Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4473/01

ADDITIONAL SCIENCE/PHYSICS

PHYSICS 2
FOUNDATION TIER

A.M. THURSDAY, 23 May 2013

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**7**	
2.	**9**	
3.	**6**	
4.	**7**	
5.	**7**	
6.	**12**	
7.	**12**	
Total	**60**	

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ADDITIONAL MATERIALS

In addition to this paper you may require a calculator.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

If you run out of space, use the continuation pages at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

A list of equations is printed on page 2. In calculations you should show all your working.

You are reminded that assessment will take into account the quality of written communication (QWC) used in your answer to question **7**(i).

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Equations

power = voltage × current	$P = VI$
current = $\frac{\text{voltage}}{\text{resistance}}$	$I = \frac{V}{R}$
speed = $\frac{\text{distance}}{\text{time}}$	
acceleration [or deceleration] = $\frac{\text{change in velocity}}{\text{time}}$	$a = \frac{\Delta v}{t}$
acceleration = gradient of a velocity-time graph	
momentum = mass × velocity	$p = mv$
resultant force = mass × acceleration	$F = ma$
force = $\frac{\text{change in momentum}}{\text{time}}$	$F = \frac{\Delta p}{t}$
work = force × distance	$W = Fd$

SI multipliers

Prefix	Multiplier	
m	10^{-3}	$\frac{1}{1\,000}$
k	10^{3}	1 000
M	10^{6}	1 000 000

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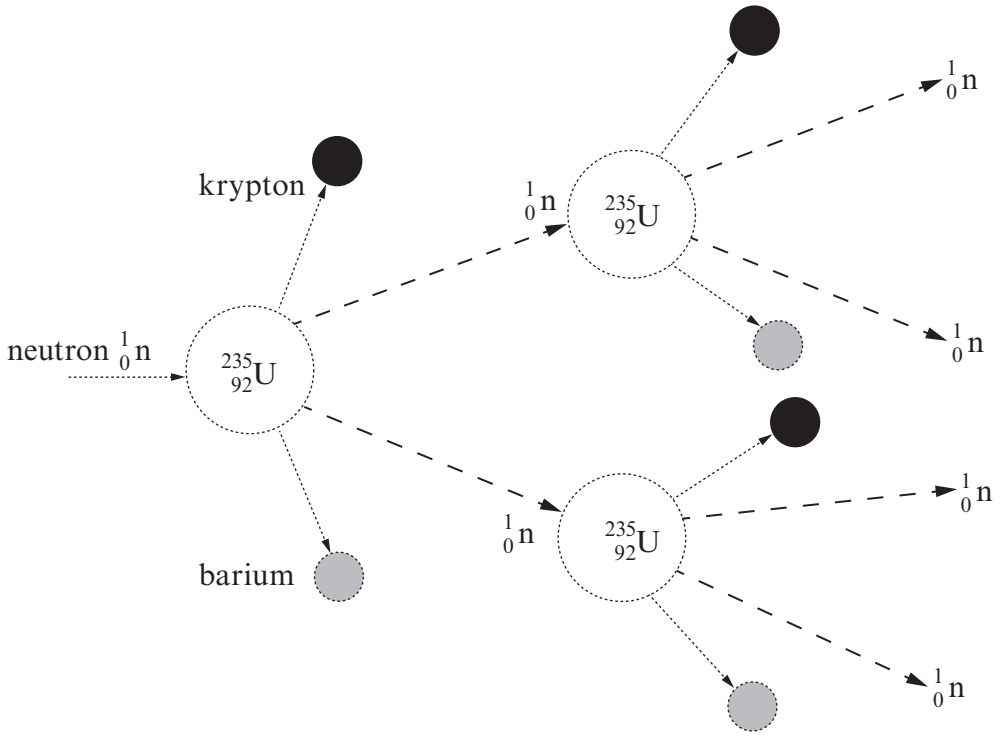
Answer **all** *questions.*

1. *(a)* Draw a line from **each** of the four boxes on the left to a **box on the right**. [3]

Part of nuclear reactor	Its function
Control rods	Provides atoms for fission to occur
Moderator	Absorb neutrons
Steel and concrete container	Slow down neutrons
Uranium	Absorb radiation

Examiner only

(b) A nuclear reaction that takes place in a nuclear reactor is shown below. Use the diagram to help you answer the questions that follow.



