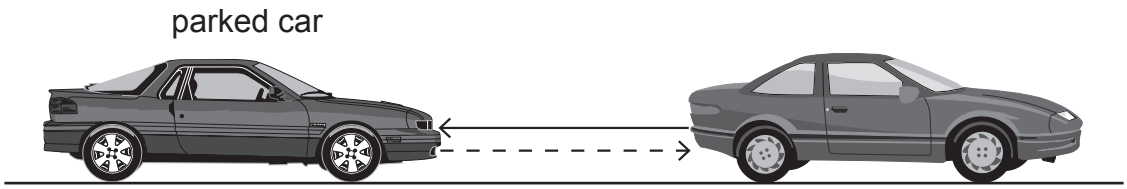
(b) Explain what is meant by the term 'ultrasound'.

_____

_____ [2]

Examiner Only	
Marks	Remark

(c) The diagram below shows a car using ultrasound to help it park.



Source: Principal Examiner

The car sends an ultrasound signal to the parked car. This signal is reflected and received 0.01 s after being sent.
The speed of ultrasound in air is 330 m/s.

Use the formula:

distance = speed × time

to calculate the distance between the cars.

(Show your working out.)

Answer _____ m [3]

Examiner Only

Marks	Remark

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The table below shows the percentage of sound reflected by different materials at different frequencies.

Material \ Frequency/Hz	Percentage of sound reflected/%					
	125	250	500	1000	2000	4000
Carpet	90	80	70	65	50	40
Curtains	85	88	75	65	60	55
Lino	97	97	97	97	97	98
Glass fibre tile	30	15	25	15	10	10

© CCEA

(d) The owner of a large hall plans to use it for music concerts. He needs to improve the sound quality by using **one** of the materials from the table.
Which material should he use? Explain your answer fully.

_____

_____

_____

_____

_____ [3]

Examiner Only

Marks	Remark

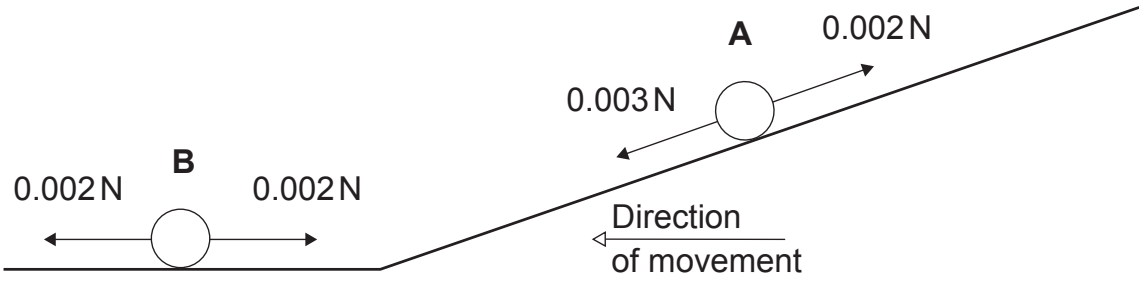
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(Questions continue overleaf)

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Examiner Only	
Marks	Remark

6 The diagram below shows the forces acting on a moving marble at two positions (**A** and **B**).



(a) Explain fully, naming the forces, the motion of the marble at position **A**.

_____

_____

_____

_____ [3]

(b) Explain fully, in terms of the resultant force, the motion of the marble at position **B**.

_____

_____

_____ [2]

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(c) The marble has a momentum of 9×10^{-3} kg m/s and a velocity of 1.5 m/s.

Use the formula:

momentum = mass × velocity

to calculate the mass of the marble.

(Show your working out.)

Answer _____ kg [2]

(d) It is possible to measure both the instantaneous and average speed of marble **A**. Explain fully the difference between average speed and instantaneous speed.

_____

_____

_____ [2]

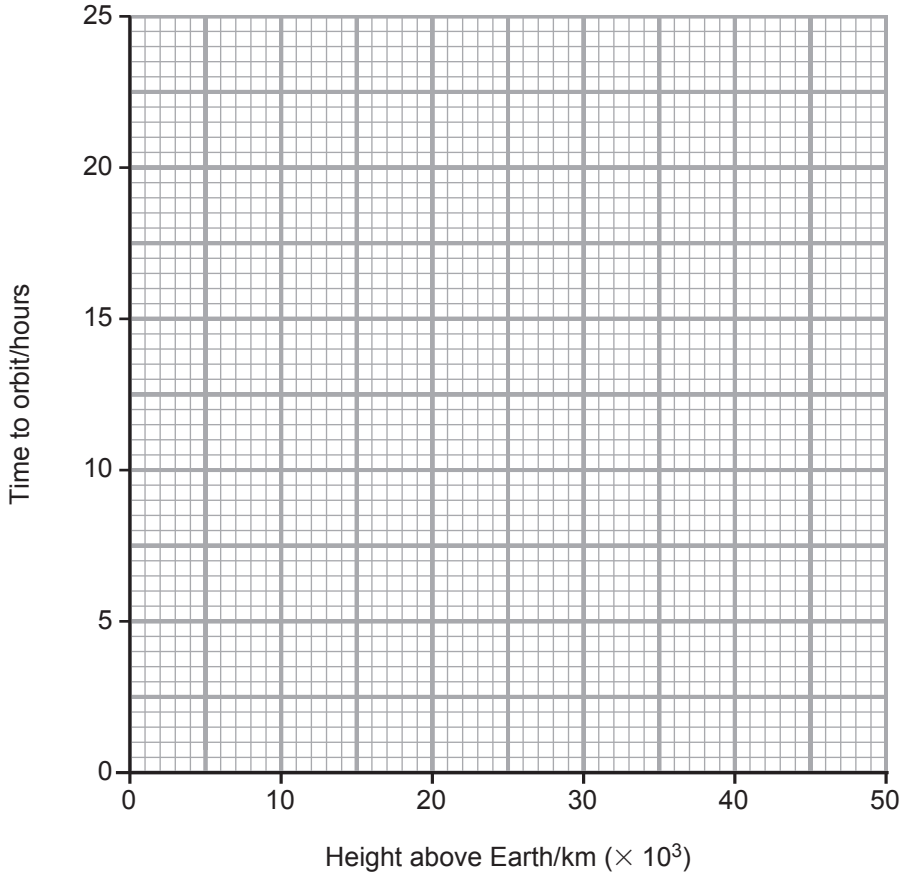
Examiner Only

Marks	Remark

7 **(a)** The table below shows the height and orbital time of four satellites.

Satellite	Height above Earth's surface/km	Time to orbit the Earth/ hours
Galileo	23 000	14
GPS	20 000	12
GLONASS	19 000	11
Hubble	500	1.5

(i) On the grid below plot and draw a line graph for this information.



[3]

(ii) Another satellite needs to orbit the Earth every 24 hours.
Use your graph to find the height above the Earth this satellite needs to be positioned.

Answer _____ km (× 10^3) [1]

Examiner Only

Marks	Remark

(b) The table below gives the distance to five galaxies and the speed they are moving away from Earth.

Galaxy	Distance from Earth/ million light years	Speed away from Earth/ m/s ($\times 10^4$)
A	2.8	6
B	9.8	21
C	9.0	20
D	4.8	10
E	11.2	23

(i) Describe the trend shown by this data.

_____

_____ [1]

(ii) Use the information in the table above, and your knowledge, to describe how the red-shift of galaxy **A** compares with galaxy **E**.

_____

_____ [1]

(c) Explain fully the Big Bang theory for the formation of the Universe.

_____

_____

_____

_____

_____ [3]

(d) Name an alternative scientific theory to the Big Bang.

_____ [1]

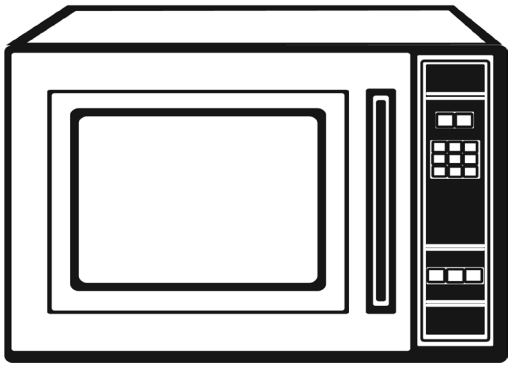
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

8 **(a)** The diagram below shows a microwave oven.



Source: Principal Examiner

Explain fully how the rays in a microwave oven heat food.

_____

_____

_____

_____

_____ [3]

(b) Shown below are the frequencies and wavelengths of some electromagnetic waves.

Frequency/Hz	3×10^8	3×10^9	3×10^{10}	3×10^{11}
Wavelength/m	1×10^0	1×10^{-1}	1×10^{-2}	1×10^{-3}

increasing energy →

Microwave ovens can use frequencies of 9.15×10^8 Hz or 2.44×10^9 Hz. Suggest which of these frequencies would heat food quicker. Explain your answer fully.

_____

_____

_____ [2]

(c) The label below was found on the back of a microwave oven.

Examiner Only	
Marks	Remark

Stainless Steel Microwave Oven
Model: MSS6216
230–240 V
1200 W

Describe fully how the electrical cost of using this appliance is calculated.

You may find the following formula useful.

Cost = number of units (kWh) × cost per unit (p)

In your answer you will need to state what additional information is required.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

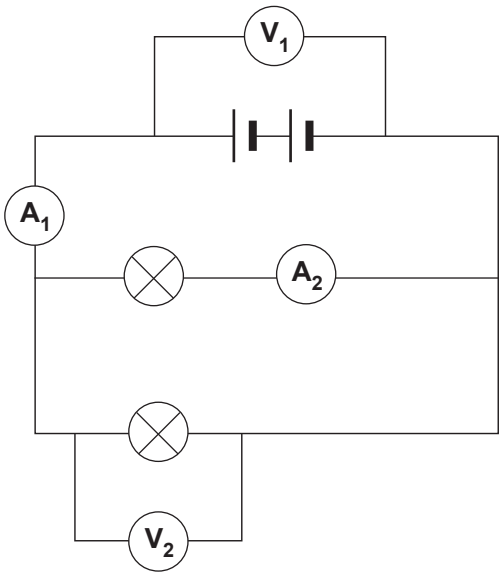
[6]

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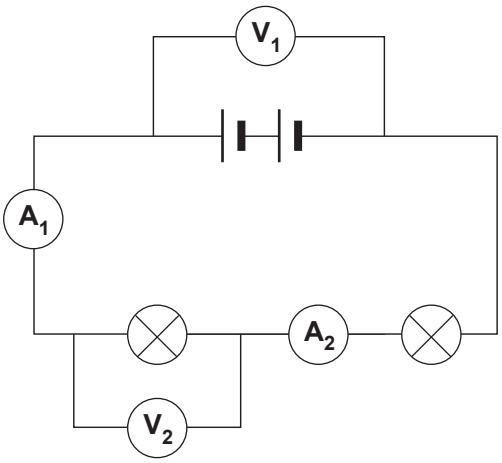
Examiner Only	
Marks	Remark

9 **(a)** Shown below are two types of electrical circuit, each containing identical bulbs.

Circuit A



Circuit B



Complete the table below.

Circuit	V_1/V	V_2/V	A_1/A	A_2/A
A	6	6	4	
B	6		1	

[3]

(b) Explain fully the difference between conventional and actual current flow.

_____

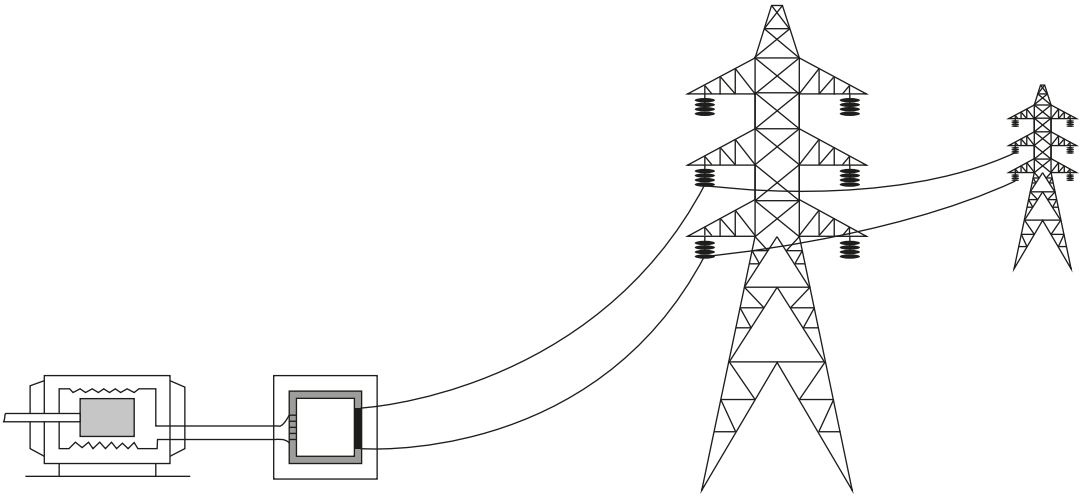
_____

_____

_____ [3]

(c) The diagram below shows part of the electricity grid.

Examiner Only	
Marks	Remark



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Explain fully why this transformer is used in the grid.

_____

_____

_____ [2]

THIS IS THE END OF THE QUESTION PAPER

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Rewarding Learning

General Certificate of Secondary Education
2015–2016

Science: Single Award

Unit 3 (Physics)

Higher Tier

[GSS32]

FRIDAY 26 FEBRUARY 2016, MORNING

MARK SCHEME

STEMUP.CO.UK

General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

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The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

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				AVAILABLE MARKS
1	**(a)**	Dead plants and animals [1] compressed/high temperature [1] over millions of years [1]	[3]	
	(b)	**(i)** A – boiler [1] B – turbine [1]	[2]	
		(ii) Magnet and coil [1] implied movement of magnet/coil [1]	[2]	
	(c)	**(i)** Answer between 20–22%	[1]	
		(ii) To reduce the use of fossil fuels/reduce global warming	[1]	
	(d)	Heating oil [1] cheapest per kWh [1]	[2]	11
2	**(a)**	The time [1] it takes the radioactivity to fall by half [1]	[2]	
	(b)	260	[1]	
	(c)	**(i)** $^{1}/_{4}$	[1]	
		(ii) radium-224 – (passes through air and) stopped by paper [1] radium-226 – passes through aluminium and stopped by lead [1] radium-228 – (passes through paper and) stopped by aluminium [1]	[3]	7

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AVAILABLE MARKS

3 Indicative content

- ammeter measures current
- voltmeter measures voltage
- voltmeter wired in parallel
- ammeter wired in series
- keep type of wire the same/width
- change the length
- use formula V=IR
- the longer the wire the higher the resistance

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe fully, in a logical sequence, how to measure the resistance of different lengths of resistance wire (using at least **six** of the above points). They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates use some appropriate specialist terms to partially describe, in a logical sequence, how to measure the resistance of different lengths of resistance wire (using **four or five** of the above points). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates describe how to measure the resistance of different lengths of resistance wire (using **one to three** of the above points). However these are not in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Response not worthy of credit.	[0]

6

4 (a) A – cornea [1]
B – retina [1] [2]

(b) C [1]

3

				AVAILABLE MARKS
5	**(a)**	Amplitude doubles [1] ± 1 square tolerance wavelength stays the same [1]	[2]	
	(b)	A sound wave which has a frequency [1] greater than 20 000 Hz [1]	[2]	
	(c)	0.01/2 [1] 0.005 × 330 [1] 1.65 m [3]	[3]	
	(d)	Glass fibre tiles [1] reduce echoes [1] they reduce the reflection most at all frequencies [1]	[3]	10
6	**(a)**	Friction is overcome by gravity [1] unbalanced force/resultant force of 0.001 [1] marble accelerates/increase (velocity, speed) [1]	[3]	
	(b)	0 N [1] steady speed [1]	[2]	
	(c)	0.009/1.5/9 × 10^{-3}/1.5 [1] 0.006/6 × 10^{-3} [2]	[2]	
	(d)	Average speed is measured over a given distance [1] instantaneous speed is measured at a specific point [1]	[2]	9
7	**(a)**	**(i)** all points plotted correctly [2] 3 points plotted correctly [1] line [1]	[3]	
		(ii) Correct value from candidate's graph (36 to 39 km [× 10^3])	[1]	
	(b)	**(i)** As the distance from Earth increases the speed away from Earth increases	[1]	
		(ii) Galaxy E has a greater red-shift	[1]	
	(c)	Singularity/single point [1] large expansion/explosion [1] gravity pulled matter together [1]	[3]	
	(d)	Steady State	[1]	10

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8 **(a)** Microwaves penetrate the food [1]
microwaves cause water molecules to oscillate/vibrate [1]
faster vibration causes increase in temperature [1] [3]

(b) 2.44×10^9 Hz (it has the highest frequency) [1]
the higher the frequency the more energy [1] [2]

(c) **Indicative content:**

- find power rating on the label/power is 1200 W
- convert power into kW
- find out how long the appliance is used for
- convert time into hours
- multiply power by time/to find the number of units used
- need to find cost per unit.

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe fully, in a logical sequence, how to calculate the electrical cost of using the appliance (using at least **five** of the above points). They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates use some appropriate specialist terms to partially describe, in a logical sequence, how to calculate the electrical cost of using the appliance (using **three or four** of the above points). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates describe how to calculate the electrical cost of using the appliance (using **one or two** of the above points). However these are not in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Response not worthy of credit.	[0]

[6] 11

9 **(a)**

Circuit	V_1/V	V_2/V	A_1/A	A_2/A
A				2 [1]
B		3 [1]		1 [1]

[3]

(b) Electrons are negative [1]
actual flow is a flow of electrons [1]
from the negative to positive terminal/conventional from positive to negative [1] [3]

(c) To increase the voltage + decrease current [1]
reduce energy loss [1] [2] 8

Total **75**

AVAILABLE MARKS

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Rewarding Learning

General Certificate of Secondary Education
2015–2016

Science: Single Award

Unit 3 (Physics)

Higher Tier

[GSS32]

FRIDAY 13 NOVEMBER 2015, MORNING

MARK SCHEME

STEMUP.CO.UK

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					AVAILABLE MARKS
1	**(a)**		Neutrons [1] protons [1]	[2]	
	(b)	**(i)**	300 cpm	[1]	
		(ii)	80 cpm	[1]	
	(c)	**(i)**	Gamma	[1]	
		(ii)	Stop radiation escaping [1] prevent cancer/tumour [1]	[2]	
		(iii)	Kills bacteria [1] keeps food fresh longer/prevents fruit rotting/longer sell-by date [1] more profit/less waste [1]	[3]	10
2	**(a)**	**(i)**	Any **two** from: • same driver • same speed • same road (conditions) • same car • same fuel type	[2]	
		(ii)	More mpg = more efficiency	[1]	
		(iii)	Lighter cars	[1]	
	(b)		Remains of plants/animals [1] compressed/pressure [1] millions of years [1]	[3]	7

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AVAILABLE MARKS

3 (a) Indicative content

- Bulbs connected in branches in parallel
- Bulbs connected side by side in series
- If one bulb goes out, the rest stay lit in parallel/all go out in series/ easier to find broken bulb in parallel
- Bulbs are brighter in a parallel circuit
- More bulbs connected, same brightness in parallel/dimmer in series
- Same current all around a series circuit/every bulb gets a constant voltage in a series circuit
- Current is split among the branches in parallel/voltage is shared in a parallel circuit
- More wiring/more expensive

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe fully the differences between parallel and series circuits (using **6 or more** of the above points) to explain why a parallel circuit should be chosen in a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates use some appropriate specialist terms to partially describe the differences between parallel and series circuits (using **3 to 5** of the above points) to explain why a parallel circuit should be chosen in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates describe the differences between parallel and series circuits (using **1 or 2** of the above points) to explain why a parallel circuit should be chosen. However these are not in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Response not worthy of credit.	[0]

[6]

(b) 722 units [1]
10830/£108.30 [2] [2] 8

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					AVAILABLE MARKS
4	**(a)**	**(i)**	D is dearer than C but has a higher SAR rating [1] higher SAR = more radiation = more danger [1]	[2]	
		(ii)	Tumour/cancer	[1]	
		(iii)	Any **two** from: • increase distance between phone + body/implied • reduce time of phone calls • text rather than talk	[2]	
	(b)		Any **three** from: • messages sent using microwaves • message sent to nearest mast • mast to mast relay/masts act as repeaters • area around a mast is called a cell	[3]	8
5	**(a)**		Correct reference to frequency [1] over 20 kHz/humans don't hear as high as dogs/dogs hear higher [1]	[2]	
	(b)	**(i)**	Distance from car to person [1] time between lights and sound [1]	[2]	
		(ii)	Different wind speed/weather	[1]	
	(c)	**(i)**	As depth decreases, wavelength decreases/amplitude increases/ speed decreases	[1]	
		(ii)	Height [1] from midpoint [1]	[2]	
		(iii)	$284/23 \times 10^3$ [1] 0.012 [2]	[2]	10
6	**(a)**	**(i)**	5–5.5 $\times$ 10^8 km from Sun	[1]	
		(ii)	Any figure between –170 and –190 (–180)	[1]	
		(iii)	Time taken for a planet to go round the Sun	[1]	
		(iv)	Any figure between 0.5 and 0.8 (0.62)	[1]	
	(b)	**(i)**	Distance from Sun changes during an orbit/not circular orbits	[1]	
		(ii)	Heliocentric	[1]	
		(iii)	Earth was in centre (of geocentric) [1] fewer planets (in geocentric) [1]	[2]	8

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		AVAILABLE MARKS
7	**(a)** Any 2 correct values [1] 7 [2] [2]	
	(b) Straight line through (0,0) [1] completely below current line [1] [2]	
	(c) **(i)** Momentum will be transferred from A to B [1] producing a force [1] gives B velocity [1] [3]	
	(ii) They absorb energy [1]	8
8	**(a)** **Indicative content** • chemical energy is changed into heat energy • this occurs in the burner • heat energy is used to turn water into steam • this occurs in the boiler • heat energy changed into kinetic energy (in steam) • kinetic energy of steam drives the turbine • kinetic energy is changed into electrical energy • this occurs in the generator • generator consists of a magnet and coil of wire	

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to explain fully, in a logical sequence, how electricity is made inside this power station (using **7 or more** of the above points). They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates use some appropriate specialist terms to partially explain, in a logical sequence, how electricity is made inside this power station (using between **4 and 6** of the above points). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates explain how electricity is made inside this power station (using up to **3** of the above points). However these are not in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Response not worthy of credit.	[0]

[6]

	(b) Step up transformer [1] increases voltage/decreases current [1] saves energy/less heat loss in wires [1] [3]	9

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			AVAILABLE MARKS
9	**(a)** B = decrease/decelerate C = none/constant speed D = increase/accelerate 1 or 2 correct [1] All 3 correct [2]	[2]	
	(b) Hybrid consists of a diesel/petrol engine + battery/electrical [1] regenerative system recharges the battery [1] buses braking converts kinetic energy into electricity [1]	[3]	
	(c) Two surfaces rub together [1] increased friction [1]	[2]	7
		Total	**75**

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Rewarding Learning

General Certificate of Secondary Education
2014–2015

Science: Single Award

Unit 3 (Physics)

Higher Tier

[GSS32]

WEDNESDAY 20 MAY 2015, AFTERNOON

MARK SCHEME

STEMUP.CO.UK

General Marking Instructions

Introduction

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					AVAILABLE MARKS
1	(a)	(i)	Any **one** from: • same thickness/type of aluminium sheet • beta source same distance from aluminium sheets each time • counter same distance from aluminium sheets each time • same beta source each time/same amount of beta	[1]	
		(ii)	Any **two** from: • the thicker the aluminium the less radiation passes through • greater decrease in radiation count at lower thicknesses • above 10 (9 or 10) sheets the count is constant/remains at 100 cpm	[2]	
		(iii)	Background radiation is present	[1]	
	(b)		Horizontal line starting at 4000	[1]	
	(c)			[3]	8

Position	Types of Radiation
A	alpha, beta, gamma [1]
B	beta, gamma [1]
C	none [1]

2	(a)	(i)	Average speed cameras allow drivers to slow down/there are more instantaneous cameras	[1]	
		(ii)	Number of people speeding increases with age/number of people speeding decreased [1] up to aged 40–54/5639 and then decreases [1]	[2]	
	(b)		03:00–05:59 [1] there are fewer cars on the road/fewer people on road [1]	[2]	5
3	(a)		Refraction at lens [1] rays meet at retina [1]	[2]	
	(b)		lens too weak/eye**ball** too short/lens too thin [1] rays brought to focus behind the retina [1] close objects **blurry**/not clear/can't read close up/distant objects clear [1]	[3]	
	(c)		The older you get the greater the minimum distance your eyes can focus	[1]	6

4 Indicative content

- friction is a force
- which opposes motion/stops movement/holds things back/slows down
- change height/angle of slope
- until block moves
- change the type of surface
- the greater the height the greater the friction
- use the same mass/weight of block/same block (must relate)
- repeat the experiment 3 times/average the results for height (reliability/ validity to correct response)

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe and explain fully (using **seven to eight** of the above points) how friction can be measured. They use good spelling, punctuation and grammar and form and style are of a high standard.	[5–6]
B	Candidates use some appropriate specialist terms to describe and explain how friction can be measured (using **four to six** of the above points) in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3–4]
C	Candidates describe/explain how friction can be measured using **one to three** of the above points. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1–2]
D	Response not worthy of credit.	[0]

AVAILABLE MARKS

6

5 (a) Will not run out [1]

(b) A magnet and coil [1]
relative movement/spins/turns [1] [2]

(c) Area behind the dam is flooded [1]
this will destroy habitats [1]
unsightly = neutral [2]

5

			AVAILABLE MARKS
6	**(a)**	Any **two** from: • case/outside made of plastic/no exposed metal parts • all metal parts cased in plastic/insulator • user cannot contact live part [2]	
	(b)	Too much **current** could flow through the appliance [1] causing damage to the appliance/user [1] [2]	
	(c)	0.06 kW/0.75 h [1] **either conversion** 0.06 kW $\times$ 0.75 h [2] 0.045 kWh [3] [3]	7
7	**(a)**	The longer the wire, the higher the resistance [1] the higher the resistance, the lower the current [1] [2]	
	(b)	**(i)** All points drawn correctly [1] smooth curve [1] [2]	
		(ii) 1.4–1.6 A [1]	
	(c)	1.5/4.5 [1] 0.33/$\frac{1}{3}$ [2] [2]	
	(d)	Resistance stays the same [1]	8
8	**(a)**	**(i)** Cosmic radiation/intensity rises up to a maximum at a wavelength of 2×10^{-3} m [1] then decreases (still need reference to intensity/wavelength) [1] [2]	
		(ii) $3 \times 10^{8} / 2 \times 10^{-3}$ [1] 1.5×10^{11} [2] [2]	
	(b)	**Universe**/everything started as a single point (singularity) [1] Universe was created from a large explosion/expansion [1] (after millions of years) gravity **pulled this matter** together to (eventually form stars and galaxies) [1] [3]	
	(c)	Galaxy **B** is further away [1] galaxy **B** is moving faster [1] [2]	
	(d)	Heliocentric model [1]	10

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					AVAILABLE MARKS
9	**(a)**	**(i)**	As mass increases the acceleration decreases/converse	[1]	
		(ii)	Same force used each time/1 N	[1]	
	(b)	**(i)**	0.95 N	[1]	
		(ii)	Accelerating/speeding up [1] Unbalanced force [1]	[2]	
	(c)		Instantaneous speed is the speed of a car at any **instant**/moment in time [1] the average speed of a car is the speed over a **given distance**/time [1]	[2]	7

10 (a) Indicative content

- transformer A is a step-up transformer – after power station
- increases voltage
- decreases current
- (smaller current) in wire produces less heat/less waste/less energy
- (smaller current) means transmission lines with a smaller diameter can be used
- thinner wires are cheaper
- step-down transformer (either named transformer [1] mark only) – before houses
- decrease voltage

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe and explain fully (using **seven or eight** of the above points) how transformers work. They use good spelling, punctuation and grammar and form and style are of a high standard.	[5–6]
B	Candidates use some appropriate specialist terms to describe and explain how these transformers work (using **four to six** of the above points). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3–4]
C	Candidates describe/explain using **one to three** of the above points how transformers work. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1–2]
D	Response not worthy of credit.	[0]

[6]

(b) Underground cables produce the **highest** magnetic field at **close distances** [1]
overhead cables produce **higher magnetic** fields than **underground** cables as the distance **increases** [1] [2] 8

				AVAILABLE MARKS
11	**(a)**	Fossil fuels are running out/methanol renewable [1] these will reduce the reliance on fossil fuels [1]	[2]	
	(b)	Extenders are **added** to (fossil) fuels [1] substitutes are used **instead**/in place of fossil fuels [1]	[2]	
	(c)	A car which uses **electricity** and **petrol/diesel**	[1]	5
			Total	**75**

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Rewarding Learning

General Certificate of Secondary Education
2014–2015

Science: Single Award

Unit 3 (Physics)

Higher Tier

[GSS32]

THURSDAY 26 FEBRUARY 2015, MORNING

MARK SCHEME

STEMUP.CO.UK

General Marking Instructions

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					AVAILABLE MARKS
1	(a)	(i)	14 cpm	[1]	
		(ii)	2 days	[1]	
		(iii)	5 cpm	[1]	
	(b)		Nucleus is unstable [1] due to the combination of protons and neutrons [1]	[2]	
	(c)	(i)	D [1] gamma radiation most penetrating [1] lasts a long time/doesn't need replacing [1]	[3]	
		(ii)	Food preservation/sterilising surgical instruments/tracers/smoke alarm	[1]	9
2	(a)	(i)	10 s	[1]	
		(ii)	24 s	[1]	
		(iii)	225–135 [1] 90 [1]	[2]	
	(b)		Friction is reduced [1] increasing braking distance [1]	[2]	6

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AVAILABLE MARKS

3 (a) Indicative content

- message sent to nearest mast
- area around mast is called a cell
- masts act as repeater stations
- signals are microwaves
- microwaves are absorbed by cells
- causing cancer/tumour
- shorter calls
- text rather than call/use loudspeaker

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe fully how mobile phones operate, the dangers associated and how these dangers can be reduced (using at least **6** of the above points). They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5–6]
B	Candidates use some appropriate specialist terms to partially describe how mobile phones operate, the dangers associated and how these dangers can be reduced (using **4 or 5** of the above points). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3–4]
C	Candidates describe how mobile phones operate, the dangers associated and how these dangers can be reduced (using **1 to 3** of the above points). However these are not in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1–2]
D	Response not worthy of credit.	[0]

[6]

(b) (i) Depth = 210 [1]

(ii) Any 2 correct distance/time figures from table [1]
1500 [1] [2]

(iii) Return time will be less [1]

10

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					AVAILABLE MARKS
4	(a)	(i)	Long sight [1] lens too weak/thin/eyeball too small [1] focus behind the retina/blurred image on retina (for near objects) [1]	[3]	
		(ii)	Near objects/reading	[1]	
	(b)		Refraction = bending of light [1] cornea + lens [1] most refraction takes place in the cornea [1]	[3]	7
5	(a)	(i)	13.5–14 billion years	[1]	
		(ii)	Galaxies are moving apart [1] further galaxies are moving faster [1]	[2]	
		(iii)	Red shift/cosmic background radiation	[1]	
	(b)		Light year is the distance light travels in 1 year [1] light left these stars 4.3/8.6/10.8 years ago/ so light we see is 4.3/8.6/10.8 years old [1]	[2]	6
6	(a)	(i)	Ohm	[1]	
		(ii)	6/1.6 [1] 3.75/3.8 [1]	[2]	
		(iii)	As cross-sectional area increases, resistance decreases	[1]	
	(b)	(i)	As voltage increases, current increases for both [1] current increase is steady for wire/changing for bulb [1]	[2]	
		(ii)	Resistance is constant	[1]	7
7	(a)	(i)	600/2500 [1] 24%/0.24 [1]	[2]	
		(ii)	You cannot get more energy out than you put in/waste energy	[1]	
		(iii)	Ends up as heat [1] making our surroundings warmer [1]	[2]	
	(b)	(i)	Extenders = methanol/ethanol/alcohol [1] substitutes = hydrogen/biodiesel [1]	[2]	
		(ii)	Extenders are added to petrol/diesel [1] substitutes are used instead of petrol/diesel [1]	[2]	
		(iii)	Saves fossil fuels	[1]	10

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				AVAILABLE MARKS
8	**(a)**	Speed has no effect on weight [1] as speed increases, air resistance increases [1]	[2]	
	(b)	**(i)** Parachutist is accelerating [1] as weight > air resistance [1] creating an unbalanced force [1]	[3]	
		(ii) Travelling at steady/constant speed [1] due to balanced forces [1]	[2]	
	(c)	**(i)** 120/80 [1] 1.5 [1]	[2]	
		(ii) Zero momentum [1] zero velocity [1]	[2]	11

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AVAILABLE MARKS

9 (a) Indicative content

- generator contains a magnet + coil of wire
- relative movement between magnet + coil
- energy change = kinetic --- electrical
- step up transformers increase voltage
- decreases current
- producing less heat in power lines/less energy lost in power lines
- less money wasted

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe how electricity is made in a generator and changed by a transformer (using **six or seven** of the above points). They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5–6]
B	Candidates use some appropriate specialist terms to describe how electricity is made in a generator and changed by a transformer (using **4 or 5** of the above points). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3–4]
C	Candidates describe how electricity is made in a generator and changed by a transformer (using **1, 2 or 3** of the above points). However these are not in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1–2]
D	Response not worthy of credit.	[0]

[6]

(b) (i) Step-down transformers have fewer turns on the secondary/ step-up transformers have fewer turns on primary [1]

(ii) Step-up – more turns on secondary [1]

(c) Kilowatt hours/kWh [1]

9

Total **75**

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Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2014–2015

Science: Single Award

Unit 3 (Physics)

Higher Tier

[GSS32]

GSS32

FRIDAY 14 NOVEMBER 2014, MORNING

TIME

1 hour 15 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 eleven** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Questions **4(c)** and **8(b)**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
Total Marks	

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Examiner Only	
Marks	Remark

1 **(a)** Given below are the names of some telescopes and the electromagnetic wave they detect.

Name of telescope	Electromagnetic wave
Lovell	radio
COBE	microwave
Spitzer	infrared
Hubble	visible
Galaxy Evolution Explorer	ultraviolet
XMM Newton	X-rays
Fermi Large Area	gamma

(i) All electromagnetic waves can travel through a vacuum. Give **one** other feature of all electromagnetic waves.

