Candidate Name	Centre Number	Candidate Number
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WJEC CBAC

GCSE

241/02

ADDITIONAL SCIENCE

HIGHER TIER

PHYSICS 2

A.M. FRIDAY, 27 May 2011

45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark awarded**
1.	**9**	
2.	**8**	
3.	**4**	
4.	**6**	
5.	**5**	
6.	**9**	
7.	**9**	
Total	**50**	

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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.

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.

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 of the examination paper. In calculations you should show all your working.

EQUATIONS

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

Power = current × voltage

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

Resultant force = mass × acceleration

Acceleration = $\frac{\text{change in speed}}{\text{time}}$

Force = $\frac{\text{work done}}{\text{distance}}$

Kinetic Energy = $\frac{\text{mass} \times \text{speed}^2}{2}$

= $\frac{1}{2}\ mv^2$

Change in potential energy = mass × gravitational field strength × change in height

= mgh

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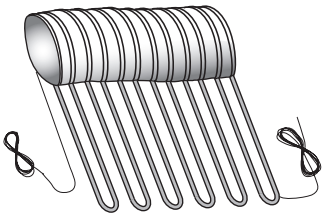
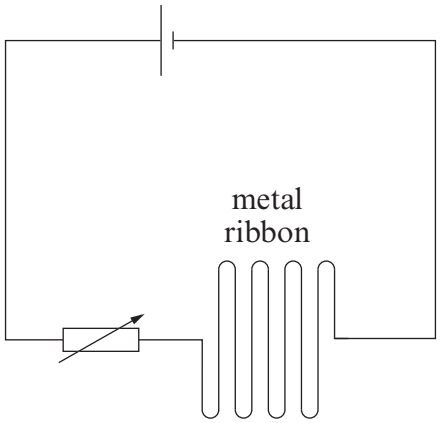
Answer **all** *questions in the spaces provided.*

1. Homes can now be heated using metal ribbons laid under carpets.



The circuit below is used to find the resistance of the metal ribbons and the power developed in them.



(a) (i) **Add meters to the circuit** that allow you to calculate the resistance of the metal ribbon. [2]

(ii) What is the purpose of the variable resistor? [1]

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Examiner only

(b) When in use the voltage across the ribbons is 230 V and a current of 0.5 A flows through them.

(i) Write down in words an equation from page 2, and use it to calculate the resistance of the ribbons. [3]

Equation: .....

.....

Calculation:

Resistance = ... Ω

(ii) Write down in words an equation from page 2, and use it to calculate the power developed in the ribbons. [3]

Equation: .....

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Calculation:

Power = ... W

9

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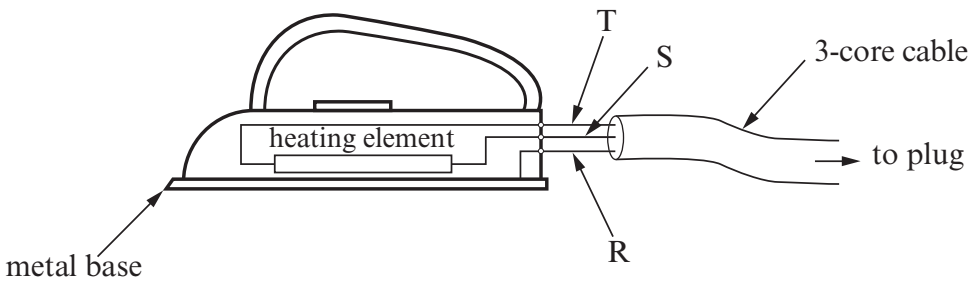
2. The diagram shows the wiring to an electric iron.



(a) (i) Which wire, R, S or T, is the earth wire? ..... [1]

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

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(iii) Explain how the earth wire protects the user from an electric shock. [2]

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(b) (i) State the colour of the insulation covering the live wire. ..... [1]

(ii) Explain why the live wire is connected to the fuse in the plug. [2]

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(c) What is the purpose of the neutral wire? [1]

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8

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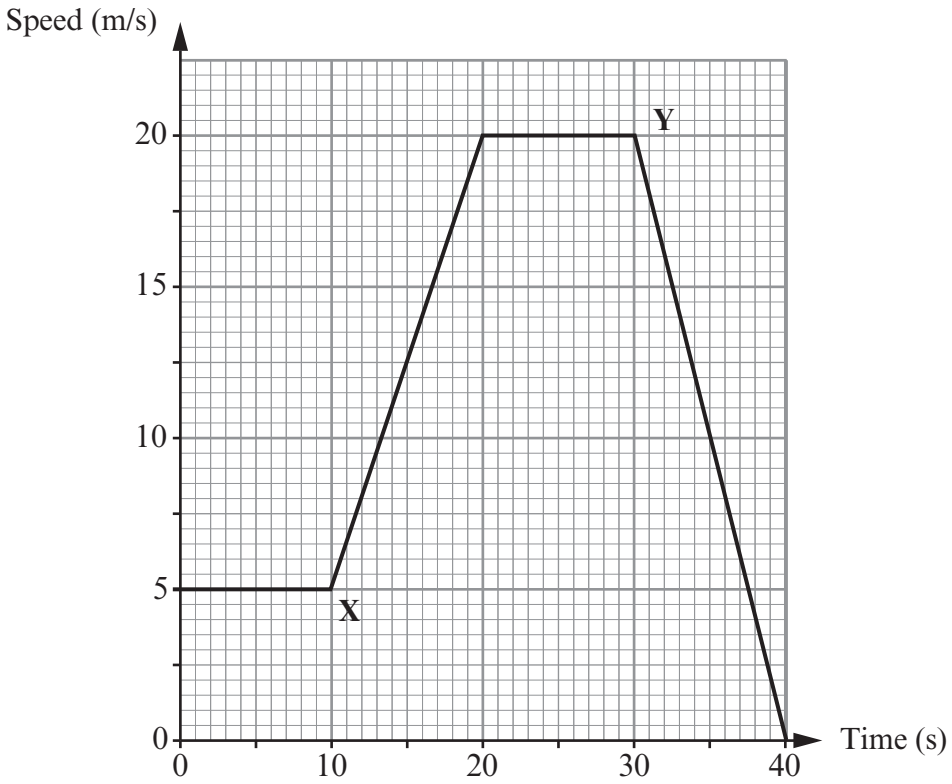
3. The graph shows the motion of a van for 40 s.



