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	
4	
5	
6	
7	
8	
9	
Total Marks	

Examiner Only	
Marks	Remark

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

_____

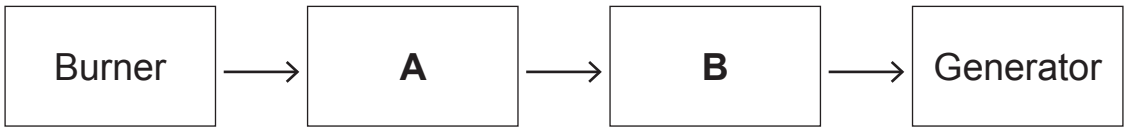
_____

_____

_____

_____ [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.

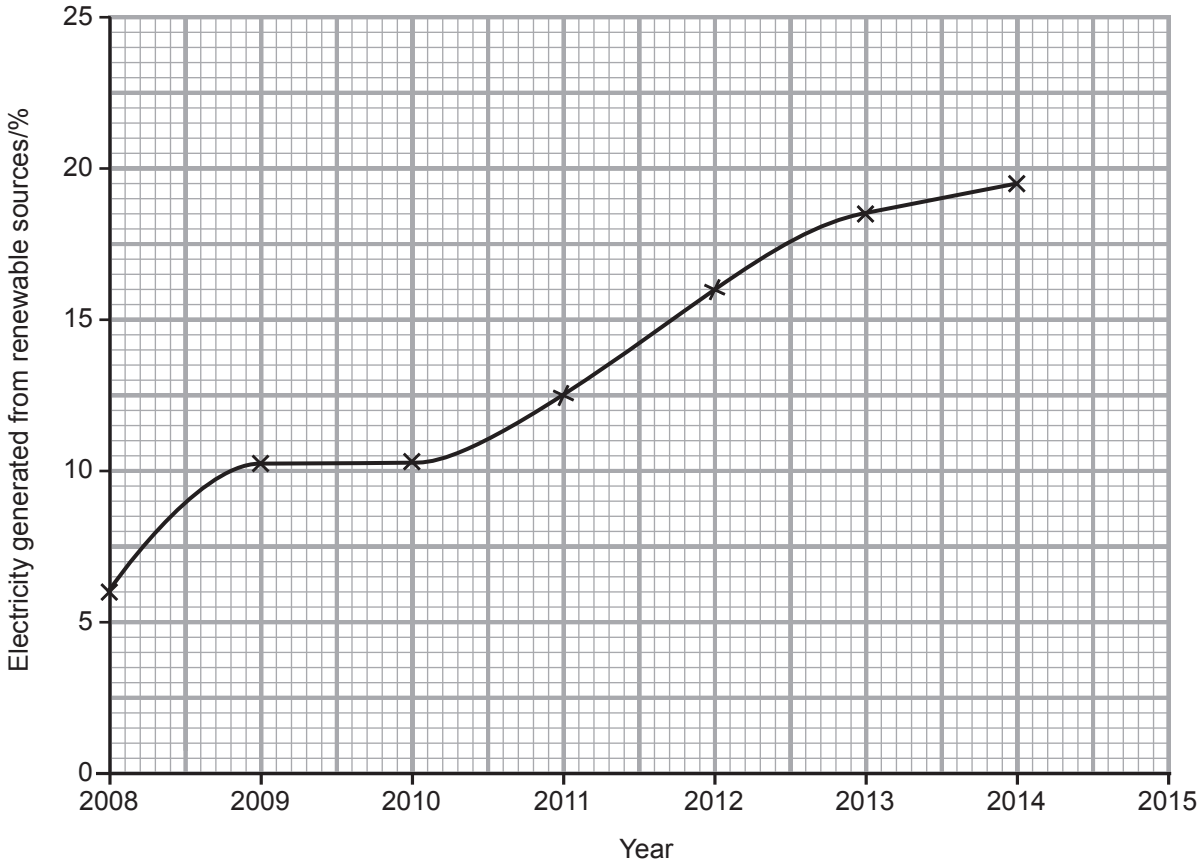
_____

_____

_____ [2]

Examiner Only	
Marks	Remark

(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]