_____

_____ [1]

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Each type of electromagnetic wave comes from a main source in Space as shown in the table below.

Source	Electromagnetic wave
cool gas	radio
background radiation	microwave
cool stars	infrared
surface of stars	visible
very hot stars	ultraviolet
hot gas	X-rays
materials around black holes	gamma

Use the information from both tables to answer the following questions.

(ii) Name the telescope which could be used to observe very hot stars.

_____ [1]

(iii) Which **source** will be detected using the XMM Newton telescope?

_____ [1]

(b) European astronomers have discovered a planet the same size as Earth orbiting a star in the Alpha Centauri system. The Alpha Centauri system is 4.3 light years away. Explain fully why astronauts could not travel to this planet.

_____

_____

_____ [2]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

2 **(a)** The table below shows the amount of natural radiation which occurs in some foods. This forms part of the radiation that constantly surrounds us.

	Radioactive isotope	
Food	**Potassium/ pCi/kg**	**Radon/ pCi/kg**
Bananas	3520	1.00
Carrots	3400	1.30
Potatoes	3400	1.75
Lima beans	4640	3.50

(i) What name is given to this radiation that constantly surrounds us?

_____ [1]

(ii) Name the food which gives the **lowest** combined dose of radiation.

_____ [1]

(b) A person receives about 30 millirem of radiation each year from these sources. Radiation of 1 millirem shortens a person's life by 70 seconds.

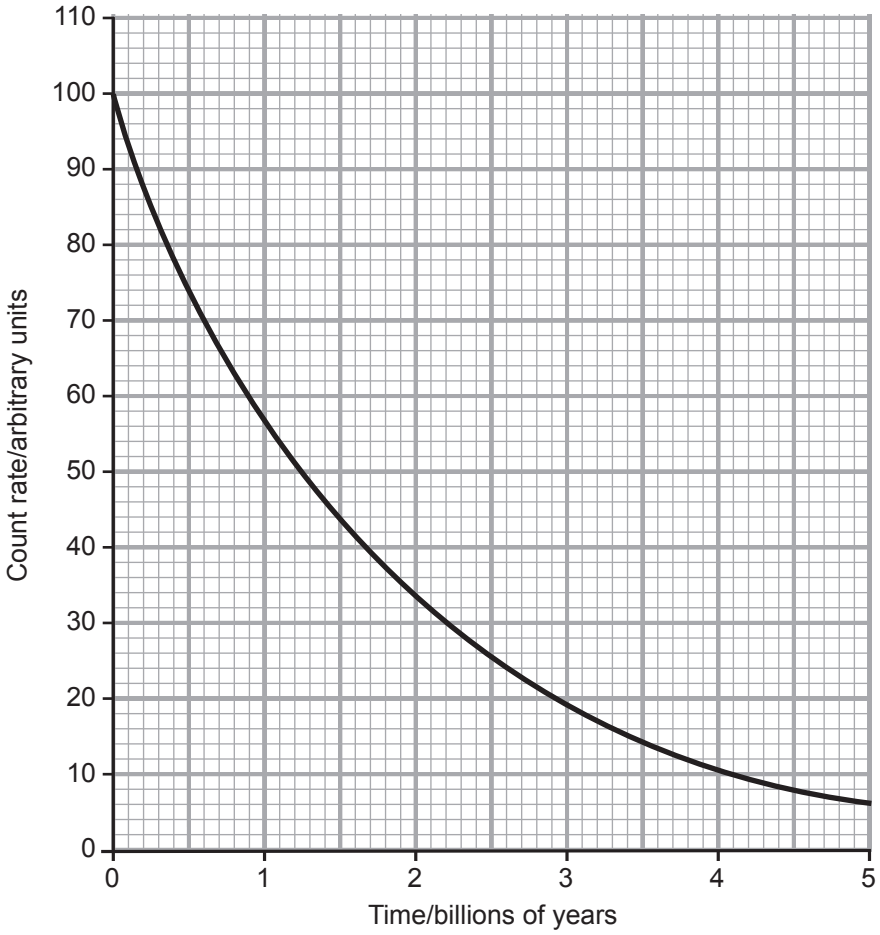
Explain why we should **not** be concerned about eating foods containing natural radiation.

_____

_____ [1]

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(c) The graph below shows how the count rate of potassium-40 varies with time.



(i) Describe fully the trend shown by these results.

_____

_____

_____ [2]

(ii) Use the graph to find the half-life of potassium-40.

Answer _____ billion years [1]

(iii) A radioactive source has a half-life of five days.
What fraction of the original source will be left after ten days?

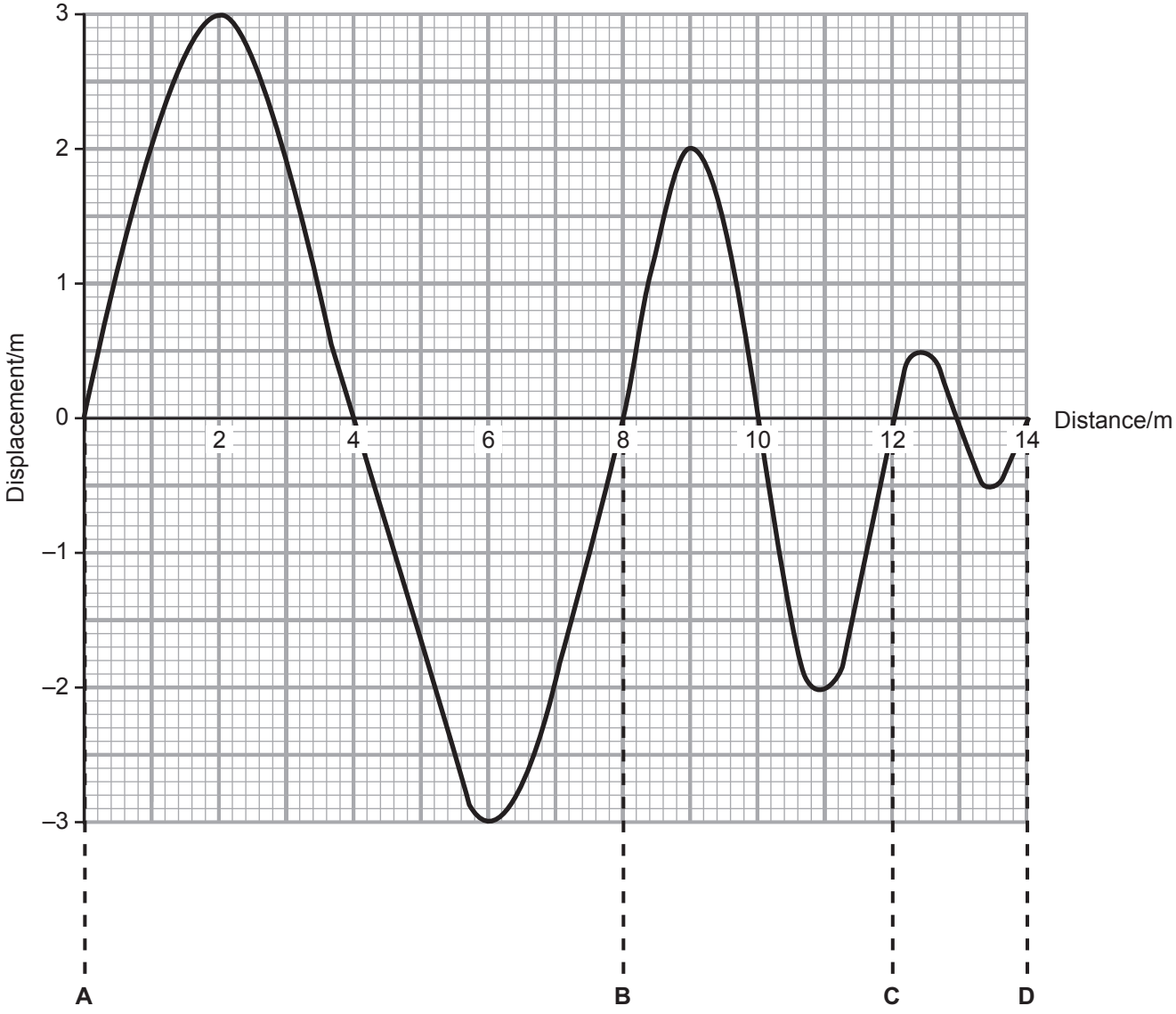
Answer _____ [1]

Examiner Only

Marks	Remark

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3 The diagram below shows a sound wave travelling through the air.



Examiner Only	
Marks	Remark

(a) What is the amplitude of the section labelled **A**–**B**?

Answer _____ m [1]

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(b) (i) What is the wavelength of the section labelled **B**–**C**?

Answer _____ m [1]

(ii) Sound waves travel at a speed of 330 m/s in air.

Use the equation:

$$\textbf{frequency} = \frac{\textbf{speed}}{\textbf{wavelength}}$$

to calculate the frequency of the section labelled **B**–**C**.

(Show your working out.)

Answer _____ Hz [2]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

4 **(a)** Explain fully how fossil fuels are formed.

_____

_____

_____

_____ [3]

(b) The table below shows the electrical energy (GWh) generated in Northern Ireland from different energy sources between 2008–2012.

Year / Energy source	2008	2009	2010	2011	2012
Coal	2077	1402	1858	1450	2403
Hydroelectric	26	31	36	20	21
Wind, wave, solar	568	754	639	893	1047
Oil	369	112	107	88	79
Gas	6568	5674	4884	5397	3732
Total	**9608**	**7973**	**7524**	**7848**	**7282**

(i) Name all the fossil fuels shown in the table above.

_____ [1]

(ii) Give the trend in **total** energy generated between 2008–2012. Describe the significant changes in the energy sources used over this period.

_____

_____

_____

_____ [3]

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(c) A company is proposing to develop an offshore wind farm fifteen kilometres off the coast of Northern Ireland. This would involve up to 100 turbines.
Discuss the advantages and disadvantages of the plan to build this wind farm.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

_____

_____

_____

_____

_____

_____

_____

_____

_____

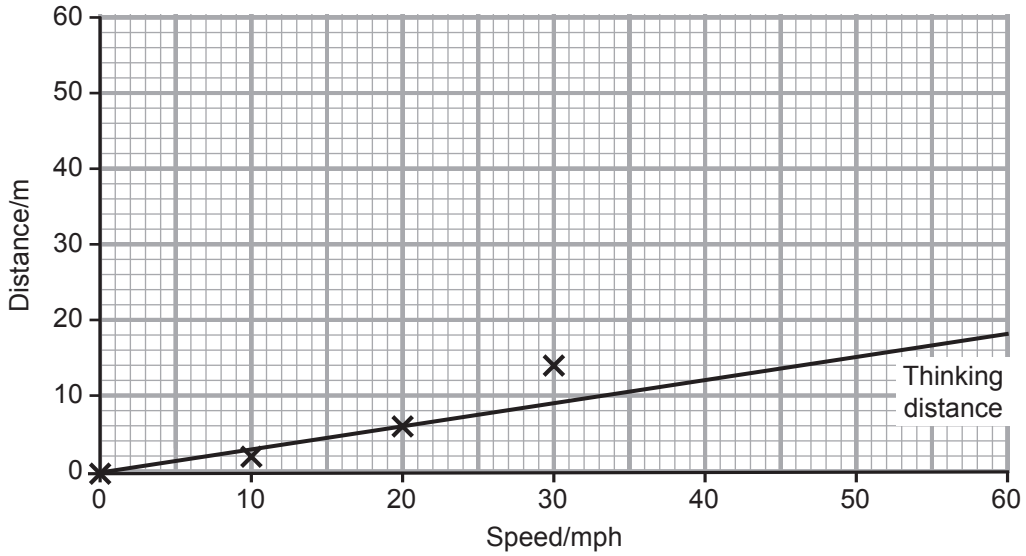
_____

_____ [6]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

5 **(a)** The graph below shows how thinking distance changes with speed.



(i) On the same axes plot a graph for braking distance using the results below.
The first four points have already been plotted.

Speed/mph	Braking distance/m
0	0
10	2
20	6
30	14
40	24
50	38
60	55

[2]

(ii) Use the information to calculate the **stopping distance** for a car travelling at 60 mph.

Answer _____ m [1]

(b) The distances given in part **(a)** are for a car on a dry road.

What effect, if any, would a wet road have on:

1. thinking distance?

_____

2. braking distance? Explain your answer in terms of forces.

_____

_____

_____ [3]

(c) Explain fully why drinking alcohol may increase the risk of a driver being involved in a car crash.

_____

_____ [2]

(d) The table below shows the number of fatal accidents which occurred on different types of roads, in different conditions, in Great Britain during 2012.

	Daylight			Darkness		
	Dry	**Wet**	**Snow**	**Dry**	**Wet**	**Snow**
Motorway	27	8	1	22	21	1
Built up area	354	106	3	154	120	8
Countryside	355	119	12	160	153	11

Data taken from DFT STATS19

Compare the overall results shown for dry roads in daylight with dry roads in darkness and suggest **one** reason for the difference.

_____

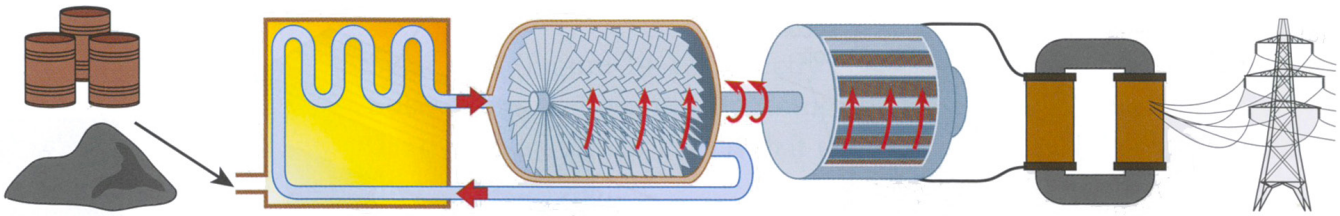
_____

_____ [2]

Examiner Only

Marks	Remark

6 The diagram below shows the parts of a fossil fuel power station including a step-up transformer.



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Examiner Only	
Marks	Remark

(a) Explain fully why the electricity is passed through a step-up transformer before going into the grid.

_____

_____

_____

_____ [3]

(b) State the energy changes which take place:

when the fuel is burnt _____

_____

in the boiler _____

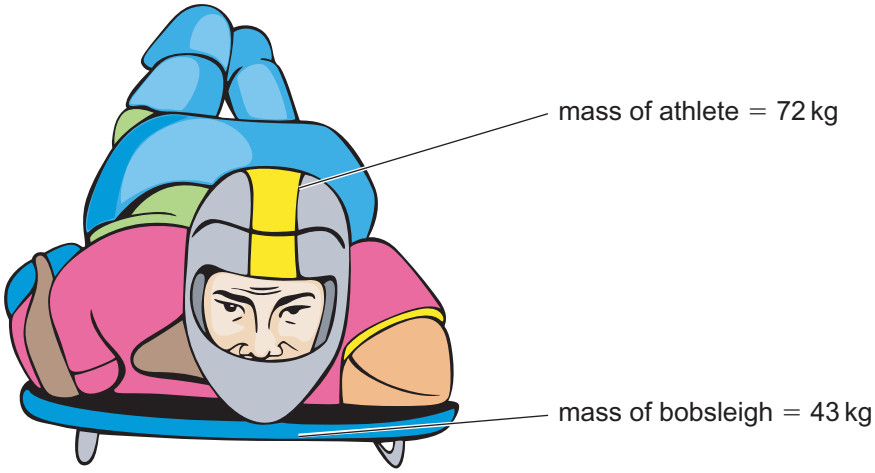
_____

in the generator _____

_____ [3]

Examiner Only	
Marks	Remark

7 The diagram below shows a bobsleigh and athlete.



© Rocich/iStock/Thinkstock

(a) The athlete and bobsleigh had a momentum of 4140 kg m/s.

Use the equation:

momentum = mass × velocity

to calculate the velocity of the bobsleigh.

(Show your working out.)

Answer _____ m/s [2]

(b) Explain fully, in terms of forces, why the bobsleigh increases speed as it moves downhill.

_____

_____

_____

_____ [3]

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Examiner Only	
Marks	Remark

8 **(a)** James blows a whistle and a short time later he hears the echo.



(i) Explain fully why he hears the sound of the whistle twice.

_____

_____

_____ [2]

(ii) James uses a stopwatch to measure the time between blowing the whistle and hearing the whistle for a second time. The stopwatch records a time of 1.2 s. The speed of sound in air is 330 m/s.

Use the equation:

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

to calculate James' distance from the wall.

(Show your working out.)

Answer _____ m [3]

(b) The flash-bang method can be used to measure the speed of sound in air.

Describe fully how the flash-bang method is used to measure the speed of sound accurately.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ [6]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

9 **(a)** The table below gives the distance to some galaxies and the speed they are moving away from Earth.

Name of Galaxy	Distance from Earth/light years ($\times 10^6$)	Speed away from Earth/ m/s ($\times 10^4$)
M110	2.8	6
Sextans B	4.8	10
Dwingloo 1	9.0	20
Maffei 1	9.8	21
Holmberg 11	11.2	23

(i) Describe the trend shown by this data.

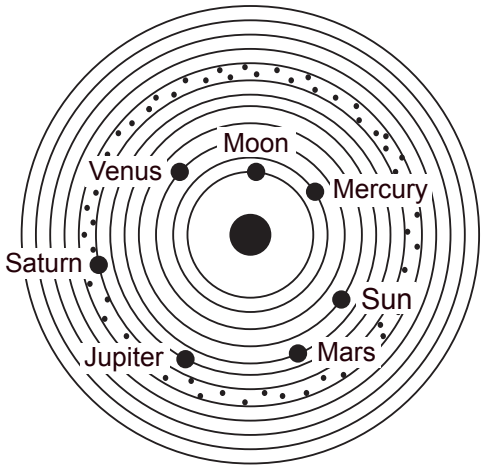
_____

_____ [1]

(ii) In what way would the red shift from Holmberg 11 differ from Sextans B?

_____ [1]

(b) The diagram below shows the Geocentric model of the Solar System.



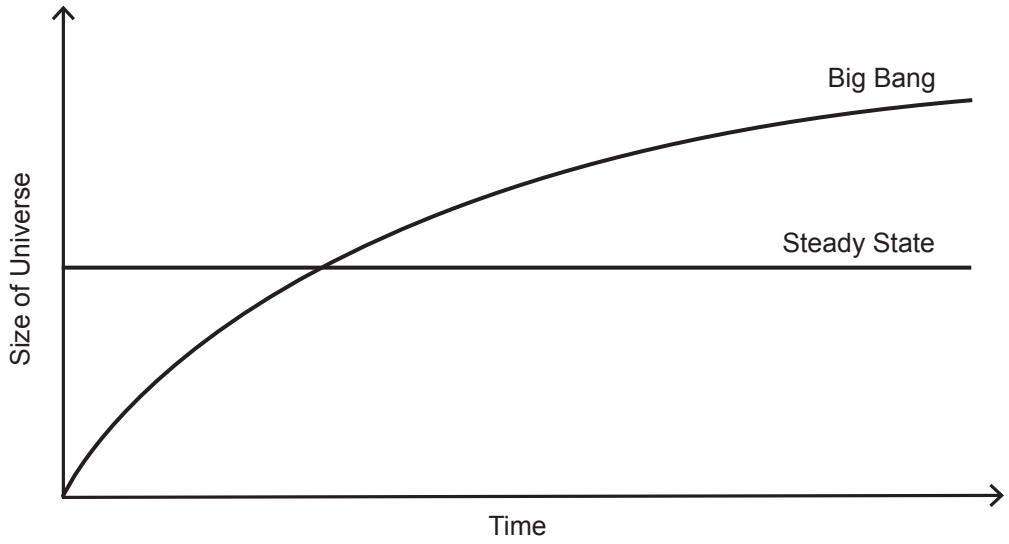
© Sheila Terry/Science Photo Library

The planets Uranus and Neptune are missing from this model of the Solar System. Suggest **one** reason why they are not shown.

_____

_____ [1]

(c) The graph below represents two possible theories for the formation of the Universe.



Use the graph to give **two** main differences between the Big Bang theory and the Steady State theory.

_____

_____

_____ [2]

Examiner Only

Marks	Remark

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10 The picture below shows a microwave oven.



© Lonely__/iStock/Thinkstock

(a) Explain fully how the rays in a microwave oven heat food.

_____

_____

_____

_____ [3]

(b) Thermal imaging cameras are often used to search for people (body temperature 37°C) trapped in buildings. The camera produces a colour picture; each colour represents a different temperature and infrared wavelength as shown below.

Image colour	Temperature of object/°C	Infrared wavelength/m
orange-yellow	38	9.34×10^{-6}
orange	36	9.40×10^{-6}
red-orange	34	9.46×10^{-6}
red	32	9.52×10^{-6}

Using the information provided, predict the wavelength emitted by a trapped person.

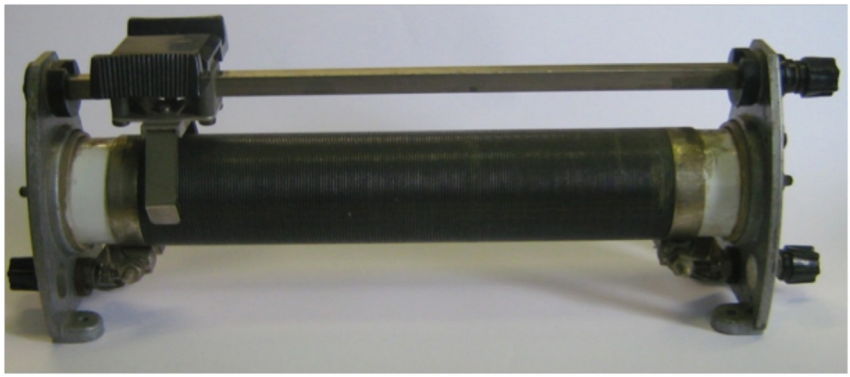
Answer _____ m [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

11 (a) The photograph below shows a rheostat (a variable resistor).



© CCEA

Describe fully how a variable resistor changes the current in a circuit.

_____

_____

_____

_____ [3]

(b) The table shows how diameter and wire type affect resistance.

Diameter of wire /mm	Resistance of wire/ ohms per metre	
	nichrome	copper
0.05	550	8.7
0.08	215	3.4
0.09	170	2.7
0.10	138	2.1
0.12	47.6	1.5

Give **two** conclusions provided by the data.

_____

_____

_____

_____ [2]

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Rewarding Learning

General Certificate of Secondary Education
2014–2015

Science: Single Award

Unit 3 (Physics)

Higher Tier

[GSS32]

FRIDAY 14 NOVEMBER 2014, MORNING

MARK SCHEME

STEMUP.CO.UK

General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

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The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

					AVAILABLE MARKS
1	**(a)**	**(i)**	Any **one** from: • they all travel at the speed of light • all carry energy • all transverse	[1]	
		(ii)	Galaxy Evolution Explorer	[1]	
		(iii)	Hot gas	[1]	
	(b)		Unable to survive for the length of time to reach the planet/distance too great [1] cannot carry sufficient food/water/fuel/oxygen [1]	[2]	5
2	**(a)**	**(i)**	Background	[1]	
		(ii)	Carrots	[1]	
	(b)		It would only reduce their life expectancy 2100 seconds per year makes little difference.	[1]	
	(c)	**(i)**	Count decreases with time [1] faster decrease at start [1]	[2]	
		(ii)	1.25/(1.2 – 1.3)	[1]	
		(iii)	$\frac{1}{4}$	[1]	7
3	**(a)**		3 m	[1]	
	(b)	**(i)**	4 m	[1]	
		(ii)	$\frac{330}{4}$ [1] 82.5 [1]	[2]	4

AVAILABLE MARKS

4 **(a)** Dead plants/animals [1]
compressed/under pressure/high temperature [1]
for millions of years [1] [3]

(b) **(i)** Coal, oil and gas [1]

(ii) Total generated has decreased over time [1]
the fossil fuels oil/gas have decreased [1]
the renewables wind, wave and solar have increased [1] [3]

(c) **Indicative content**

- renewable
- good for economy/creates jobs
- reduce use of fossil fuels
- no gas (CO_2) emissions/no polluting gases
- unreliable – not always windy or switch off at high speeds
- hazard to shipping/destroys habitats
- expensive to build
- unsightly
- expensive to get electricity from farm to main-land

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe fully, in a logical sequence, the advantages and disadvantages of using offshore wind farms (using at least **seven** of the above points). They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5–6]
B	Candidates use some appropriate specialist terms to partially describe, in a logical sequence, the advantages and disadvantages of using offshore wind farms (using **three to six** of the above points). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3–4]
C	Candidates describe the advantages and disadvantages of using offshore wind farms (using **one to two** of the above points). However these are not in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1–2]
D	Response not worthy of credit.	[0]

[6]

13

					AVAILABLE MARKS
5	**(a)**	**(i)**	All points plotted correctly [1] smooth curve [1]	[2]	
		(ii)	73 m	[1]	
	(b)		1. No effect [1] 2. Increase braking distance [1] less friction [1]	[3]	
	(c)		Longer reaction times/slower reactions [1] increase thinking distance/stopping distance [1]	[2]	
	(d)		Less fatalities in dark compared to the light [1] fewer cars on the road in the dark/drivers more cautious when dark [1]	[2]	10
6	**(a)**		Any 3 from: • Decreases the current [1] • increase voltage [1] • smaller diameter cables required [1] • cables are cheaper [1] • wastes less energy/less heat wasted in power transmission [1]	[3]	
	(b)		Chemical to thermal [1] thermal to kinetic [1] kinetic to electrical [1]	[3]	6
7	**(a)**		4140/115 [1] 36 m/s [1]	[2]	
	(b)		Gravity pulls the bobsleigh down [1] overcoming friction [1] providing an unbalanced force [1]	[3]	5

AVAILABLE MARKS

8 (a) (i) Hears the sound travelling directly from the whistle to the ear [1]
also hears the reflection of the whistle off the wall [1] [2]

(ii) 330 × 1.2 [1]
330 × 0.6 [1]
198 m [1] [3]

(b) Indicative content

- car and person over a measured distance
- 1 km apart/long distance
- beep horn and flash lights at same time
- start watch when lights seen
- stop watch when horn heard
- use speed = distance/time
- repeat the experiment
- same person measures the time
- car and timer reverse positions to reduce error caused by wind

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe fully, in a logical sequence, the flash-bang method (using at least **seven** of the above points). They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5–6]
B	Candidates use some appropriate specialist terms to partially describe, in a logical sequence, the flash-bang method (using **four to six** of the above points). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3–4]
C	Candidates describe the flash-bang method (using **one to three** of the above points). However these are not in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1–2]
D	Response not worthy of credit.	[0]

[6] 11

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					AVAILABLE MARKS
9	**(a)**	**(i)**	The greater the distance of the galaxy from Earth the faster it is moving.	[1]	
		(ii)	It would have a greater red shift.	[1]	
	(b)		(Too small to see from Earth hence) had not been discovered.	[1]	
	(c)		The Big Bang started at a single point [1] It is still expanding/size increasing [1] (allow converse)	[2]	5
10	**(a)**		Any **three** from: • microwave can penetrate food • microwaves carry energy • wavelength of microwaves is one which is absorbed by water • microwaves cause water molecules in food to vibrate faster • increased vibrations raise the temperature of the food	[3]	
	(b)		9.37×10^{-6} m	[1]	4
11	**(a)**		The longer the wire [1] the higher the resistance [1] the less current flows [1]	[3]	
	(b)		As the diameter increases the resistance decreases [1] Copper wires (of the same diameter) less resistance than nichrome/ copper wires are better conductors [1]	[2]	5
				Total	**75**

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Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2013–2014

Science: Single Award

Unit 3 (Physics)

Higher Tier

[GSS32]

MONDAY 19 MAY 2014, AFTERNOON

TIME

1 hour 15 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 nine** questions.

INFORMATION FOR CANDIDATES

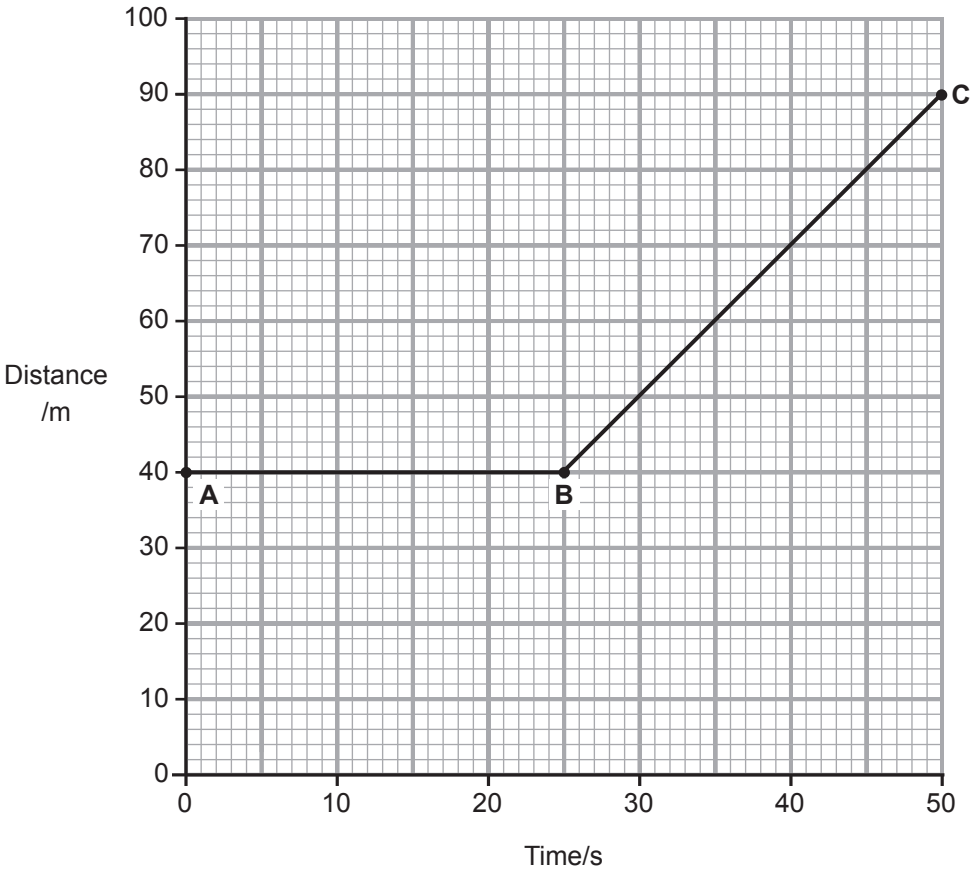
The total mark for this paper is 75.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Questions **4(b)** and **9(b)**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total Marks	

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Examiner Only	
Marks	Remark

1 **(a)** The distance–time graph for part of a train journey is shown below.



(i) Describe the motion of the train from:

A to **B** _____

B to **C** _____ [2]

(ii) Use the equation:

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

to calculate the average speed of the train between **A** and **C**.

(Show your working out.)

Answer _____ m/s [2]

(b) Patrick investigated the average speeds of five racing cars (**A**, **B**, **C**, **D** and **E**) over a two lap race.

The results are shown in the table below.

Car	1st lap time/s	2nd lap time/s
A	40	55
B	50	50
C	55	55
D	55	45
E	40	75

If all the cars start at the same time, which **two** will finish together?

_____ and _____ [1]

Examiner Only

Marks	Remark

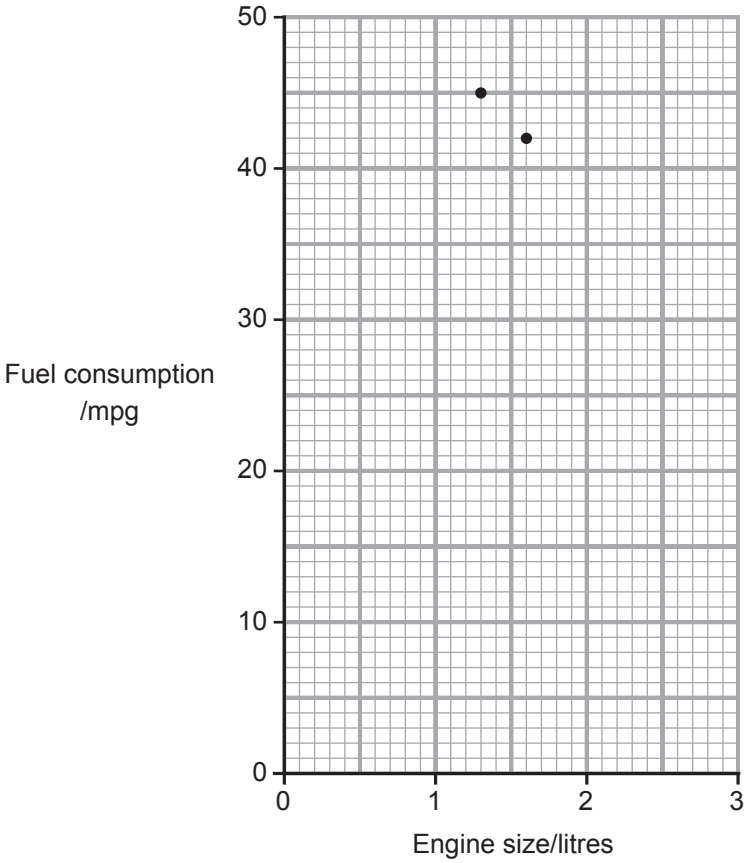
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Examiner Only	
Marks	Remark

2 **(a)** The table below gives information about five different makes of car.

Make	Engine size/ litres	Fuel consumption/ mpg
Aster	1.3	45
Lazio	1.6	42
Torino	1.8	39
Viva	2.0	37
Megro	2.5	32

(i) Use this information to complete the graph below, including a line of best fit.



[2]

(ii) Use your graph to find the fuel consumption of a 1.0 litre engine.

Answer _____ mpg [1]

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(b) Car manufacturers are trying to make cars more efficient.

(i) Suggest **one** way car manufacturers are making cars more efficient.

_____

_____ [1]

(ii) Petrol and diesel are made from oil, a finite fossil fuel. Explain the term 'finite' and why it is important to have more efficient cars.

