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)**.

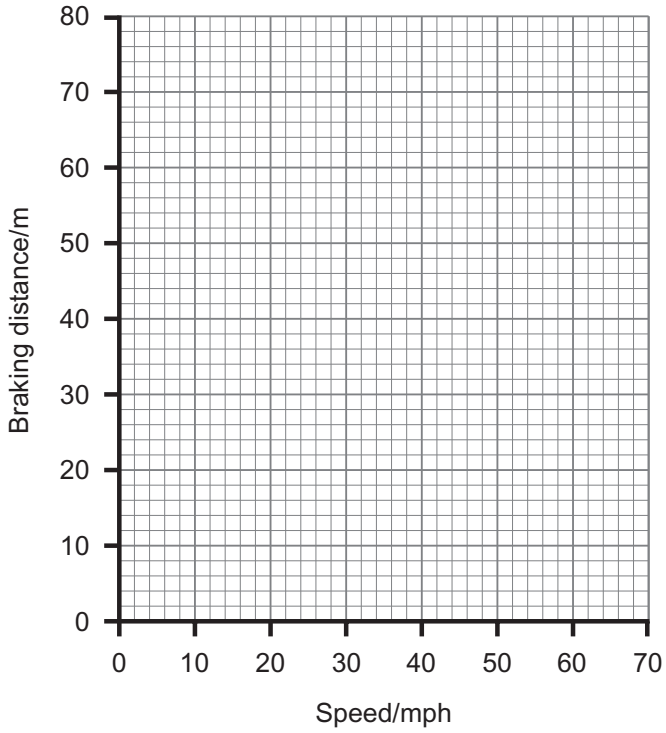
For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total Marks	

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]

(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.

_____

_____

_____

_____

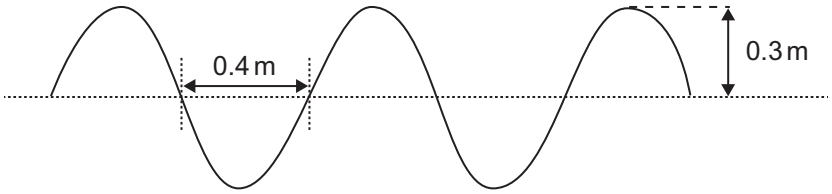
_____ [3]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

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]

(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.)

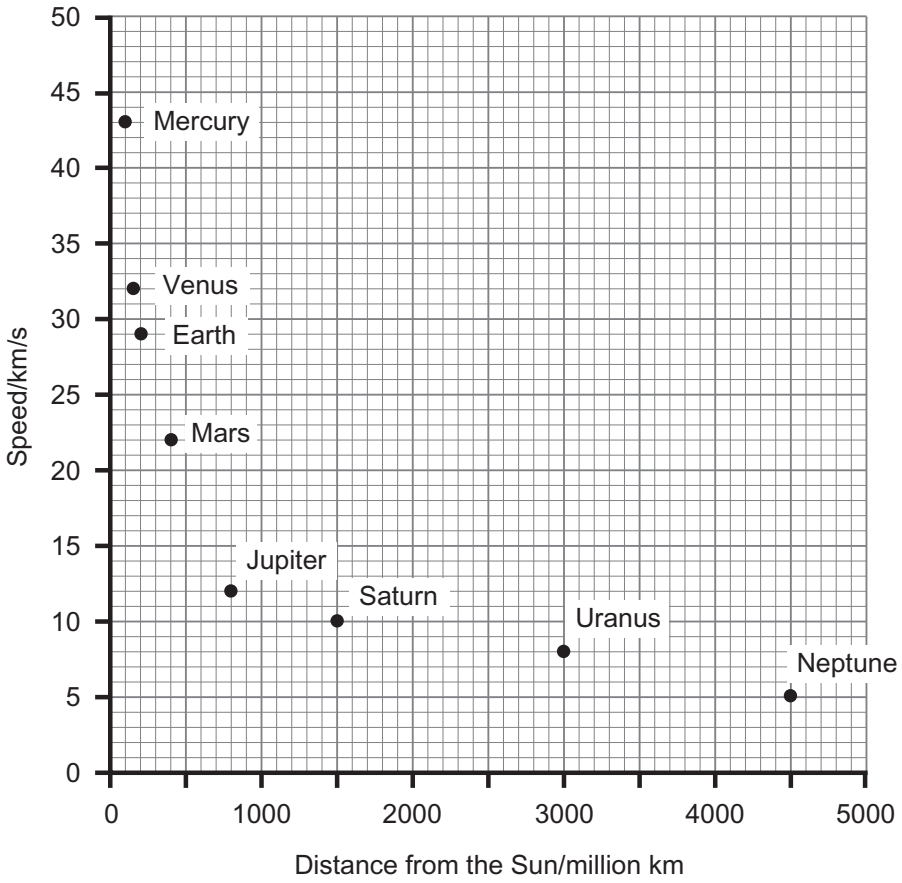
Answer _____ m [3]