(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)

Examiner Only	
Marks	Remark

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

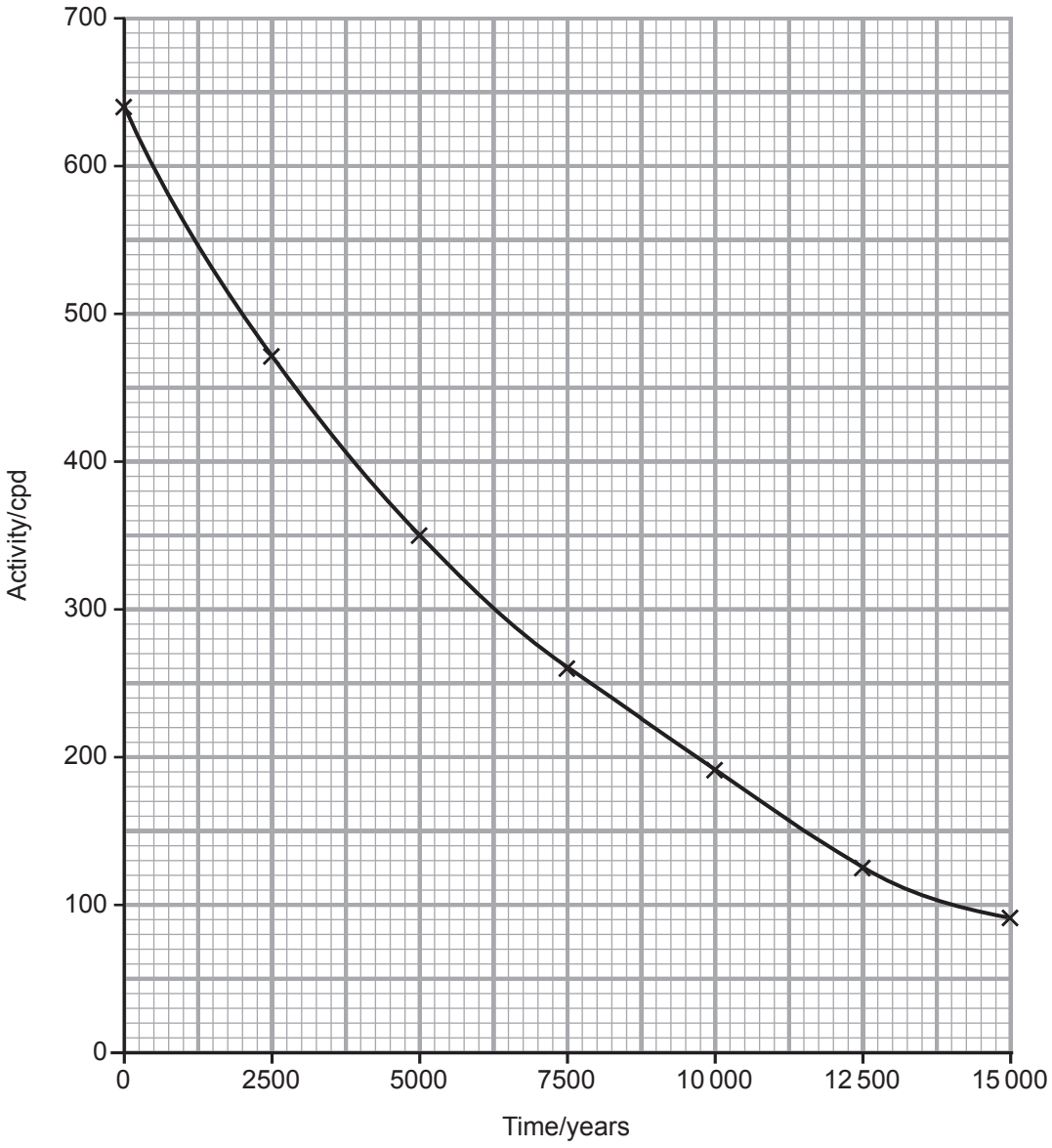
(a) What is meant by the term 'half-life'?

