Candidate Name	Centre Number	Candidate Number
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GCSE

241/02

ADDITIONAL SCIENCE

HIGHER TIER

PHYSICS 2

P.M. WEDNESDAY, 10 June 2009

45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark awarded**
1.	**6**	
2.	**6**	
3.	**10**	
4.	**9**	
5.	**9**	
6.	**10**	
Total	**50**	

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator.

INSTRUCTIONS TO CANDIDATES

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

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

$$\text{power of appliance} = \text{current} \times \text{voltage}$$

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

$$\text{acceleration (or deceleration)} = \frac{\text{change in speed}}{\text{time}}$$

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

$$\text{work} = \text{force} \times \text{distance}$$

$$\text{kinetic energy} = \frac{\text{mass} \times \text{speed}^2}{2} \; ; \qquad \text{KE} = \frac{mv^2}{2}$$

$$\text{change in potential energy} = \text{mass} \times \text{gravitational field strength} \times \text{change in height}$$

$$\text{PE} = mgh$$

Examiner only

Answer **all** *questions*.

1. Radon is a radioactive gas. It emits alpha particles which have a very short range in air. It occurs naturally and rises through small cracks in the Earth's rocks. It enters buildings through the floor.

(a) (i) Radon is a danger to our health and can cause lung cancer.
Explain why. [2]

.....

.....

(ii) What actions can a householder take to prevent radon gas entering the home? [2]

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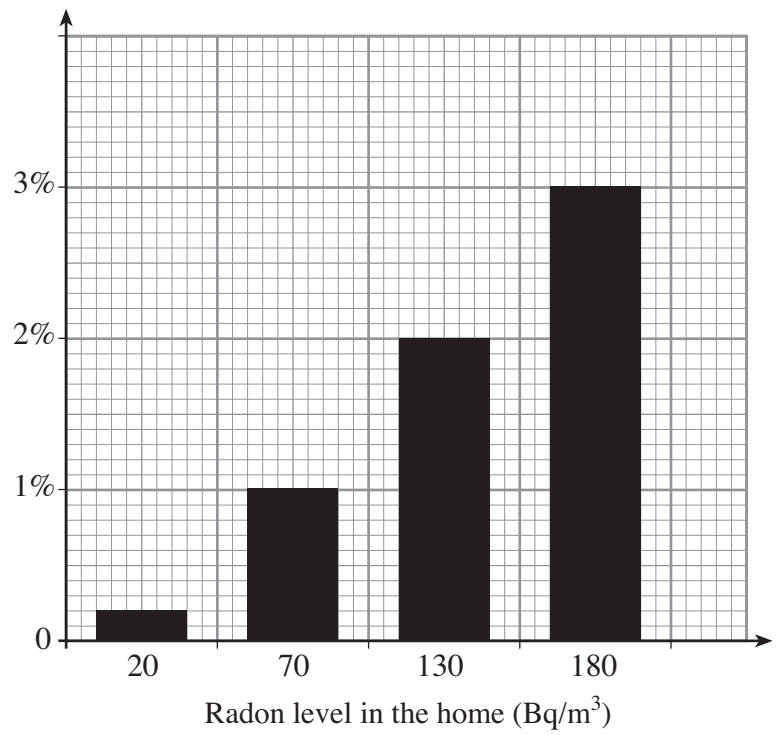
(b) The graph below shows the Health Protection Agency's assessment of risk of a person getting lung cancer from radon gas and how it depends on the radon level **in the home**.



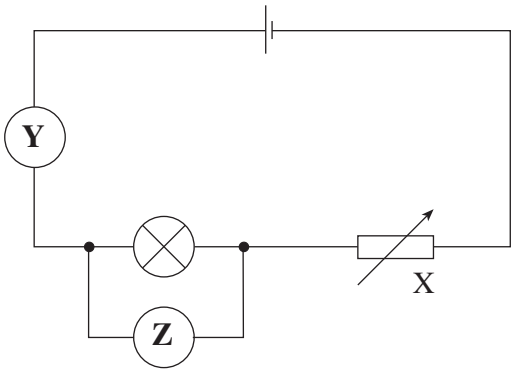
Use only the information in the graph to find:

(i) the percentage risk to health from a radon level of 20 Bq per m^3? ..... % [1]

(ii) the radon level that gives a 2% risk of getting lung cancer? ..... Bq/m^3 [1]

Examiner only

2. The circuit diagram below is used to investigate how the current passing through a lamp changes with the voltage across it.



