Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4473/01

W16-4473-01

ADDITIONAL SCIENCE/PHYSICS

PHYSICS 2
FOUNDATION TIER

A.M. THURSDAY, 14 January 2016

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**6**	
2.	**5**	
3.	**9**	
4.	**6**	
5.	**10**	
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 page 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***(b)*.

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Equations

power = voltage × current	$P = VI$
resistance = $\frac{\text{voltage}}{\text{current}}$	$R = \frac{V}{I}$
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}	$\frac{1}{1000}$
k	10^{3}	1000
M	10^{6}	1000000

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Answer **all** *questions.*

1. One possible fission reaction that takes place in a nuclear reactor is shown below.

$$^{235}_{92}\mathrm{U} \quad + \quad ^{1}_{0}\mathrm{n} \longrightarrow \quad ^{90}_{36}\mathrm{X} \quad + \quad ^{143}_{56}\mathrm{Y} \quad + \quad \ldots\ldots\ldots \, ^{1}_{0}\mathrm{n}$$

(a) Answer the following questions using numbers from the box. Each value may be used **once**, **more than once**, or **not at all**.

235	36	2	3	90	92

(i) **Complete** the equation above. [1]

(ii) Complete the following sentences. [3]

I. The number of protons in a uranium (U) nucleus is .....

II. The number of particles in a nucleus of element X is .....

III. The number of protons in the nucleus of another isotope of uranium is

.....

(b) (i) Name the part of a nuclear reactor that slows down neutrons. [1]

.....

(ii) Name the part of a nuclear reactor that prevents an uncontrollable chain reaction. [1]

.....

6

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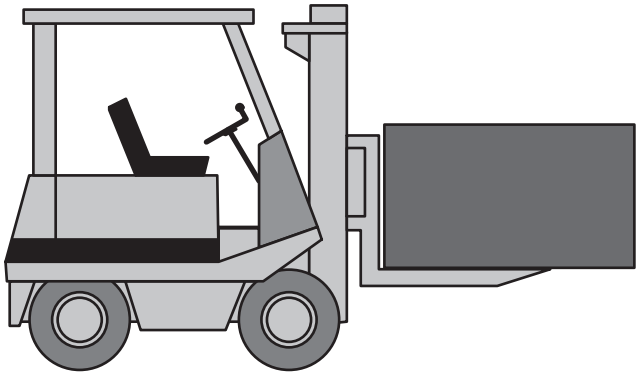
2. A forklift truck is used to lift heavy loads.



(a) The maximum mass that can be lifted by the truck is 1 800 kg. Calculate the weight of this mass. (A 1 kg mass has a weight of 10 N.) [1]

weight = ... N

(b) The forklift truck uses a force of 1 000 N to lift a load through a vertical distance of 6 m.

(i) Select an equation from page 2 and use it to calculate the work done. [2]

work done = ... J

(ii) State how much work, if any, the forklift truck does when the load is held stationary at 6 m. [1]

work done = ... J

(iii) Name the type of energy possessed by the load when it is stationary at a height of 6 m. [1]

.....

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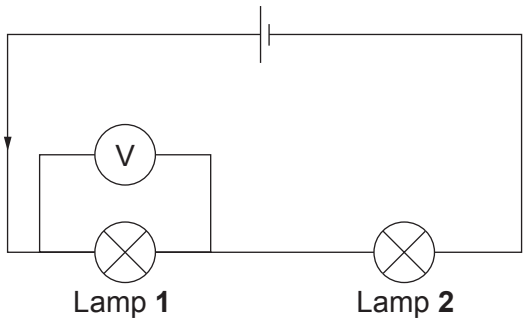
3. A student sets up the following circuit:



The current through lamp **1** is 2.5 A and the voltmeter reading is 5 V.

(a) (i) Use the information above and the equation:

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

to calculate the resistance of lamp **1**. [2]

resistance = ... Ω

(ii) Use the information above and the equation:

power = voltage × current

to calculate the power of lamp **1**. [2]

power = ... W

(iii) State the current through lamp **2**. [1]

current = ... A

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(b) The student sets up the circuit again but without lamp **2**. This causes the current to increase. Choose words from the box to complete the following sentences. Each word or phrase may be used **once**, **more than once**, or **not at all**. [3]

increases	decreases	stays the same

When lamp **2** is removed, the brightness of lamp **1** ..... . The battery voltage ..... . The circuit resistance ..... .