_____

_____

_____ [2]

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



(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.

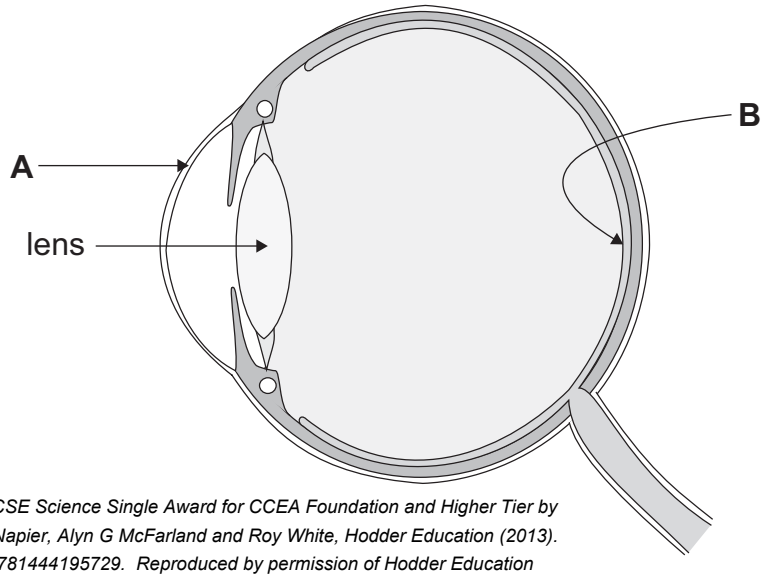
[6]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

4 The diagram below shows the eye.

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



A _____

B _____ [2]

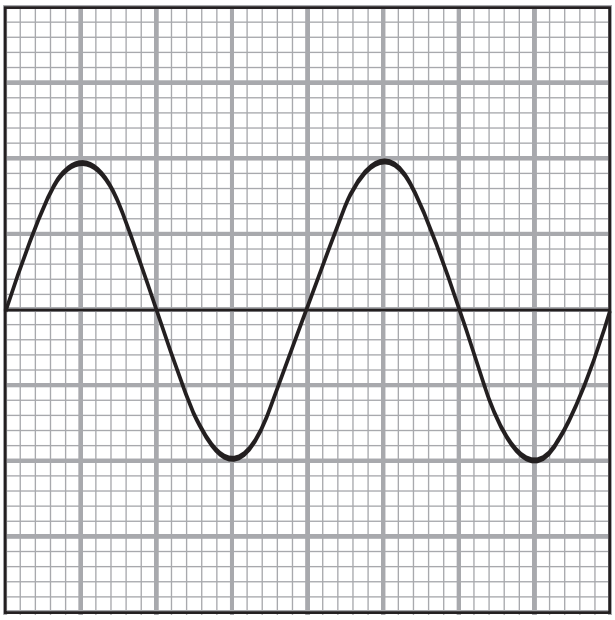
Long and short sight are eye defects that cause people difficulty in seeing objects clearly as shown in the table.

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]

5 The diagram below shows a wave.



Examiner Only	
Marks	Remark

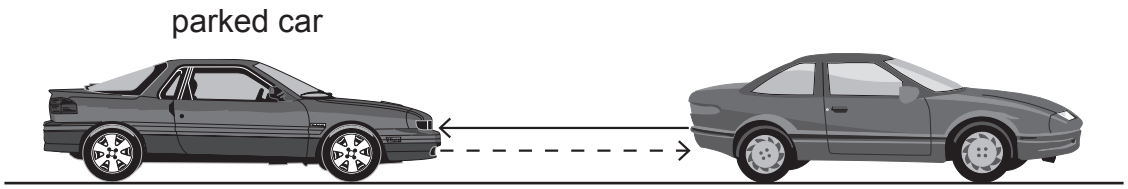
(a) On the same grid draw another wave with the same wavelength but double the amplitude of the one shown. [2]