(a) (i) Which component, X, Y or Z measures the current through the lamp? ..... [1]

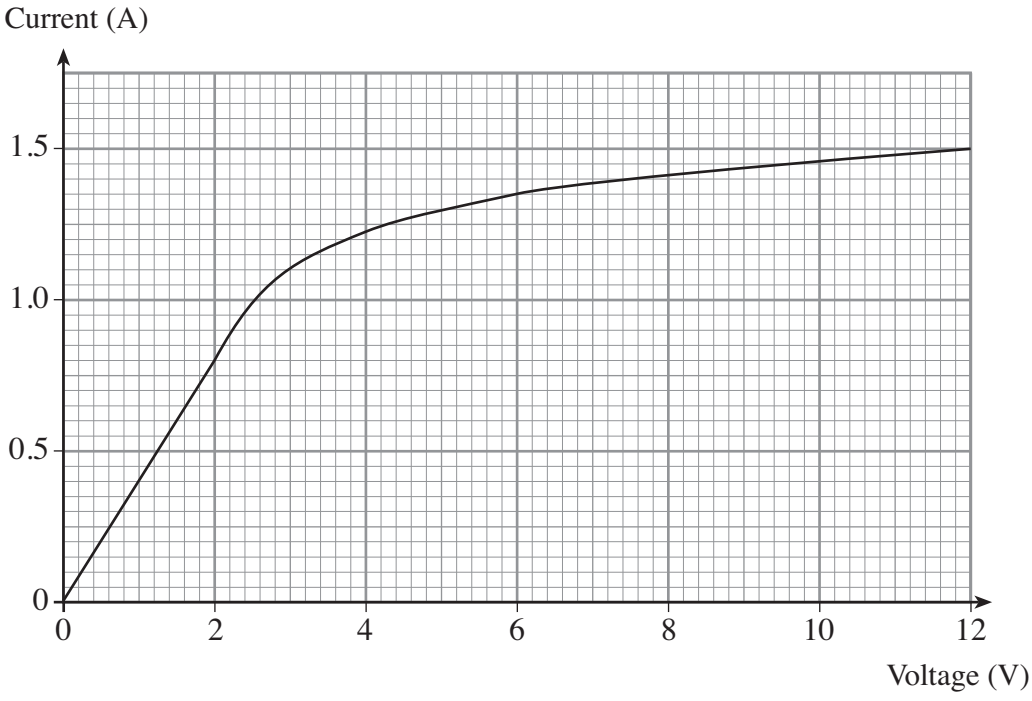
(ii) I. Which of X, Y or Z can be used to adjust the current through the lamp?

..... [1]

II. What adjustment will **decrease** the current? [1]

.....

(b) Results obtained from using the above circuit produced the following graph.



(i) The resistance of the lamp at 2 V is 2·5 Ω .
Use the equation

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

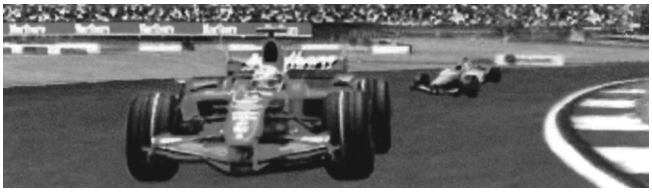
to find the resistance of the lamp at 12 V. [2]

Resistance = ... Ω

(ii) At what voltage does the resistance of the lamp start to increase? ..... V [1]

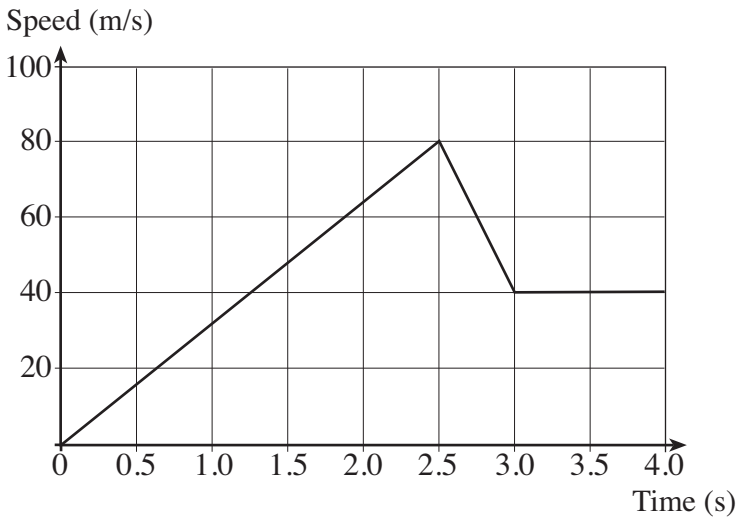
6

3.