_____

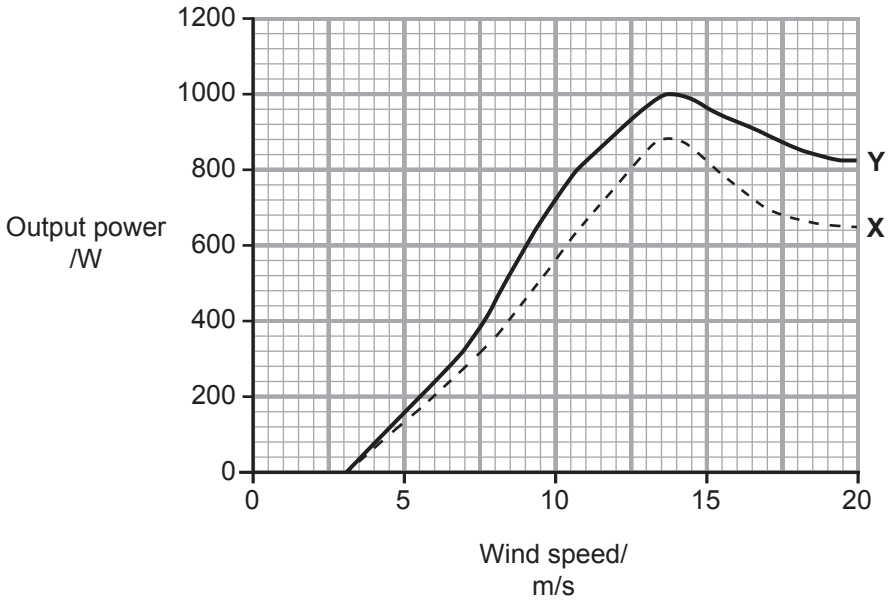
_____

_____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

3 **(a)** The graph below shows the performance of two types of wind turbine (**X** and **Y**).



(i) Calculate the difference between the maximum power produced by the two turbines.

(Show your working out.)

Answer _____ W [2]

(ii) Describe in detail how the output power of turbine **X** changes as the wind speed increases.

_____

_____

_____

_____

_____ [3]

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(b) (i) Wind energy is classed as renewable. What does the term 'renewable' mean?

_____

_____ [1]

(ii) Give **one** environmental advantage and **one** disadvantage of using wind energy.

Advantage _____

_____

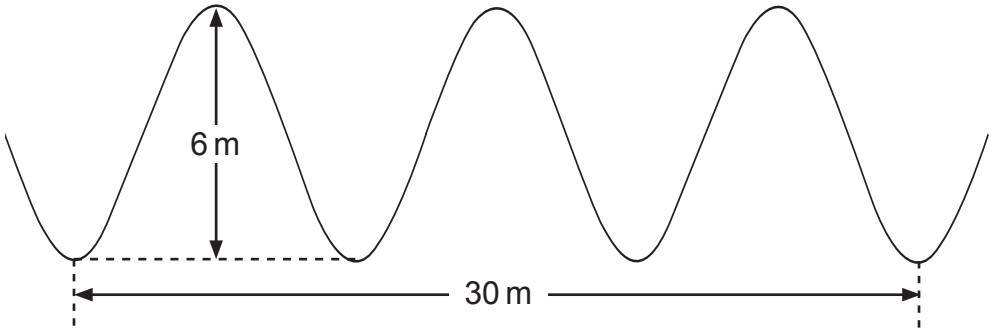
Disadvantage _____

_____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

4 **(a)** The diagram below shows some sea waves.



Use the information in the diagram to answer the following questions.

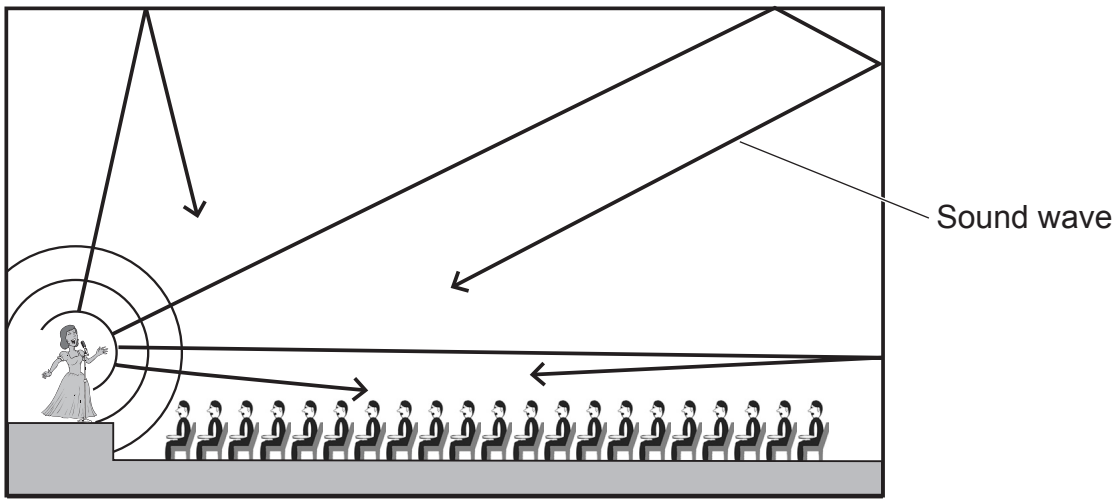
(i) What is the amplitude of these waves?

Answer _____ m [1]

(ii) What is the wavelength of these waves?

Answer _____ m [1]

(b) The diagram below shows the sound waves in a badly designed concert hall. Some of the audience complain that the sound they hear is not very clear.



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Explain fully why some people may not hear the sound clearly.

Your answer should include:
- the cause of the problem
- what the audience will hear and why
- what can be done to correct the problem

In this question you will be assessed on your written communication skills including the use of specialist terms.

[6]

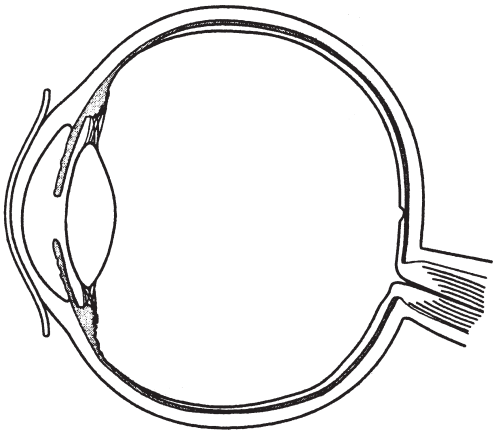
(c) Explain fully what ultrasound is.

[2]

Examiner Only	
Marks	Remark

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5 The diagram below shows the human eye.



© CCEA

(a) Explain the term refraction and describe fully the passage of light through the eye for normal vision.

_____

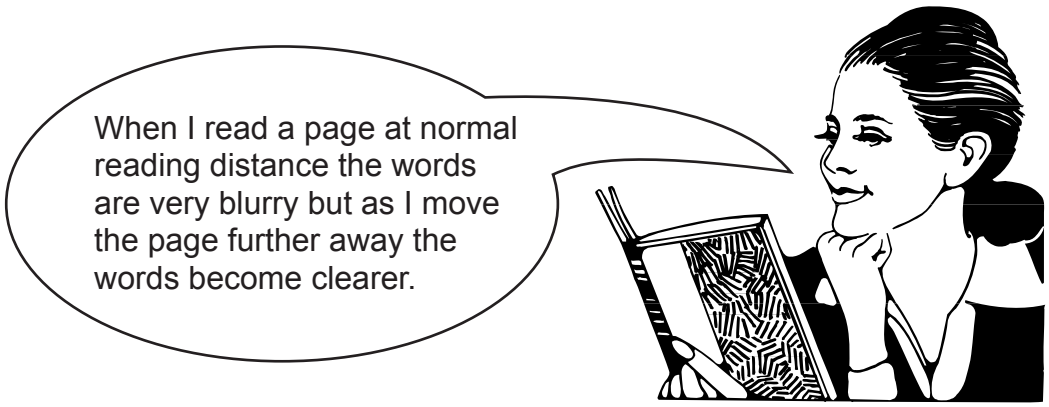
_____

_____

_____ [3]

Examiner Only	
Marks	Remark

(b) On a visit to the opticians a lady was heard to say:



(i) Name the sight defect this lady has and describe fully what causes the defect.

_____

_____

_____

_____ [3]

(ii) Name the type of lens used to correct this sight defect.

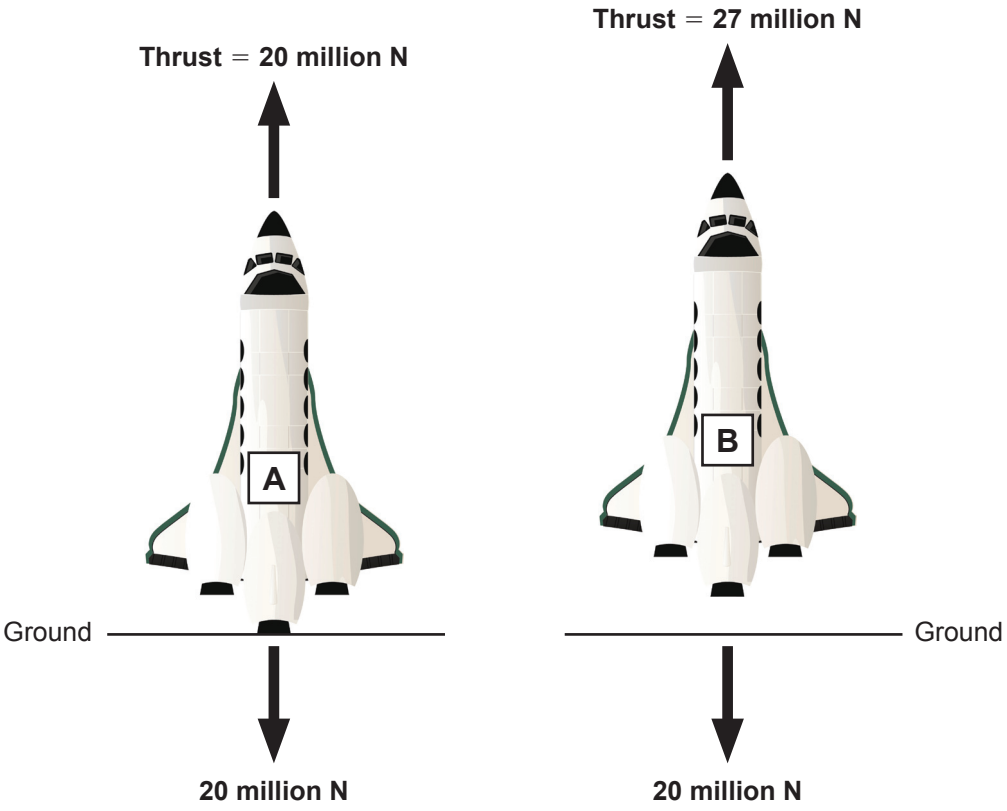
_____ [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

6 The diagrams below show the space shuttle on the ground one second before take off (**A**) and then one second after take off (**B**).



© *iStock/ Thinkstock*

(a) (i) Name the 20 million N downward force in diagram **A**.

_____ [1]

(ii) Explain fully in terms of forces the movement, if any, of the space shuttle in diagram **A**.

_____

_____

_____ [2]

(iii) Calculate the size of the resultant force in diagram **B**.
Describe the effect this resultant force has on the space shuttle.

_____

_____

_____ [2]

(b) A short time after take off the space shuttle (mass 2×10^6 kg) reaches a velocity of 4.5×10^2 m/s.

Examiner Only

Marks	Remark

(i) Use the equation:

momentum = mass × velocity

to calculate the momentum of the space shuttle.

(Show your working out.)

Answer _____ [2]

(ii) State the unit of momentum.

Answer _____ [1]

Examiner Only	
Marks	Remark

7 The picture below shows a wind-up torch. The torch makes electricity in the same way as the generator in a power station.



© iStock/ Thinkstock

(a) Explain fully how this torch makes electricity and state how the brightness could be increased.

_____

_____

_____

_____ [3]

(b) In a fossil fuel power station the chemical energy in the fuel is changed into heat in the burner. Describe the **three** other energy changes, stating where they occur in the power station.

_____

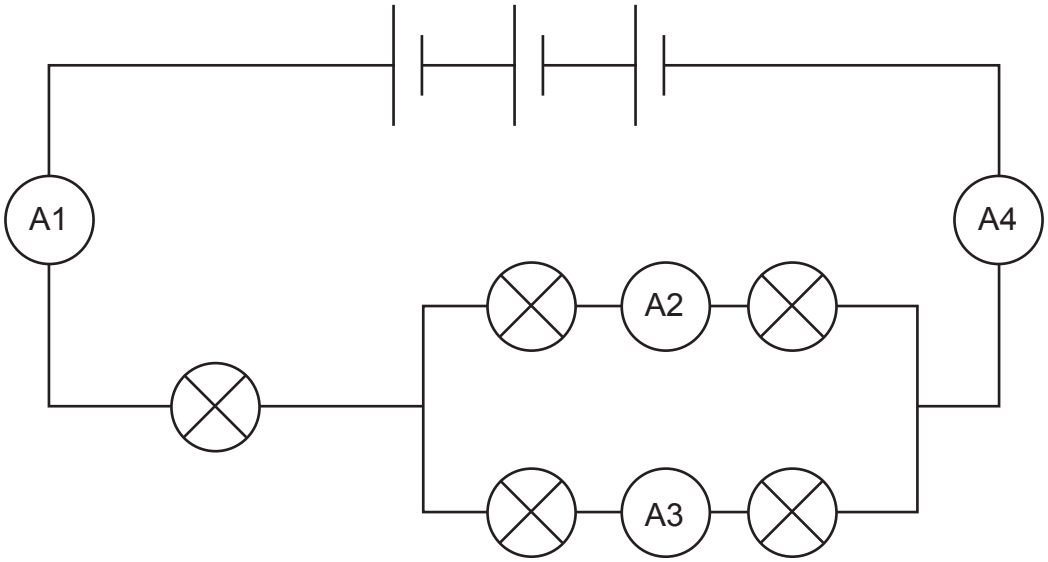
_____

_____

_____ [3]

Examiner Only	
Marks	Remark

(c) The circuit below was used to investigate current flow. All the bulbs are identical.



(i) If ammeter A1 reads 0.6 A, what will be the readings on ammeters A2, A3 and A4?

A2 _____ A

A3 _____ A

A4 _____ A [2]

(ii) Describe and explain fully how current actually flows around a circuit.

_____

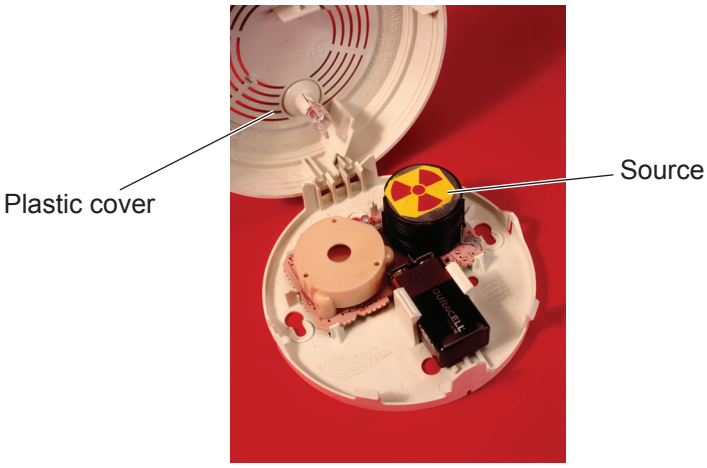
_____

_____

_____ [3]

Examiner Only	
Marks	Remark

8 The picture below shows a radioactive source inside a common type of smoke alarm.



© Andrew Lambert Photography/Science Photo Library

The most common radioactive source used in smoke alarms is americium-241 which emits alpha radiation.

(a) Explain fully why some atoms are radioactive.

_____

_____

_____ [2]

(b) The smoke alarm works by having a constant flow of radiation from the source. When this flow is interrupted by smoke the alarm sounds.

(i) Explain fully why an alpha source is best to use in smoke alarms.

_____

_____

_____

_____ [3]

(ii) Americium-241 has a half-life of 432 years.
Suggest **one** reason why a long half-life is important in a smoke alarm.

_____

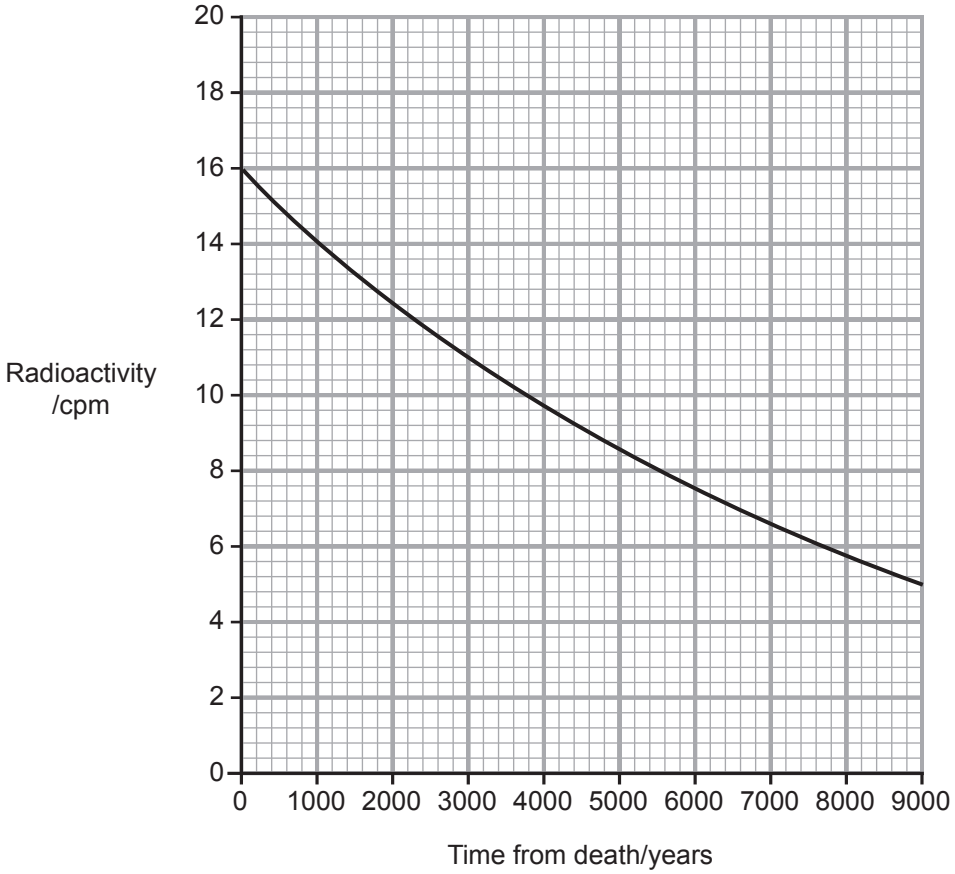
_____ [1]

(iii) Radioactivity is the emission of ionising radiation. What is meant by the term ionising radiation?

_____

_____ [1]

(c) The graph below shows how the radioactivity of carbon-14 decreases in the remains of a once living organism.



(i) Use the graph to find the half-life of carbon-14.

Answer _____ years [1]

(ii) In 1985 a human body was found in an English peat bog and the radioactivity of the carbon-14 found in the body was 10 cpm. Use the graph to find how many years ago this person died.

Answer _____ years [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

9 The table gives information about seven galaxies (**A** to **G**) in the Universe.

Galaxy	Amount of red shift /arbitrary units	Time for light to reach Earth/years
A	0.0043	59 million
B	0.01	140 million
C	0.1	1.3 billion
D	0.5	5 billion
E	1.0	7.7 billion
F	2.0	10.3 billion
G	3.0	11.5 billion

(a) Which galaxy is furthest away? Explain your answer.

[2]

(b) Use the information in the table and your knowledge to explain the Big Bang theory and how red shift provides evidence for this theory. Your answer should describe star formation.

In this question you will be assessed on your written communication skills including the use of specialist terms.

[6]

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(c) How many years ago did the Big Bang take place?

Answer _____ [1]

(d) Name an alternative scientific theory to the Big Bang theory.

_____ [1]

(e) What is meant by the term light year?

_____

_____ [1]

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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Rewarding Learning

General Certificate of Secondary Education
2013–2014

Science: Single Award

Unit 3 (Physics)

Higher Tier

[GSS32]

MONDAY 19 MAY 2014, AFTERNOON

MARK SCHEME

STEMUP.CO.UK

General Marking Instructions

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					AVAILABLE MARKS
1	**(a)**	**(i)**	A to B = stopped [1] B to C = steady speed [1]	[2]	
		(ii)	50/50 [1] 1.0 [1]	[2]	
	(b)		B and D	[1]	5
2	**(a)**	**(i)**	3 points plotted correctly [1] Line of best fit [1]	[2]	
		(ii)	48 mpg (from script)	[1]	
	(b)	**(i)**	Electric/hybrid/smaller engines/stop-start technology/ lighter cars/more streamlined	[1]	
		(ii)	fossil fuels/energy sources are running out/non-renewable [1] more efficient uses less fuel [1]	[2]	6
3	**(a)**	**(i)**	1000 – 880 [1] 120 [1]	[2]	
		(ii)	Any 3 from: • no power produced until speed reaches 3 m/s (at low wind speed) • as wind speed increases, output power increases • up to a maximum of 880 W/14 m/s (units not required) • then power decreases after maximum/at high wind speed	[3]	
	(b)	**(i)**	Will not run out	[1]	
		(ii)	Less air pollution/(less) carbon dioxide/(less) global warming [1] Unsightly/noisy [1]	[2]	8

4 **(a)** **(i)** 3 [1]

(ii) 10 [1]

(b) **Indicative content**

- echoes
- reflected sound
- hard surfaces
- hear the same sound at different times
- sound travels different distances
- use soft materials (Named surface)
- to absorb sound

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe fully, in a logical sequence, why some people may not hear the sound clearly (using **6 or more** of the above points). They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5–6]
B	Candidates use some appropriate specialist terms to partially describe, in a logical sequence, why some people may not hear the sound clearly (using **4** or **5** of the above points). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3–4]
C	Candidates describe why some people may not hear the sound clearly (using **1**, **2**, or **3** of the above points). However these are not in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1–2]
D	Response not worthy of credit.	[0]

[6]

(c) Sounds with a frequency [1]
greater than 20kHz [1] [2]

AVAILABLE MARKS

10

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					AVAILABLE MARKS
5	**(a)**	•	refraction = bending of light [1]		
			Any 2 from: • cornea/lens both refract light inwards/converge • cornea refracts more than the lens • clear image formed on retina	[3]	
	(b)	**(i)**	Long sight [1] lens too weak [1] image would be focussed behind retina [1]	[3]	
		(ii)	Converging/convex lens	[1]	7
6	**(a)**	**(i)**	Weight/gravity	[1]	
		(ii)	Stationary/at rest/not moving [1] balanced forces [1]	[2]	
		(iii)	Resultant = 7 million (N) [1] causes an acceleration/change in speed [1]	[2]	
	(b)	**(i)**	2 000 000 x 450 [1] 900 000 000 / 9 x 10^8 [1]	[2]	
		(ii)	kgm/s / Ns	[1]	8
7	**(a)**		Magnet + coil of wire [1] handle is turned (to create relative movement) [1] faster movement makes brighter light [1]	[3]	
	(b)	•	heat --- kinetic (in boiler) [1] • kinetic (steam) --- kinetic (blade) (in turbine) [1] • kinetic --- electric (in generator) [1]	[3]	
	(c)	**(i)**	A2 = 0.3 A3 = 0.3 A4 = 0.6 All 3 correct = 2 marks 1/2 correct = 1 mark	[2]	
		(ii)	• flow of electrons [1] • from negative to positive side of batteries [1] • electrons are negatively charged [1]	[3]	11

				AVAILABLE MARKS
8	**(a)**	(Combination of) protons and neutrons [1] making the nucleus unstable/disintegrate [1]	[2]	
	(b)	**(i)** Any 3 from • alpha would be stopped by smoke • beta/gamma would not be stopped by smoke • beta/gamma would go straight through cover/Alpha won't • beta/gamma could cause cancer/tumour to user/Alpha won't • beta/gamma would not let alarm sound	[3]	
		(ii) Will not need replacing so often	[1]	
		(iii) Radiation that produces ions/removes electrons	[1]	
	(c)	**(i)** 5500 ± 100	[1]	
		(ii) 3800 ± 100	[1]	9

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AVAILABLE MARKS

9 **(a)** G [1]
Light takes longest to get here / most red shift [1] [2]

(b) **Indicative content**

- starts from a singularity
- explosion
- gravity
- pulls dust and gas together
- to form stars and planets
- Universe is still expanding
- further galaxies more red shift
- red shift occurs when galaxies are moving away
- as red shift increase time for light to reach Earth increases

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe fully, in a logical sequence, the Big Bang theory and how it is proved by red shift (using **at least seven** of the above points). They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5–6]
B	Candidates use some appropriate specialist terms to partially describe, in a logical sequence, the Big Bang theory and how it is proved by red shift (using **4** to **6** of the above points). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3–4]
C	Candidates describe the Big Bang theory and how it is proved by red shift (using **1**, **2** or **3** of the above points). However these are not in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1–2]
D	Response not worthy of credit.	[0]

[6]

(c) 13.5 → 14 billion (years) [1]

(d) steady state theory [1]

(e) distance light travels in 1 year [1] 11

Total **75**

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Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2013–2014

Science: Single Award

Unit 3 (Physics)

Higher Tier

[GSS32]

GSS32

WEDNESDAY 26 FEBRUARY 2014, MORNING

TIME

1 hour 15 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 eleven** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Questions **3** and **7(a)**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
Total Marks	

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Examiner Only	
Marks	Remark

1 Pilots are exposed to higher levels of radiation because they spend long periods of time at high altitudes (heights).



© Victor De Schwanberg / Science Photo Library

The table below shows the amount of radiation (dose) received by pilots travelling to different destinations from Belfast.

Destination	Flight time/hrs	Amount of radiation/ mSv
Paris	1.75	8.34
New York	7.7	50.00
Sharm El Sheikh	6.2	24.18
Manchester	1.0	1.82

(i) State the trend shown by this data.

_____

_____ [1]

(ii) Background radiation causes this increase in dose. Suggest **one** possible source of radiation which could affect the pilots at this height.

_____

_____ [1]

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(iii) The maximum safe radiation dose for pregnant women is 2000 mSv. Use this information to calculate the maximum number of return flights a woman should make to New York during a pregnancy. (Show your working out.)

Answer _____ [2]

(iv) Explain fully how radiation can harm humans.

_____

_____

_____ [2]

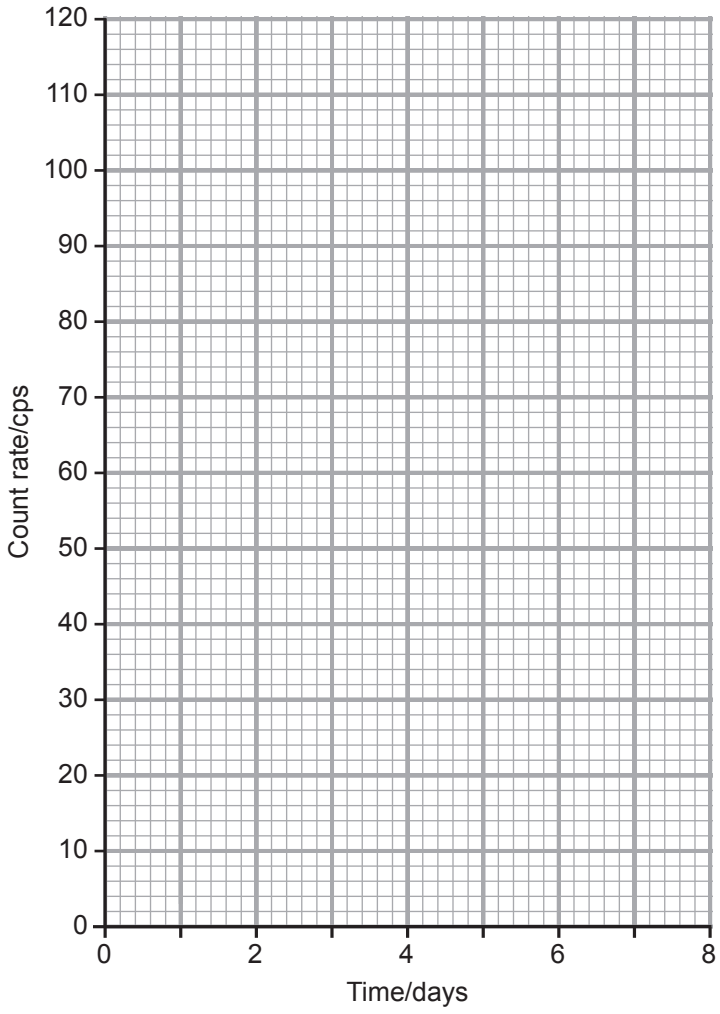
Examiner Only	
Marks	Remark

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2 **(a)** The table below shows the count rate of a radioactive isotope.

Time/days	Count rate/ cps
0	120
2	76
4	48
6	30
8	19

(i) Plot these points on the axes below and draw a curve of best fit.



[3]

Examiner Only

Marks	Remark

(ii) Use the graph to find the half-life of the radioactive isotope.

Answer _____ days [1]

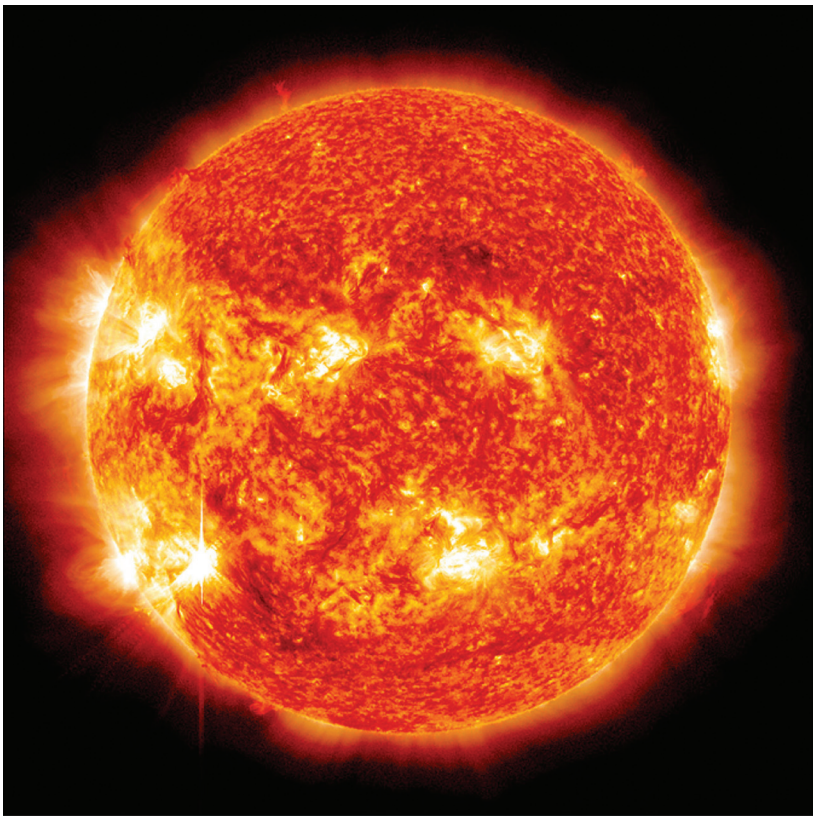
(b) Radioactive phosphorus has a half-life of 20 days. What fraction of the original mass of phosphorus will be left after 40 days?

Answer _____ [1]

Examiner Only	
Marks	Remark

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3 The photograph below shows the Sun, our closest star.



© NASA/SDO

Describe fully the formation of the Sun, naming the gases and forces involved.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

4 **(a)** The table below shows information on generating electrical power.

	Tidal	Coal	Wind	
			Onshore	Offshore
Power output/ MW	12	1600	24	94
Life expectancy/ years	15	30	20	20
Annual operating costs per kW/£	56	24	24	57
Generating costs per kWh/p	6.63	3.33	5.35	7.19

(i) The government want to replace fossil fuel power stations with alternative sources.
Use the information to explain fully why this might not be the best option.

_____

_____

_____

_____ [3]

(ii) Give **two** reasons why more alternative energy sources are being introduced.

1. _____

2. _____ [2]

(b) Explain fully the formation of fossil fuels from dead plants and animals.

_____

_____

_____ [2]

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Examiner Only	
Marks	Remark

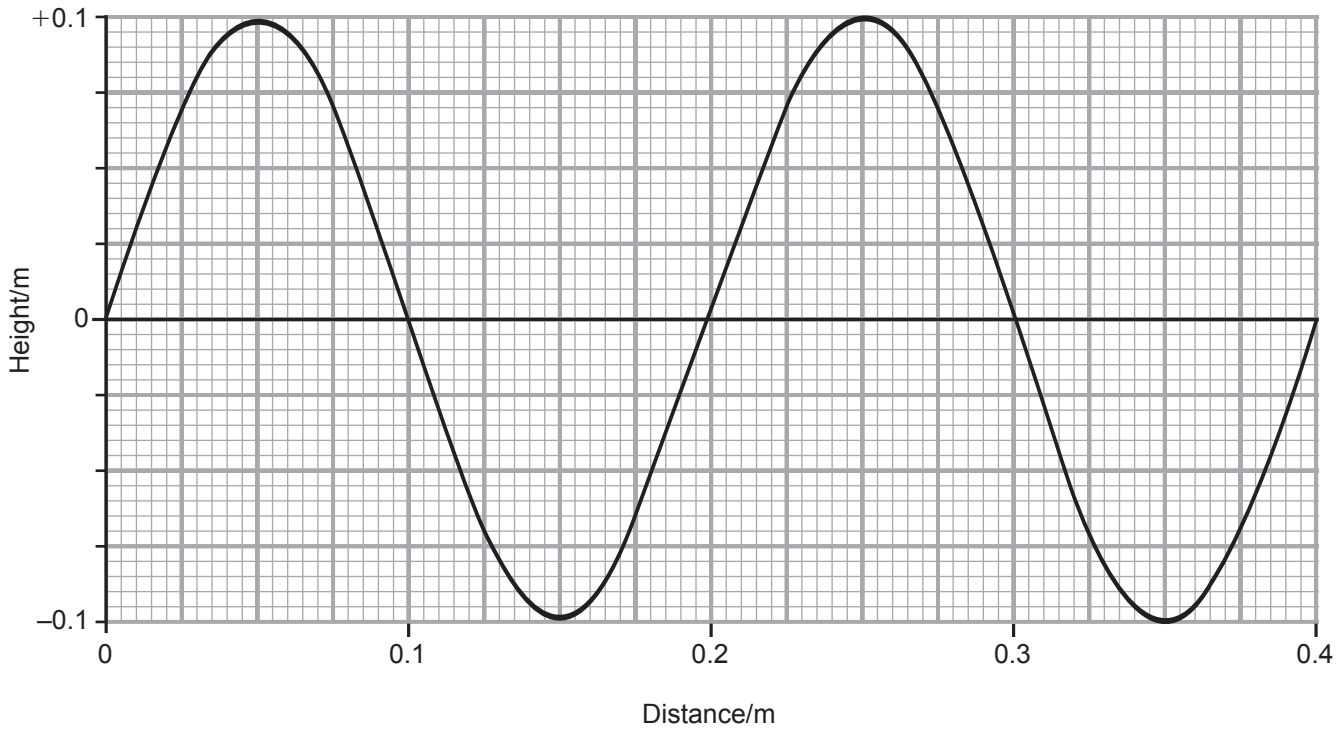
(c) Given below are some of the processes involved in producing electricity using a coal fired power station.