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

_____

_____ [2]

(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

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

(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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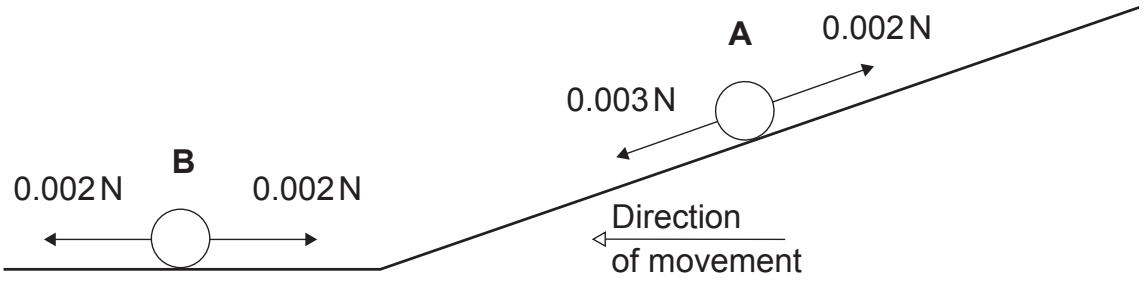
(Questions continue overleaf)

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]

(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]

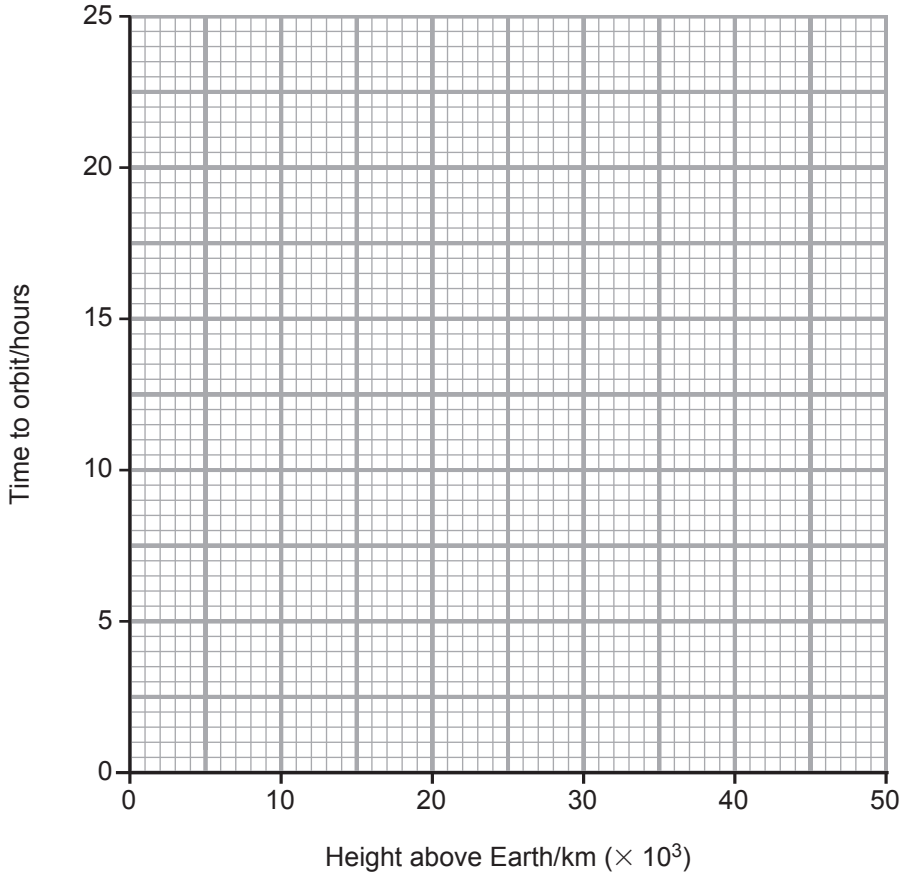
Examiner Only

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.