(i) Write down the name of this type of reaction. ..... [1]

(ii) Name **one** waste product of this reaction. ..... [1]

(c) State **two** reasons why waste radioactive materials from nuclear reactors need to be stored **safely** for a **long period** of time. [2]

1. .....

.....

2. .....

.....

7

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Turn over.

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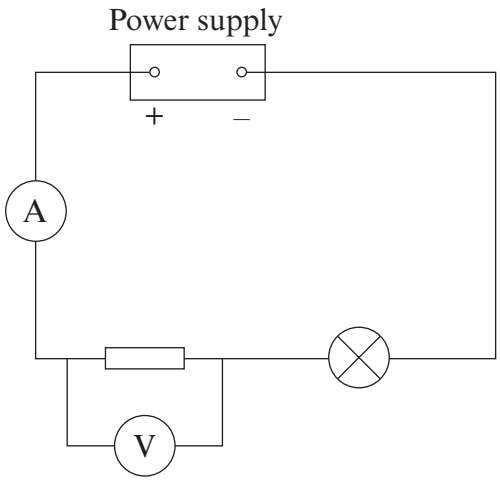
2. A student measures the voltage across a resistor and the current through it using the circuit below.

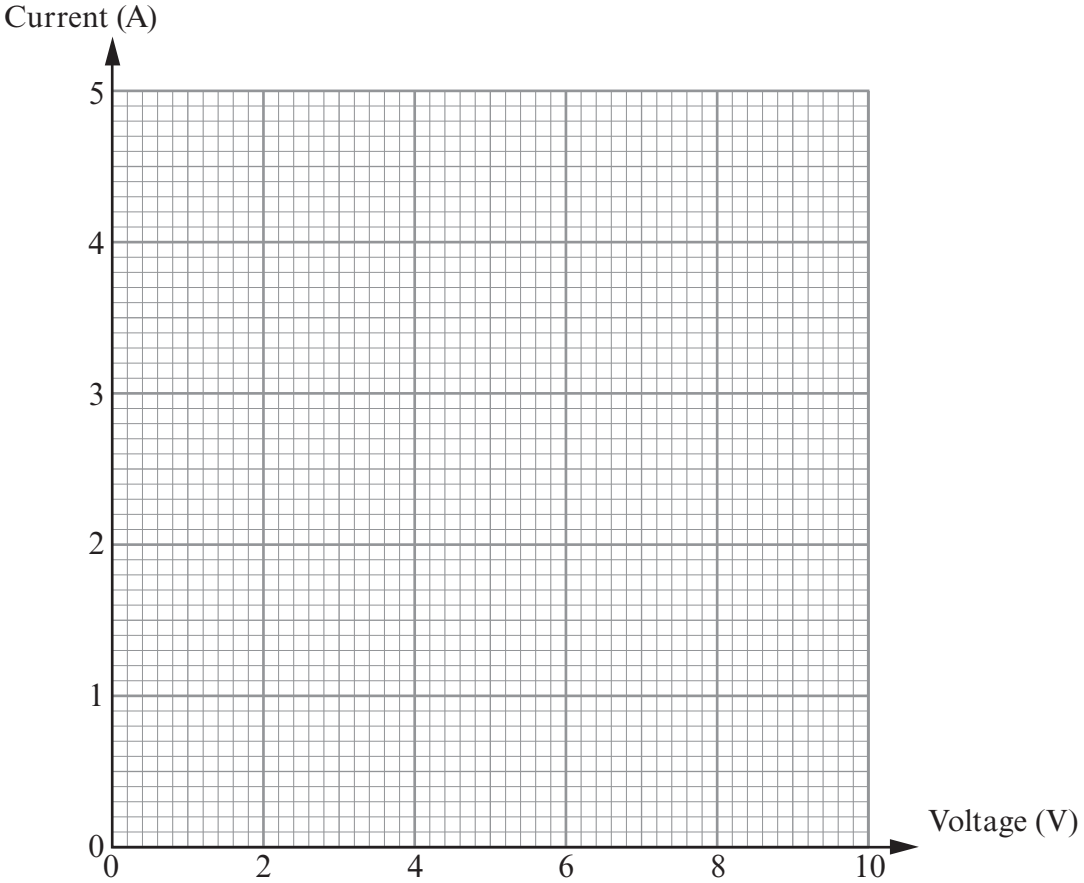


(a) The ammeter in the diagram reads **3.0 A** and the voltmeter reads **9.0 V**.

(i) Write down the size of the current that flows through the **lamp**. [1]

Current = ... A

(ii) Plot these ammeter and voltmeter readings as a **point** on the grid below. [1]



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(iii) Draw the graph **line** for the resistor on the grid opposite. [1]

(b) (i) Use the equation:

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

to calculate the resistance of the resistor when the voltage is 9.0 V. [3]

Resistance = ...