(Courtesy of indiaserver.com)

The graph below shows the speed of a formula 1 racing car in the first 4 seconds of a race as it accelerates and slows down to go around the first bend.



(a) Write down an equation as it appears on page 2 and use it to calculate the acceleration of the car.

Equation: .....

..... [1]

Calculation: [2]

Acceleration = ... m/s^2

(b) The average speed of the car is 42·5 m/s **for the part of the race shown**.
Use the equation

distance = average speed × time

to calculate the distance travelled by the car [2]

Distance travelled = ... m

(c) The mass of the car plus driver is 400 kg.

Use the equation

decelerating force = mass × deceleration

together with data from the graph to calculate the decelerating force on the car when approaching the first bend. [4]

Decelerating force = ... N

(d) Explain why there is no resultant force on the car between 3 s and 4 s. [1]

.....

.....

10

Examiner only

4. The voltage of the mains electricity in the U.K. is 230 V, whilst in the U.S.A. the voltage is 110 V.

A hair dryer has information on it stating 1500 W, 230 V. It is intended for use in the U.K.

(a) Write down an equation as it appears on page 2 and use it to find the current that flows through the hair dryer when it is used in the U.K.

Equation: .....

..... [1]

Calculation: [2]

Current = ... A

(b) The resistance of the hairdryer is 35·3 Ω.
A holidaymaker takes **the same** hairdryer to the U.S.A. to use whilst there.
Find the power of the hairdryer when used in the U.S.A. [3]

Power = ... W

(c) Why would it be unwise to buy a hairdryer in the U.S.A. and bring it back to the U.K. to use here? [1]

.....

.....

(d) The U.S.A operates on a lower voltage than is used in the U.K.

(i) State **one** advantage of this. [1]

.....

.....

(ii) To operate on the same power, U.S.A appliances use thicker wire.
Give a reason for this. [1]

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.....

Examiner only

5. Sodium has a number of different forms, some of which are radioactive. The table below shows the properties of three of them.

Type of sodium	Half life	Radiation emitted
Sodium 22	2.6 years	Beta
Sodium 23	Not radioactive	None
Sodium 24	15 hours	Beta

(a) The half life of sodium 22 is 2.6 years. Explain what this means. [2]

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(b) Explain why atoms of sodium 23 are not radioactive, whilst the others are. [1]

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(c) As a medical tracer, a chemical compound containing sodium is to be injected into a patient and the effects are observed from outside the body.
State which type of sodium is best to use, giving reasons for your choice. [2]

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(d) A Geiger counter shows a background radiation count of 20 counts per minute.
When a sample of sodium 22 is placed in front of the counter, the recorded count rate is 740 counts per minute (including the background, 20 counts per minute).

(i) Explain what "background radiation" means. [1]

.....

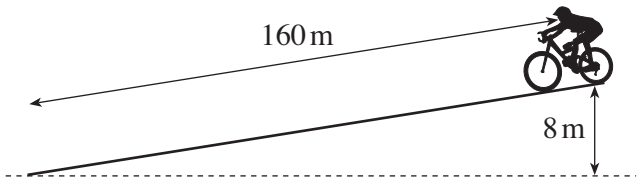
.....

(ii) After what period of time would the activity, measured on a Geiger counter, fall to 110 counts per minute? [3]

Time = ...

Examiner only

6. A bicycle and rider of total mass 80 kg are released from rest at the top of a hill that is 8 metres high and 160 metres long.



(a) Write down an equation as it appears on page 2 and use it to find the potential energy of the bicycle when it is at the top of the hill.
[Gravitational field strength = 10 N/kg]

Equation: .....

..... [1]

Calculation: [2]

Potential energy = ... J

(b) When the bicycle reaches the bottom of the hill its kinetic energy is 1960 J.
Write down an equation as it appears on page 2 and use it to find the speed of the bicycle at the bottom.

Equation: .....

..... [1]

Calculation: [2]

speed = ... m/s

(c) (i) Calculate the work done against friction as the bicycle rolls down the hill. [1]

Work done against friction = ... J

(ii) Use the equation

Work done = force × distance

to calculate the average friction force acting. (The cyclist does not pedal down the hill) [2]

Friction force = ... N

(d) At the bottom of the hill, the cyclist free-wheels until he stops. The kinetic energy to start with is 1960 J.
By calculation or otherwise, show that the cyclist will travel less than 160 m. [1]

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