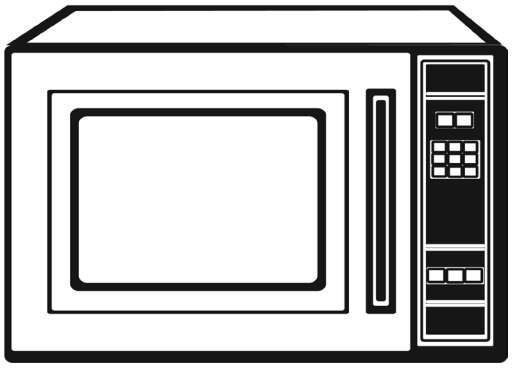
_____ [1]

Examiner Only

Marks	Remark

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.

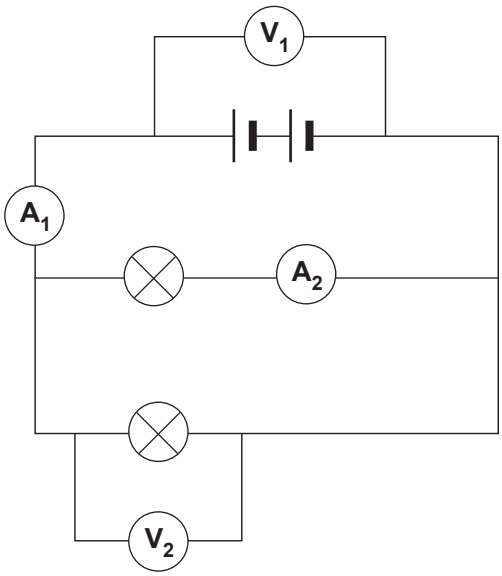
In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

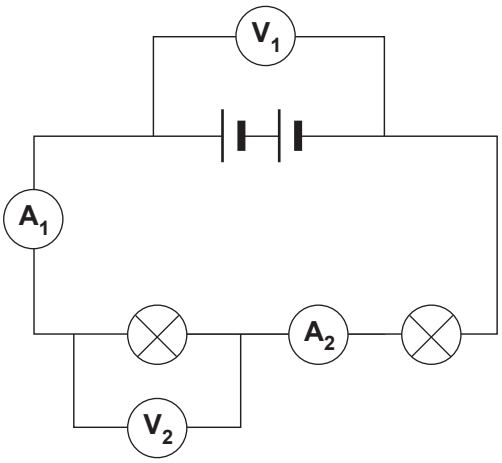
Examiner Only	
Marks	Remark

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.

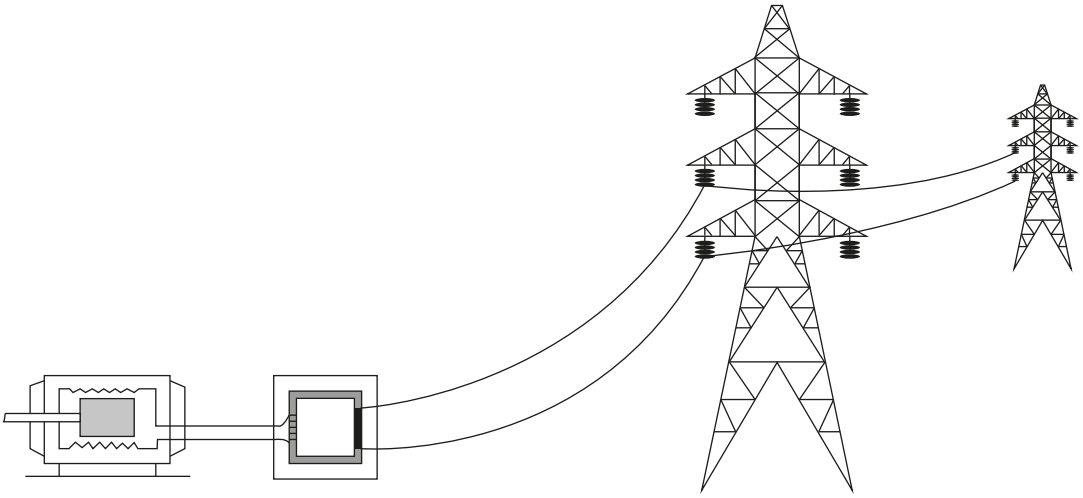
_____

_____

_____

_____ [3]

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



Explain fully why this transformer is used in the grid.

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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