Unit of resistance .....

(ii) Use an equation from page 2 to calculate the power of the resistor when the voltage is 9.0 V. [3]

Power = ...

Unit of power .....

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Turn over.

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3. Radioactive carbon-14 is an isotope of carbon. It is produced high in the atmosphere when a neutron (n) combines with a nitrogen (N) nucleus, releasing a proton (p) in the process.

Carbon-14 written in the form ${}^{A}_{Z}\mathrm{X}$ is ${}^{14}_{6}\mathrm{C}$.

(a) Write down carbon-12 in the form ${}^{A}_{Z}\mathrm{X}$. ..... [1]

(b) The nuclear reaction that produces carbon-14 is written below.

$$ {}^{1}_{0}\mathrm{n} \; + \; {}^{\ldots\ldots}_{7}\mathrm{N} \longrightarrow {}^{14}_{6}\mathrm{C} \; + \; {}^{1}_{\ldots\ldots}\mathrm{p} $$

Fill in the missing numbers in the equation above. [2]

(c) Complete the following sentences with the number of particles, if any, in a ${}^{14}_{6}\mathrm{C}$ **nucleus**. [3]

A ${}^{14}_{6}\mathrm{C}$ **nucleus** contains ..... protons.

A ${}^{14}_{6}\mathrm{C}$ **nucleus** contains ..... neutrons.

A ${}^{14}_{6}\mathrm{C}$ **nucleus** contains ..... electrons.