A	The coal produces heat	The boiler produces steam	The steam turns the blades of the turbine to make electricity directly
B	The coal produces heat	The heat turns the blades of the turbine	The turbine turns the generator which produces electricity
C	The boiler produces steam	The steam turns the blades of the turbine	The turbine turns the generator which produces electricity
D	The turbine heats the boiler	The boiler produces steam	The steam turns the generator which produces electricity

Which letter **A**, **B**, **C** or **D** gives the correct order of processes?

Answer _____ [1]

5 The graph below shows a wave.



Examiner Only	
Marks	Remark

(a) Use the information in the graph to answer the following questions.

(i) What is the wavelength of this wave?

Answer _____ m [1]

(ii) What is the amplitude of this wave?

Answer _____ m [1]

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

_____

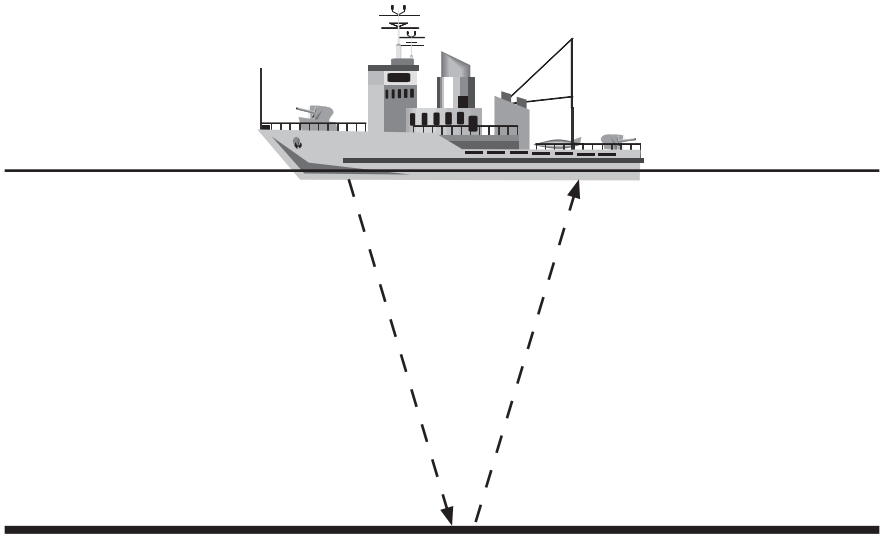
_____

_____ [2]

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Examiner Only	
Marks	Remark

(c) Ultrasound can be used to measure the depth of the sea as shown in the diagram below.



(i) Ultrasound travels at 1500 m/s in water.

The ship sends out an ultrasound pulse and the echo returns 6 seconds later.

Use the equation:

distance = speed × time

to calculate the depth of the water.
(Show your working out.)

Answer _____ m [3]

(ii) How will the captain of the ship know if a shoal of fish swims under the ship?

_____

_____ [1]

(d) Ultrasound can have a frequency of 30 000 Hz.

Use the equation:

$$\textbf{wavelength} = \frac{\textbf{speed}}{\textbf{frequency}}$$

to calculate the wavelength of this ultrasound.
(Show your working out.)

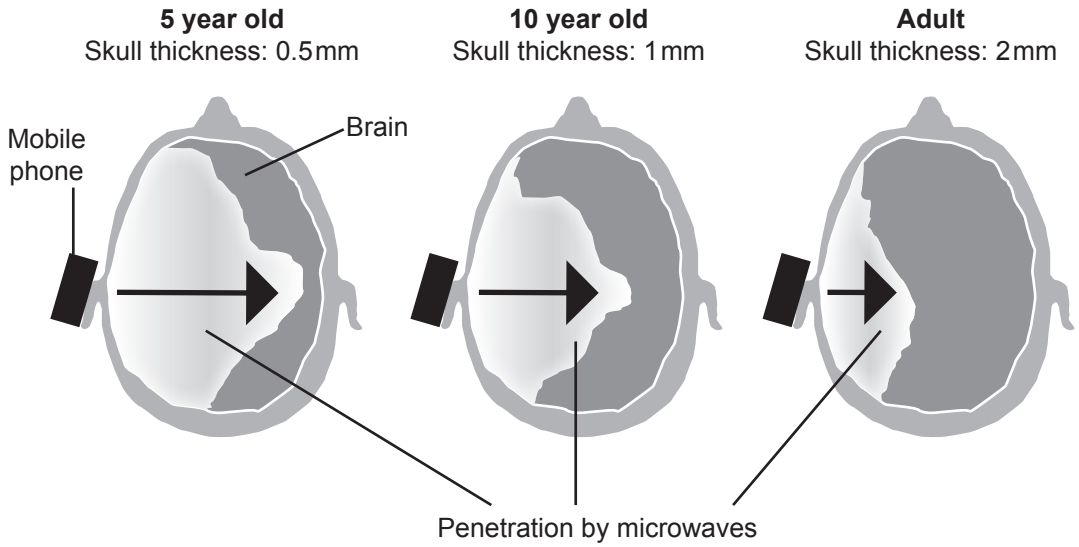
Answer _____ m [2]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

6 **(a)** SAR (specific absorption rate) is a measurement of how much radiation is absorbed by body tissue. The higher the value the more radiation is absorbed. The diagrams below show how microwaves penetrate the brain when using a mobile phone.



Use the information to explain fully why it may be dangerous for 5 year olds to use mobile phones.

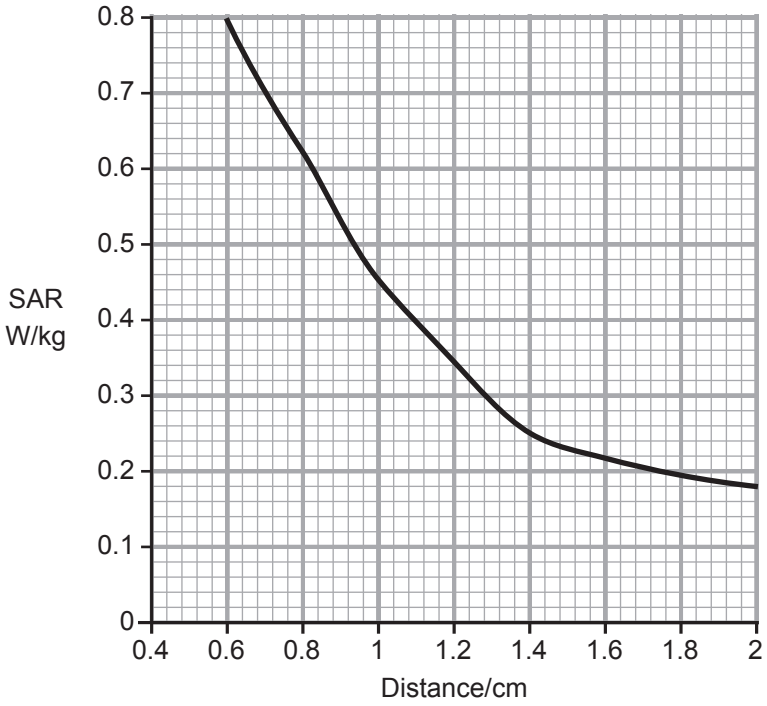
_____

_____

_____ [2]

Examiner Only	
Marks	Remark

(b) The graph below shows how the SAR is affected by the distance of the phone from the head.



(i) Describe fully the trend shown by the graph.

_____

_____

_____ [2]

(ii) Apart from increasing the distance of a mobile phone from the head suggest **two** ways mobile phone users can reduce their exposure to microwave radiation.

1. _____

2. _____ [2]

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Examiner Only	
Marks	Remark

7 **(a)** Describe, in detail, an investigation to find how the thickness of a wire affects its resistance. State the conclusion you would expect.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ [6]

(b) **(i)** Describe how a variable resistor changes the current in a circuit.

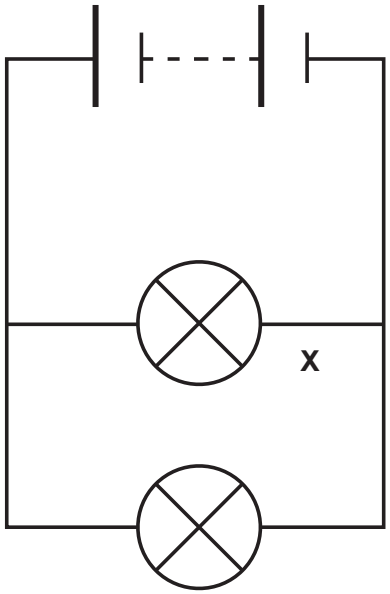
_____

_____ [1]

(ii) Give an example of where a variable resistor is used.

_____ [1]

(c) On the circuit below, draw an arrow to show the direction of electron flow at position **X**.



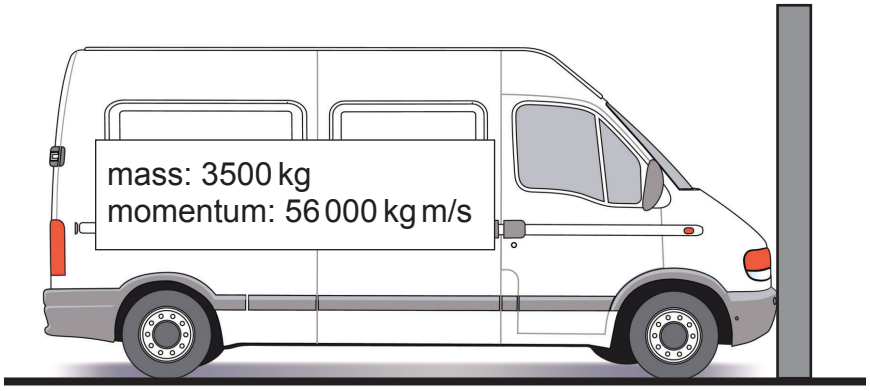
[1]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

8 **(a)** The diagram below gives the mass and momentum of a van as it hits a wall.



© Kamaga / iStock / Thinkstock

Use the equation:

momentum = mass × velocity

to calculate the velocity of the van at impact.
(Show your working out.)

Answer _____ m/s [2]

(b) When the van collides with the wall some of the energy is absorbed. Give **one** feature of the van designed to absorb this energy.

_____ [1]

(c) Car manufacturers are trying to minimise the reliance on fossil fuels by using substitutes and extenders. Explain fully the difference between substitutes and extenders.

_____

_____

_____

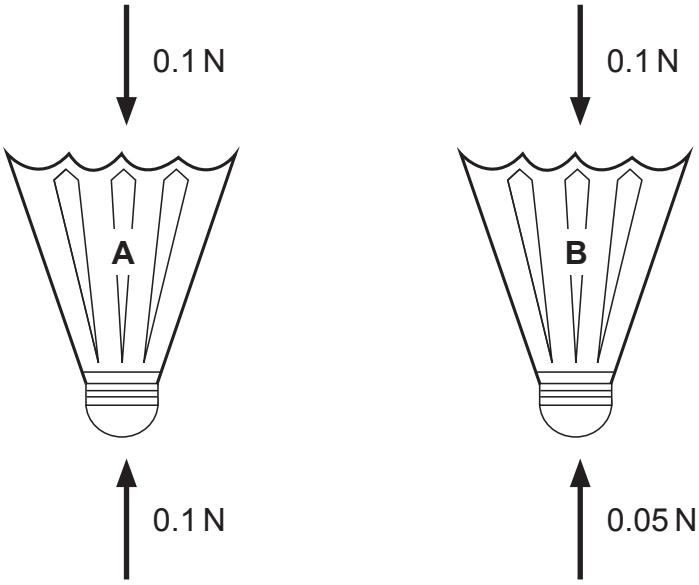
_____ [2]

(d) Give an example of a fuel substitute and a fuel extender.

Substitute _____

Extender _____ [2]

(e) The diagrams below show two shuttlecocks (**A** and **B**) falling.



(i) Describe and explain the motion of shuttlecock **B**.

_____

_____

_____ [2]

(ii) What is the value of the resultant force on shuttlecock **A**?

Answer _____ N [1]

Examiner Only

Marks	Remark

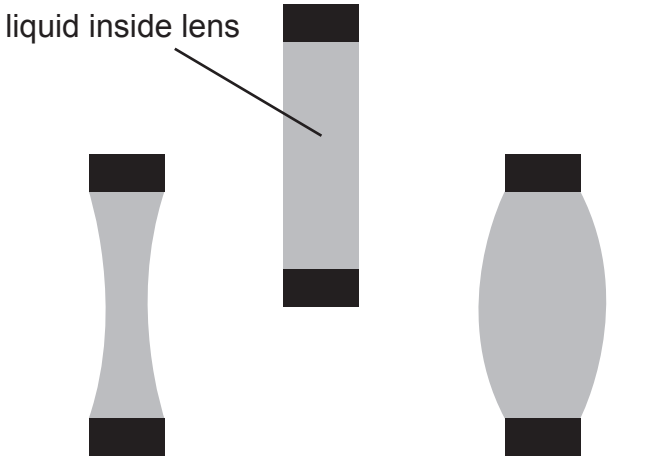
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Examiner Only	
Marks	Remark

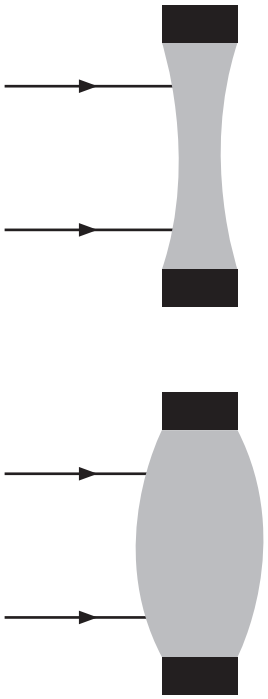
9 The first self-adjustable glasses were invented by Professor Josh Silver. He used liquid-filled lenses that could change shape as shown below.



© The Centre for Vision in the Developing World



(a) Complete the diagram below to show how the rays of light pass through these lenses.



[2]

(b) Long sight is caused by a weak lens which does not converge the light enough.
Describe the effect of long sight and suggest how these self-adjustable glasses can provide the greater convergence required.

_____

_____

_____

_____

_____ [3]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

10 (a) (i) What name is given to the present model of the Solar System?

_____ [1]

(ii) What is the main difference between this model of the Solar System and the model proposed hundreds of years ago?

_____

_____ [1]

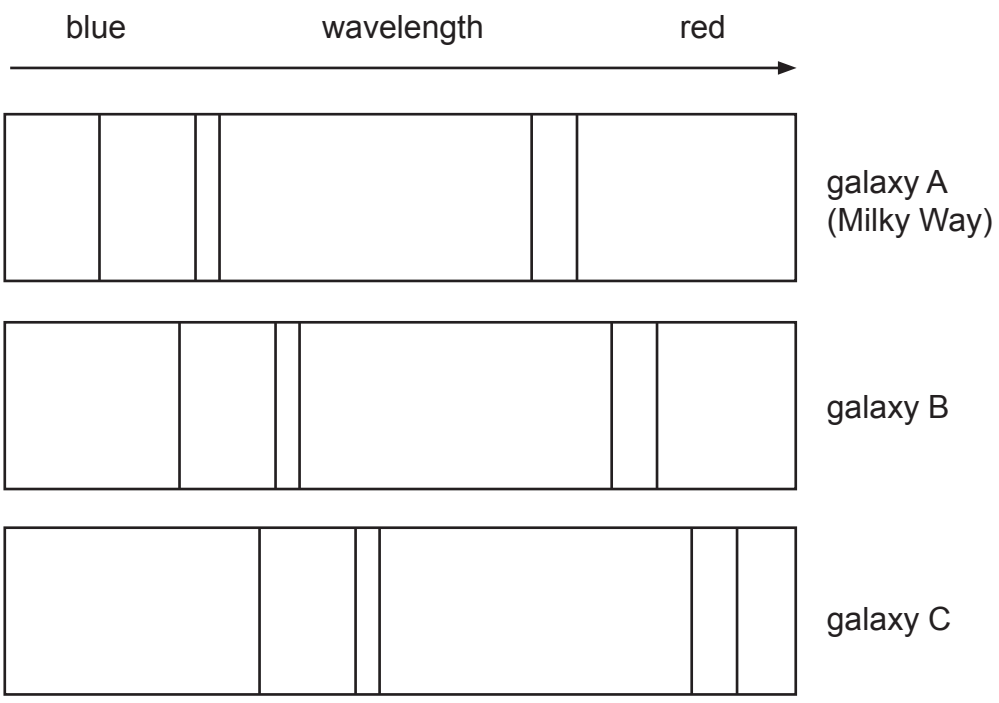
(b) Based on the Big Bang Theory how old is the Universe thought to be?

_____ [1]

(c) Give an alternative scientific theory to the Big Bang.

_____ [1]

(d) When astronomers look at light from galaxies they see the following black lines in their spectrum.



Describe fully what this information suggests to astronomers about galaxy C compared to galaxy B.

_____

_____ [2]

11 The table below gives information about electromagnetic radiation.

Radiation	Wavelength range/m
radio waves	1×10^{6} to 1×10^{-1}
microwaves	1×10^{-1} to 1×10^{-3}
infrared	1×10^{-3} to 7×10^{-7}
visible	7×10^{-7} to 4×10^{-7}
ultraviolet	4×10^{-7} to 1×10^{-8}
X-rays	1×10^{-8} to 1×10^{-13}
gamma rays	1×10^{-10} to 1×10^{-16}

(a) Which radiation has the smallest **range** of wavelengths?

_____ [1]

(b) Name the radiation which is most damaging to the body. Explain your choice fully.

_____

_____

_____

_____ [3]

THIS IS THE END OF THE QUESTION PAPER

Examiner Only

Marks	Remark

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113287

Rewarding Learning

General Certificate of Secondary Education
2013–2014

Science: Single Award

Unit 3 (Physics)

Higher Tier

[GSS32]

WEDNESDAY 26 FEBRUARY 2014, MORNING

MARK SCHEME

STEMUP.CO.UK

General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

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		AVAILABLE MARKS
1	**(i)** The longer the flight the greater the dose [1]	
	(ii) Cosmic [1]	
	(iii) $\frac{2000}{50}$ [1]	
	40 ÷ 2 = 20 [1] [2]	
	(iv) Damage cell [1] cause cancer [1] [2]	6
2	**(a)** **(i)** All points correctly plotted [2] (4 points correctly plotted [1]) curve of best fit [1] [3]	
	(ii) 3 days [1]	
	(b) $\frac{1}{4}$ [1]	5
3	Indicative content • clouds • hydrogen • pulled together • by gravity • helium formed • nuclear fusion [6]	

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe and explain fully (using **five or six** of the above points) star formation in a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates use some appropriate specialist terms to describe and explain star formation (using **three or four** of the above points) in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates describe/explain star formation using **one or two** of the above points. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Response not worthy of credit.	[0]

6

					AVAILABLE MARKS
4	**(a)**	**(i)**	Lower output power [1] Less life expectancy [1] Higher generating costs [1]	[3]	
		(ii)	Reduce the use of fossil fuels [1] Renewable **or** do not cause reduction in air quality **or** do not contribute to Greenhouse effect [1]	[2]	
	(b)		Millions of years [1] high pressure/compression [1]	[2]	
	(c)		C	[1]	8
5	**(a)**	**(i)**	0.2 m	[1]	
		(ii)	0.1 m	[1]	
	(b)		Particles vibrate [1] at right angles to direction of wave movement [1]	[2]	
	(c)	**(i)**	1500×6 [1] 1500×3 [1] 4500 m [1]	[3]	
		(ii)	echo returns quicker	[1]	
	(d)		$\frac{1500}{30000}$ [1] 0.05m [1]	[2]	10
6	**(a)**		Skull thinner [1] microwaves penetrate further [1]	[2]	
	(b)	**(i)**	Further away less SAR [1] Bigger affect at less 1.4 [1]	[2]	
		(ii)	Any **two** from: • less time on phone • ear phones • texting • instant message via wifi (app) • loudspeaker	[2]	6

AVAILABLE MARKS

7 **(a)** Indicative content

- ammeter in series
- voltmeter in parallel
- across the wire
- change thickness
- same type of wire
- keep wire same length
- resistance = voltage/current
- thicker the wire the lower the resistance [6]

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe and explain fully (using **six or more** of the above points) the experiment in a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates use some appropriate specialist terms to describe and explain the experiment (using **four or five** of the above points) in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates describe/explain the experiment using **one** to **three** of the above points. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Response not worthy of credit.	[0]

(b) **(i)** Increase the length (resistance) of wire decreases current [1]

(ii) volume knob/dimmer switch on light [1]

(c) ← [1] 9

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				AVAILABLE MARKS
8	**(a)**	56 000/3500 [1] 16 [1]	[2]	
	(b)	crumple zone/air bag	[1]	
	(c)	Substitutes are used instead of fossil fuels [1] extenders are added to fossil fuels [1]	[2]	
	(d)	Substitute, any one from • biodiesel • hydrogen [1]		
		Extender – alcohol [1]	[2]	
	(e)	**(i)** Accelerating [1] unbalanced force [1]	[2]	
		(ii) 0 N	[1]	10
9	**(a)**	each lens 1 mark [1] passage of ray through air [1]	[2]	
	(b)	close objects are not clear [1] liquid pumped into lens [1] forming convex lens [1]	[3]	5
10	**(a)**	**(i)** heliocentric	[1]	
		(ii) Sun is at the centre	[1]	
	(b)	13.5–14 billion years	[1]	
	(c)	Steady State Theory	[1]	
	(d)	moving faster [1] further away [1]	[2]	6
11	**(a)**	visible	[1]	
	(b)	gamma ray [1] highest frequency [1] have more energy [1]	[3]	4
			Total	**75**

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Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2013–2014

Science: Single Award

Unit 3 (Physics)

Higher Tier

[GSS32]

GSS32

FRIDAY 15 NOVEMBER 2013, AFTERNOON

TIME

1 hour 15 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 nine** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in questions **4** and **8(a)**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total Marks	

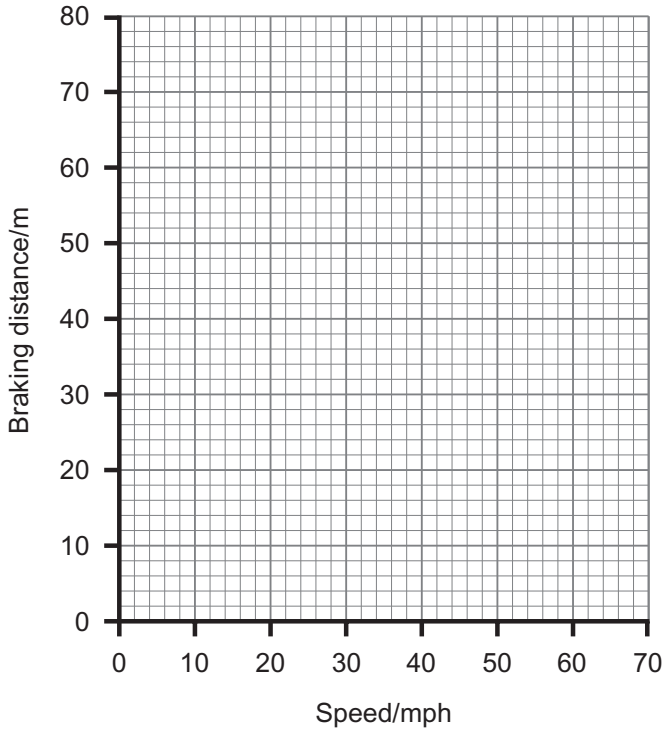
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Examiner Only	
Marks	Remark

1 **(a)** The table below shows the braking distance for a car at different speeds.

Speed/mph	Braking distance/m
0	0
20	6
30	14
50	38
70	75

(i) Plot and draw a line graph for these results.



[3]

(ii) State the trend shown by these results.

_____

_____ [1]

(iii) These results are for a dry road. On the same grid above, sketch the line you would expect if the road was wet. [1]

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(b) The table shows the increased risk that drivers will crash as their Blood Alcohol Content (BAC) rises.

BAC/ mg/100 ml	Increased risk of having a crash
40	1.4
80	3.8
120	14.7
160	32.2

The legal limit for a driver's BAC is 80 mg/100 ml. Using the information and your knowledge, describe and explain fully the effect that alcohol has on driving and why many road safety campaigners suggest that the current limit is too high.

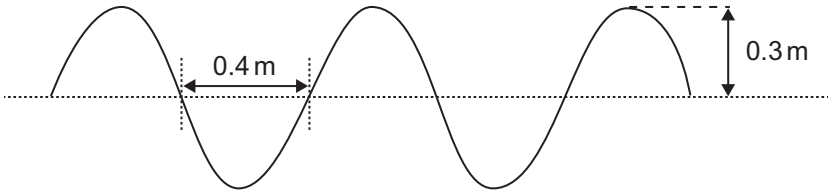
[3]

Examiner Only

Marks	Remark

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2 The diagram below represents a sound wave.



(a) What is the wavelength of this sound wave?

Answer _____ m [1]

(b) **(i)** Use the equation:

speed = wavelength × frequency

to describe how wavelength changes as frequency increases.

(Assume speed remains the same.)

_____ [1]

(ii) State the units of frequency.

Answer _____ [1]

Examiner Only	
Marks	Remark

(c) The device below is used to measure distance.



© Victor De Schwanberg / Science Photo Library

To find the length of a hall the device measures the time taken for an ultrasound wave to travel to a wall and back.

(i) Describe fully why we cannot hear the sound produced by this measuring device.

_____

_____

_____ [2]

(ii) A signal takes 0.4 s to travel from one wall of a hall to the opposite wall and back. The speed of sound in air is 330 m/s.

Use the equation:

distance = speed × time

to calculate the length of the hall.

(Show your working out.)

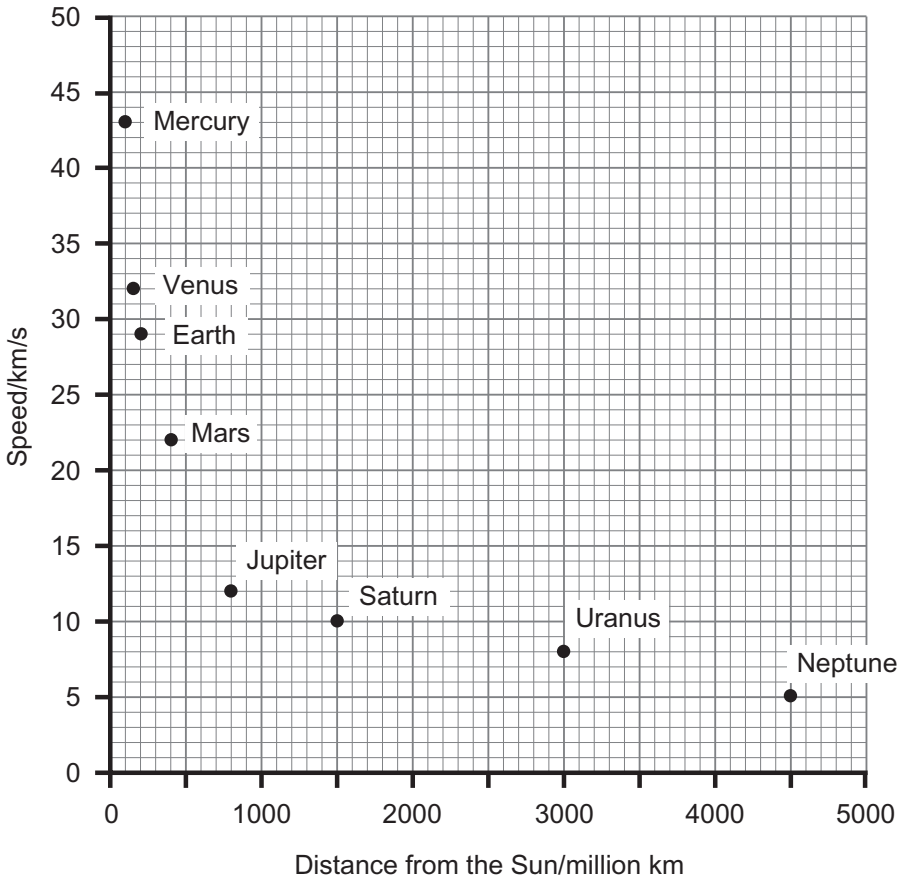
Answer _____ m [3]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

3 **(a)** The graph below shows how the (orbital) speed of a planet relates to its approximate distance from the Sun.



(i) Use the graph to find how far Venus is from the Sun.

Answer _____ million km [1]

(ii) Using information from the graph, compare the speed and distance from the Sun of Mercury and Neptune.

_____

_____

_____

_____ [3]

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(b) This information describes the Heliocentric model of the Solar System.

Give **two** differences between this model and the Geocentric model.

1. _____

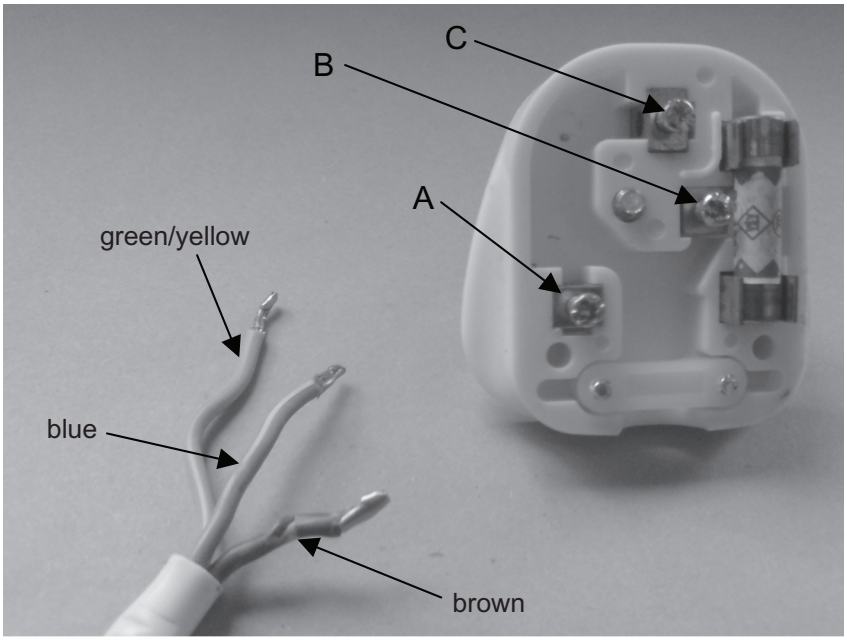
2. _____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

4 The picture below shows a 3-pin plug about to be wired.

The colours of each wire and the plug pins are labelled.



Source: Principal Examiner

Describe fully how the plug should be wired correctly, naming and explaining one safety feature found in the plug.

Your answer should:

- use the labels provided
- name the labelled parts.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

Examiner Only	
Marks	Remark

[6]

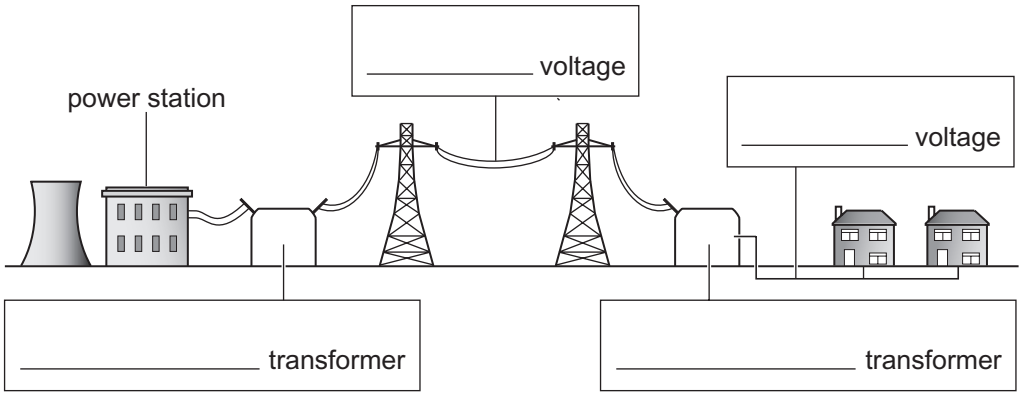
Examiner Only	
Marks	Remark

5 **(a)** The diagram below shows how electricity is distributed from the power station to our homes.

(i) What name is given to the network of cables and pylons that distributes electricity?

_____ [1]

(ii) In the correct boxes on the diagram below, name the transformer types and label the voltages as low or high. [2]



(iii) Explain fully why the voltage is changed before electricity is distributed from the power station.

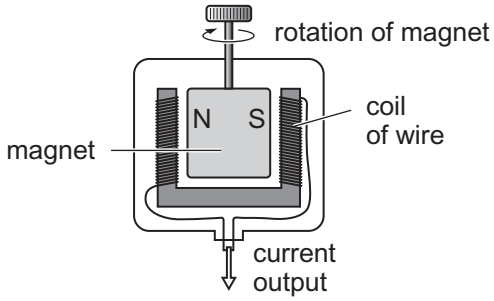
_____

_____

_____ [2]

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(b) The diagram below shows a dynamo. When the magnet is turned inside the coil, electricity is produced.



Name the part of a power station that produces electricity in the same way as the dynamo.

_____ [1]

(c) The table below shows how the amount of current produced by the dynamo changes with magnet speed.

Magnet speed/ r.p.m.	Current produced/ mA
0	0
20	2.2
30	2.9
40	4.4
50	5.0
60	5.0
70	5.0

(i) State fully the trend shown by these results.

_____

_____

_____ [2]

(ii) Apart from magnet speed, name one other factor that will change the amount of current produced by the dynamo.