(c) Lamps in houses are connected in parallel instead of series. Give **one** reason why. [1]

.....

.....

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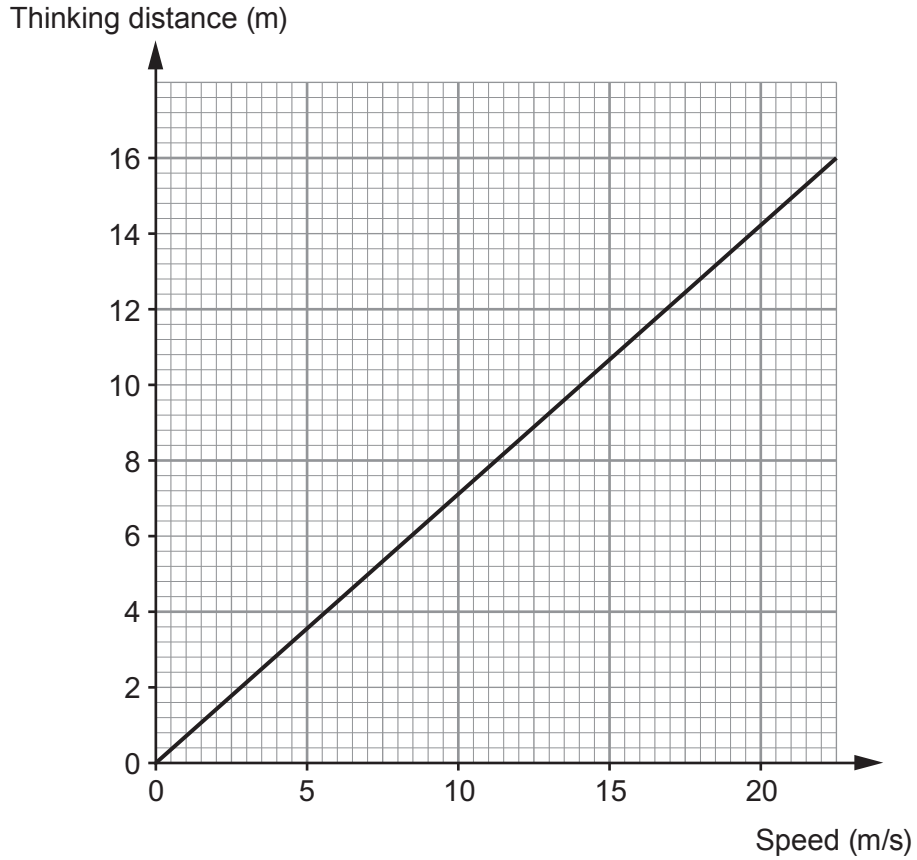
4. **Two** things happen when a car driver does an emergency stop.

- The driver sees a hazard and thinks what to do.
- The driver's foot presses the brake to stop the car.

(a) **Complete** the word equation. [1]

Overall stopping distance = Thinking distance + ...

(b) The graph below shows how thinking distance changes with speed for a **tired** driver.



(i) Describe how thinking distance depends on speed. [2]

.....

.....

(ii) **Add a line** to the graph above for an **alert** driver. [1]