6

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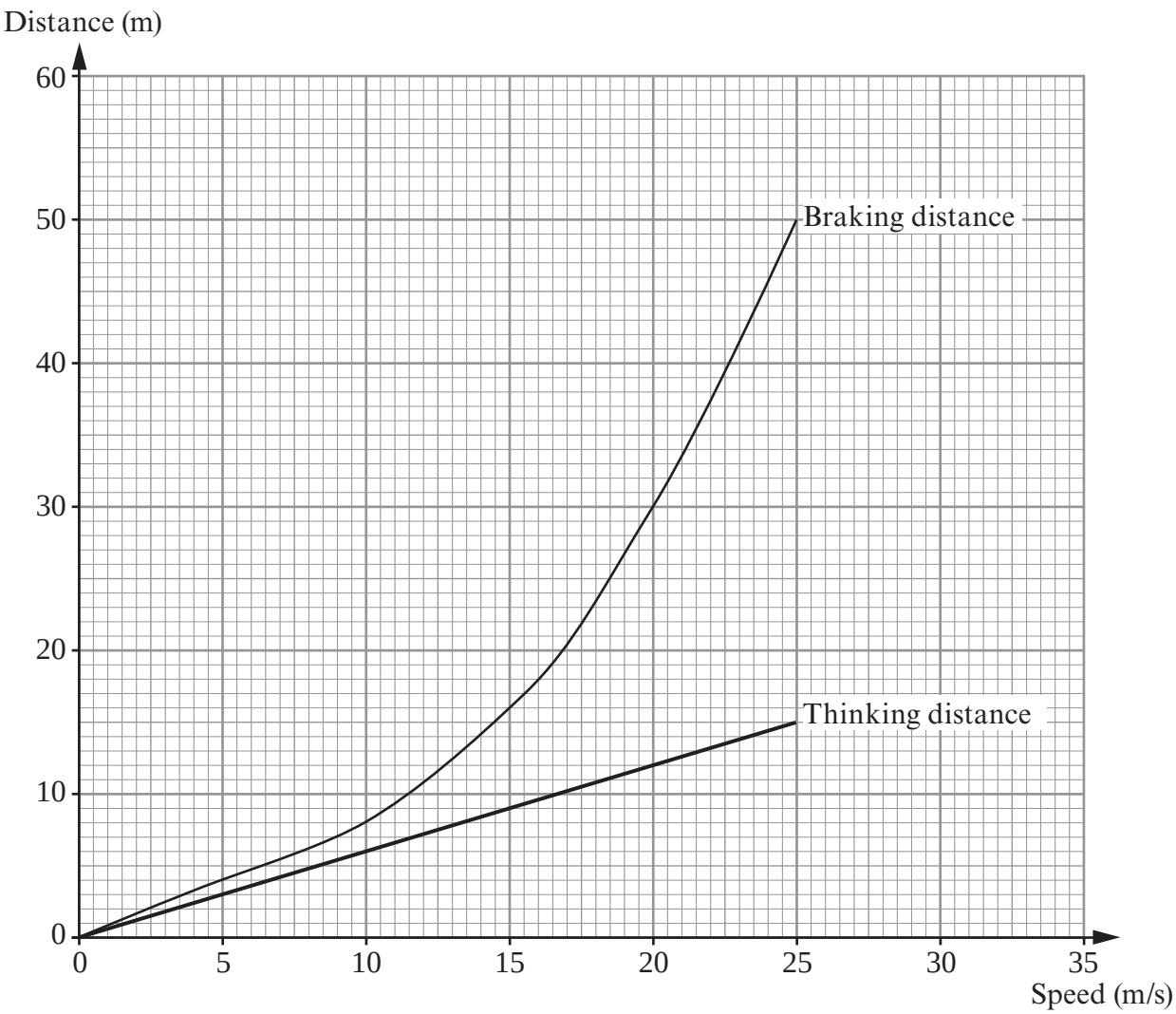
4. The graph below shows how the **braking distance** for a car and the **driver's thinking distance** change with the speed of the car.



(a) A car driver travelling along a road sees a child step on to the road ahead. The driver's thinking distance is 9 m.

(i) Use the graph to write down the speed of the car. [1]

Speed = ... m/s

(ii) Use the graph to write down the distance travelled whilst the car is braking from this speed. [1]

Distance = ... m

Examiner only

(b) The car travels on at 25 m/s.

(i) Use the equation:

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

to calculate the **thinking time** for the driver at this speed. [2]

Time = ... s

(ii) Use the graph to find the total stopping distance when the car travels at 25 m/s. [2]

Total stopping distance = ... m

(iii) State **one** factor that would decrease the braking distance at 25 m/s. [1]

.....

.....

7

Examiner only

5. A girl catches and stops a ball of mass 0.15 kg which is moving at a speed of 20 m/s.

(a) (i) Use the equation:

momentum = mass × velocity

to calculate the change in momentum of the ball. [2]

Momentum change = ... kg m/s

(ii) Use an equation from page 2 to calculate the force applied by the girl if the ball is stopped in 0.5 seconds. [2]

Force = ... N

(iii) The girl now doubles the time taken to stop the ball by moving her hands towards her as she catches it. What is the size of the force now? [1]

Force = ... N

Examiner only

(b) In some situations people have to be stopped suddenly and safely. The force on them is reduced by increasing the stopping time.

(i) Name a situation in which this happens. [1]

.....

