Surname	Centre Number	Candidate Number
Other Names		0

WJEC CBAC

New GCSE

4473/01

ADDITIONAL SCIENCE
FOUNDATION TIER
PHYSICS 2

P.M. THURSDAY, 17 January 2013

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**7**	
2.	**9**	
3.	**7**	
4.	**10**	
5.	**9**	
6.	**12**	
7.	**6**	
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 a gel pen. Do not use 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**.

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Equations

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

SI multipliers

Prefix	Multiplier
m	10^{-3}
k	10^{3}
M	10^{6}

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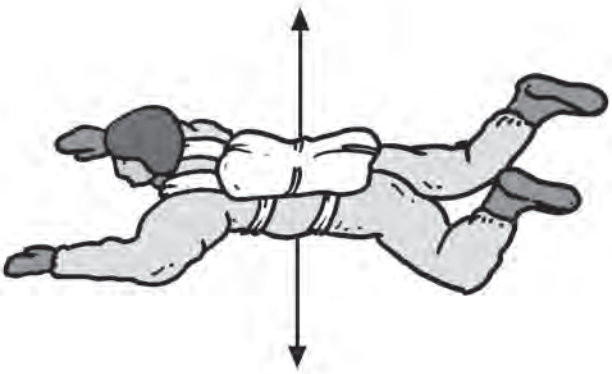
*Answer **all** questions in the spaces provided.*

1. The diagram shows the forces acting on a skydiver falling through the air.



As the skydiver jumps from an aeroplane and falls, his motion will depend on the two forces shown in the diagram.

(a) Draw **one** line from each statement in list **A** to the correct motion in list **B**. [3]

List A	List B
	The skydiver moves upwards
The forces are equal	
	The skydiver speeds up
The weight is greater than the air resistance	
	The skydiver stops
Air resistance is zero	
	The skydiver starts to fall
	The skydiver falls at constant speed

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(b) After jumping from an aeroplane, the skydiver's falling velocity increases from 0 to 30 m/s in 6 s. Use an equation from page 2 to calculate the acceleration of the skydiver. [2]

Acceleration = ... m/s^2

(c) Explain what happens to the motion of the skydiver just after the parachute is opened. [2]

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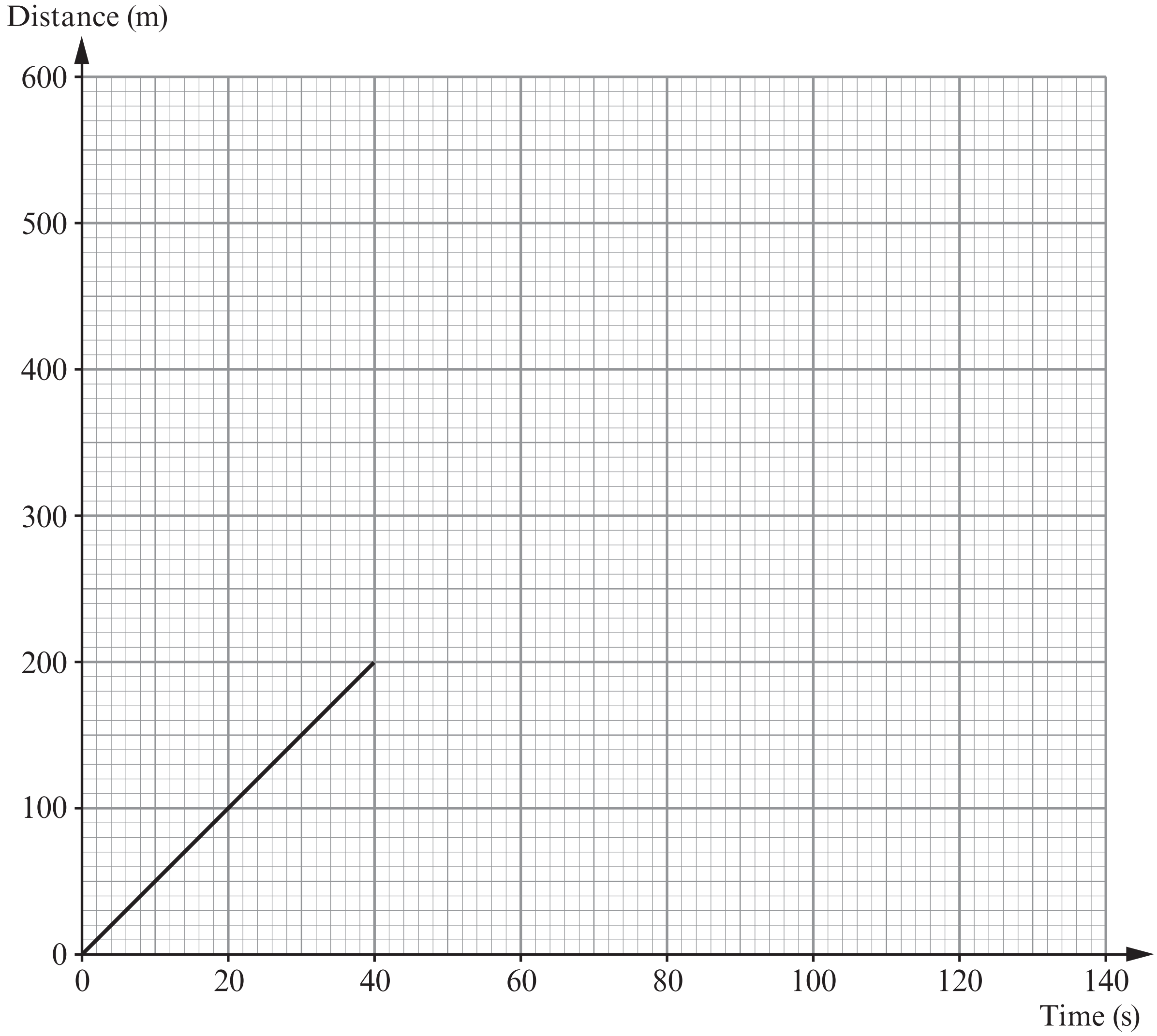
2. The distance-time graph shows part of a journey made by a cyclist.



