Candidate Name	Centre Number	Candidate Number
		0

General Certificate of Secondary Education

241/02

ADDITIONAL SCIENCE
HIGHER TIER (Grades D-A*)
PHYSICS 2

P.M. MONDAY, 21 January 2008
(45 minutes)

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**9**	
2.	**7**	
3.	**5**	
4.	**9**	
5.	**12**	
6.	**8**	
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.

No certificate will be awarded to a candidate detected in any unfair practice during the examination.

EQUATIONS

voltage = current × resistance

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

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

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

resultant force = mass × acceleration

work = Force × distance

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

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

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Answer **all** *questions.*

1. The lighting circuit in a house is protected by a 5 A fuse and connected to 230 V.
The table shows the current taken by different lamps.

Power of lamp (W)	Current (A)
40	0·17
60	.....
100	0·43

(a) **Write down** an equation as it appears on page 2 and use it to find the current through a 60 W lamp.

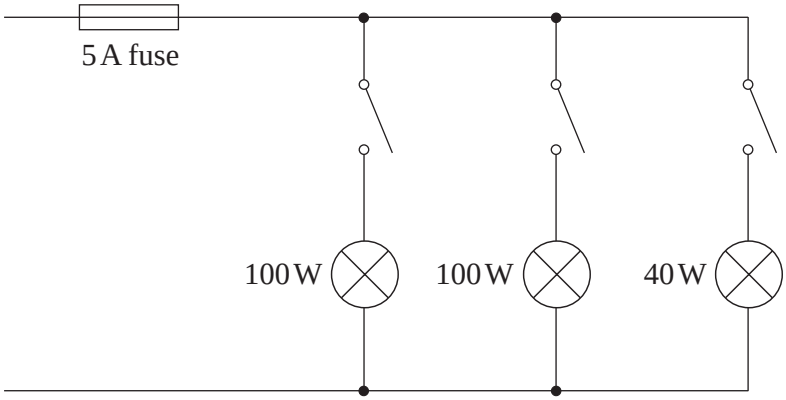
Equation: .....

..... [1]

Calculation: [2]

Current = ... A

(b) The circuit shows three lamps in a household lighting circuit connected to a 5 A fuse.
We can calculate the current through the fuse by adding up the currents through each of the lamps.



Use the information in the table to find the current flowing through the fuse when all these lamps are switched on. [2]

Current = ... A

(c) Find the maximum number of 100 W lamps that could be connected in a 5 A household lighting circuit. [2]

Number of lamps = ...

(d) In modern homes, the lighting circuit is protected by a miniature circuit breaker (mcb). Give **two** advantages of an mcb compared to a fuse. [2]

1. .....

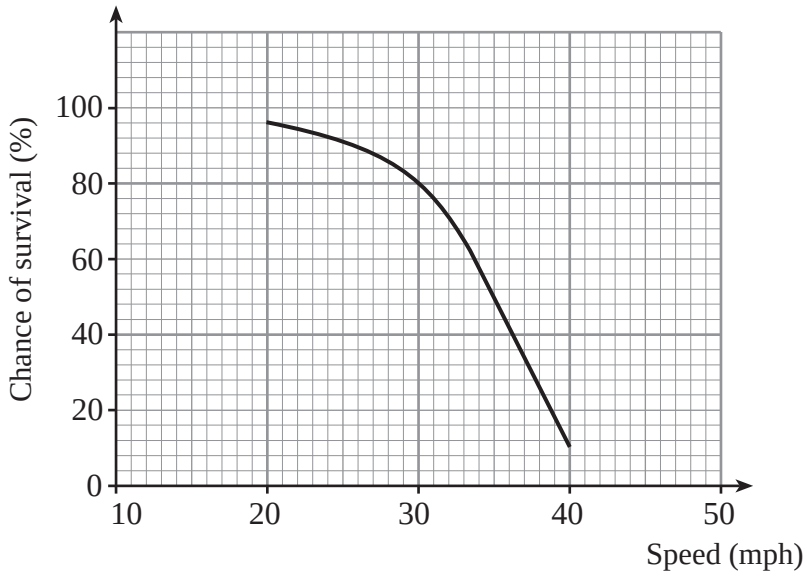
.....

2. .....

.....