(ii) Describe how the stopping time is increased. [1]

.....

.....

7

Turn over.

Examiner only

6. All living material takes in carbon-14 (C-14) which is radioactive and decays by beta emission. It has a half-life of 6000 years and is used in carbon dating which tells us the age of some old fossils. The age of things that died more than **10 half-lives** in the past cannot be accurately measured as the amount of C-14 present is too small.

(a) (i) State what you understand by the statement "the half-life of carbon-14 is 6000 years". [1]

.....

.....

(ii) Explain how carbon-14 decays by beta emission. [2]

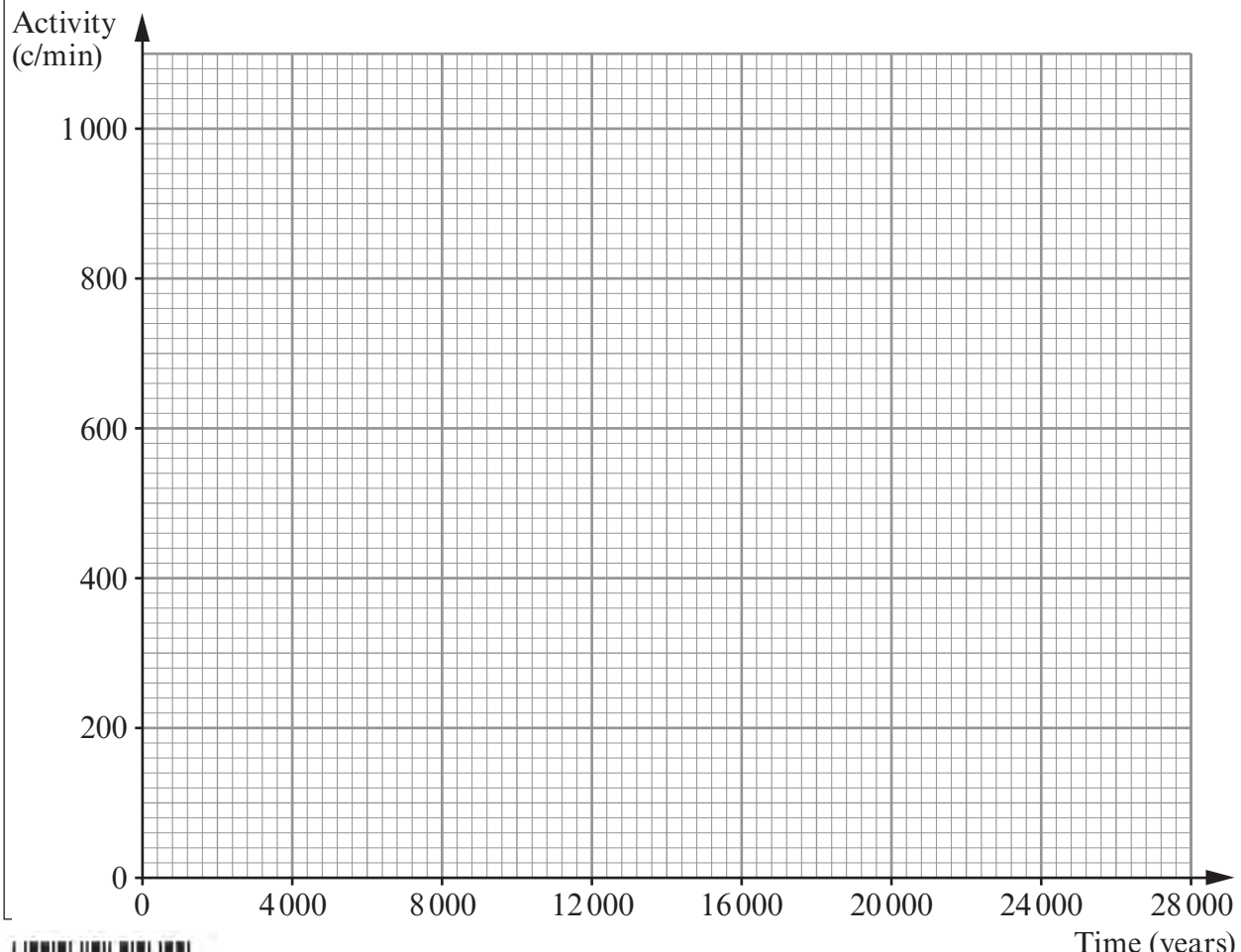
.....