(a) Complete the graph using the data in the table below. [3]

Time (s)	60	80	100	120	140
Distance (m)	200	200	200	400	600

(b) Use the graph to answer the following questions.

(i) Use an equation from page 2 to calculate the speed of the cyclist during the first 40 s. [3]

Speed = ... m/s

(ii) For how long was the cyclist not moving? .... s [1]

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(c) (i) Compare the speed of the cyclist in the first 40 seconds and the last 40 seconds. [1]

....

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(ii) Give a reason for your answer. [1]

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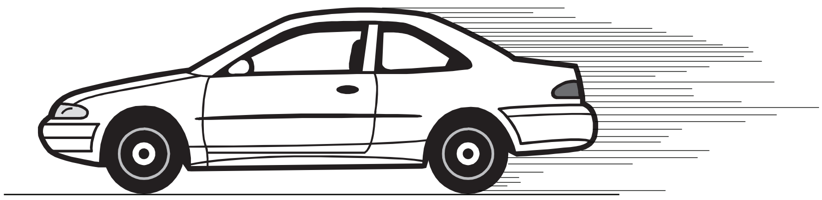
3. The diagram shows a car of mass 800 kg travelling at 12 m/s.



(a) Use an equation from page 2 to calculate the momentum of the car. [2]

Momentum = ... kg m/s

(b) As the car approaches traffic lights, they change from green to red. The car slows down from 12 m/s to 0 m/s in 3 s.

(i) What is the momentum of the car when it stops at traffic lights? .... [1]

(ii) What is the change in momentum of the car in coming to a stop? .... [1]

(iii) Use an equation from page 2 to calculate the braking force that brought the car to a stop. [2]

Braking force = ... N

(c) Name **one** factor that will increase the braking time of 3 s. [1]

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7

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Turn over.

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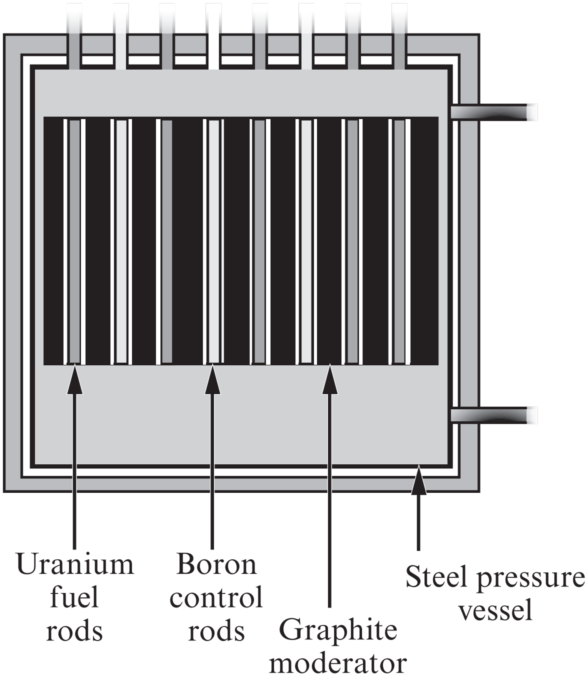
4. The diagram shows a nuclear fission reactor.