9

2. *(a)* In 2003 over 3000 people were killed and 33 000 seriously injured in collisions on Britain's roads.
The chances of a pedestrian surviving a collision depends upon how fast the vehicle is travelling. This is shown on the graph.



Give a reason why some people think that there should be a 20 mph speed limit outside schools instead of the present limit of 30 mph. [1]

.....

.....

(b) Speed cameras have been placed around Britain to encourage drivers to stay within the speed limit, to reduce the number of deaths and serious injuries.
The photograph shows a car passing a camera in a 30 mph speed limit area.

A camera detects a speeding car and it takes two photographs.
The white road markings are painted 1·5 m apart.
From the first to the second photograph the car has moved forward 5 spaces.

(i) Calculate the distance travelled by the car in the time it took to take the two photographs. [1]

Distance = ... m

(ii) The second photograph is taken 0·5 seconds after the first one.
Write down in words an equation as it appears on page 2, and use it to find the speed of the car.

Equation: .....

..... [1]

Calculation: [2]

Speed = ... m/s

(iii) Use information in the table to estimate the speed of the car in mph. [1]

speed in m/s	speed in mph
9·0	20
13·5	30
18·0	40
22·5	50

Speed = ... mph

(iv) If the car hits a pedestrian at this speed, what is the percentage chance of the pedestrian surviving? [1]

.....

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3. (i) Give **two** reasons why it is important to dispose of radioactive waste safely. [2]

1. .....

.....

2. .....

.....

(ii) Several disposal methods are being considered.

These include:

1. Leaving the radioactive waste where it is.
2. Burying it deep underground.
3. Sealing it in steel barrels which will be dumped in the sea.
4. Firing it into space by rocket.
5. Burying it in ice sheets at the poles.
6. Burying it under remote unpopulated islands.

Choose **three** of these methods and give **one different** disadvantage for **each**. [3]

Complete the table with your answers.

Method number	Disadvantage of this method
.....	....
.....	....
.....	....

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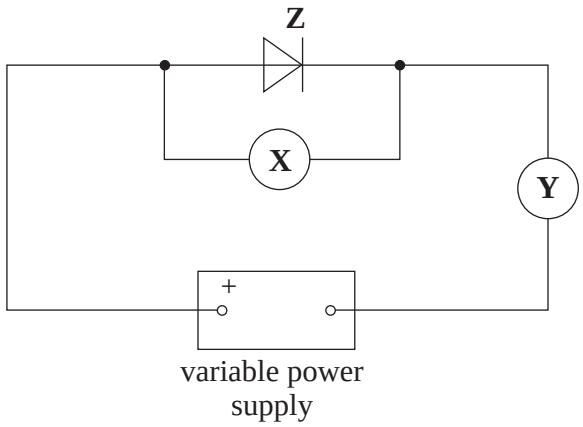
4. The circuit shown is used to investigate how the current changes with voltage for component **Z**.



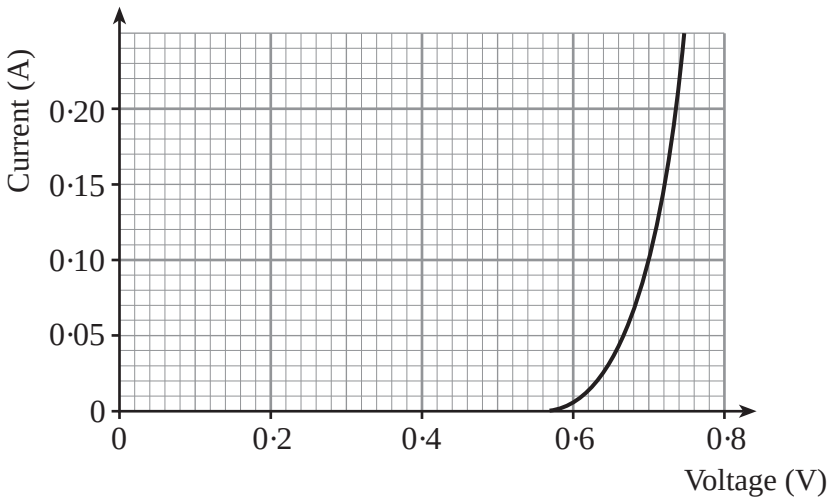
(a) Name the component:

X .....

Y .....