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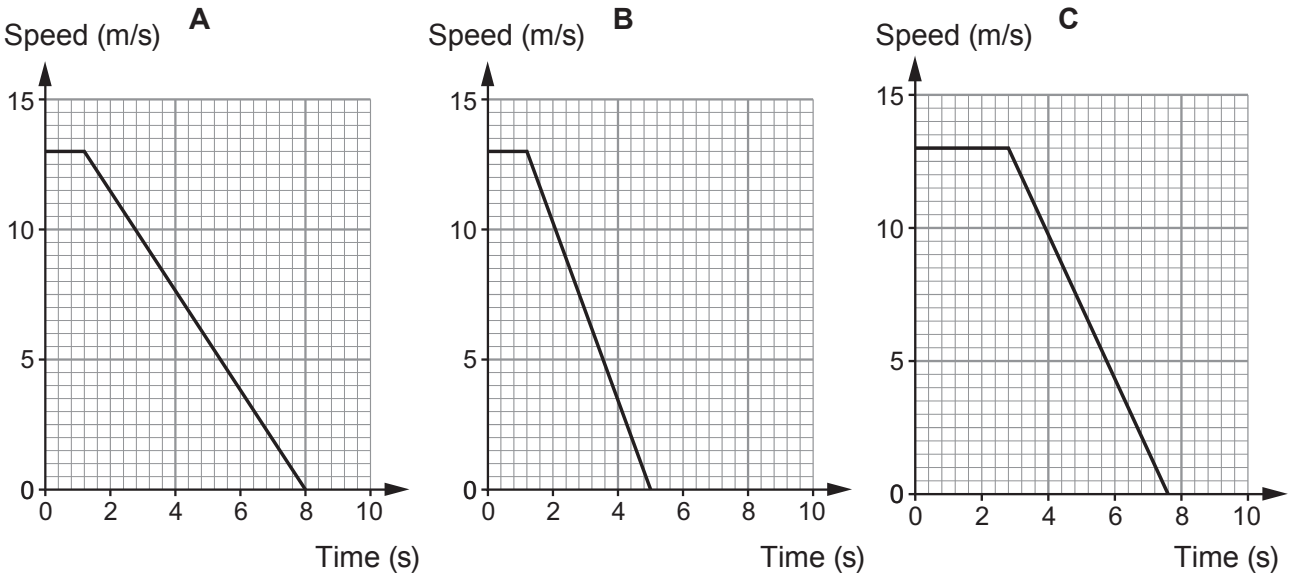
(c) Three cars, **A**, **B** and **C**, are travelling towards traffic lights. The graphs below show how the speed of each car changes **after** the drivers see the lights turn to red. [2]



(i) Which graph shows the car driven by a tired driver? .....

(ii) Which graph shows the car with badly worn tyres? .....

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5. *(a)* The diagrams below show the drag and forward driving forces acting on a car at different times in a journey.

Draw a line to link each diagram to the description of the car's motion. [3]

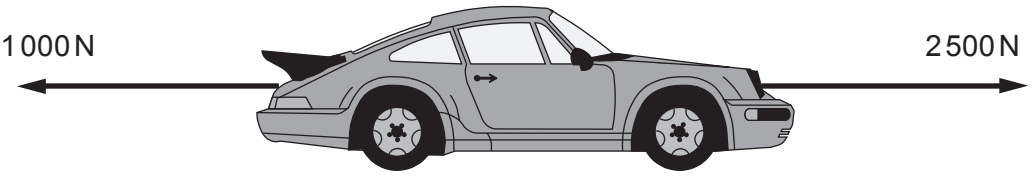
at rest

speeding up

constant speed

slowing down

(b) The diagram below shows the horizontal forces acting on car **A** of mass 1 200 kg.



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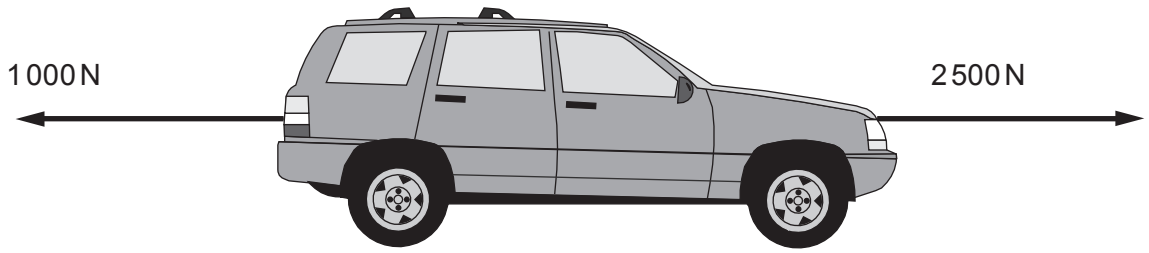
Use the equation:

$$\text{acceleration} = \frac{\text{resultant force}}{\text{mass}}$$

to calculate the acceleration of car **A**. [3]

acceleration = ... m/s^2

(c) The same two horizontal forces act on car **B**.



Car B has a **mass twice as big** as car A.

(i) Write down the acceleration of car **B**. [1]

acceleration of car **B** = ... m/s^2

(ii) State what happens to the size of the drag force as car **B** accelerates. [1]

.....

(iii) Explain why car **B** reaches a maximum speed. [2]

.....

.....

.....

10

Turn over.