_____ [1]

Examiner Only	
Marks	Remark

6 Below are three electrical appliances that can heat water.



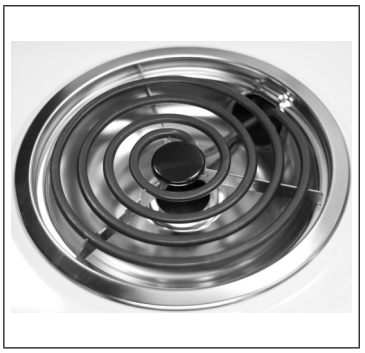
Kettle

© Mile Atanasov / iStock / Thinkstock



Microwave oven

© Mile Atanasov / iStock / Thinkstock



Cooker ring

© Feng Yu / iStock / Thinkstock

(a) Explain fully how a microwave oven heats water.

_____

_____

_____ [2]

(b) Adrian carries out an investigation to find the best way to boil water for tea. His results are shown in the table below.

	Electric Kettle	**Microwave oven**	**Electric cooker ring**
Average time to boil/mins	3.05	2.95	6.0
Power of appliance/W	850	1350	2500
Electrical energy used/kWhr	0.043	0.066	

(i) State **two** things that must be done to make the investigation fair.

1. _____

_____

2. _____

_____ [2]

(ii) Use the equation:

energy used = power × time

to calculate the electrical energy used by the electric cooker ring.

(Show your working out.)

Answer _____ kWhr [3]

(iii) Adrian wants to make the cup of tea quickly and cheaply. Explain fully why he decides to use the electric kettle.

_____

_____

_____

_____ [3]

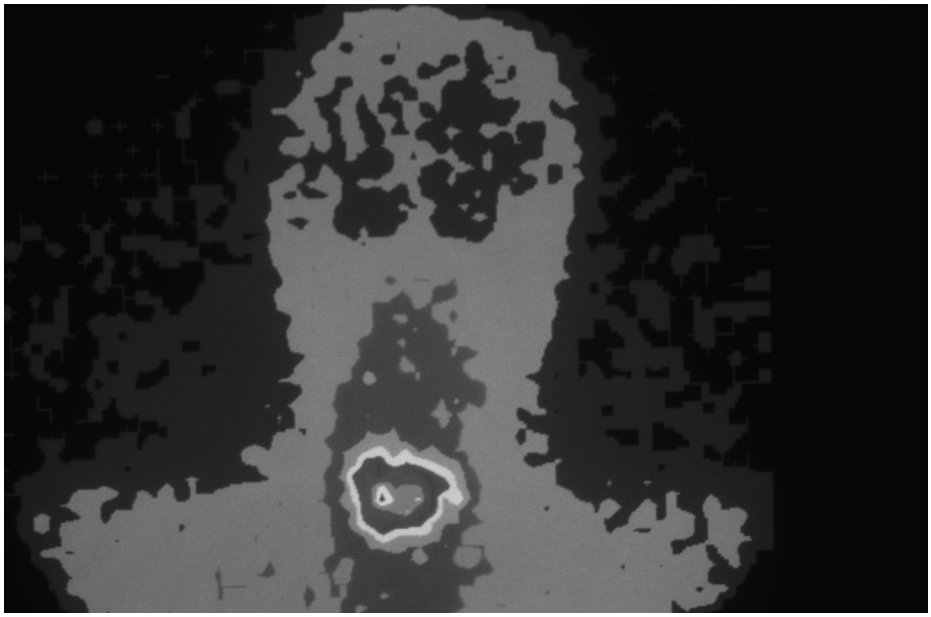
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

7 **(a)** Radioactive sources can be used to trace problems inside the human body. The source is put into the body and the radiation emitted is detected outside the body. This produces images as shown in the picture below.



© Prof. J. Leveille / Science Photo Library

The table below gives information on four radioactive sources.

Source	Half-life	Radiation emitted
A	4 days	alpha
B	6 hours	gamma
C	10 years	beta
D	10 years	gamma

Which source would be the most suitable to use? Explain fully your answer.

_____

_____

_____

_____

_____ [3]

Examiner Only	
Marks	Remark

(b) The table below shows how the count rate of a radioactive source changes with time.

Time/mins	0	10	20	30	40
Count rate/cpm		1024	512	256	128

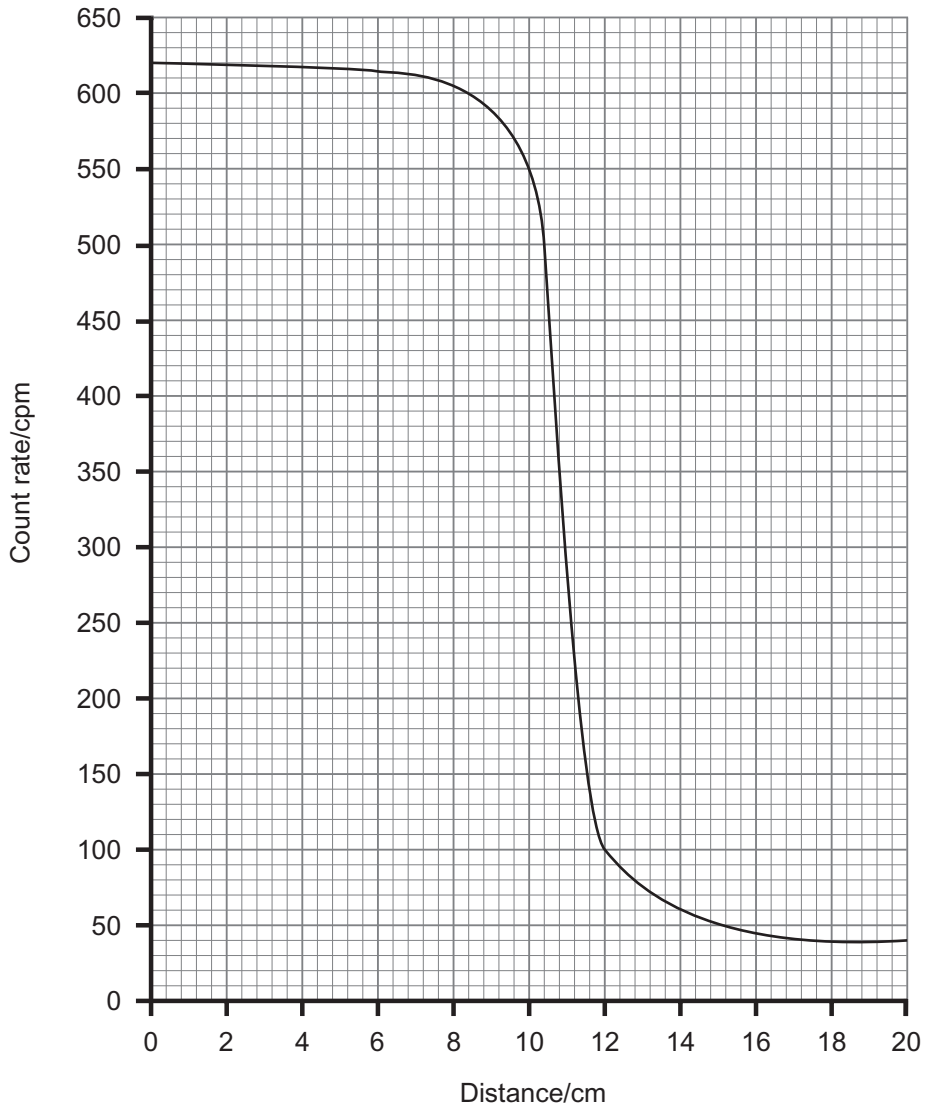
(i) What is the half-life of this source?

Answer _____ mins [1]

(ii) Calculate the count rate at 0 minutes.

Answer _____ cpm [1]

(c) The graph below shows the results of an experiment to find the range of a type of radiation in air.



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(i) What is the count rate when the detector is 6 cm from the source?

Answer _____ cpm [1]

(ii) Name the type of radiation being tested in this experiment.
Explain your answer fully by referring to all types of radiation.

_____

_____

_____

_____ [3]

(iii) Explain why the count rate does not fall to zero.

_____ [1]

Examiner Only

Marks	Remark

8 The table below gives efficiency figures in miles per gallon (mpg) for some cars on different road types.

Model	Motorway/ mpg	Town/ mpg	Combined/ mpg
VW Jetta TDi	42	30	34
Smart For Two	41	33	36
Ford Fiesta	40	29	33
Hyundai Elantra	40	29	33
Toyota Prius Hybrid	48	51	50
Honda Civic Hybrid	43	40	41
Lexus CT200 Hybrid	40	43	42
Honda Insight Hybrid	43	40	41

(Data taken from a range of comparative websites.)

(a) Using the information in the table and your knowledge, explain how hybrid engines can help reduce our reliance on fossil fuels. Your answer should include a full description of what fossil fuels are and why it is important to reduce their use.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

Examiner Only

Marks	Remark

(b) Apart from hybrid engines, give **two** other strategies developed by car manufacturers to reduce reliance on fossil fuels for transport.

1. _____

2. _____ [2]

(c) The Toyota Prius gives the most miles per gallon.

Using the equation:

$$\textbf{efficiency} = \frac{\textbf{useful energy output}}{\textbf{total energy input}}$$

explain fully why the Toyota Prius is the most efficient car shown in the table.

_____

_____

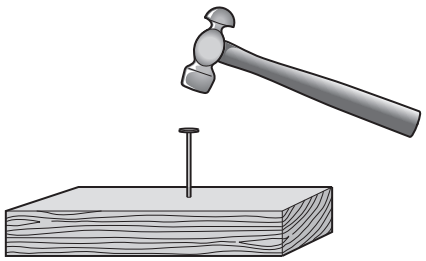
_____ [2]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

9 The diagram below shows a hammer striking a nail into a block of wood.



The mass of the hammer is 1.2 kg and the nail is 200 g. The velocity of the hammer just before it hits the nail is 14 m/s.

(a) (i) Use the equation:

momentum = mass × velocity

to calculate the momentum of the hammer just before it hits the nail.

(Show your working out.)

Answer _____ [2]

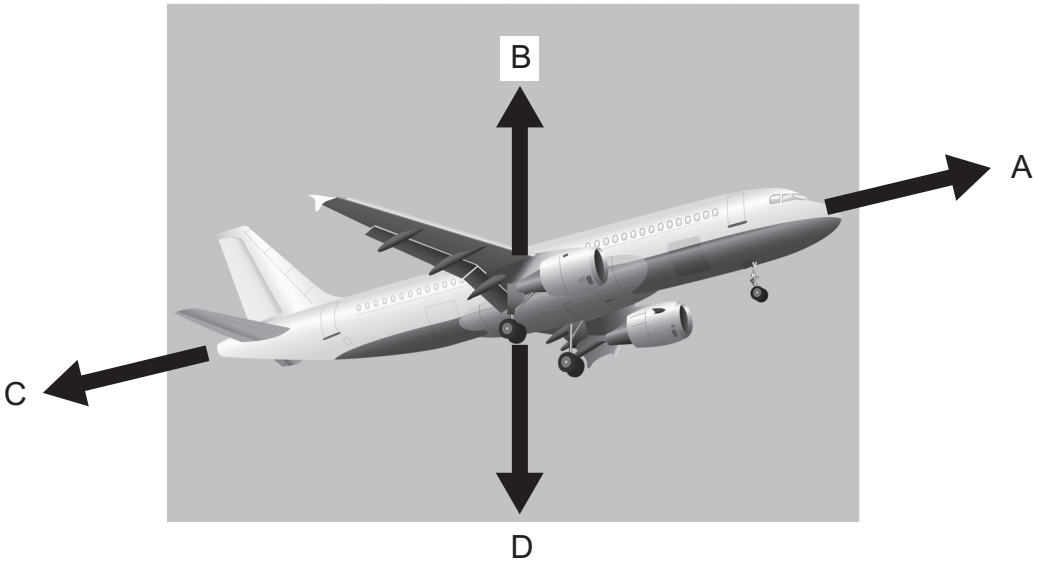
(ii) State the units of momentum.

Answer _____ [1]

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Examiner Only	
Marks	Remark

(b) The picture below shows an aeroplane accelerating during take off.



© Maksym Dragunov / iStock / Thinkstock

(i) Explain fully, the movement of the plane in terms of the forces shown.

_____

_____

_____

_____ [3]

(ii) When cruising the plane flies at a constant speed and height. State the relationship between the forces (**A**, **B**, **C** and **D**) when cruising.

_____

_____

_____ [2]

THIS IS THE END OF THE QUESTION PAPER

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Oven hob_99013282_Hemera_Thinkstock.com
Passenger plane_95714676_iStockphoto_Thinkstock.com

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113975

Rewarding Learning

General Certificate of Secondary Education
2013–2014

Science: Single Award

Unit 3 (Physics)

Higher Tier

[GSS32]

FRIDAY 15 NOVEMBER 2013, AFTERNOON

MARK SCHEME

STEMUP.CO.UK

General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

					AVAILABLE MARKS
1	**(a)**	**(i)**	5 points correct = 2 marks 4/3 points = 1 mark correct line = 1 mark	[3]	
		(ii)	As speed increases, braking distance increases	[1]	
		(iii)	Line starting from 0,0 and with greater gradient	[1]	
	(b)		More alcohol increases risk of crashing [1] as it slows reactions/increasing thinking distance [1] legal levels of alcohol still increased risk [1]	[3]	8
2	**(a)**		0.8	[1]	
	(b)	**(i)**	Wavelength decreases	[1]	
		(ii)	Hertz/Hz	[1]	
	(c)	**(i)**	Frequency [1] too high for humans to hear/above 20 kHz [1]	[2]	
		(ii)	330 × 0.4 [1] 330 × 0.2 [2] 66 m [3]	[3]	8
3	**(a)**	**(i)**	150 million km	[1]	
		(ii)	**Any 3 from** ● Neptune further ● By 4400 million km ● Mercury is faster ● By 38 km/s	[3]	
	(b)		Geocentric has earth in middle/Heliocentric has sun at centre [1] Heliocentric has more planets [1]	[2]	6

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4 Indicative content

- blue wire connects to pin A
- brown wire connects to pin B
- green/yellow wire connects to pin C
- name blue wire/pin A as neutral
- name brown wire/pin B as live
- name green/yellow wire or pin C as earth
- naming 1 other safety feature from:
  Cable grip/plastic cover/fuse
- correct explanation of safety feature

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe fully, in a logical sequence how to wire a 3-pin plug safely including another safety feature (using at least **seven** of the above points). They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5–6]
B	Candidates use some appropriate specialist terms to partially describe, in a logical sequence, how to wire a 3-pin plug safely including another safety feature (using **four to six** of the above points). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3–4]
C	Candidates describe how to wire a 3-pin plug safely including another safety feature (using **one to three** of the above points). However these are not in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1–2]
D	Response not worthy of credit	[0]

[6] 6

AVAILABLE MARKS

					AVAILABLE MARKS
5	**(a)**	**(i)**	Electrical/National/power grid	[1]	
		(ii)	High + low voltage marked correctly [1] Step up + step down transformer marked correctly [1]	[2]	
		(iii)	High voltage = less current [1] less heat/energy loss/thinner wire [1]	[2]	
	(b)		Generator	[1]	
	(c)	**(i)**	As speed increases, so does current [1] up to a maximum 5 mA [1]	[2]	
		(ii)	Strength of magnet/number of coils	[1]	9
6	**(a)**		Microwaves absorbed by molecules [1] molecules vibrate faster [1]	[2]	
	(b)	**(i)**	Same amount of water [1] same starting temperature [1]	[2]	
		(ii)	6/60 converting minutes to hours [1] 2500/1000 converting watts to kilowatts [1] 2.5×0.1 [2] 0.25 [3]	[3]	
		(iii)	Less energy/less power [1] Less cost [1] Not significantly slower [1]	[3]	10

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				AVAILABLE MARKS
7	**(a)**	B [1] Gamma penetrates skin [1] (Short half life means) radiation is inside body less time [1]	[3]	
	(b)	**(i)** 10 mins	[1]	
		(ii) 2048	[1]	
	(c)	**(i)** 615 ± 2	[1]	
		(ii) Alpha [1] Stops within 10–14 cm/short distance [1] Beta/Gamma would travel much further [1]	[3]	
		(iii) Background radiation	[1]	10

AVAILABLE MARKS

8 (a) Indicative content

- coal/oil/gas named as fossil fuel
- petrol/diesel made from oil/fossil fuels
- remains of plants and animals
- made millions of years ago/compression
- fossil fuels are running out/non-renewable/finite resource
- hybrid engines powered by electricity/batteries + petrol/diesel
- more mpg from hybrid engines
- less fossil fuels used, longer they will last

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe fully, in a logical sequence, fossil fuels, hybrid engines and how a hybrid car can help reduce our reliance on fossil fuels (using **seven or eight** of the above points). They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5–6]
B	Candidates use some appropriate specialist terms to partially describe, in a logical sequence, fossil fuels, hybrid engines and how a hybrid car can help reduce our reliance on fossil fuels (using at least **four to six** of the above points). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3–4]
C	Candidates describe fossil fuels, hybrid engines and how a hybrid car can help reduce our reliance on fossil fuels (using **one to three** of the above points). However these are not in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1–2]
D	Response not worthy of credit	[0]

[6]

(b) Any 2 from

- biodiesel
- hydrogen fuel cells
- methanol/gasohol
- alcohol extenders
- regenerative braking systems
- stop-start technology
- other appropriate response [2]

(c) Same amount of energy in [1]
Prius gives more useful energy out/more movement energy [1] [2]

10

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					AVAILABLE MARKS
9	**(a)**	**(i)**	1.2×14 [1] 16.8 [2]	[2]	
		(ii)	kgm/s or Ns	[1]	
	(b)	**(i)**	**Any 3 from** ● force A is greater than C/A and C are unbalanced ● producing a resultant forward force ● force B is greater than D/B and D are unbalanced ● producing a resultant upward force/causing lift	[3]	
		(ii)	A = C [1] B = D [1]	[2]	8
				Total	**75**

Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2012–2013

Science: Single Award

Unit 3 (Physics)

Higher Tier

[GSS32]

GSS32

THURSDAY 23 MAY 2013, MORNING

TIME

1 hour 15 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 ten** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in questions **5** and **10(a)**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total Marks	

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1 The table below shows how the percentage of children wearing seat belts in a car has changed from 1995 to 2012.

	Year				
Age group	**1995**	**2000**	**2005**	**2010**	**2012**
Under 1 year	96	97	98	98	100
1–4	65	82	92	96	97
5–9	49	68	82	94	94
10–13	47	65	82	93	95
All children	**59**	**74**	**86**	**93**	**96**

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(a) State **two** trends that can be seen in this data.

1. _____

_____

2. _____

_____ [2]

(b) The government are still advertising the need for children to wear seat belts. Use the information in the table to suggest why this is necessary.

_____

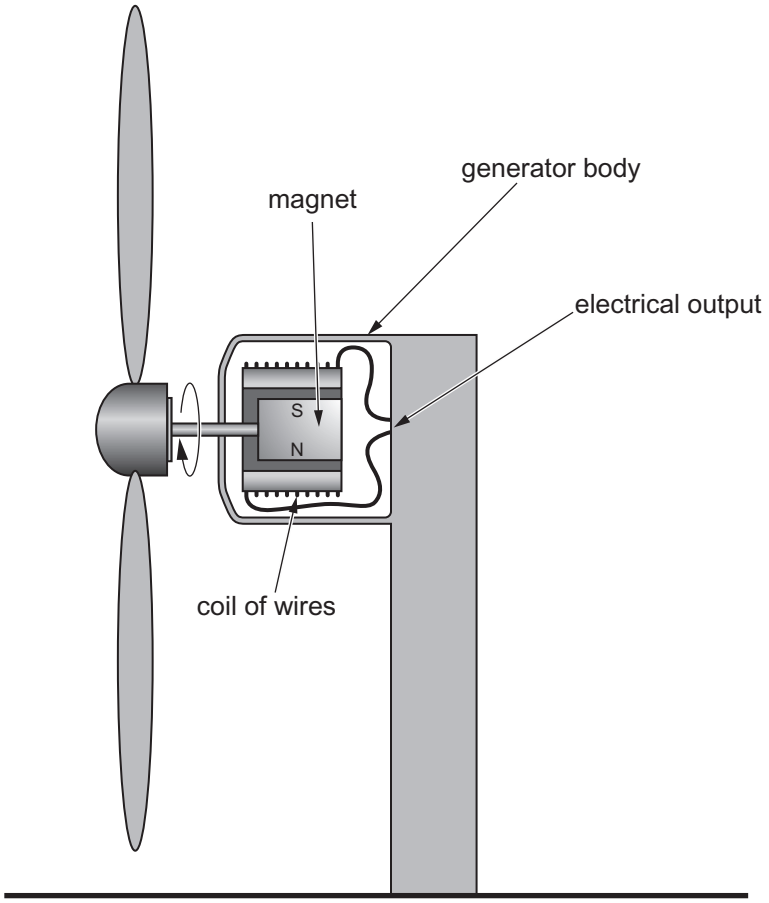
_____ [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

2 The diagram below shows a cross-section through a wind turbine. When the blade spins a current is produced.



© CCEA GCSE Single Award in Science Foundation Tier by A McFarland, C Murphy & J Napier, published by Hodder Education 2009

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

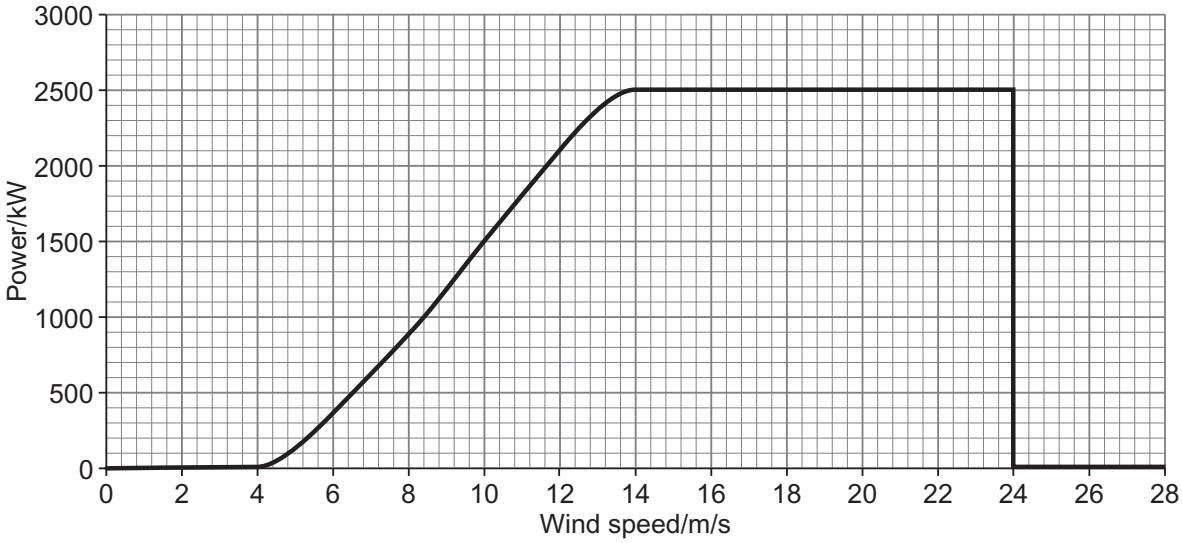
1. a weaker magnet is used.

_____

2. more coils of wire are used.

_____ [2]

(b) The graph below shows how the wind speed affects the amount of power produced.



(i) Describe fully how the power produced by the turbine changes with wind speed.

_____

_____

_____

_____ [3]

(ii) Suggest why the turbine is designed to stop at high wind speeds.

_____

_____ [1]

(c) Explain fully why the government has introduced more wind turbines in the past ten years.

_____

_____

_____ [2]

(d) Suggest **one** reason why some people object to wind turbines near their home.

_____

_____ [1]

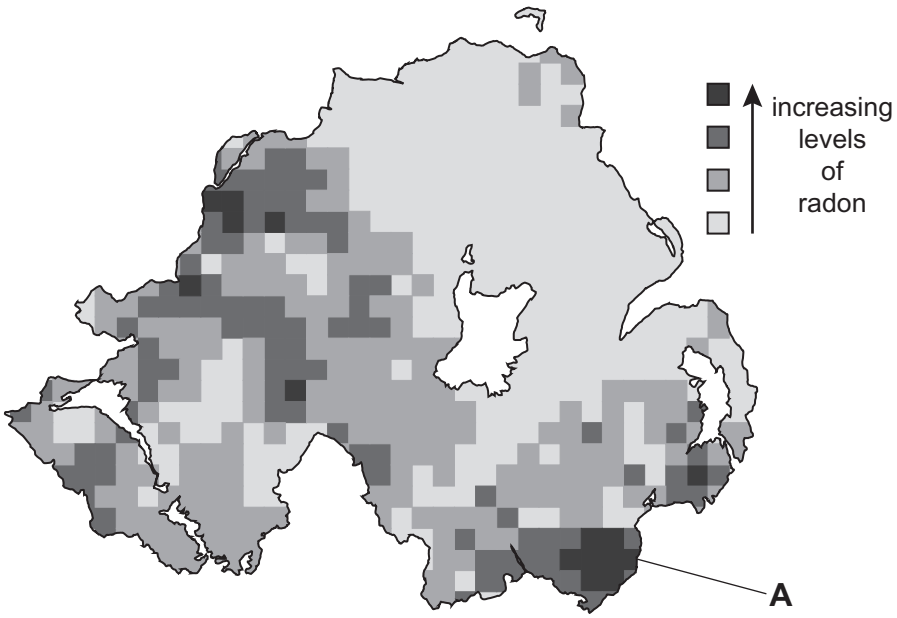
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

3 **(a)** The diagram below shows the amount of radon gas which occurs naturally in Northern Ireland.



© Crown copyright - DEFRA

(i) Radon gas is a source of background radiation. What is meant by the term background radiation?

_____

_____ [1]

(ii) Explain fully why someone living in area **A** could be concerned about their health.

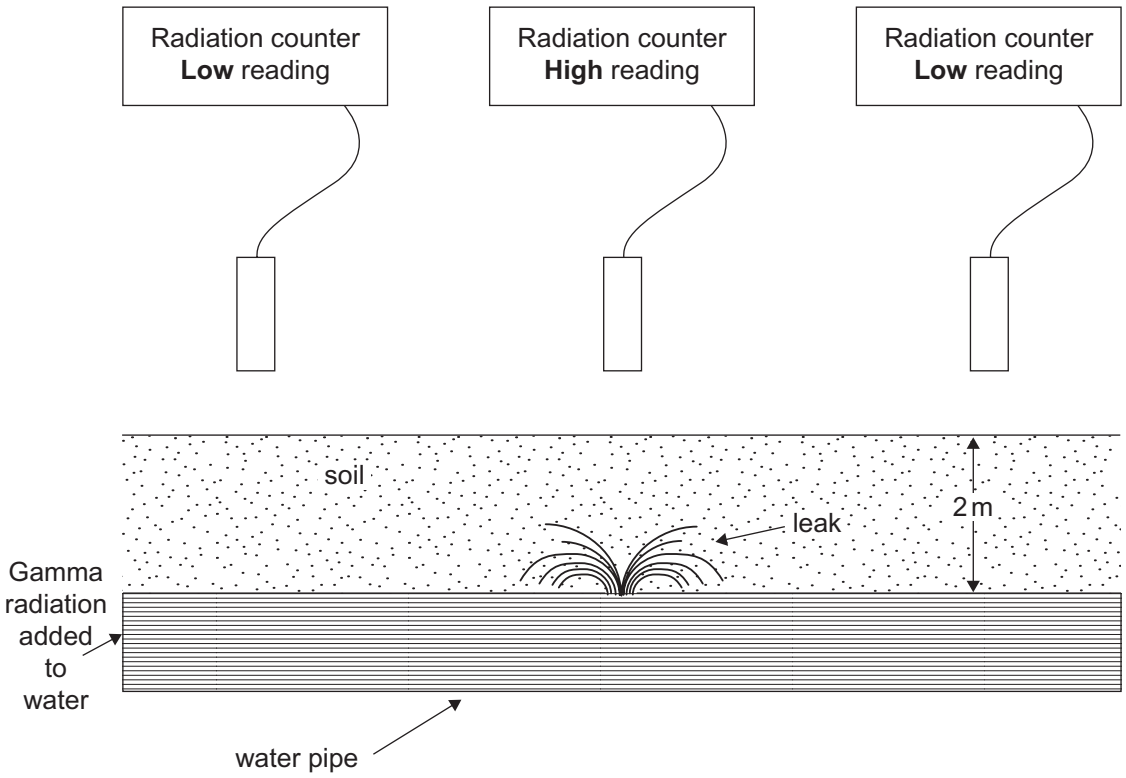
_____

_____

_____ [2]

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(b) Gamma radiation can be used to check for leaks in water pipes.



Explain fully why gamma radiation is the best source to use.

_____

_____

_____

_____

_____ [2]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

4 The information below shows information about three types of bulb. Each bulb produces the **same** light power output.

	Energy saving bulb	Filament bulb	LED spotlight
	 © CCEA	 © CCEA	 © CCEA
Power input/W	11	60	7
Cost to run for 1000 hours	£1.87	£10.20	£1.19
Average life/hours	10 000	1000	20 000
Cost to buy	£3.50	£0.90	£10.00

(a) Which bulb is the most efficient?

_____ [1]

(b) Which bulb, including the cost to buy, would be the cheapest to run for 1000 hours?

_____ [1]

(c) The energy saving bulb uses 11 J of energy per second and has an efficiency of 0.6. What is its light energy output per second?

Use the equation:

light energy output = efficiency × energy input

(Show your working out.)

Answer _____ J [2]

(d) Calculate how much energy this bulb wastes per second.

Answer _____ J [1]

(e) The efficiency of a filament bulb is much less than the efficiency of an energy saving bulb. Explain fully why the government has recommended that the use of filament bulbs should be stopped.

_____

_____ [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

5 Long sight is a common eye defect. Explain fully the **cause**, the **effect** and the **correction** of long sight. Your answer should refer to the parts of the eye involved and the passage of light through the eye.



In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

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(Questions continue overleaf)

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Examiner Only	
Marks	Remark

6 **(a)** The photograph below shows asteroid 243 Ida. It is 56 kilometres in length.



Source: NASA / Galileo Image Library

If an asteroid like the one shown above hit the Earth, describe fully how this could affect life on Earth.

_____

_____

_____

_____

_____

_____ [3]

(b) The table below shows data on the asteroids most likely to hit Earth.

Name of asteroid	Possible impact year	Chance of hitting Earth/%	Impact velocity km/s	Estimated diameter m
2012 TY52	2014–2020	0.0003	14.13	180
2012 QD8	2042–2050	0.0007	20.77	18
2012 TC4	2020–2110	0.0049	6.51	16
2012 SY49	2031–2084	0.0013	15.66	23
2011 AG5	2040–2047	0.2000	9.55	140

(i) Explain fully why scientists are **not** very concerned about impact from the asteroids shown in the table opposite.

_____

_____

_____

_____

_____ [2]

(ii) Name the asteroid that is least likely to hit Earth.

_____ [1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

7 The diagram below shows a microwave oven.



(a) Explain fully how microwave rays heat food.

_____

_____

_____

_____

_____ [3]

(b) Microwaves have a wavelength of 0.15 m and travel at a speed of 3.0×10^8 m/s.

Use the equation:

$$\textbf{frequency} = \frac{\textbf{speed}}{\textbf{wavelength}}$$

to calculate the frequency of these waves.

(Show your working out.)

Answer _____ Hz [2]

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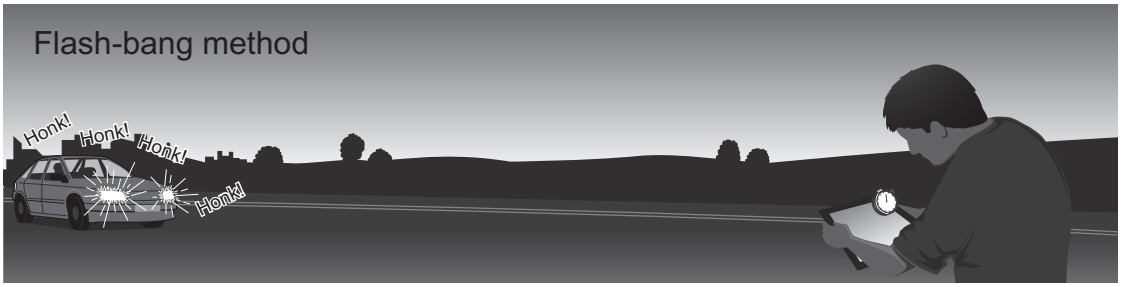
Examiner Only	
Marks	Remark

(c) Microwaves and gamma rays are both types of electromagnetic radiation. Explain fully why gamma rays cause more damage to living cells.

_____

_____ [2]

(d) Shown below are two pupils measuring the speed of sound.



© GCSE Single Award Science for CCEA by Theo Laverty, James Napier & R White published by Hodder Murray, 2006. ISBN 978 0 340 926000. "Reproduced by permission of Hodder Education".

(i) Describe fully how the flash-bang method can be used to measure the speed of sound in air.

_____

_____

_____

_____

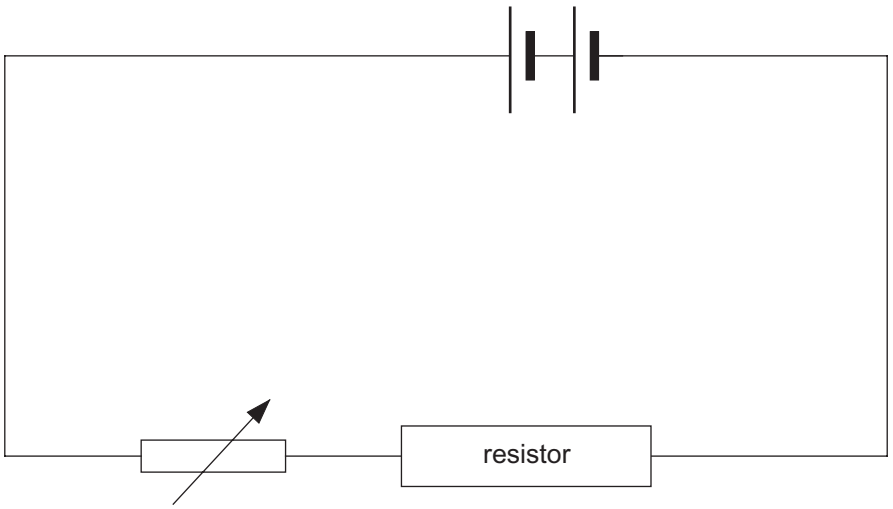
_____ [3]

(ii) The speed of sound in air is 330 m/s. When this experiment was carried out the pupil got a result of 300 m/s. Suggest **one** reason why there is a difference.