.....

(b) The activity of an amount of carbon-14 reduces with time in the way shown in the table below. (All values have been adjusted for background radiation.)

Time (years)	0	6000	12000	18000	24000
Activity (c/min)	800	400	200	100	50

(i) Use the information in the table to **plot a graph** on the grid below. [3]



Examiner only

(ii) Use the graph to give the activity from the carbon at 16000 years. [1]

Activity = ... c/min

(iii) Calculate the number of years after which carbon dating proves to be impossible. [2]

Number of years = ...

(c) (i) A sample of bone taken from a skeleton at an archaeological site gave a reading of 32 c/min. An identical mass of bone in a living animal gives a reading of 80 c/min. Use the graph to find the age of the skeleton. [1]

Age = ... years

(ii) State the method you used to arrive at your answer and show it on the graph. [2]

.....

.....

12

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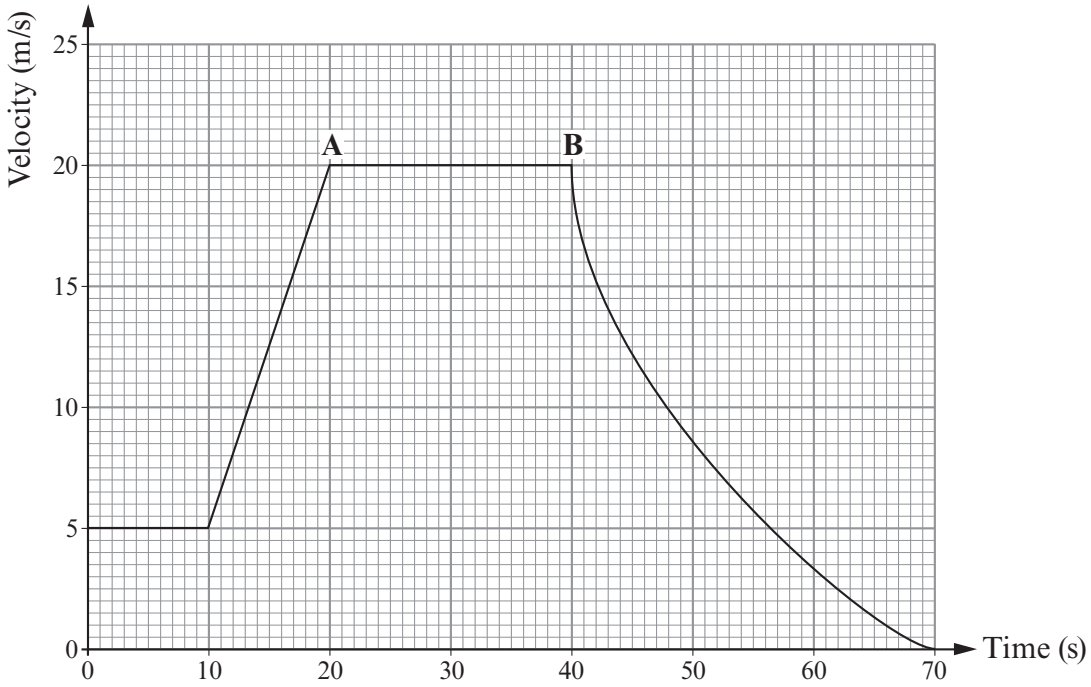
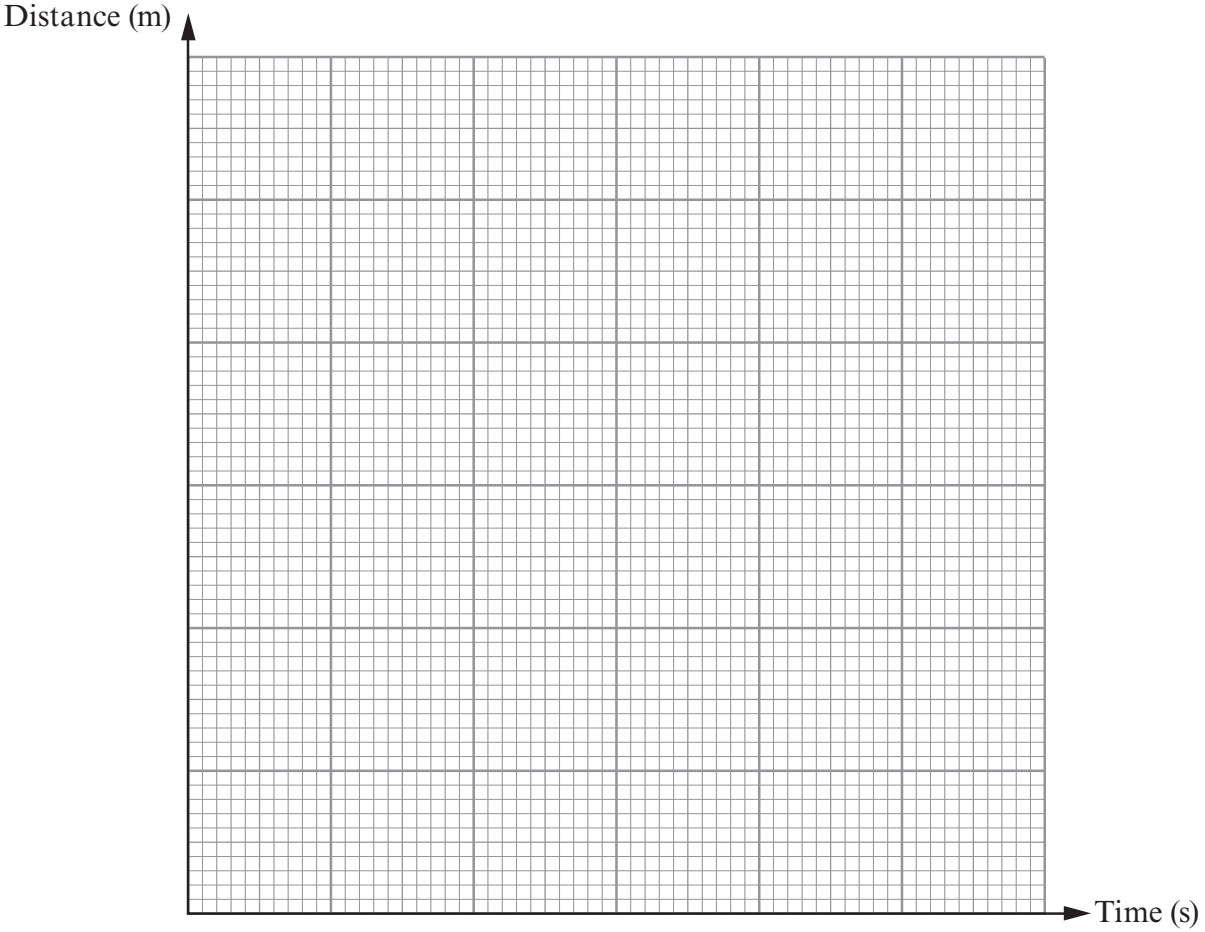
7. The velocity-time graph for part of a journey of a bus is shown below.



(i) Using data from the graph, describe the motion of the bus during the 70 s shown. [6 QWC]

Examiner only

(ii) During the first 10 s, the bus travels 50 m. Use this information to construct a distance-time graph for the **first 10 s only** on the grid below. [3]



(iii) Use the equation:

distance = speed × time

to calculate the distance travelled by the bus between **A** and **B** on the graph opposite. [3]

Distance travelled = ... m

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END OF PAPER

Question number	**Additional page, if required. Write the question numbers in the left-hand margin.**

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