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6. A student does an experiment with **dice** to investigate **radioactive decay**. The dice, which represent radioactive atoms, are thrown together onto the floor. Those that show a **six** are removed. These represent the atoms whose nuclei have decayed. The remaining dice (undecayed atoms) are thrown again and the process is repeated several times.

The student starts with **600** dice.

(a) (i) Predict how many of the dice would show a "six" on the first throw. [1]

.....

(ii) State why the student cannot predict **which** dice will show a "six". [1]

.....

.....

(b) The results of the experiment are shown in the table below.

Throw	Number of sixes	Number of dice remaining
0	0	600
1	95	505
2	85	420
3	.....	350
4	60	290
5	50	240
6	40	200
7	30	170
8	25	145

(i) **Fill in the gap** in the table above. [1]

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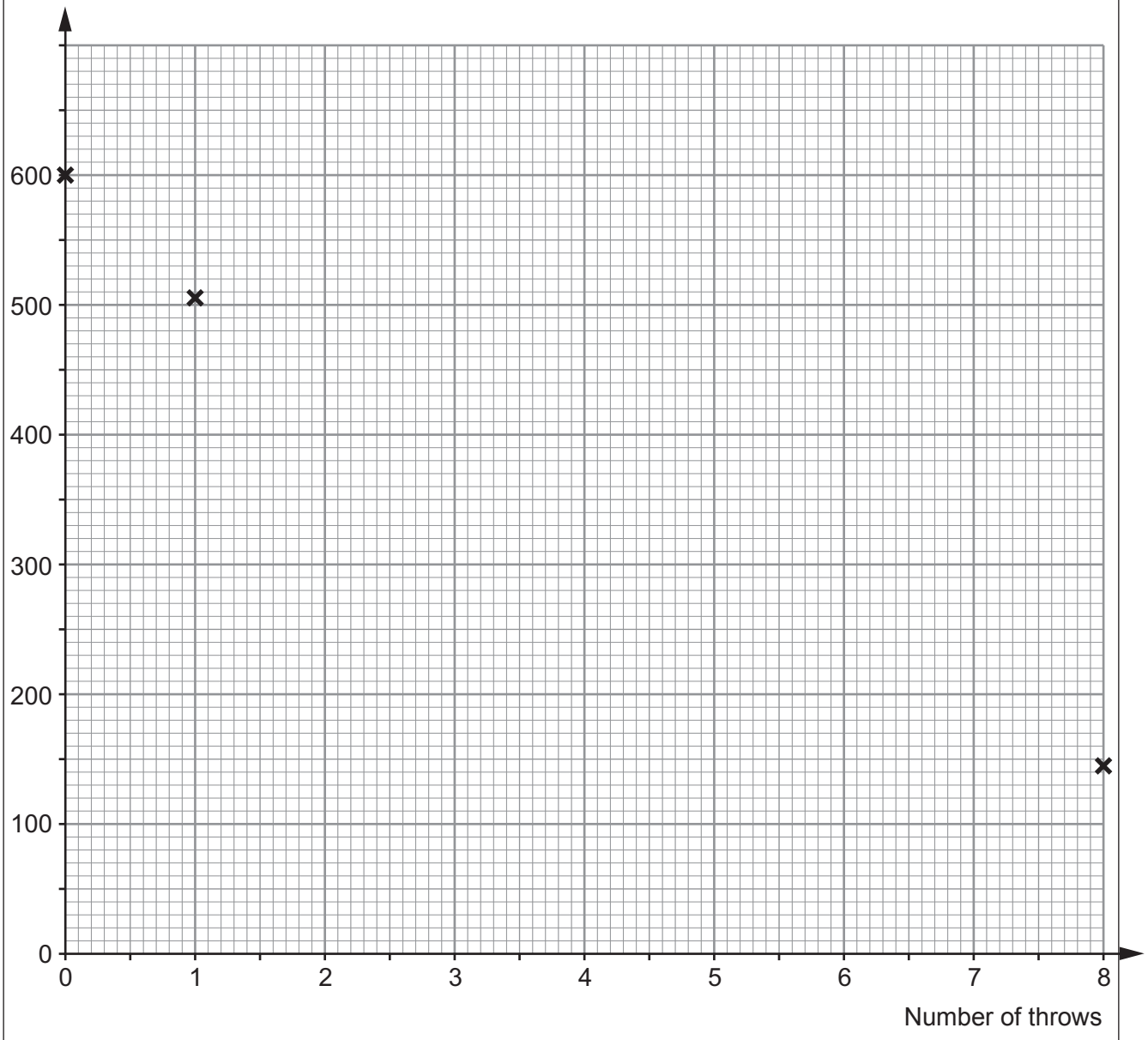
(ii) Plot the results on the grid below and draw a suitable line. [3]
Three points have been plotted for you.