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]

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

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

1. _____

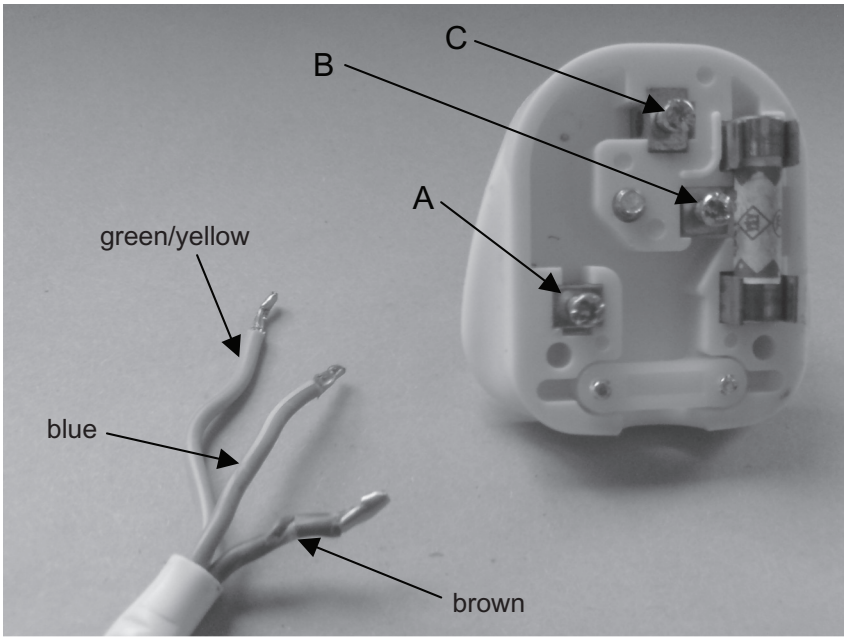
2. _____ [2]

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.

[6]

Examiner Only

Marks	Remark

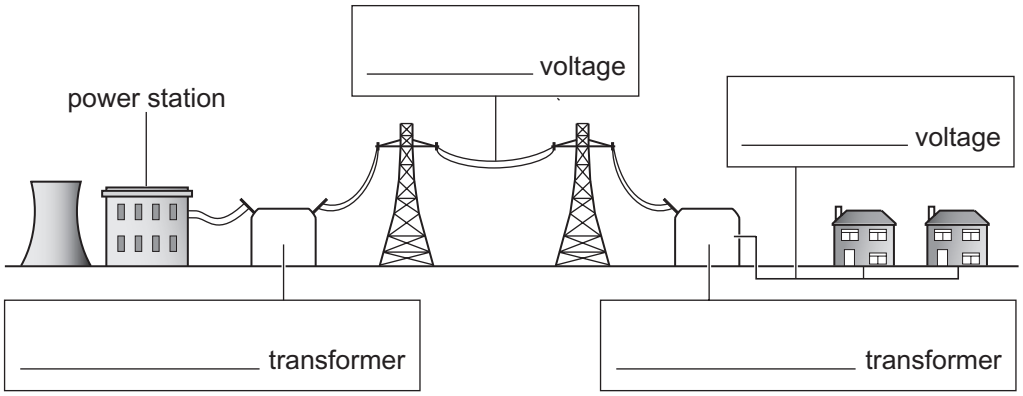
Examiner Only	
Marks	Remark

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]



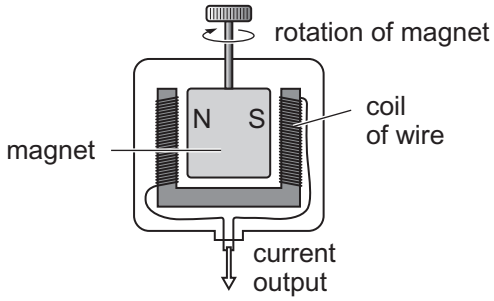
(iii) Explain fully why the voltage is changed before electricity is distributed from the power station.