(a) (i) State which labelled part of the reactor slows down neutrons. [1]

....

(ii) Give a reason why the neutrons need to be slowed down. [1]

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....

(b) (i) State which labelled part of the reactor absorbs neutrons. [1]

....

(ii) Give a reason why neutrons need to be absorbed. [1]

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(c) The reaction in this type of reactor is shown below.

$$^{235}_{92}U + ^{1}_{0}n \longrightarrow ^{142}_{56}Ba + ^{91}_{36}Kr + 3^{1}_{0}n$$

Use the information in the equation to answer the questions below.

(i) State the nucleon number of uranium (U). .... [1]

(ii) State the proton number of krypton (Kr). .... [1]

(iii) Calculate the number of neutrons in an atom of krypton. .... [1]

(d) One of the products, barium (Ba), has other isotopes.
Circle the correct symbol of an isotope of barium in the following list. [1]

$$^{142}_{57}Ba \qquad ^{136}_{56}Ba \qquad ^{136}_{51}Ba$$

(e) The other product krypton, decays into rubidium (Rb) by emitting beta particles.
Complete the decay equation shown below. [2]

$$^{91}_{36}Kr \longrightarrow ^{91}_{\dots\dots}Rb + ^{\dots\dots}_{-1}e$$

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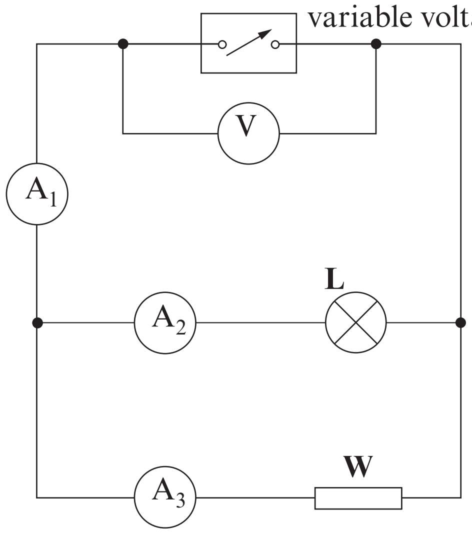
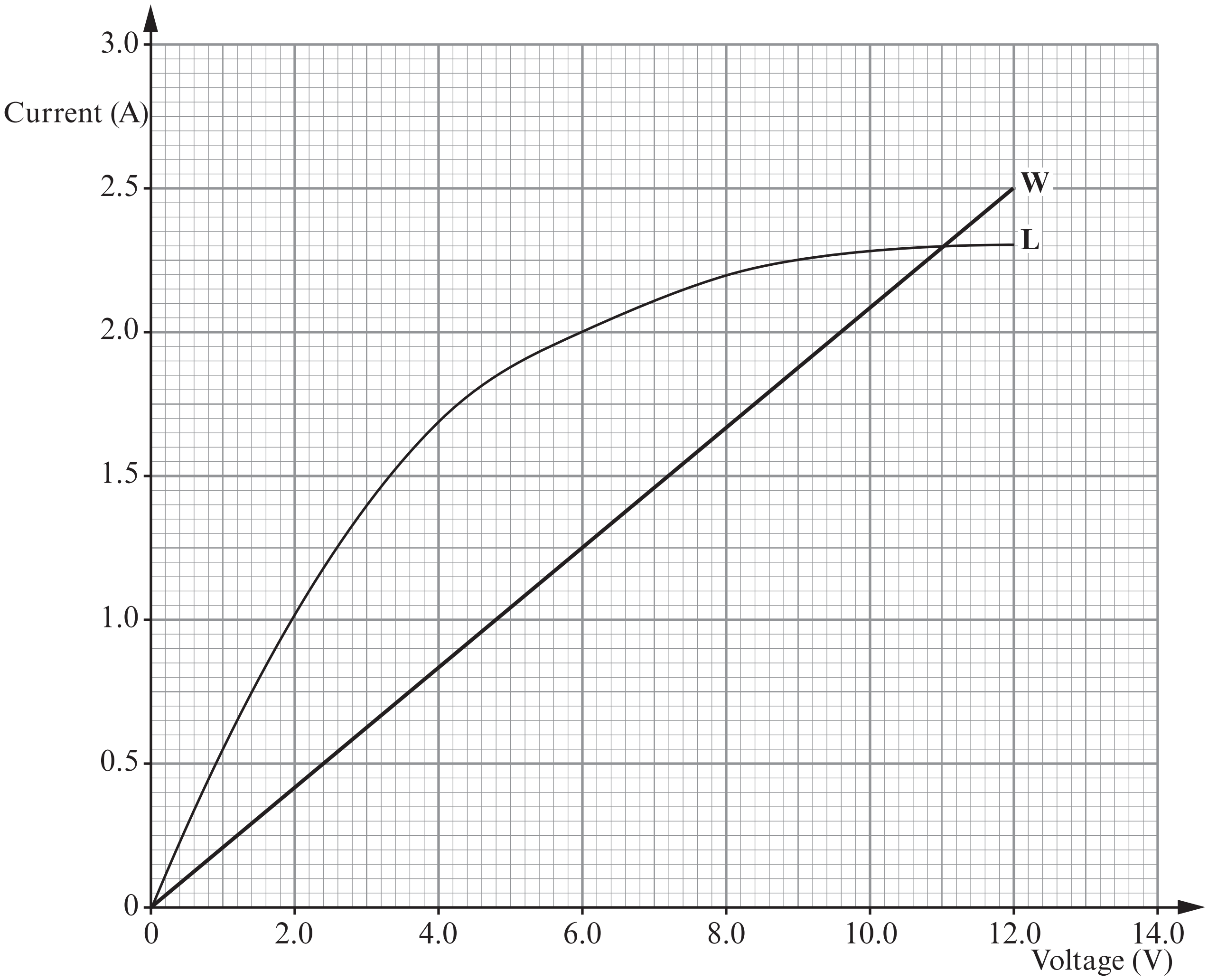
5. The diagram shows a circuit used to investigate currents in a parallel circuit when the voltage is varied. A lamp **L** and a wire **W** are connected in parallel with a variable voltage supply. The circuit has 3 ammeters A_1, A_2 and A_3 as shown.