_____ [1]

8 Colin set up the circuit below to measure the voltage across a resistor.

Examiner Only	
Marks	Remark



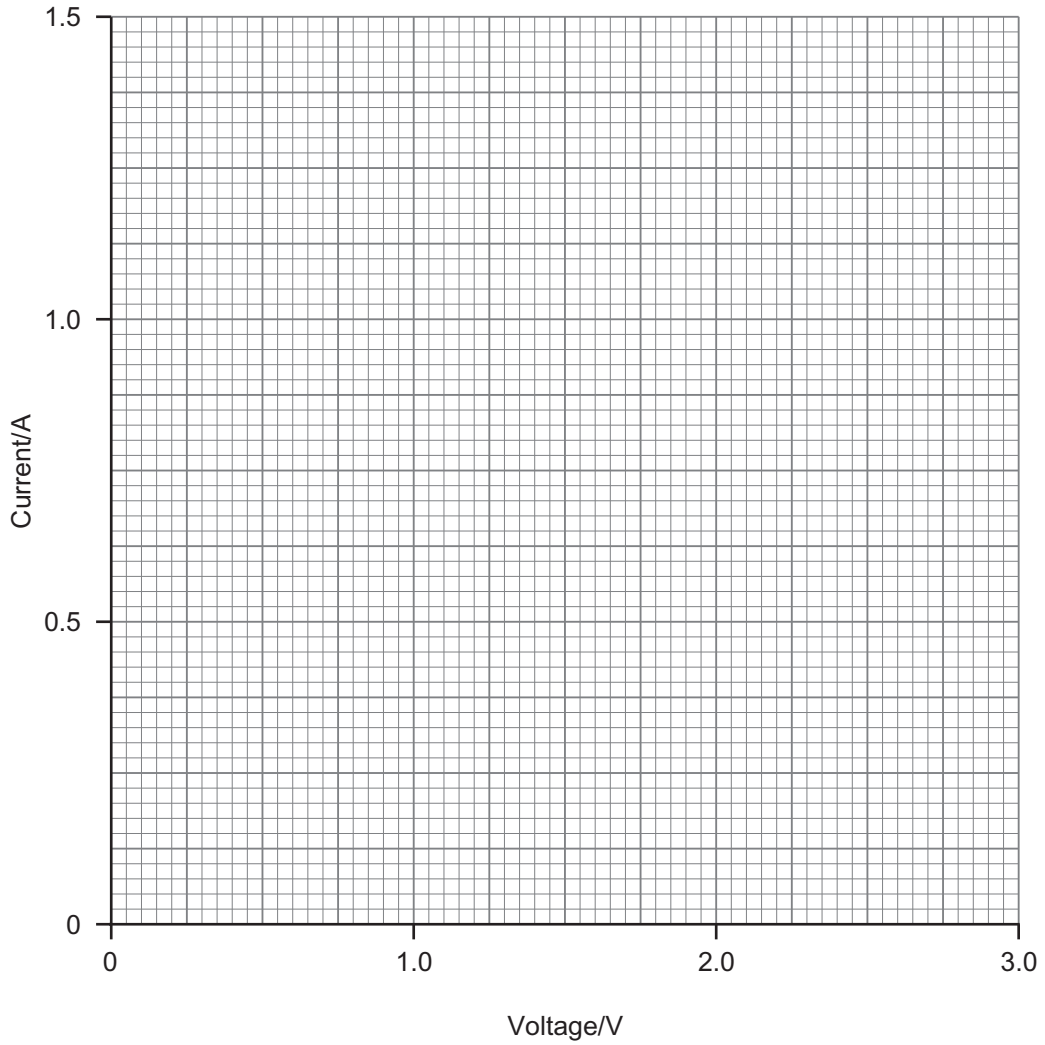
(a) Complete the circuit to show where he would place a voltmeter to measure the voltage across the resistor. [1]

(b) Colin obtained the following results.

Voltage/V	Current/A
0.5	0.2
1.0	0.4
1.5	0.6
3.0	1.25

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(i) On the grid below plot and draw a line graph of these results.



[3]

(ii) What conclusion can be drawn from these results?

_____

_____ [1]

(iii) From the graph what current flows when the voltage is 2.0 V?

Answer _____ A [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

(iv) The resistor was found to have a value of 2.5 ohms.

Use the equation:

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

to calculate the current that flows when the voltage is 4 V.

(Show your working out.)

Answer _____ A [2]

(c) The photograph below shows a step-down transformer that is part of the National Grid system.



© Andrew Lambert Photography / Science Photo Library

Describe fully what changes, if any, the step-down transformer makes to the current and voltage. Explain why transformers are used in the National Grid.

_____

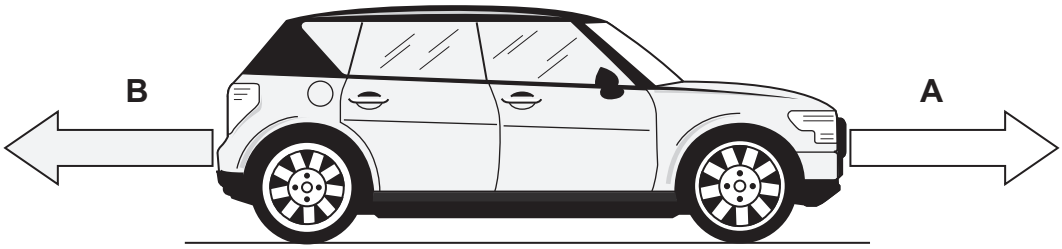
_____

_____

_____ [3]

Examiner Only	
Marks	Remark

9 **(a)** The diagram below shows a car on a straight road. The forces **A** and **B** are equal.



(i) What is the value of the resultant force on the car?

_____ [1]

(ii) What are the **two** possible states of motion of this car?

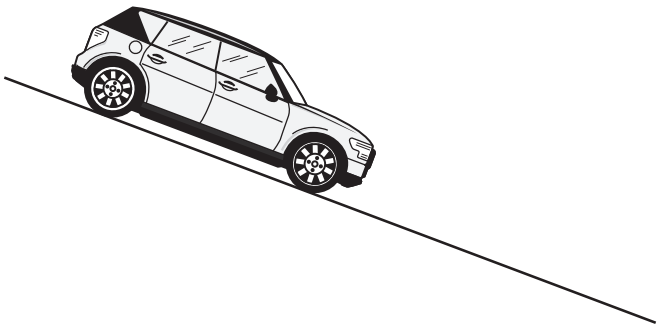
1. _____

2. _____ [2]

(b) Force **A** is now decreased. What effect, if any, will this have on the movement of the car?

_____ [1]

(c) The car below is at rest on a slope.



The handbrake is released and the car begins to accelerate. Explain fully in terms of forces, why it accelerates.

_____

_____

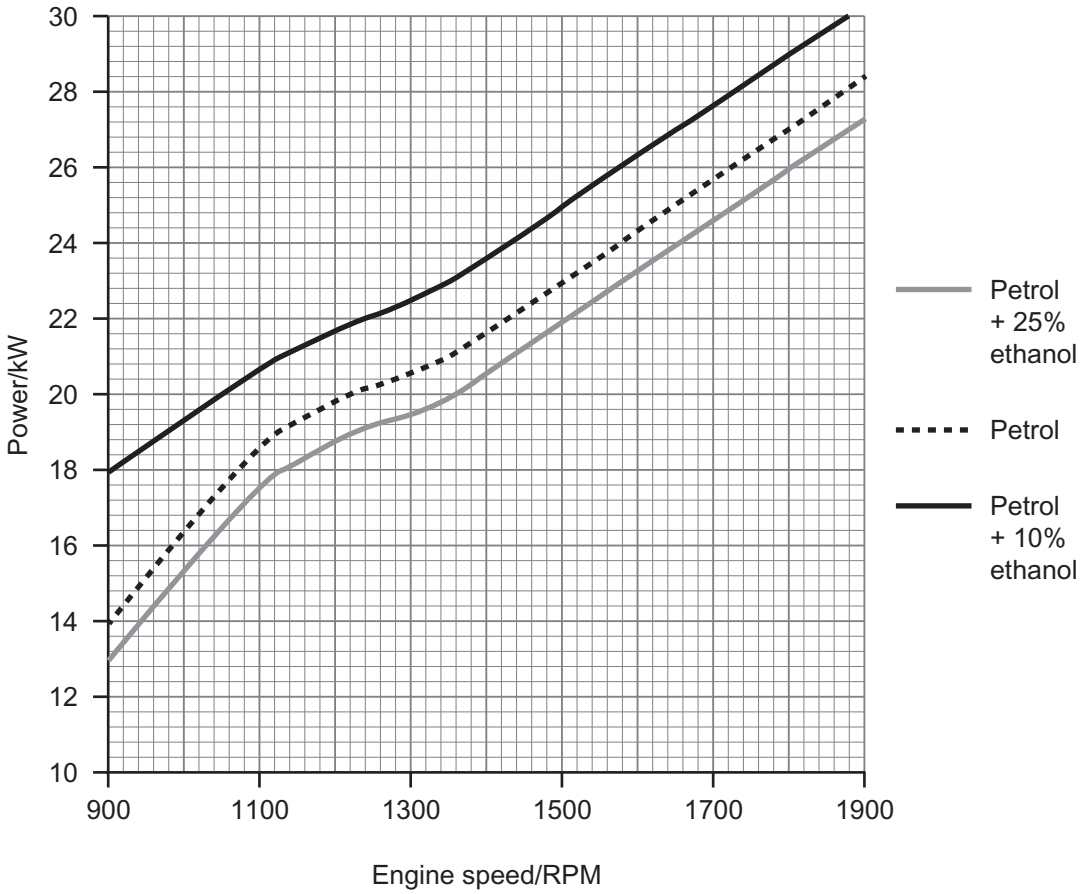
_____

_____

_____ [3]

Examiner Only	
Marks	Remark

(d) The graph below shows how extenders affect the power produced by an engine.



To save fossil fuels, manufacturers are designing cars to use petrol which contains an extender (ethanol). Use the graph to fully describe the effect of the extenders.

_____

_____

_____ [2]

(e) Name **one** substitute fuel that can be used instead of fossil fuels.

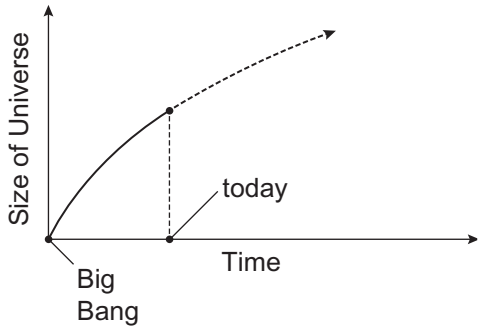
_____ [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

10 (a) The graph below shows how the size of the Universe changes with time.



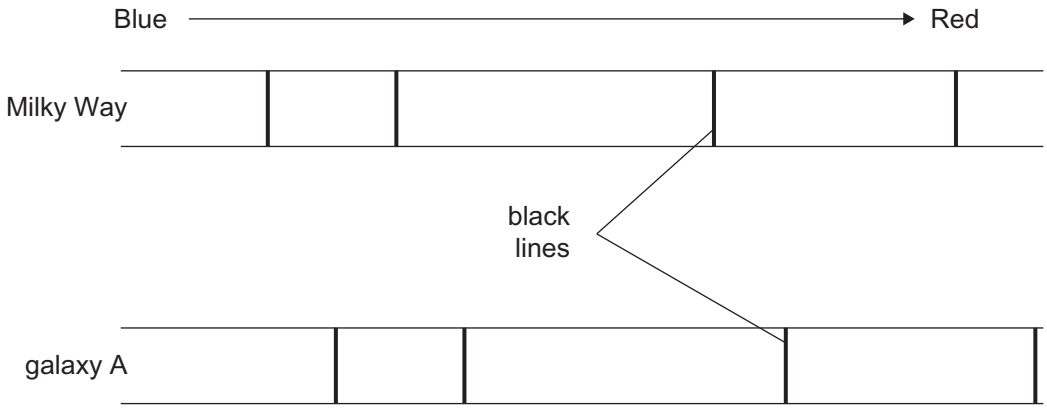
Describe fully the Big Bang theory. Explain how the graph above supports this theory.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

Examiner Only	
Marks	Remark

(b) When scientists analyse light from the Milky Way and galaxy A they see the following black lines in the spectrum.



(i) Name the phenomenon shown in these diagrams.

_____ [1]

(ii) What do these diagrams tell us about galaxy A?

_____ [1]

THIS IS THE END OF THE QUESTION PAPER

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Rewarding Learning

General Certificate of Secondary Education
2012–2013

Science: Single Award

Unit 3 (Physics)

Higher Tier

[GSS32]

THURSDAY 23 MAY 2013, MORNING

MARK SCHEME

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General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

			AVAILABLE MARKS
1	**(a)** **Any 2 from** ● more children now wear seat belts ● greatest increase in 10–13 year olds wearing seat belts ● older children are less likely to wear seat belts	[2]	
	(b) Not all children are wearing seat belts	[1]	3
2	**(a)** less current [1] more current [1]	[2]	
	(b) **(i)** **Any 3 from** ● at wind speeds up to 4 m/s no power is produced ● rapid increase up to 14 m/s ● from 14–24 power produced remains constant ● no power produced after 24 m/s	[3]	
	(ii) Wind turbine shuts down to prevent damage	[1]	
	(c) **Any 2 from** ● renewable source of energy ● saves fossil fuels ● produces no air pollution	[2]	
	(d) Wind turbines are a visual eyesore/noise.	[1]	9
3	**(a)** **(i)** Radiation which is always around us	[1]	
	(ii) Increased radon levels [1] causes cancer [1]	[2]	
	(b) **Any 2 from** ● alpha and beta cannot pass through/gamma can pass through ● the soil ● more water present, gamma is in high concentration	[2]	5
4	**(a)** LED spotlight	[1]	
	(b) Energy saving bulb	[1]	
	(c) 0.6×11 [1] 6.6 J [1]	[2]	
	(d) $11 - 6.6 = 4.4$	[1]	
	(e) More energy is wasted using filament light	[1]	6

5 Indicative Content:

- lens too weak/eyeball too short/lens too thin
- light not refracted enough by the lens/cornea
- light would be focused behind the retina
- near images are not clear/blurry
- far images are clear
- convex lens used to correct
- this converges light more

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe and explain fully (using **five or more** of the above points) long sight in a logical sequence. They use good spelling, punctuation and grammar and form and style are of a high standard.	[5–6]
B	Candidates use some appropriate specialist terms to describe and explain long sight (using **three or four** of the above points) in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3–4]
C	Candidates describe/explain long sight (using **one or two** of the above points.) However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1–2]
D	Response not worthy of credit	[0]

[6] 6

6 **(a)** Dust clouds [1]
would be sent high into atmosphere, reducing sunlight [1]
causing plants and eventually animals to die [1] [3]

(b) **(i)** Chances of being hit low [1]
small diameter [1] [2]

(ii) 2012 TY52 [1] 6

AVAILABLE MARKS

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7 **(a)** **Any 3 from**
- Microwaves can penetrate food
- Microwaves carry energy
- Wavelength of microwaves is one which is best absorbed by water
- Microwaves cause water molecules in food to vibrate [3]

(b) $3 \times 10^8/0.15$ [1]
2×10^9 [1] [2]

(c) High frequency [1]
carry more energy [1] [2]

(d) **(i)** **Any 3 from**
- large distance
- Flash lights and horn at same time
- start time when lights flash and stop when horn heard
- speed = distance/time [3]

(ii) Windy day/reaction times [1] 11

8 **(a)** Voltmeter in parallel over resistor [1]

(b) **(i)** 4 points correct [2]
2–3 points correct [1]
straight line [1] [3]

(ii) as voltage increases so does the current [1]

(iii) 0.825 A [1]

(iv) $\frac{4}{2.5}$ [1]
1.6 [1] [2]

(c) Voltage decreases [1]
current increases [1]
reduces energy losses/heat production [1] [3] 11

9 **(a)** **(i)** 0 [1]

(ii) Stationary [1]
steady speed [1] [2]

(b) Slows down/decelerates/backwards [1]

(c) Gravity overcomes friction [1]
gravity pulls car down [1]
forces unbalanced [1] [3]

(d) Using a small amount of ethanol increases power [1]
Adding too much reduces power [1] [2]

(e) hydrogen/biodiesel [1] 10

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10 (a) Indicative Content:

- Universe started as a singularity
- 14 Billion years ago
- Universe was created from a large explosion
- after millions of years gravity pulled this matter together
- to form stars/galaxies/planets
- graph begins from origin
- graph shows it expands with time

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe and explain fully (using **five or more** of the above points) the formation of the Universe in a logical sequence. They use good spelling, punctuation and grammar and form and style are of a high standard.	[5–6]
B	Candidates use some appropriate specialist terms to describe and explain the formation of the Universe (using **three or four** of the above points) in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3–4]
C	Candidates describe/explain the formation of the Universe (using **one or two** of the above points.) However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1–2]
D	Response not worthy of credit	[0]

[6]

(b) (i) Red shift [1]

(ii) Moving away from us/moving faster [1]

Total

AVAILABLE MARKS

8

75

Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2012–2013

Science: Single Award

Unit 3 (Physics)

Higher Tier

[GSS32]

GSS32

WEDNESDAY 27 FEBRUARY 2013, MORNING

TIME

1 hour 15 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 ten** questions.

INFORMATION FOR CANDIDATES

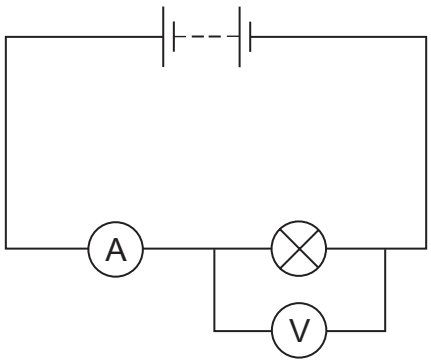
The total mark for this paper is 75.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Questions **3** and **9(c)**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total Marks	

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Examiner Only	
Marks	Remark

1 Pupils set up the circuit below to investigate the effect of adding extra batteries.



The pupils' results are shown in the table below.

Number of batteries	Voltage/V	Current/A
1	1.5	0.10
2	3.0	0.19
3	4.5	0.30
4	6.0	0.41
5	7.5	0.50

(a) State **two** trends shown by these results.

1. _____

_____

2. _____

_____ [2]

(b) The pupils then used a light meter to measure how the brightness of a bulb was affected by the number of batteries.

The results are shown below.

Number of batteries	Bulb brightness/lux
1	14
2	22
3	35
4	35
5	35

(i) Explain the advantage of using only three batteries with this bulb.

_____

_____

_____ [2]

(ii) Use the table opposite and the equation:

power = voltage × current

to calculate the power used when three batteries are connected to this bulb.

(Show your working out.)

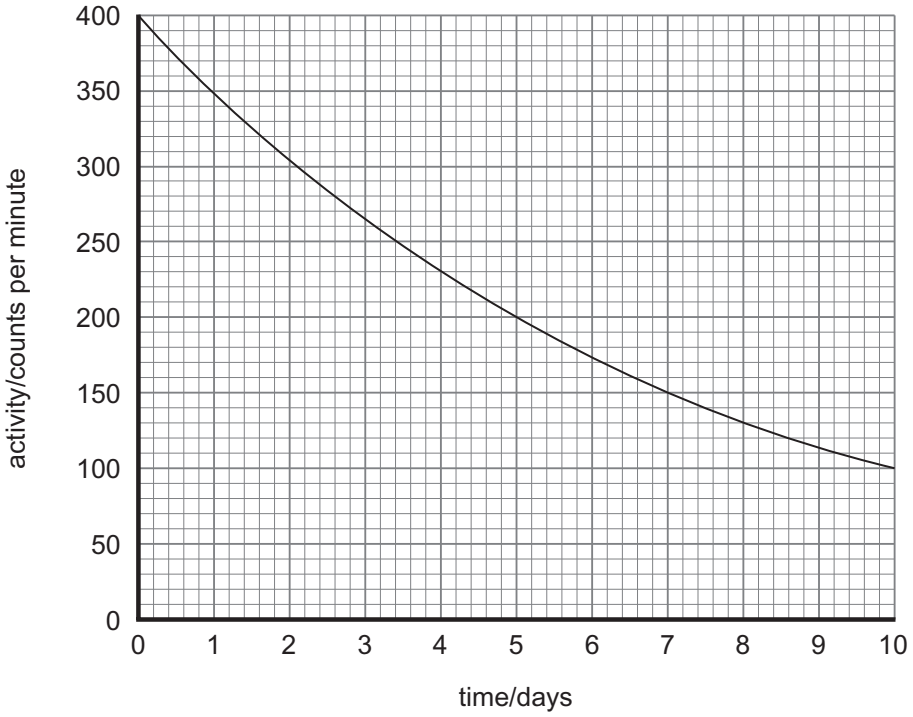
Answer _____ W [2]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

2 **(a)** The graph below shows how the activity of a radioactive isotope varies with time.



(i) What is the activity at 7 days?

_____ counts per minute [1]

(ii) Describe the trend shown by this graph.

_____

_____ [1]

(iii) Use the graph to give the half-life of this isotope.

_____ days [1]

(b) Explain fully why some nuclei are radioactive.

_____

_____

_____ [2]

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This isotope produces gamma radiation.

(c) Explain fully why gamma radiation can be used to treat cancer within the body.

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

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3 The Northern Ireland government has recently announced that there will be an increase in the amount of electricity generated from sources other than fossil fuels.

Explain fully what fossil fuels are, how they are formed, and why the emphasis on developing alternative sources has increased in recent years.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

Examiner Only	
Marks	Remark

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(Questions continue overleaf)

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Examiner Only	
Marks	Remark

4 The table below gives information on the different types of wave in the electromagnetic spectrum.

Type	Wavelength/m	Energy/ arbitrary units
Gamma	0.00000000001	300 000
X-rays	0.0000000001	3000
	0.00000001	30
Visible light	0.0000005	6
	0.00001	0.3
Microwaves	0.03	0.001
Radio waves	1000	0.00003

(a) State the relationship between wavelength and energy in the table above.

_____

_____ [1]

(b) Complete the table by correctly naming the other **two** types of electromagnetic radiation. [2]

(c) All these waves travel at the same speed (300 000 000 m/s).

(i) Use the equation:

$$\textbf{frequency} = \frac{\textbf{speed}}{\textbf{wavelength}}$$

to calculate the frequency of radio waves.

(Show your working out.)

Answer _____ Hz [2]

(ii) Use the equation to suggest how frequency will change when wavelength increases.

_____

_____ [1]

(d) **(i)** Microwaves are used in mobile phone communications. Suggest **one** other use of microwaves.

_____ [1]

(ii) Using the information provided and your knowledge, explain fully why microwaves are more likely than X-rays to affect the health of young people.

_____

_____

_____

_____ [2]

(iii) Name the medical condition associated with exposure to electromagnetic radiation.

_____ [1]

Examiner Only	
Marks	Remark

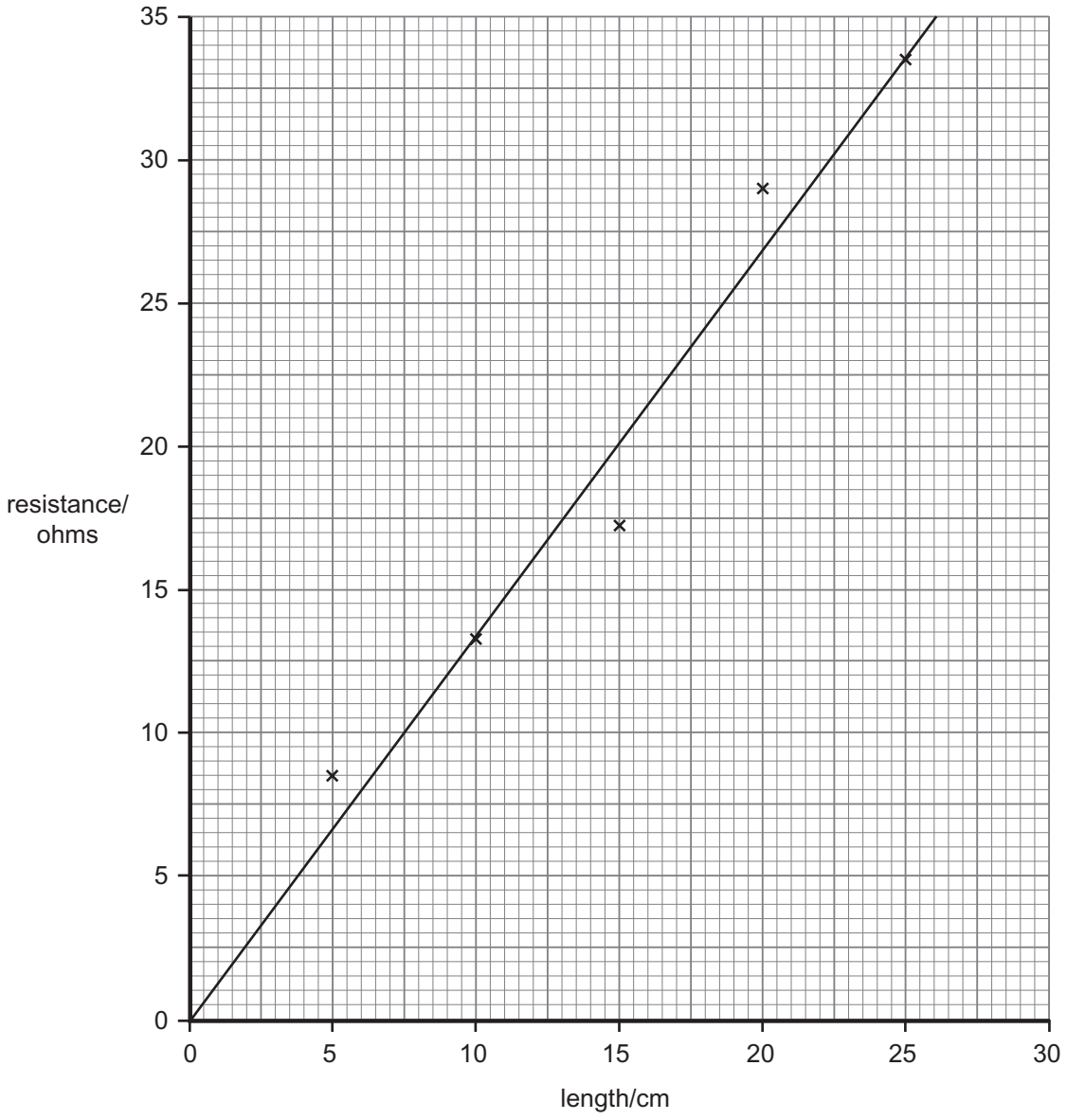
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Examiner Only	
Marks	Remark

5 **(a)** Two pupils were investigating the effect of length on resistance.

To do this they rolled conducting putty into different lengths keeping the thickness the same.

The results are shown in the graph below.



(i) What is the effect of length on resistance?

_____

_____ [1]

(ii) What evidence in the graph suggests that some of these results could be improved?

_____

_____ [1]

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(iii) In a second experiment, thicker pieces of putty were used for each length. Draw a line on the graph to show the results you would expect. [2]

(b) The teacher suggests repeating the experiment using wire instead of putty. The table below gives information about some available spools of wire.

Spool	Material	Cross-section area/mm^2	Length of spool/m	Resistance per metre/ohms
A	Constantan	0.27	228	7.8
B	Constantan	0.31	180	6.3
C	Constantan	0.91	22	2.6
D	Copper	0.27	1120	0.43
E	Copper	0.40	450	0.14
F	Copper	0.91	100	0.04
G	Nichrome	0.27	244	17
H	Nichrome	0.46	94	10
I	Nichrome	0.60	23	3.5

(i) The teacher suggests using spool **G** to investigate the effect of length on resistance. Explain why.

_____ [1]

(ii) The teacher wants to find the effect of different materials on resistance. Select three spools that would be suitable for this investigation. Explain your answer fully.

_____

_____

_____

_____ [3]

(iii) Using the graph and the table, state what length of conducting putty has the same resistance as 1 metre of the wire in spool **H**.

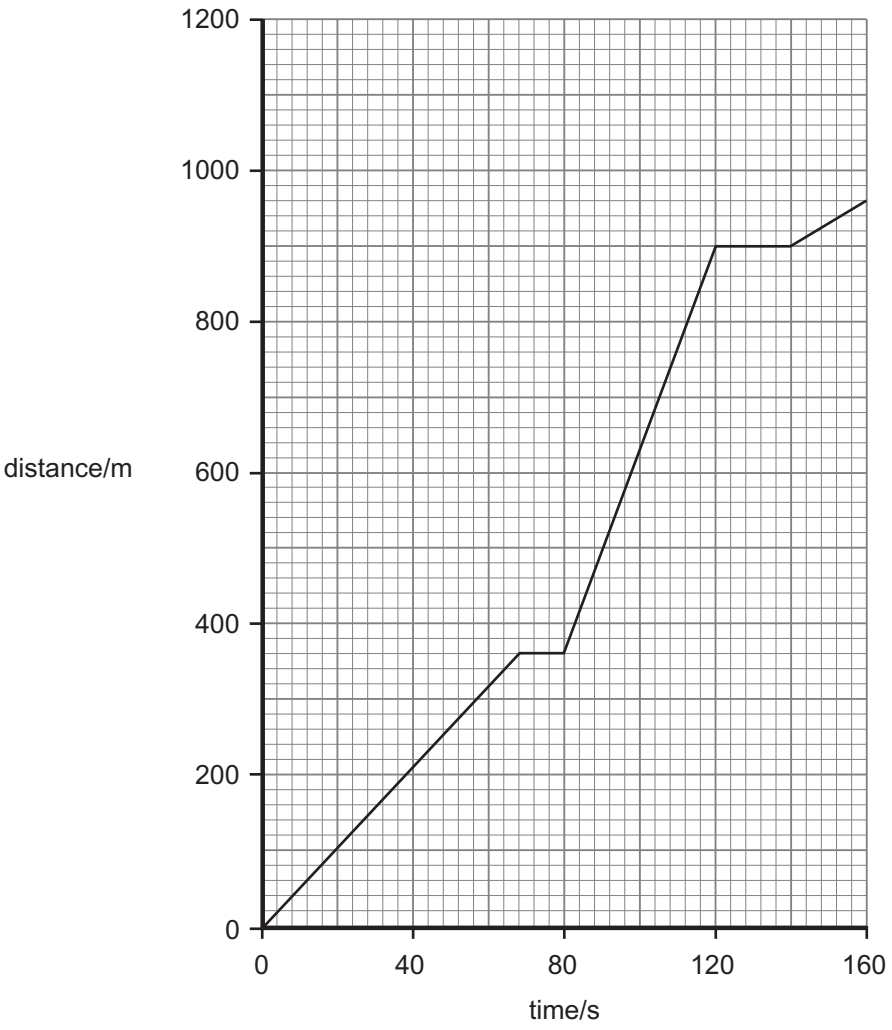
_____ cm [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

6 **(a)** Shown below is the distance-time graph for a car journey.



(i) Between which times of the journey is the car moving the fastest?

_____ and _____ s [1]

(ii) Use the equation:

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

to calculate the average speed of the car for the whole journey.

(Show your working out.)

Answer _____ m/s [2]

(iii) For how long was the car stopped?

_____ s [1]

The photograph below shows safety features on a car being tested.



© TRL Ltd / Science Photo Library

(b) State **two** safety features of a car that are designed to absorb energy in a collision.

_____

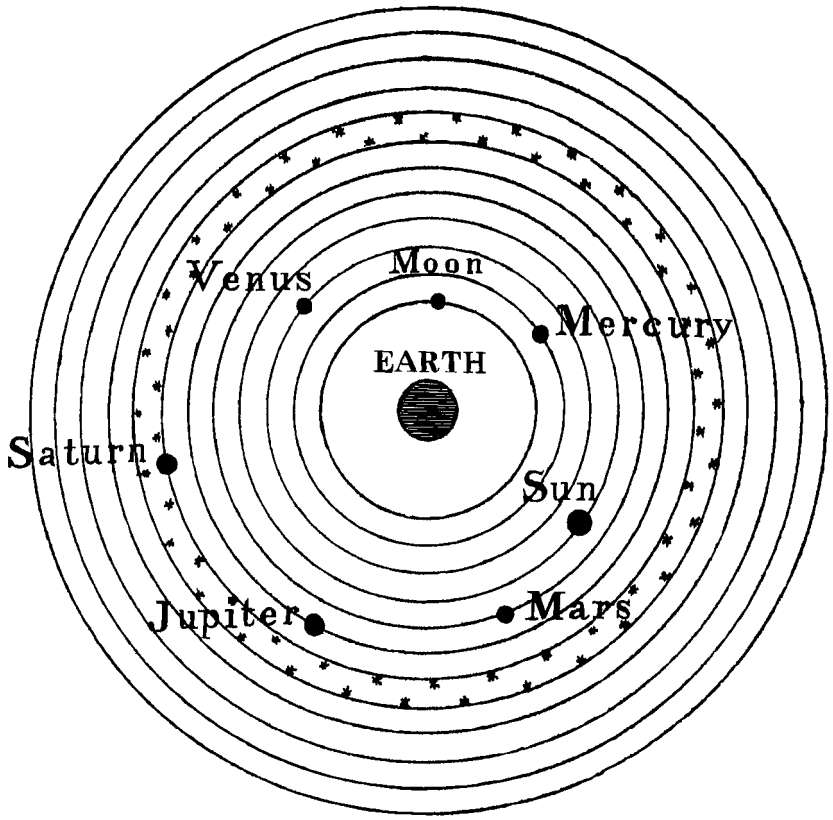
_____ [2]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

7 **(a)** The diagram below shows the model of the Solar System used by the ancient Greeks.



© Sheila Terry / Science Photo Library

Name this model of the Solar System and give **two** differences between this model and the current model.

_____

_____

_____

_____ [3]

(b) The table below gives the speeds of galaxies in our Universe at different distances from Earth.

Galaxy	Distance from Earth/ tens of millions of light years	Speed away from Earth/ thousands of km/s
A	5	1
B	65	15
C	95	22
D	170	39
E	260	61

(i) Explain fully how the information in the table provides evidence for the Big Bang theory.

_____

_____

_____

_____ [3]

(ii) Give **one** other piece of evidence that supports the Big Bang theory.

_____ [1]

(iii) How many years ago did the Big Bang occur?

_____ [1]

(iv) Explain the meaning of the term 'light year'.

_____

_____ [2]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

8 **(a)** The table below gives information about four types of electric lights.