_____

_____

_____ [2]

(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.

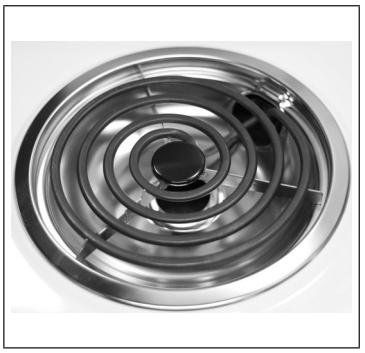
_____ [1]

6 Below are three electrical appliances that can heat water.

Examiner Only	
Marks	Remark

Kettle

Microwave oven



Cooker ring

(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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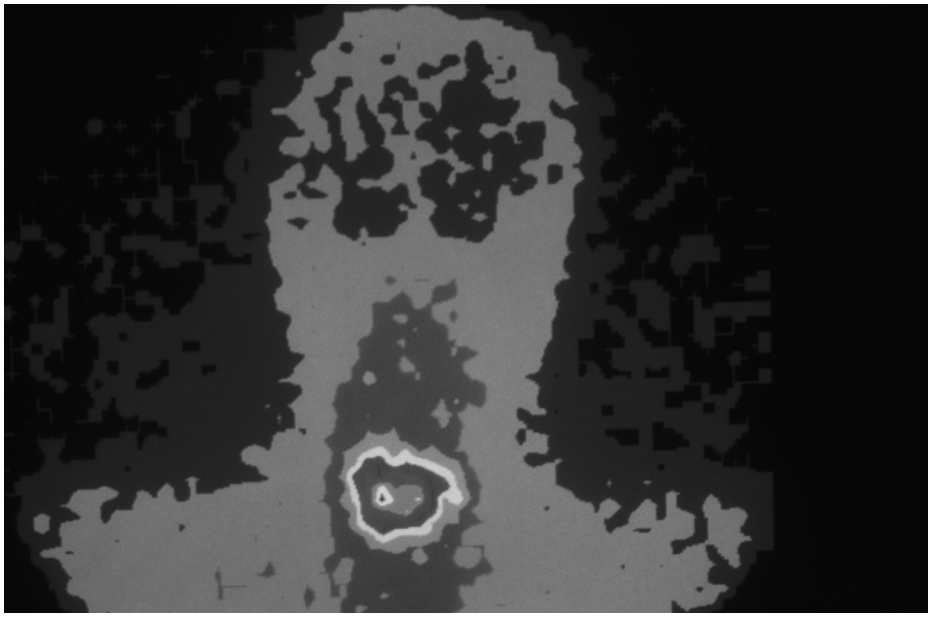
Examiner Only	
Marks	Remark