The currents through the lamp, **L**, and the wire, **W**, depend on the voltage applied to them in the way shown on the graph below.



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(a) (i) Use the graph to find the current through the lamp when the voltmeter reading is 6 V. [1]

Current = ... A

(ii) Using an equation from page 2, calculate the resistance of the lamp at 6 V. [2]

Resistance = ... Ω

(iii) Using an equation from page 2, calculate the power produced by the lamp at 6 V. [2]

Power = ... W

(iv) At what voltage, were the power of the lamp and wire the same? .... V [1]

(v) Find the current through ammeter A_1 at 6 V. [1]

Current = ... A

(b) The voltage supply in the diagram is increased from 6 V to 12 V.

(i) Compare the resistances of the lamp and wire at 12 V. [1]

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(ii) Give a reason for your answer. [1]

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6. A smoke detector works as follows:

- It uses a radioactive source that emits alpha particles.
- The alpha particles ionise the air inside the detector causing an electric current.
- Any smoke getting into the detector absorbs the alpha particles and changes the current.
- The change in current sets off the alarm.

(a) (i) What is an alpha particle? .... [1]

(ii) Explain why the detector would not work if the radioactive source emitted gamma rays only. [2]

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(iii) Explain why, in normal use, the radioactive source in the detector is not a risk to human health. [2]

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(b) Americium-241 has a half-life of 432 years. Curium-242 has a half-life of 160 days. Both isotopes are alpha emitters.

(i) Explain why Americium-241 is more suitable for use in the smoke detector than Curium-242. [2]

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(ii) An average smoke detector contains about 0.4 micrograms (μg) of Americium-241 which has an initial activity of 52 000 units.

(I) Name the unit of activity. .... [1]

(II) Calculate how long it will take for the activity to drop to 26 000 units. [2]

Time = ... years

(III) Calculate the mass of Americium-241 remaining after 864 years. [2]

Mass remaining = ... μg

12

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7. The government is considering increasing the motorway speed limit from 70 miles per hour (mph) to 80 mph.
Standard thinking distances and braking distances for a variety of speeds are given in the table below. They apply to an alert driver on a dry day.

Speed (mph)	Thinking Distance (m)	Braking Distance (m)	Total Stopping Distance (m)
60	18	55	73
70	21	75	
80	24	97.5	

Discuss the advantages and disadvantages for taking a journey of 280 miles at 80 mph compared with 70 mph.
Include in your answer information from the table above and your knowledge on the topic.
You should use the equation: $\text{time} = \dfrac{\text{distance}}{\text{speed}}$ *to help in part of your answer.* [6 QWC]

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

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