Light	Power input/watts	Light power output/watts	Average lifetime/ hrs	Cost to buy/£	Efficiency/ %
Filament bulb	100	30	1000	0.5	
Halogen lamp	40	30	10 000	4	75
LED spotlight	10	7	30 000	6	70
Fluorescent tube	15	10	5000	5	67

(i) Use the equation:

$$\textbf{efficiency} = \frac{\textbf{useful power output}}{\textbf{total power input}}$$

to calculate the efficiency of the filament bulb.

(Show your working out.)

Answer _____ % [2]

(ii) The total cost of lighting includes the cost to buy and the cost of electricity used.

You need to provide 30 000 hours of lighting for the lowest overall cost.

Explain fully why you might choose the LED spotlight rather than the halogen lamp.

_____

_____

_____ [2]

(b) State the law of conservation of energy.

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

9 **(a)** During a cycle race a cyclist of mass 60 kg travelled at a velocity of 15 m/s on a bicycle of mass 10 kg.



(i) Use the equation:

momentum = mass × velocity

to calculate the momentum at this velocity.

(Show your working out.)

Answer _____ [2]

(ii) State the units of momentum.

_____ [1]

(b) Explain the terms average and instantaneous speed.

_____

_____

_____ [2]

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(c) Explain fully, in terms of forces and their effects, the differences between cyclists **A** and **B** below.



A **B**

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

Examiner Only

Marks	Remark

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

_____

_____

_____

_____ [3]

(b) State how short sight is corrected.

_____ [1]

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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113806

Rewarding Learning

General Certificate of Secondary Education
2012–2013

Science: Single Award

Unit 3 (Physics)

Higher Tier

[GSS32]

WEDNESDAY 27 FEBRUARY 2013
9.30 am–10.45 am

MARK SCHEME

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General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

					AVAILABLE MARKS
1	**(a)**	**(i)**	**Any two from** more batteries = more volts more volts = more current more batteries = more current	[2]	
	(b)	**(i)**	brightness is maximum using 3 batteries [1] extra batteries do not increase brightness/saves money [1]	[2]	
		(ii)	4.5×0.3 [1] 1.35 [1] (allow 1.4)	[2]	6
2	**(a)**	**(i)**	150	[1]	
		(ii)	the longer the time, the lower the activity	[1]	
		(iii)	5 days	[1]	
	(b)		protons and neutrons [1] disintegrate/split/unstable [1]	[2]	
	(c)		gamma penetrates body [1] to kill cancer/cells [1]	[2]	7

3 indicative content

- remains of animals + plants
- lived millions of years ago
- pressure
- fossil fuels are running out/non-renewable/ alternative sources are renewable/will not run out
- developing alternative sources will save fossil fuels
- named fossil fuel/named alternative source
- relevant environmental impact for alternatives

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to explain fully, in a logical sequence, what fossil fuels are and why we need to find alternative energy sources (using **6** or **7** of the above points). They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5–6]
B	Candidates use some appropriate specialist terms to partially explain, in a logical sequence, what fossil fuels are and why we need to find alternative energy sources (using **4** or **5** of the above points). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3–4]
C	Candidates explain what fossil fuels are and why we need to find alternative energy sources (using **1** to **3** of the above points). However these are not in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1–2]
D	Response not worthy of credit.	[0]

[6] 6

4 **(a)** as wavelength increases, energy decreases [1]

(b) ultraviolet [1]
infrared [1] [2]

(c) **(i)** $\frac{300{,}000{,}000}{1000}$ [1]
300,000 [1] [2]

(ii) frequency decreases [1]

(d) **(i)** use of microwave oven/satellite TV + radio/wireless computer connection [1]

(ii) X-rays have more energy [1]
although the exposure time is far less [1] [2]

(iii) cancer/sunburn [1] 10

AVAILABLE MARKS

					AVAILABLE MARKS
5	**(a)**	**(i)**	resistance increases with length	[1]	
		(ii)	some points not on line	[1]	
		(iii)	diagonal line drawn below [1] through (0,0) [1]	[2]	
	(b)	**(i)**	highest resistance (per metre)	[1]	
		(ii)	ADG [1] same cross-sectional area [1] makes results valid/fair test [1]	[3]	
		(iii)	7.5 cm	[1]	9
6	**(a)**	**(i)**	80 to 120s [1]	[1]	
		(ii)	960/160 [1] 6 [1]	[2]	
		(iii)	32 seconds	[1]	
	(b)		crumple zone [1] air bag [1]	[2]	6
7	**(a)**		geocentric [1] Sun at the centre of heliocentric [1] more planets in heliocentric [1]	[3]	
	(b)	**(i)**	table shows that further galaxies are moving faster [1] this shows expansion [1] Big Bang states that the Universe is still expanding [1]	[3]	
		(ii)	red shift/background radiation	[1]	
		(iii)	14 billion years ago ($\pm$0.5)	[1]	
		(iv)	distance [1] light travels in one year [1]	[2]	10

	AVAILABLE MARKS

8 **(a)** **(i)** 30/100 [1]
30% [1] [2]

(ii) it uses less input electricity/less efficient [1]
halogen would cost more for 30,000 hours/LED cheaper [1] [2]

(b) energy cannot be created or destroyed [1]
can only be transformed from one type to another [1] [2]

6

9 **(a)** **(i)** 70 × 15 [1]
1 050 [1] [2]

(ii) kgm/s [1]

(b) the average speed is across a period of time [1]
Instantaneous is at any moment [1] [2]

(c) indicative content

- in picture A the forces are balanced
- cyclist is stationary/moving at constant speed
- in picture B forces unbalanced
- in picture B resultant = 50N
- cyclist is accelerating in picture B

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to explain fully, in a logical sequence, (using ALL of the above points) the forces and their effects in the two pictures. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5–6]
B	Candidates use some appropriate specialist terms to partially explain, in a logical sequence, (using **3** or **4** of the above points) the forces and their effects in the two pictures. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3–4]
C	Candidates explain the forces and their effects in the two pictures (using **1** or **2** of the above points). However these are not in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1–2]
D	Response not worthy of credit.	[0]

[6]

11

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			AVAILABLE MARKS
10	**(a)**	lens too strong/too much refraction in lens/cornea/too thick/eyeball too long [1] focus before retina [1] near vision clear/far vision blurry [1] [3]	
	(b)	concave/diverging lens/laser surgery [1] [1]	4
		Total	**75**

New Specification

Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2012–2013

Science: Single Award

Unit 3 (Physics)

Higher Tier

[GSS32]

GSS32

WEDNESDAY 14 NOVEMBER 2012, AFTERNOON

TIME

1 hour 15 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 eight** questions.

INFORMATION FOR CANDIDATES

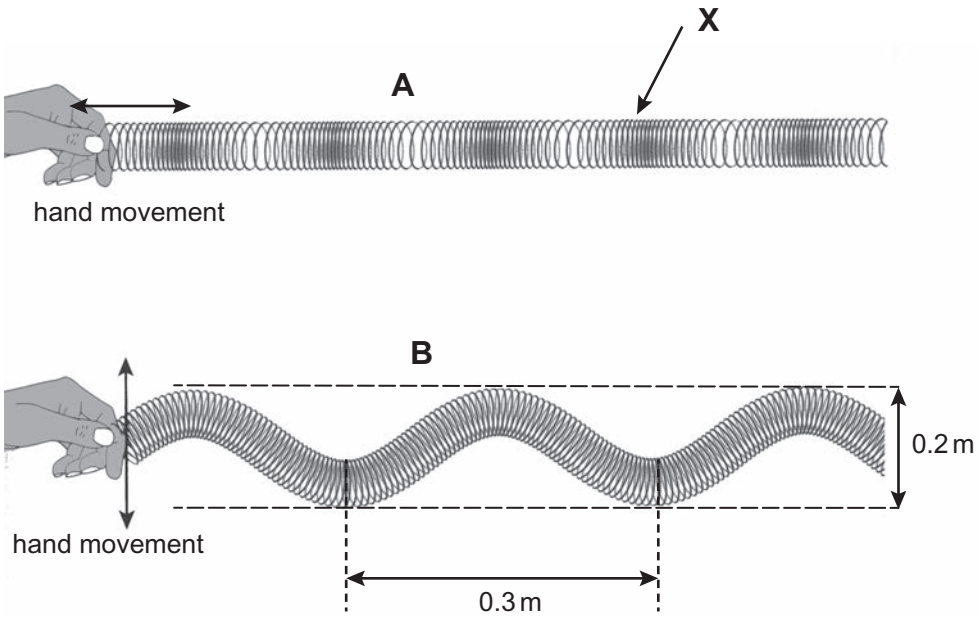
The total mark for this paper is 75.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in questions **3(a)** and **6(a)**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
Total Marks	

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Examiner Only	
Marks	Remark

1 **(a)** Slinky springs are often used to demonstrate waves as shown in the diagrams **A** and **B** below.



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(i) Name the type of wave represented by diagram **A**.

_____ [1]

(ii) Describe fully how point **X** moves as the wave passes along the slinky in diagram **A**.

_____

_____ [2]

(iii) What is the amplitude of the wave represented by diagram **B**?

Answer _____ m [1]

(iv) What is the wavelength of the wave represented by diagram **B**?

Answer _____ m [1]

(b) Wave **B** produces 20 complete waves in 5 seconds.

Calculate the frequency of the wave.

Answer _____ Hz [1]

(c) Use the equation:

speed = frequency × wavelength

to calculate the speed of a wave with a frequency of 20 Hz and a wavelength of 90 m.

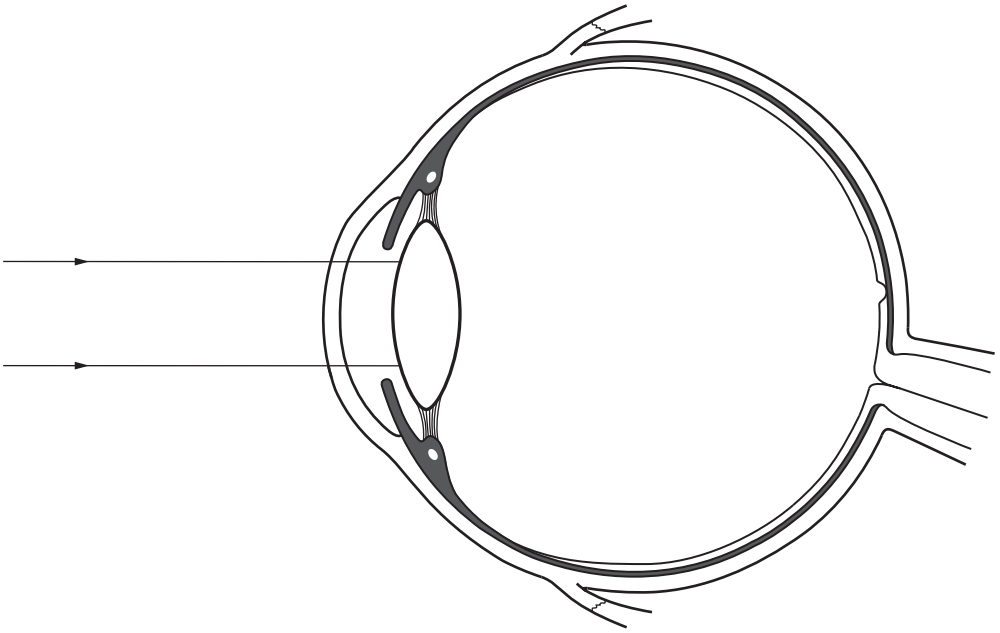
(Show your working out.)

Answer _____ m/s [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

2 **(a)** The diagram below shows two parallel rays of light entering the eye. Complete the diagram to show the path of the rays in the formation of a clear image.



[2]

(b) **(i)** Short sight is a common eye defect. Explain fully the cause and effect of short sight.

_____

_____

_____

_____ [3]

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

_____ [1]

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(Questions continue overleaf)

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Examiner Only	
Marks	Remark

3 (a) The photograph below shows the radioactive source found in a smoke alarm.



© Martin Bond / Science Photo Library

Describe a simple experiment to show which type of radiation (alpha, beta or gamma) is emitted by the radioactive source in the smoke alarm.

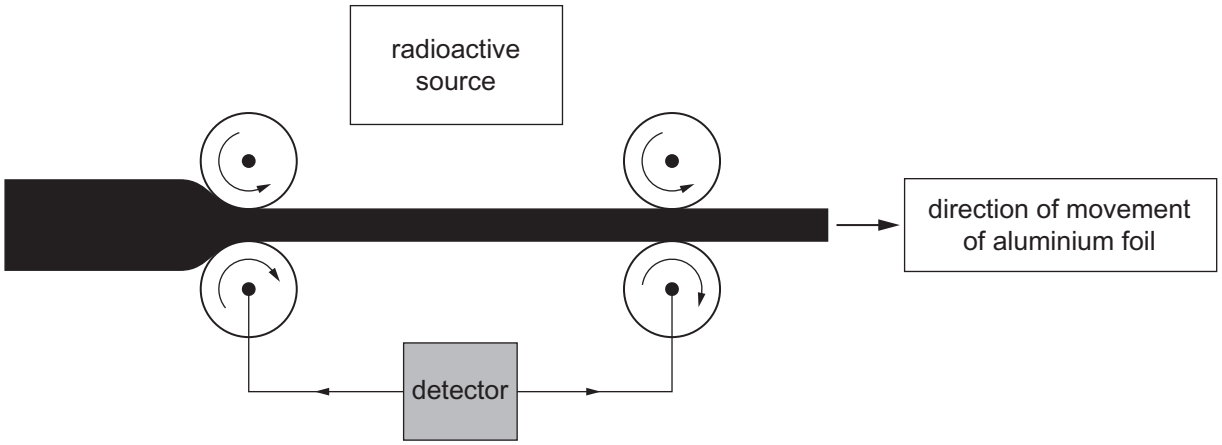
Your answer should include one way to ensure valid results.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

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(b) The equipment shown below is used in industry to monitor the thickness of aluminium foil.



The table below gives possible radioactive sources which could be used.

Radioactive source	Radiation emitted	Half-life
A	alpha	1000 years
B	beta	1000 years
C	beta	2 minutes
D	gamma	4 years

(i) Explain fully what is meant by the term 'half-life'.

_____

_____ [2]

(ii) Which source, **A**, **B**, **C** or **D** would be best to monitor the thickness of the aluminium? Explain your answer.

Source _____ [1]

Explanation _____

_____

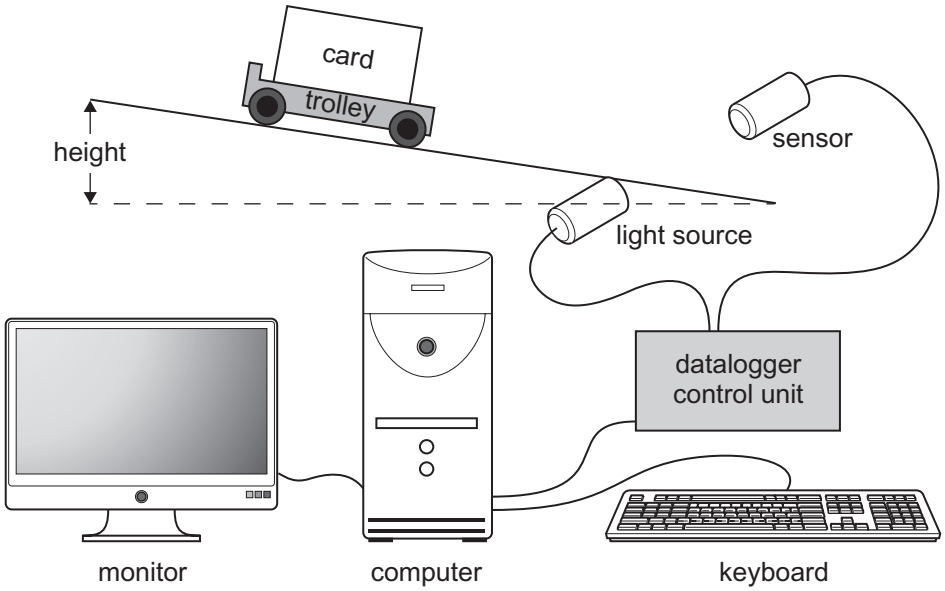
_____ [2]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

4 **(a)** The apparatus below was used to measure the time taken for a trolley to travel 1 m down a ramp raised to different heights.



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The results of the experiment are shown below.

height/cm	distance/m	time/s
10	1	1.4
20	1	1.1
30	1	0.9
40	1	0.8

(i) At which height did the trolley reach the fastest speed? Explain your answer.

_____

_____

_____ [2]

(ii) State **one** thing that should be done to make the results reliable.

_____

_____ [1]

Examiner Only	
Marks	Remark

(iii) This apparatus can also be used to measure average and instantaneous speed. Explain fully the terms average speed and instantaneous speed.

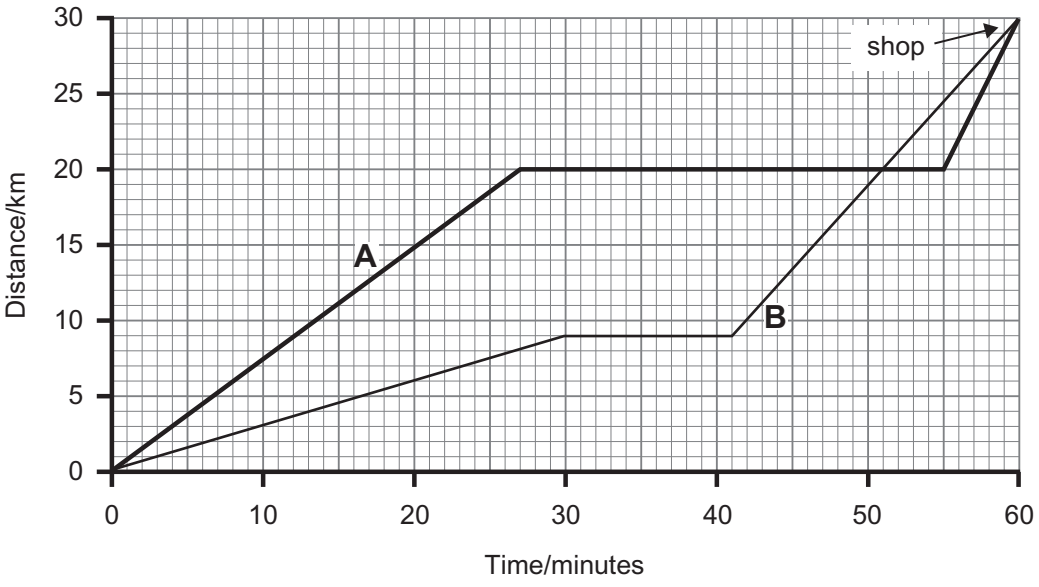
Average speed _____

_____

Instantaneous speed _____

_____ [2]

(b) The distance–time graph below shows two cars, **A** and **B**, travelling to the same shop.



(i) At what times have the cars travelled the same distance?

Answer _____ and _____ minutes [1]

(ii) Use the graph to compare the **average** speeds of the cars over the sixty minutes. Explain your answer.

_____

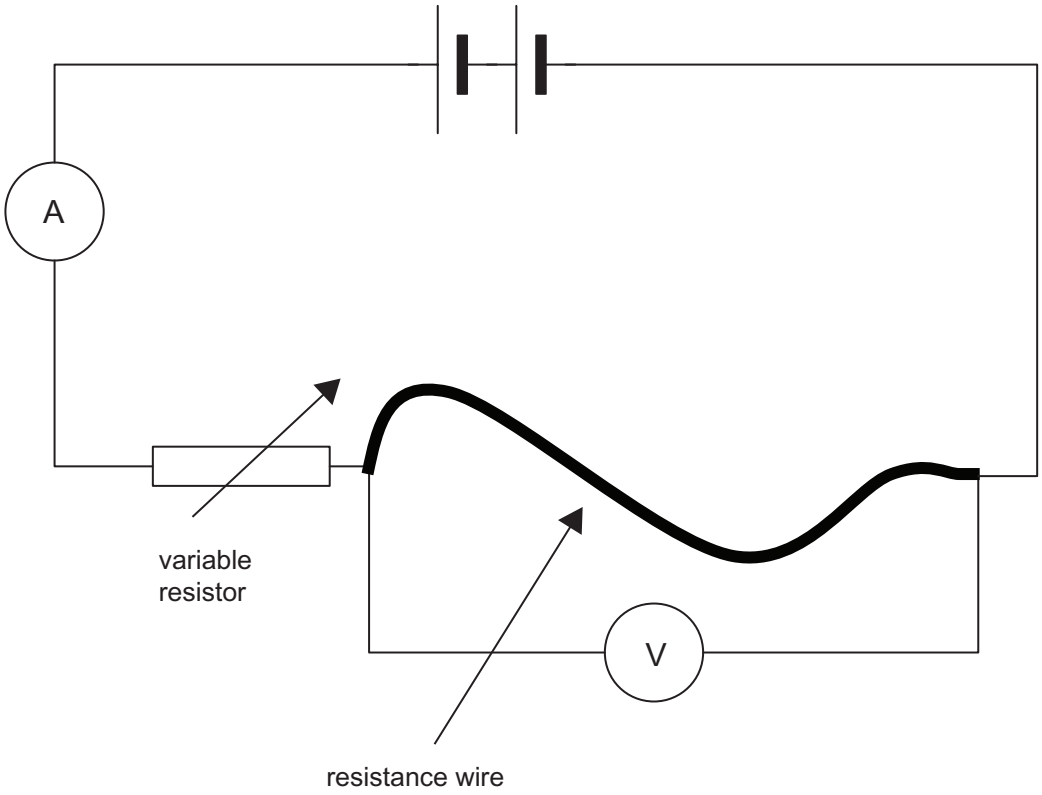
_____

_____ [2]

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Examiner Only	
Marks	Remark

5 **(a)** George set up the following circuit to measure the resistance of different cross-sectional areas of wire.



(i) Draw an arrow at position **X** to show the direction electrons flow in the circuit. [1]

(ii) Give **one** way George could make sure his results were valid.

_____ [1]

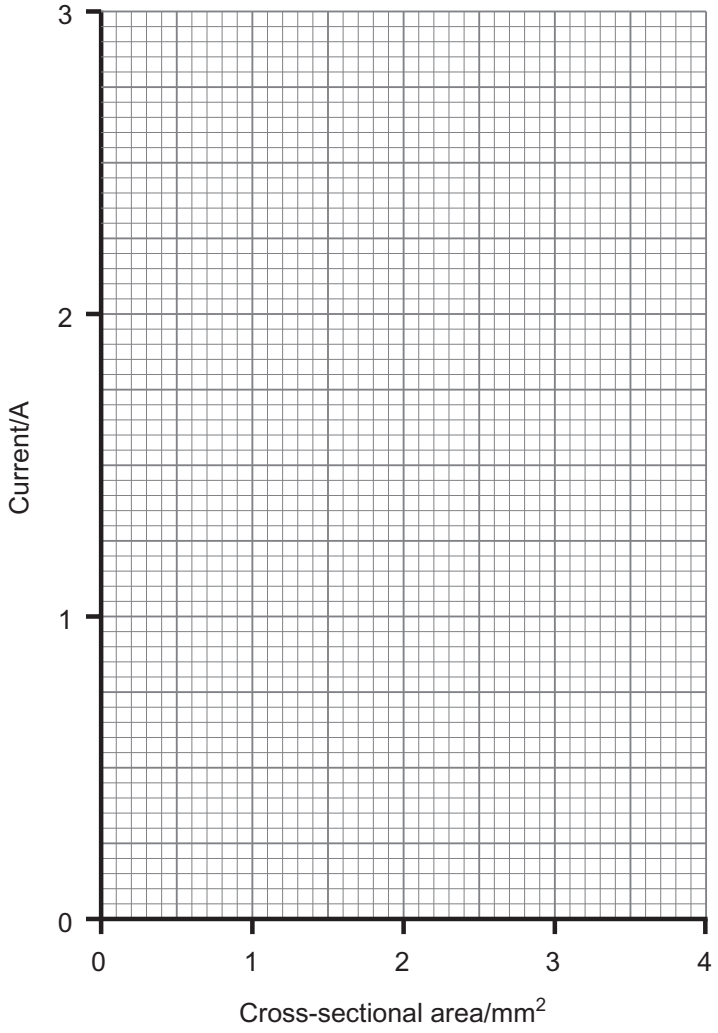
(iii) Suggest a suitable application for a variable resistor in the home.

_____ [1]

(b) The table below shows how the current flowing through a wire varies with its cross-sectional area.

Cross-sectional area/mm^2	1	2	3	4
Current/A	0.65	1.30	1.95	2.60

(i) On the grid below plot and draw a **line graph** of these results.



[2]

(ii) State the trend shown by these results.

_____

_____ [1]

(iii) From the graph, what is the current when the wire has a cross-sectional area of 2.5 mm^2?

Answer _____ A [1]

Examiner Only

Marks	Remark

(iv) Use the equation:

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

to calculate the resistance of a 2.5 mm^2 wire when the voltmeter reads 3.2 V.

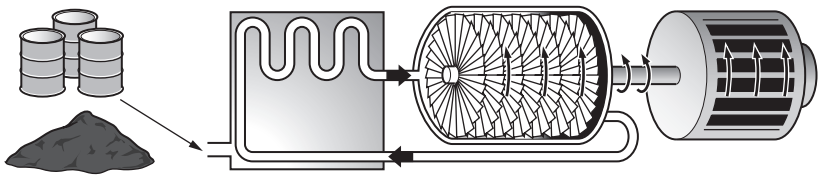
(Show your working out.)

Answer _____ Ω [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

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



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(a) Describe fully, including the energy changes, how this power station makes electricity.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

(b) The table below gives the estimated cost of generating electricity from different energy sources.

Energy source	Time to build/years	Output power /MW	Annual cost per kW/£	Cost to build per kW/£	Customer cost per kWhr/p
Gas	1	40	34	330	3.64
Wind	2	21	24	740	5.35
Biomass	2	10	225	1840	6.67
Coal	4	1600	24	840	3.33

The Government needs to build some new power stations quickly to produce electricity with a low customer cost. Suggest a suitable energy source giving reasons for and against.

_____

_____

_____

_____

_____

_____ [3]

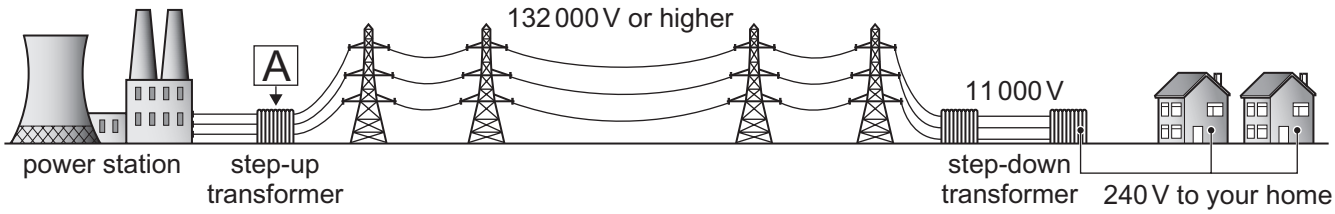
(c) Fossil fuels are described as finite energy sources. Explain what is meant by the term 'finite'.

_____

_____ [1]

Examiner Only	
Marks	Remark

(d) The diagram below shows the transmission of electricity through the National Grid.



© Diagram sourced from 'Physics for you' by Keith Johnson, published in 2011 by Nelson Thornes Ltd

Examiner Only	
Marks	Remark

The part labelled A is a step-up transformer. Describe fully what it does and explain why it is used as part of the grid system.

_____

_____

_____

_____

_____ [3]

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(Questions continue overleaf)

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Examiner Only	
Marks	Remark

7 **(a)** The diagram below shows a car moving on a straight road.



© *Hemera / Thinkstock*

(i) Describe fully in terms of forces the motion of the car.

_____

_____

_____ [2]

The driver needs to increase the forward force to produce a resultant force of 6000 N.

(ii) Assuming friction stays the same, what forward force would provide a resultant force of 6000 N?

Answer _____ N [1]

(b) How would the driver increase the frictional force and what effect, if any, would this have on the motion of the car?

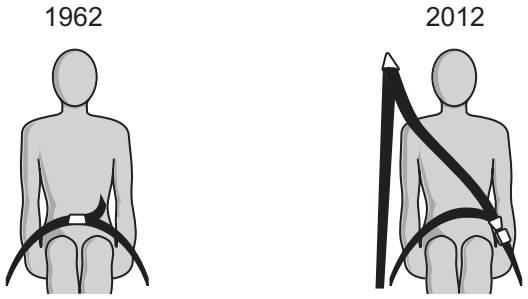
_____

_____

_____ [2]

Examiner Only	
Marks	Remark

(c) The diagrams below show how seatbelts have changed in the last 50 years.



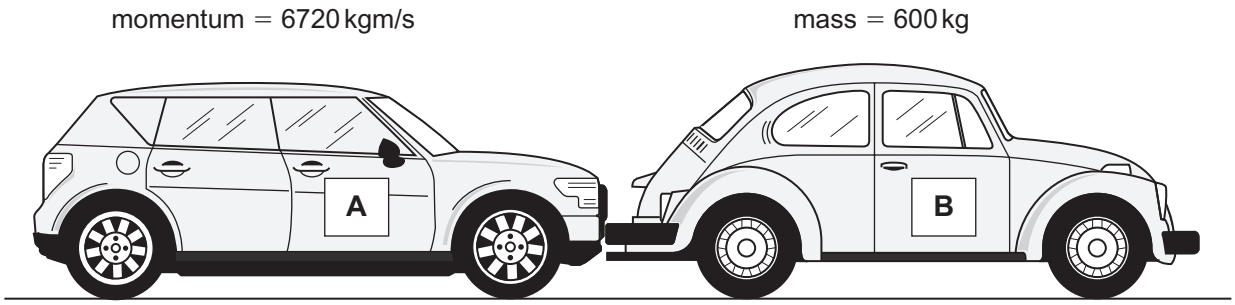
Describe and explain how changes in the design of the seatbelt have improved driver safety.

_____

_____

_____ [2]

(d) The diagram below shows a collision between the moving car **A** and a stationary car **B**.



Examiner Only	
Marks	Remark

When they collide the moving car **A** stops instantly and all the momentum is transferred to car **B**.

Use the equation:

momentum = mass × velocity

to calculate the maximum velocity at which car **B** moves.

(Show your working out.)

_____ m/s [2]

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Examiner Only	
Marks	Remark

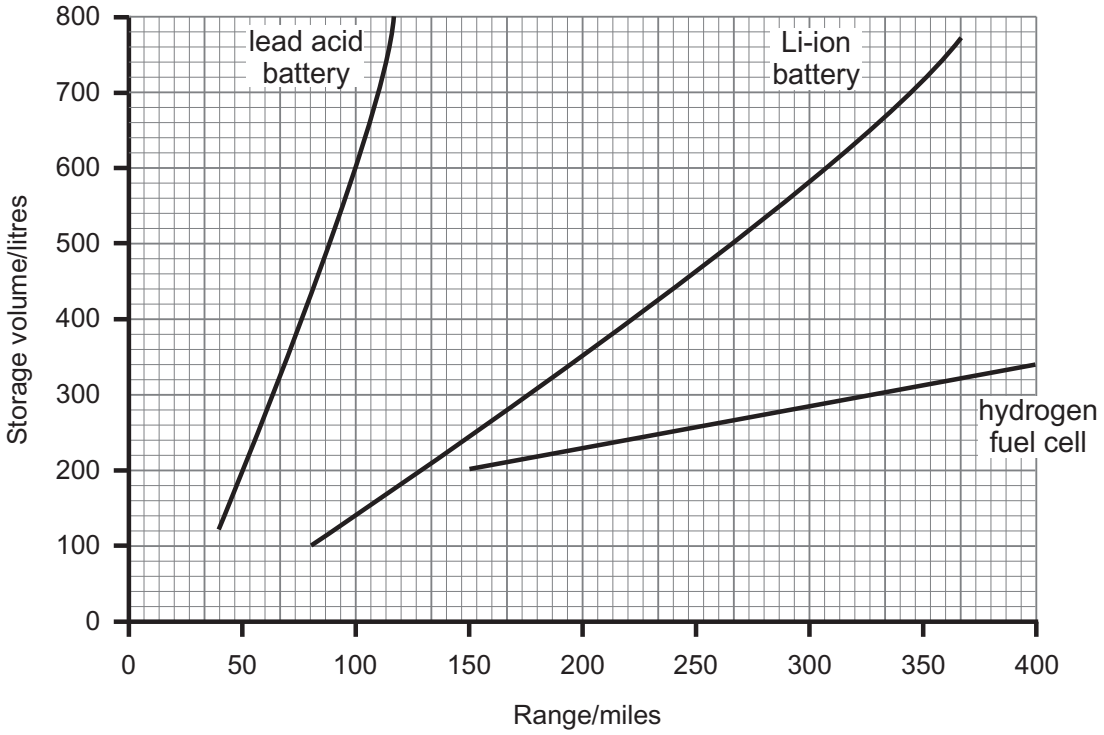
(e) State **two** ways that cars are designed to absorb energy in a collision, therefore reducing injury to the driver.

1. _____

2. _____ [2]

(f) Many manufacturers are designing both electric and hydrogen fuelled cars. The electric cars need to store batteries and the hydrogen cars need to store fuel cells.

The graph shows the relationship between storage volume and range for various fuel types.



© Isidor Buchmann www.batteryuniversity.com

Using this information explain fully the advantage of hydrogen fuelled cars over electric cars.

_____

_____

_____

_____

_____ [2]

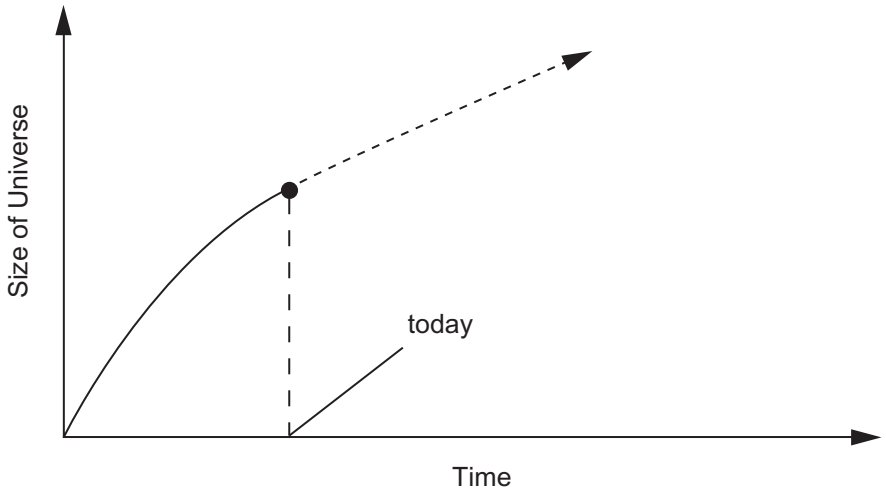
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(Questions continue overleaf)

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Examiner Only	
Marks	Remark

8 **(a)** The graph below shows how the size of the Universe changes with time.