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

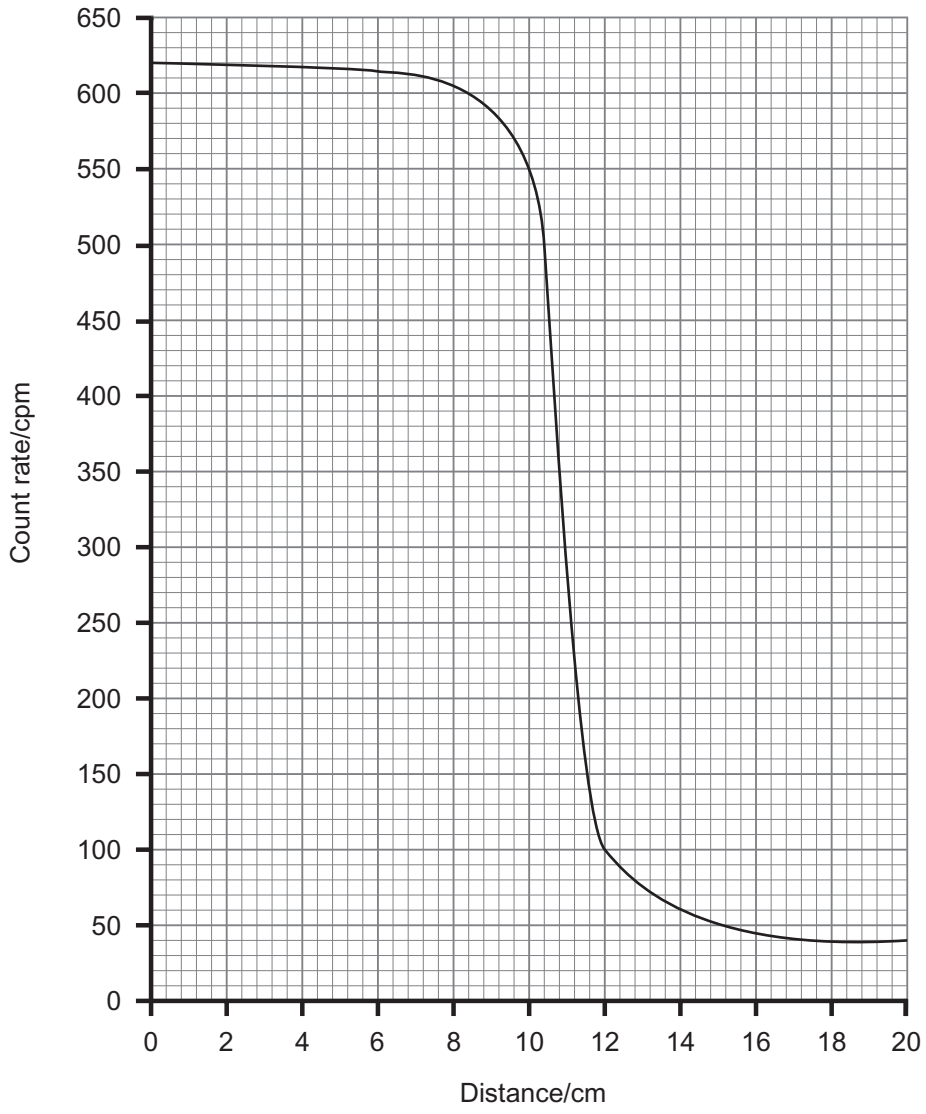
(i) What is the half-life of this source?

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.



(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.

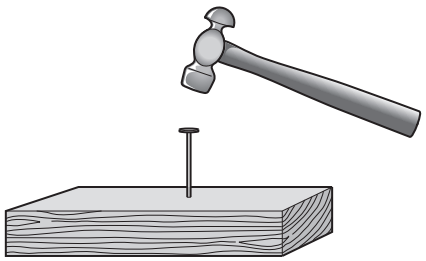
_____

_____

_____ [2]

Examiner Only	
Marks	Remark

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.

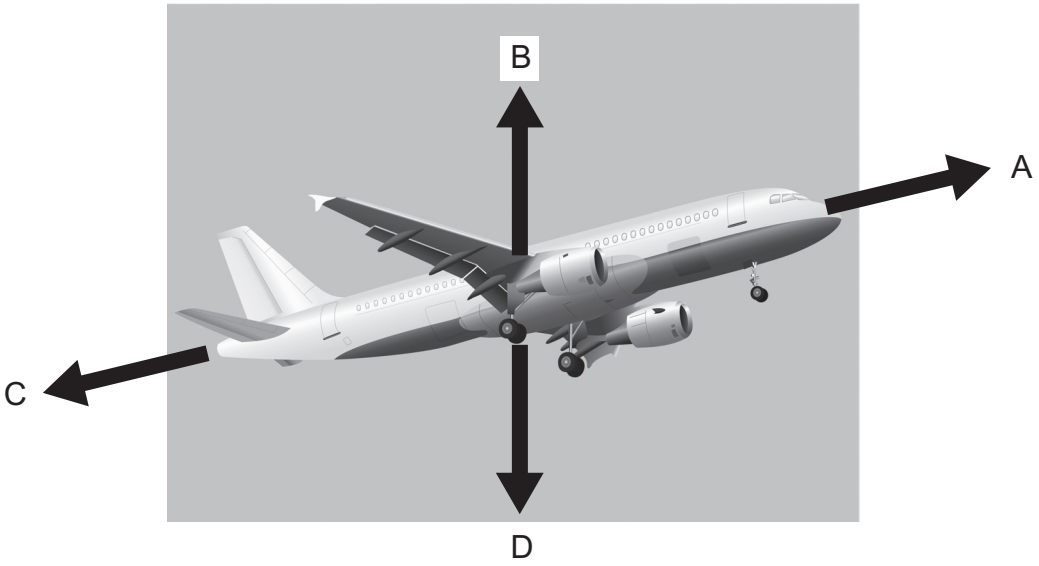
Answer _____ [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

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



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(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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