Describe carefully, giving numerical values, the motion of the van between X and Y. [4]

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4

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4. A car travels at 30 m/s. During an accident, the force on a passenger will depend on how long the car takes to stop as shown in the table below.

Time to stop (s)	Force (N)
0.2	12 000
0.4	6 000
0.6	4 000
0.8	3 000

(a) Use the information above and the equations

$$\text{deceleration} = \frac{\text{change in speed}}{\text{time}}$$

$$\text{Force} = \text{mass} \times \text{deceleration}$$

to find the mass of the passenger. [4]

Mass = ... kg

(b) Explain how crumple zones in cars protect passengers. [2]

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6

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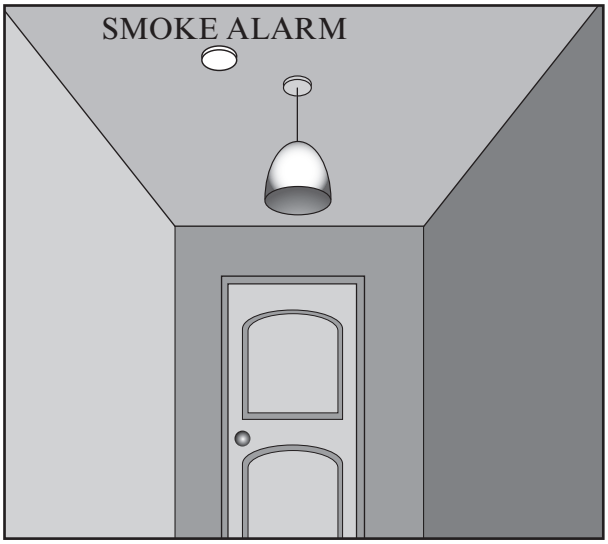
5. Smoke alarms contain a radioactive source, americium, that emits alpha particles. The alpha radiation produces ions in the air which cross a gap to be picked up by a detector. Smoke stops the alpha radiation from ionising the air. Smoke alarms are usually placed on ceilings.



(a) (i) Explain why americium nuclei are unstable. [1]

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(ii) Explain why a radioactive source that emits beta particles would be unsuitable for use in the smoke alarm. [1]

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(b) The safety leaflet in the smoke alarm pack informs users that they are at no risk from radiation when the smoke alarm is in normal use. However, there is a significant risk of harm if the smoke alarm is dismantled and the radioactive source swallowed. Explain why there is a difference in risk. [3]

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Examiner only

6. The photograph shows the vertical loop of a roller coaster 30 m high.

A car of mass 500 kg enters the bottom of the loop with a kinetic energy of 250 000 J.

(a) (i) Use the equation

$$\text{Potential energy} = \text{mass} \times g \times \text{height}$$

where g = 10 N/kg, to find the gain in potential energy of the car between the bottom and the top of the loop.. [2]

Gain in potential energy = ... J

(ii) What is the kinetic energy of the car at the top of the loop? [1]

Kinetic energy = ... J

(iii) Use the equation

$$\text{kinetic energy} = \frac{\text{mass} \times \text{speed}^2}{2}$$

to calculate the speed of the car at the top of the loop. [2]

Speed = ... m/s

(b) Explain why in practice, the speed of the car will be less than the value you have calculated above. [2]

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(c) Towards the end of the ride the KE of the car is 20 000 J and it brakes to a stop in 8 m. Use the equation

Work done = force × distance

to calculate the braking force. [2]

Braking force = ... N

9

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7. Plutonium has several isotopes, all of which are radioactive.

(a) Plutonium-239 is a waste product of nuclear power generation. It has a half life of 24 000 years.
Explain why it is so costly to dispose of plutonium-239 safely. [3]

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(b) Plutonium-238 is a radioactive isotope, with half-life of 88 years, used in radioisotope thermoelectric generators (RTG). RTG are nuclear electrical generators that obtain power from radioactive decay. They are used to provide power to unmanned spacecraft on long missions. The RTG in one type of spacecraft contains 4.8 kg of plutonium. **One gram** of plutonium-238 generates 0.5 W of power. This spacecraft will function normally until the RTG power output drops below 300 W.

(i) Calculate the initial power generated by 4.8 kg of plutonium-238. [2]

Initial power = ... W

(ii) Calculate how long the spacecraft will function normally. [3]

Time = ... years

(iii) Calculate how much plutonium-238 remains in the spacecraft when it stops functioning normally. [1]

Mass = ... kg

9