© Physics 2 for OCR by Gurinder Chada & David Sang, published by Cambridge University Press, 2009. ISBN 978 0521738309

(i) Explain fully why this graph supports the Big Bang theory.

_____

_____

_____ [2]

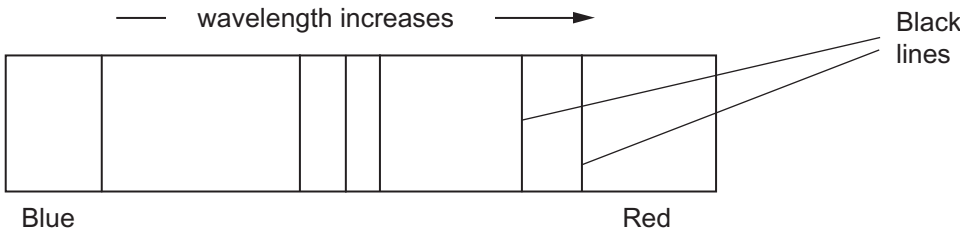
(ii) According to the Big Bang theory, how old is the Universe?

Answer _____ [1]

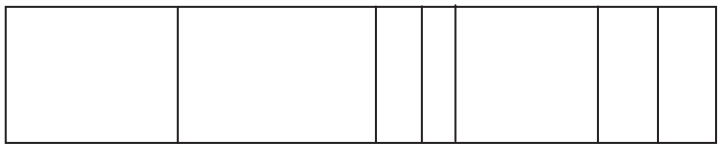
(iii) Name a scientific alternative to the Big Bang theory.

_____ [1]

When scientists analyse the spectrum of light from our galaxy they see the following black lines.



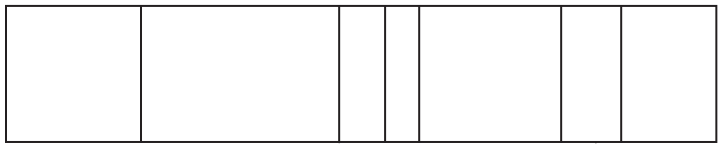
The spectra from three **different** galaxies are shown below.



Galaxy A



Galaxy B



Galaxy C

(b) Which galaxy **A**, **B** or **C** is furthest away from us?
Explain your answer.

_____

_____

_____

_____ [3]

THIS IS THE END OF THE QUESTION PAPER

Examiner Only	
Marks	Remark

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112975

New Specification

Rewarding Learning

General Certificate of Secondary Education
2012–2013

Science: Single Award

Unit 3 (Physics)

Higher Tier

[GSS32]

WEDNESDAY 14 NOVEMBER 2012
1.30 pm–2.45 pm

MARK SCHEME

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				AVAILABLE MARKS
1	**(a)**	**(i)**	longitudinal [1]	
		(ii)	vibrate/move backwards and forwards [1] in same direction as hand movement/parallel to direction of hand movement [1] [parallel to direction of energy flow/wave travel = 2] [2]	
		(iii)	0.1 m [1]	
		(iv)	0.3 m [1]	
	(b)		4 [1]	
	(c)		20 × 90 [1] 1800 m/s [2] [2]	8
2	**(a)**		Refracted by lens [1] Image forms on retina [1] [2]	
	(b)	**(i)**	Lens too strong/eyeball too long [1] Can see near things clearly/Cannot see far things clearly [1] Light focused in front retina [1] [3]	
		(ii)	Diverging lens/concave lens [1]	6

AVAILABLE MARKS

3 **(a)** Indicative Content:

- Place sheet of lead/aluminium/paper in front of source
- Make sure distance between the source and sheet is constant
- Make sure distance between the radiation counter and sheet is constant
- Measure the amount of radiation which passes through
- If radiation stopped by lead it is gamma
- If radiation stopped by aluminium it is beta
- If radiation stopped by paper it is alpha
- Same thickness of material

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe and explain fully (using **five or more** of the above points) the experiment in a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5–6]
B	Candidates use some appropriate specialist terms to describe and explain the experiment (using **three or four** of the above points) in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3–4]
C	Candidates describe/explain the experiment using **one or two** of the above points. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1–2]
D	Response not worthy of credit	[0]

[6]

(b) **(i)** time it takes [1]
for the radiation/radioactivity count to fall by half [1] [2]

(ii) B [1]
Beta can be stopped by certain thicknesses of aluminium/ appropriate reference to either alpha or gamma [1]
has a long half-life [1]
Implied [2]

11

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					AVAILABLE MARKS
4	**(a)**	**(i)**	40 cm [1] shortest time [over same distance] [1]	[2]	
		(ii)	Repeat the test	[1]	
		(iii)	the average speed of a car is the speed over a given distance/ period of time [1] Instantaneous speed is the speed of a car at any one point in time [1]	[2]	
	(b)	**(i)**	51 mins and 60 mins	[1]	
		(ii)	Same average speed [1] travelled the same distance in same amount of time [1]	[2]	8
5	**(a)**	**(i)**		[1]	
		(ii)	Same length of wire/same type of wire	[1]	
		(iii)	Volume control/cooker knob/dimmer switch	[1]	
	(b)	**(i)**	All points plotted correctly [1] straight line [1]	[2]	
		(ii)	As the cross-sectional area increases so does the current.	[1]	
		(iii)	current – allow 1.6 – 1.65 A	[1]	
		(iv)	resistance = 3.2/1.65 (allow error from above) [1] 1.94 Ω [2]	[2]	9

AVAILABLE MARKS

6 **(a)** Indicative Content:

- fossil fuels contain chemical energy
- chemical energy in fuel burned to produce heat
- thermal energy used to turn water to steam
- thermal energy converted to kinetic energy [in the turbine]
- magnet moves inside a coil
- turbine drives the generator/kinetic energy changed to electric energy in the turbine
- generator produces electrical energy when moved

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe and explain fully (using **five to seven** of the above points) the energy changes in a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5–6]
B	Candidates use some appropriate specialist terms to describe and explain the energy changes (using **three or four** of the above points) in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3–4]
C	Candidates describe/explain the energy changes using **one or two** of the above points. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1–2]
D	Response not worthy of credit	[0]

[6]

(b) Gas [1]
low cost to build [1]
low output [1] [3]

(c) They are running out/non-renewable [1]

(d) Steps up/increases voltage [1]
low current [1]
reduces energy losses/heat production [1] [3]

13

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					AVAILABLE MARKS
7	**(a)**	**(i)**	The forces are balanced [1] car is moving at a steady speed. [1]	[2]	
		(ii)	18,000 N	[1]	
	(b)		Apply the brakes [1] reduces speed/decelerates [1]	[2]	
	(c)		Belt now goes over driver's shoulder prevents the driver/passenger upper torso being flung forward in crash.	[2]	
	(d)		6,720/600 [1] 11.2 m/s [2]	[2]	
	(e)		air bag [1] crumple zone [1] impact bars [1] (any two)	[2]	
	(f)		They have a greater range [1] occupy less volume in the car. [1] A big increase in range [1] for a small increase in volume [1] (any two)	[2]	13
8	**(a)**	**(i)**	It started with a singularity [1] the Universe is still expanding. [1]	[2]	
		(ii)	14 billion years	[1]	
		(iii)	Steady State Theory	[1]	
	(b)		Galaxy A [1] increased wavelength [1] red-shift [1]	[3]	7
				Total	**75**

New Specification

Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2012–2013

Science: Single Award

Unit 3 (Physics)

Higher Tier

[GSS32]

GSS32

WEDNESDAY 29 FEBRUARY, 2012
9.30 am–10.45 am

TIME

1 hour 15 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 nine** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in questions **3(a)** and **9(a)(i)**.

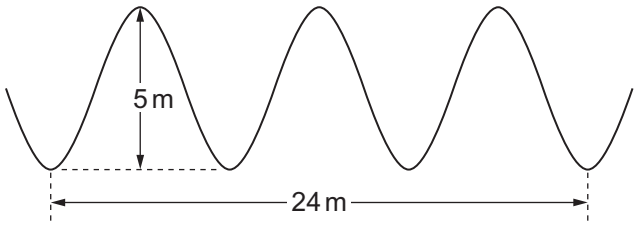
For Examiner's use only	
Question Number	Marks
1	
2	
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7	
8	
9	
Total Marks	

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Examiner Only	
Marks	Remark

1 The diagram below shows some sea waves.



(a) Use the information in the diagram to answer the following questions.

(i) What is the amplitude of these waves?

Answer _____ m [1]

(ii) What is the wavelength of these waves?

Answer _____ m [1]

(b) A student notes that **four** complete waves pass him in **two** seconds.

What is the frequency of these waves?

Answer _____ Hz [1]

(c) **(i)** Sea waves are transverse waves. Describe the motion of the particles in a transverse wave.

_____

_____ [2]

(ii) Name another example of a transverse wave.

_____ [1]

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Examiner Only	
Marks	Remark

2 **(a)** Complete the following equation about the stopping distance of a car.

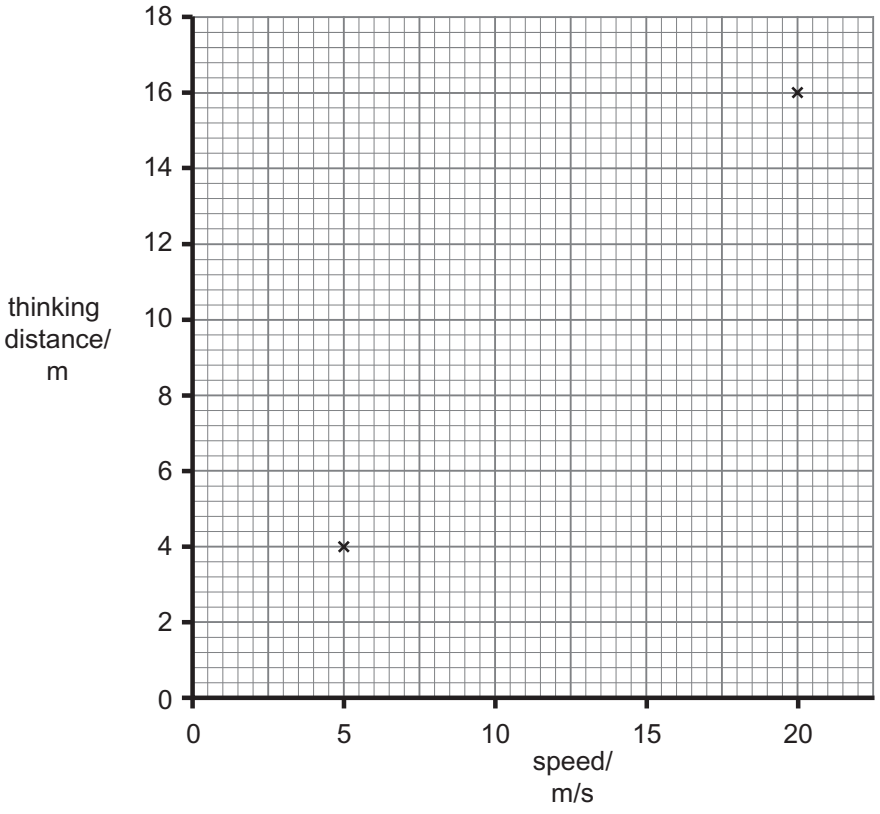
Stopping distance = thinking distance + _____ distance

[1]

(b) The table below gives the thinking distance at different speeds on a dry day.

Speed/ m/s	Thinking distance/ m
5	4
8	6.4
12	9.6
15	12
20	16

(i) Complete the plots for these values and draw a line graph on the grid below.



[2]

(ii) State the trend shown in this information.

_____

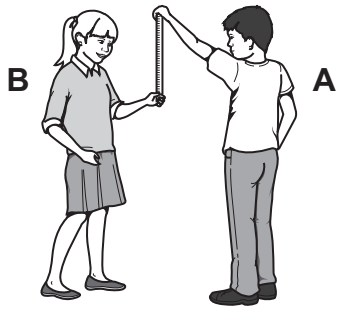
_____ [1]

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(iii) Suggest how the thinking distances shown in the table opposite will change, if at all, if taken on a wet day.

_____ [1]

(c) The picture below shows two people investigating how fast their reactions are.



The boy on the right (**A**) drops the metre stick and the girl on the left (**B**) catches it as quickly as possible.

(i) Explain fully how the distance the metre stick falls is used to show how good the girl's reactions are.

_____

_____

_____ [2]

(ii) State what can be done to make the results as:

1. reliable as possible.

_____

_____

2. accurate as possible.

_____

_____ [2]

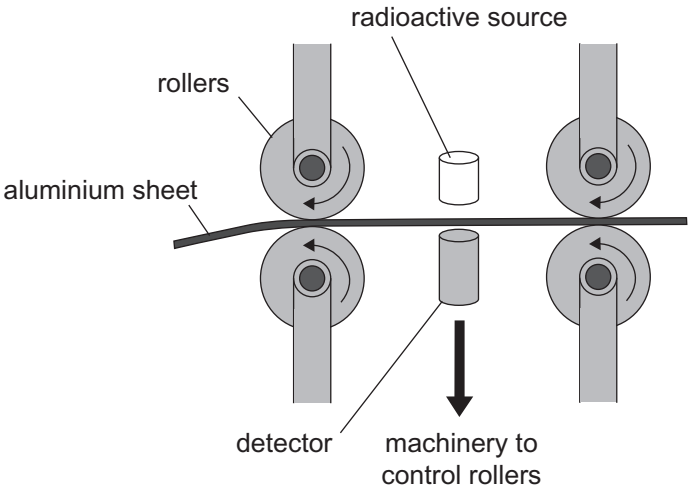
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

3 The diagram below shows how a radioactive source is used to monitor the thickness of an aluminium sheet during manufacture. If the thickness of the aluminium sheet changes, the force applied to the rollers will adjust to maintain the correct thickness.



(a) Beta is the best type of radiation to use as a source. With reference to the penetration properties of all types (alpha, beta and gamma) explain fully why beta is the best.

In this question you will be assessed on your written communication skills including the use of specialist science terms.

[6]

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(b) Radiation is used to kill bacteria and fungi found in fresh food to stop decay. The radiation is applied after packaging.

The table below gives details of some isotopes.

Isotope	Type of radiation emitted	Half-life
Radon-220	Alpha	54.5 seconds
Polonium-210	Alpha	138 days
Bismuth-83	Beta	61 minutes
Hydrogen-3	Beta	12 years
Technetium-99	Gamma	6 hours
Cobalt-60	Gamma	5 years

Which isotope would be best for a food producer to use with a packet of fresh strawberries? Explain your answer.

Isotope _____ [1]

Explanation _____

_____

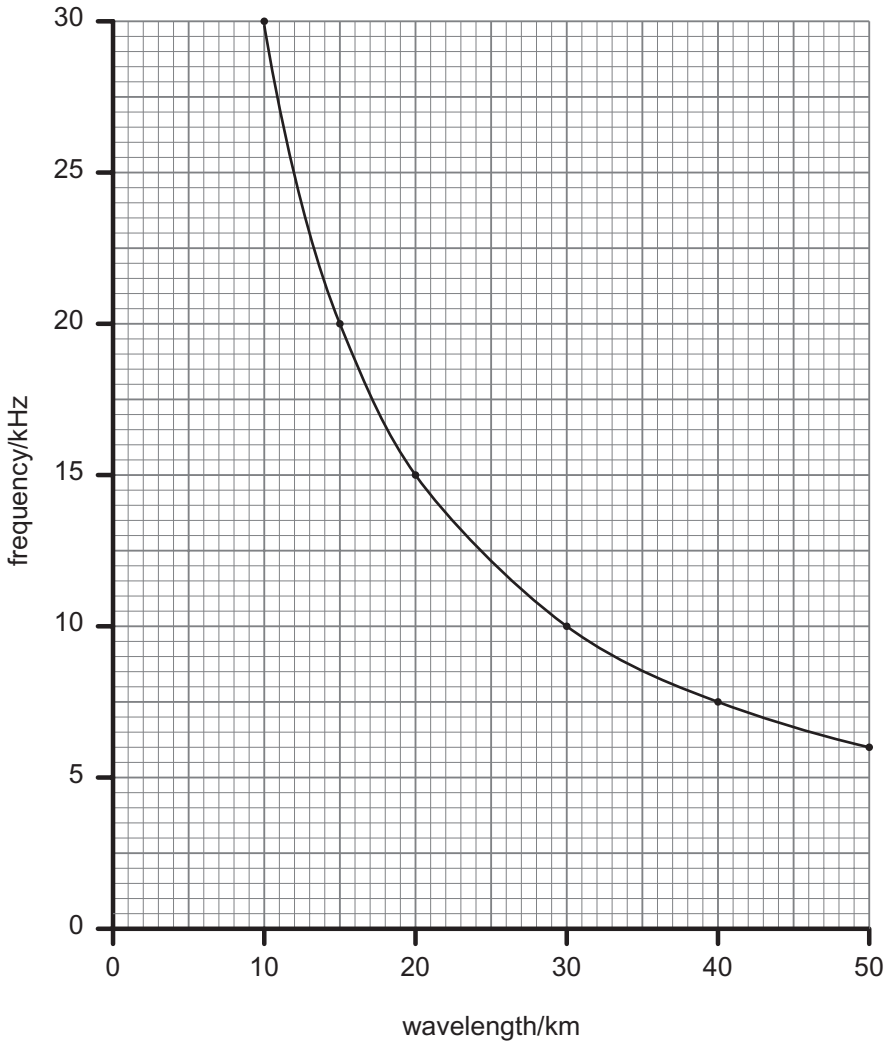
_____ [2]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

4 The graph below shows how the frequency of electromagnetic waves changes with wavelength.



(a) State the conclusion that can be drawn from this graph.

_____

_____ [1]

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(b) (i) Use the graph to find the wavelength of an electromagnetic wave with a frequency of 7.5 kHz.

Answer _____ km [1]

(ii) Use your answer to part **(i)** and the equation:

wave speed = **frequency** × **wavelength**

to calculate the speed of this wave in metres per second (m/s). (Show your working out.)

Answer _____ m/s [2]

(c) State **two** features of electromagnetic waves.

_____

_____

_____ [2]

(d) Name **two** types of electromagnetic wave that can be used in mobile phone communications.

_____

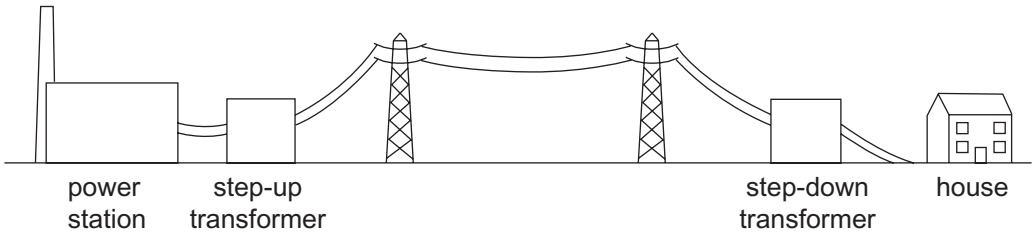
_____ [2]

Examiner Only	
Marks	Remark

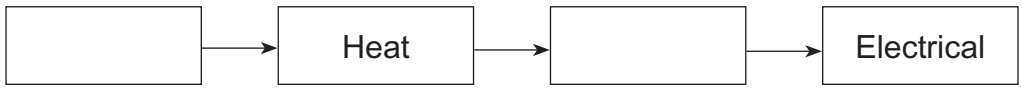
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Examiner Only	
Marks	Remark

5 The diagram below shows how electricity gets from power stations to consumers.



(a) **(i)** Complete the following energy change diagram for a fossil fuel power station.



[2]

(ii) Why is electrical the most useful type of energy?

_____ [1]

(b) Electricity from the power station is passed through a step-up transformer.

(i) What change, if any, does the step-up transformer make to the:

1. current?

_____ [1]

2. voltage?

_____ [1]

(ii) Suggest **one** advantage of passing electricity through the step-up transformer.

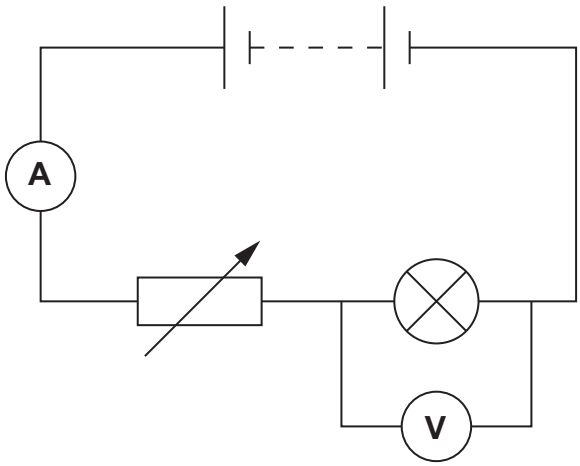
_____

_____ [1]

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Examiner Only	
Marks	Remark

(c) Below is shown a simple circuit which includes a variable resistor.



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

(ii) The table below shows the results obtained from the circuit when the variable resistor is adjusted.

Voltage/V	Current/A
2	0.10
3	0.15
5	0.25
7	0.30

State the trend shown by these results.

_____

_____ [1]

(iii) Suggest a suitable application of a variable resistor in the home.

_____ [1]

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Examiner Only	
Marks	Remark

6 **(a)** The diagrams below show a filament lamp, a halogen lamp and a compact fluorescent lamp (CFL).



filament lamp
(wire inside)

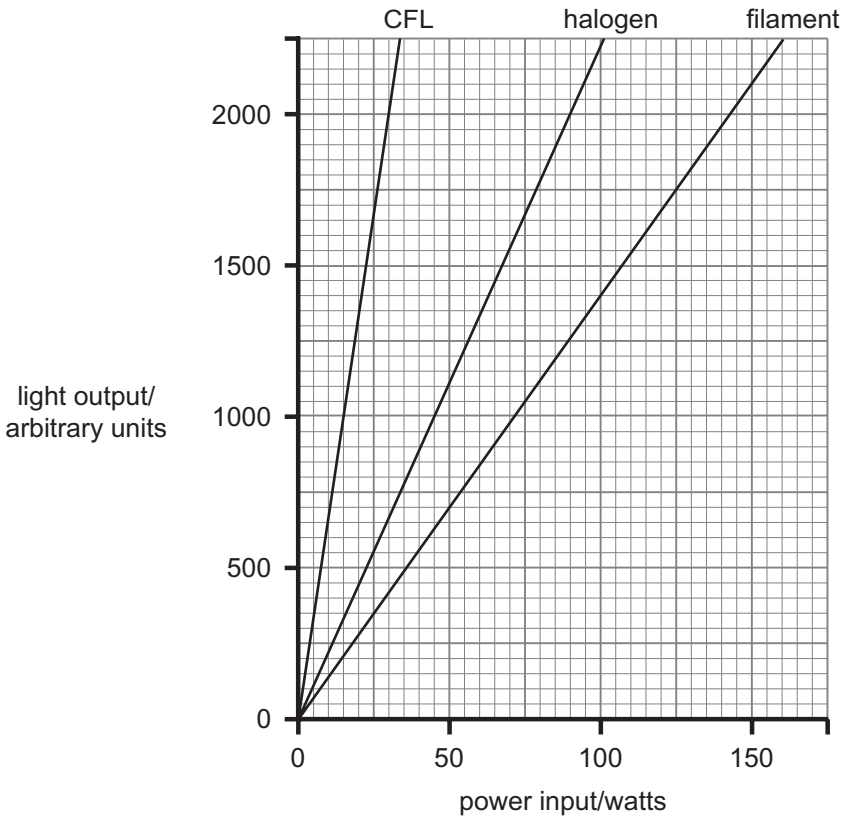


halogen lamp
(filled with argon)



CFL

The graph below shows how the light output for each type changes with power input.



(i) At 25 watts calculate how much more light a halogen lamp produces compared with a filament lamp.

_____ arbitrary units [1]

(ii) State two trends that the graph shows.

1. _____

_____

2. _____

_____ [2]

(b) The government is promoting the use of CFL bulbs and the production of filament bulbs is about to stop. Use the information provided to explain why this is the best course of action.

_____

_____

_____

_____

_____ [3]

(c) State the law of 'conservation of energy'.

_____

_____

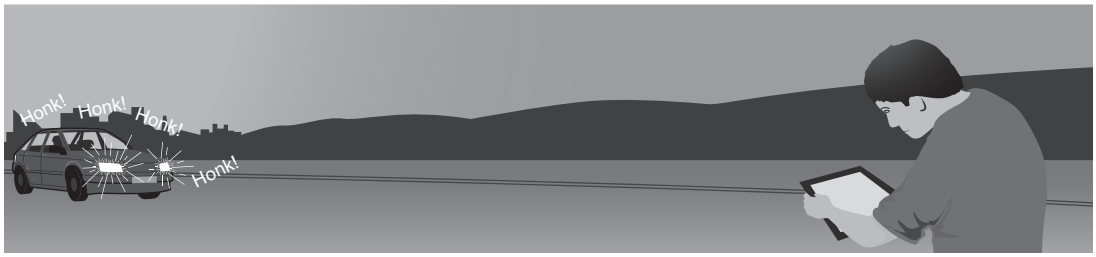
_____ [2]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

7 **(a)** The picture below shows two pupils using the flash-bang method to find the speed of sound in air.



© GCSE Single Award Science for CCEA by T Laverty, J Napier & R White, page 213, published by Hodder Murray, 2006. ISBN 978 0340 926000. 'Reproduced by permission of Hodder Education'

(i) Describe a method the pupils could use to find the speed of sound.

_____

_____

_____

_____

_____

_____ [3]

(ii) When the experiment was repeated in the opposite direction, the results were found to be different.

Suggest a reason for the difference.

_____

_____ [1]

(b) The speed of sound can also be found using the echo method.

(i) What is an echo?

_____ [1]

(ii) In concert halls echoes can distort the sound.

Explain fully how this problem can be overcome.

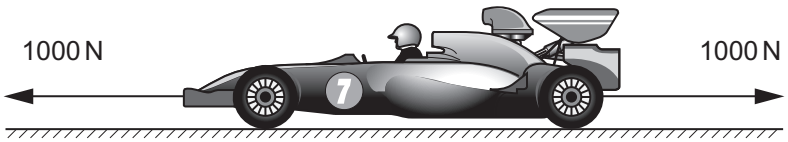
_____

_____

_____ [2]

Examiner Only	
Marks	Remark

8 The diagram below shows the forces acting on a moving racing car.



(a) (i) Explain fully, in terms of forces, the movement of this racing car.

_____

_____

_____ [2]

(ii) Describe fully, in terms of the resultant force, the effect of increasing the forward force to 1500 N.

_____

_____

_____ [2]

(b) State **two** safety features designed to absorb energy and reduce injury in a crash.

1. _____

2. _____ [2]

(c) Car speeds can be measured using instantaneous or average speed cameras.

(i) Explain the difference between instantaneous and average speed.

_____

_____

_____ [2]

(ii) Suggest a reason why there are fewer accidents when average speed cameras are used.

_____

_____ [1]

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Examiner Only	
Marks	Remark

9 **(a)** The table below gives the speed of galaxies in the Universe at different distances from Earth.

Galaxy	Distance from Earth/ tens of millions of light years	Speed away from Earth/ thousands of km/s
Virgo	5	1
Ursa Major	65	15
Corona	95	22
Bootes	170	39
Hydra	260	61

(i) Describe fully the Big Bang theory and explain how the information in the table supports this theory.

In this question you will be assessed on your written communication skills including the use of specialist science terms.

_____

_____

_____

_____

_____

_____

_____

_____

_____ [6]

(ii) Based on the Big Bang theory how old is the Universe?

Answer _____ years [1]

(iii) Explain fully the term 'light year'.

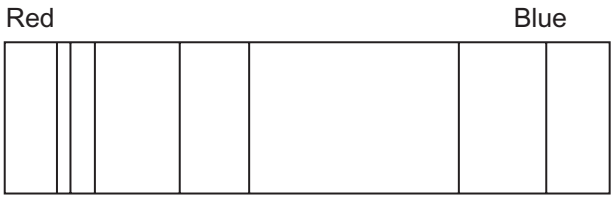
_____

_____ [1]

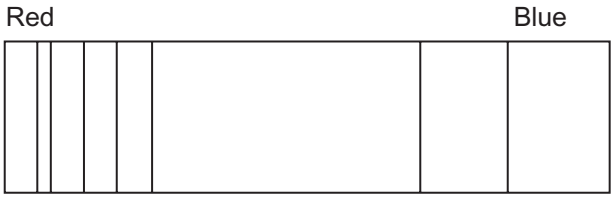
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(b) The diagrams below provide further evidence for the Big Bang theory.

Examiner Only	
Marks	Remark



Light from a star that is stationary relative to Earth



Light from a star that is moving away from Earth

Name and explain the phenomenon shown in these diagrams.

_____

_____

_____

_____ [2]

THIS IS THE END OF THE QUESTION PAPER

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112806

New Specification

Rewarding Learning

General Certificate of Secondary Education
2012–2013

Science: Single Award

Unit 3 (Physics)

Higher Tier

[GSS32]

WEDNESDAY 29 FEBRUARY, 2012
9.30 am–10.45 am

MARK SCHEME

STEMUP.CO.UK

				AVAILABLE MARKS
1	**(a)**	**(i)** 2.5 m	[1]	
		(ii) 8 m	[1]	
	(b)	2 Hz	[1]	
	(c)	**(i)** vibrations move up and down at right angles [1] to wave travel [1]	[2]	
		(ii) any electromagnetic wave	[1]	6
2	**(a)**	braking	[1]	
	(b)	**(i)** 3 points correct [1] correct line [1]	[2]	
		(ii) as speed increases, thinking distance increases	[1]	
		(iii) no change	[1]	
	(c)	**(i)** the shorter distance the stick falls [1] the quicker her reactions are [1]	[2]	
		(ii) repeat/average [1] 0 cm on ruler to be held just above hand [1]/implied drop from same place/height each time	[2]	9

3 **(a)** indicative content

- Amount of beta going through will change with thickness of aluminium
- Thicker aluminium the less beta radiation detected (or vice versa)
- Alpha would be stopped by aluminium/paper/air
- Gamma would go straight through aluminium/lead
- Beta stopped by aluminium

Band	Response	Mark
A	Candidates must use 4/5 of the above points in a logical sequence to explain fully why beta is best. They use good spelling, punctuation and grammar and the form and style are of a high standard.	5–6
B	Candidates use 3 of the above points in a logical sequence to partially explain why beta is best. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	3–4
C	Candidates explain why beta is best using 1/2 of the above points. However these are not presented in a logical sequence. They use limited spelling, punctuation and grammar.	2–1
D	Response not worthy of credit	0

[6]

(b) cobalt 60 [1]

Gamma has most penetrating power [1]/gamma kills bacteria half-life is longest/doesn't need to be replaced often [1] [2] — 9

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					AVAILABLE MARKS
4	**(a)**		the longer the wavelength, the lower the frequency	[1]	
	(b)	**(i)**	40	[1]	
		(ii)	40 000 × 7500/either transformation [1] 300 000 000 [2]	[2]	
	(c)		can travel through a vacuum/travel at the speed of light carry energy/travel at same speed transverse waves *(any 2 = 1 mark each)*	[2]	
	(d)		infra red [1] microwave [1]	[2]	8
5	**(a)**	**(i)**	chemical [1] kinetic/movement [1]	[2]	
		(ii)	easily changed into other types/forms	[1]	
	(b)	**(i)**	current = decreased	[1]	
			voltage = increased	[1]	
		(ii)	reduce amount of energy/electricity lost/less energy – electricity wasted/thinner wire/aluminium	[1]	
	(c)	**(i)**	arrow pointing from +ve to −ve (anticlockwise)	[1]	
		(ii)	current increases with voltage	[1]	
		(iii)	dimmer/volume switch/thermostat/toaster/oven not hairdryer	[1]	9
6	**(a)**	**(i)**	200 arbitrary units	[1]	
		(ii)	more light requires more power [1] for the same amount of power CFL produces more light CFL most efficient than halogen and halogen produces more light than filament	[2]	
	(b)		CFL most efficient; less power/energy used; less fossil fuels used; less global warming *(any 3)*	[3]	
	(c)		energy cannot be created or destroyed [1] it can only be changed from one type to another [1]	[2]	8
7	**(a)**	**(i)**	car + person good distance apart/measure distance Beep horn + flash lights at same time Start watch when lights seen Stop watch when horn heard Use speed = distance/time *(any 3 = 1 mark each)*	[3]	
		(ii)	wind or timing problems/human error	[1]	
	(b)	**(i)**	reflected sound/bounce back	[1]	
		(ii)	soft/named soft material [1] absorb sound [1]	[2]	7

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		AVAILABLE MARKS
8 **(a)** **(i)**	forces are equal/same/balanced [1] steady speed [1] [2]	
(ii)	resultant force = 500N [1] causing acceleration [1] [2]	
(b)	air bags/crumple zones/impact bars/crash barriers *(any 2 = 1 mark each)* [2]	
(c) **(i)**	instantaneous = at one precise moment [1] average = over whole journey [1] [2]	
(ii)	drivers slow down for longer distance [1]	9

9 **(a)** **(i)** Indicative content

- Matter originated from a single point (singularity)
- Huge explosion/expansion in which energy and particles formed
- After millions of years gravity pulled this matter together to eventually form stars and galaxies
- More distant galaxies are moving faster proves expansion
- Conclusion proves universe still expanding

Band	Response	Mark
A	Candidates must use 4/5 of the above points in a logical sequence to explain the Big Bang theory including the conclusion from the information given. They use good spelling, punctuation and grammar and the form and style are of a high standard.	5–6
B	Candidates use 2/3 of the above points in a logical sequence to partially explain the Big Bang theory including the conclusion from the information given. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	3–4
C	Candidates explain the Big Bang theory including the conclusion from the information given using some of the above points. However these are not presented in a logical sequence. They use limited spelling, punctuation and grammar.	2–1
D	Response not worthy of credit	0

[6]

(ii) 14 Billion years [1]

(iii) distance light travels in 1 year [1]

(b) red shift [1]
light from further galaxies is shifted towards the red end of the light spectrum/galaxies moving away from each other [1] [2] 10

Total **75**

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