(iii) **Draw lines on to your graph** to enable you to find the **half-life** of the dice. [2]

half-life of dice = ... throws

Turn over.

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(c) Americium-241 is a radioactive substance which is used in smoke alarms in houses. It decays by emitting alpha particles.

(i) State why Americium-241 is radioactive. [1]

.....

.....

(ii) What is an alpha particle? [1]

.....

(iii) Explain why the use of Americium-241 in house smoke alarms when in normal use, does not present a significant health risk to people living in the houses. [2]

.....

.....

.....

.....

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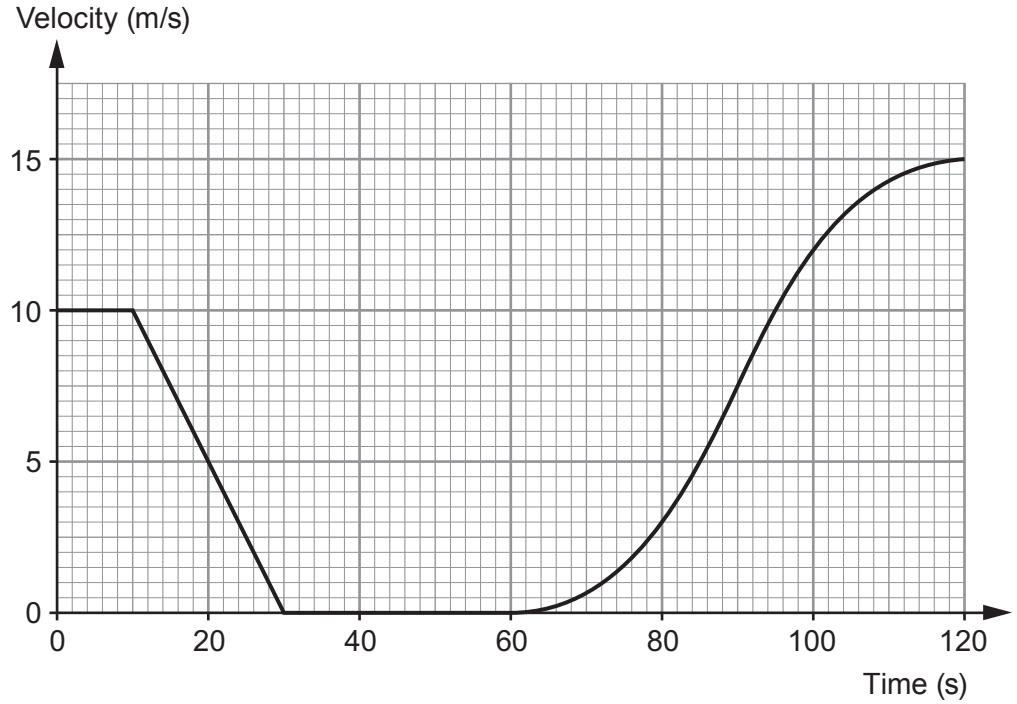
7. The velocity-time graph below shows part of the journey of an underground train.



(a) Use the graph to find the total time that the train was travelling faster than 5 m/s. (Show your workings.) [2]

total time = ... s

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(b) Describe **fully** the motion of the train for the time shown. [6 QWC]

Your answer should include:

- data from the graph;
- appropriate calculations.

(Calculations of distance should not be given in your answer.)

TURN OVER FOR THE REST OF THE QUESTION

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(c) (i) Use the equation: distance = speed × time

to calculate the distance travelled by the train in the **first 10 s** of the journey. [1]

distance = ... m

(ii) Between 10 s and 30 s, the train travels 100 m. Use an equation from page 2 to calculate the mean speed of the train between 0 s and 60 s. [3]

mean speed = ... m/s

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END OF PAPER

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Question number	Additional page, if required. Write the question number(s) in the left-hand margin.

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