Z ..... [3]

(b) The results from the investigation are shown on the graph.



(i) Describe **carefully** how the current through **Z** changes as the voltage is increased from 0·0 to 0·7 V. [3]

.....

.....

.....

.....

(ii) **Write down** in words an equation as it appears on page 2 and use it to find the resistance of **Z** when the voltage is 0·7 V.

Equation: .....

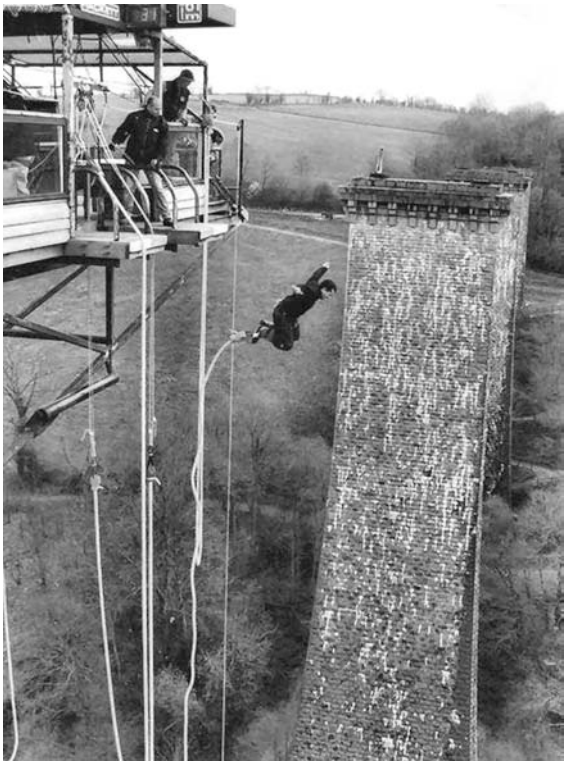
..... [1]

Calculation: [2]

Resistance = ... Ω

9

5. A lift takes people up to a jump platform in this bungee tower.



The jump platform is 55 m above the ground.

(a) The lift takes a 60 kg person from the ground to the jump platform.
Write down an equation as it appears on page 2, and use it to find the increase in potential energy of the person.
[Gravitational field strength = 10 N/kg]

Equation: .....

..... [1]

Calculation: [2]

Increase in potential energy = ... J

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(b) The bungee jumper has a kinetic energy of 18 000 J when he is falling at maximum speed.

(i) What is his potential energy when he reaches his maximum speed? [1]

.....

(ii) Write down an equation as it appears on page 2 and use it to find his maximum speed.

Equation: .....

..... [1]

Calculation: [2]

Maximum speed = ... m/s

(c) Explain in **terms of named forces** why the speed increases before the bungee rope starts to stretch. [2]

.....

.....

.....

(d) The bungee rope stretches and stops the jumper just at ground level, storing the bungee jumper's energy in the rope.

Complete the table to show the energy values at this point. [3]

Energy	Energy value (J)
Kinetic energy	.....
Potential energy	.....
Energy stored in the bungee rope	.....

Turn over.

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6. Nuclear medicine uses radioactive tracers which emit gamma rays from within the body. One radioactive tracer uses iodine, which is injected into the body to study the thyroid gland.
The table shows three of the forms of radioactive iodine.

Form of Iodine	Radiation emitted	Half life
Iodine-128	beta	25 minutes
Iodine-129	beta and gamma	15 000 000 years
Iodine-131	beta and gamma	8·4 days

(a) (i) The table shows that the half life of Iodine-128 is 25 minutes. Explain what this means. [2]

.....

.....

.....

(ii) Iodine-127 is a non-radioactive form of iodine. Explain in terms of particles in the nucleus why Iodine-127 is not radioactive but the other forms are. [2]

.....

.....

.....

(b) (i) Explain why Iodine-131 is the most suitable form of iodine for studying the thyroid gland. [2]

.....

.....

.....

(ii) Many airports now have radiation detectors in order to detect the smuggling of radioactive materials that may be used in nuclear weapons manufacture. Patients are warned that, if they choose to travel by air, they may set off radiation detectors up to 12 weeks after their treatment with Iodine-131.
Calculate the fraction of radioactivity due to Iodine-131 remaining after 12 weeks (84 days). [2]

Fraction remaining = ...

8