Candidate Name	Centre Number	Candidate Number
		0

GCSE

241/02

ADDITIONAL SCIENCE
HIGHER TIER
PHYSICS 2

A.M. MONDAY, 19 January 2009

45 minutes

For Examiner's use only	
Total Mark	

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.

VP*(W09-241-02)

EQUATIONS

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

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

distance $=$ speed $\times$ time

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

resultant force $=$ mass $\times$ acceleration

work $=$ force $\times$ distance

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

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

$= mgh$

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

1. Read the information in the box and answer the questions below.

One type of background nuclear radiation is cosmic radiation.

Cosmic radiation gets to airline pilots and passengers through the aircraft's aluminium frame.

Airline pilots are thought to be at more risk from it compared with the rest of the population because they spend more time high above the Earth.
The higher they fly, the greater the cancer risk.
The greater the time that they spend flying, the bigger is the risk.

There is evidence that airline pilots and cabin crew suffer more skin cancers than the rest of us, but that may be due to them sunbathing in hot countries for example.

INFORMATION ABOUT FLIGHTS TO AMERICA (USA)

	Ordinary aeroplanes	Concorde
Aeroplane speed from U.K. to U.S.	800 km/h	1600 km/h
Time to fly from U.K. to U.S.	6 hours	3 hours
Height of the flight from U.K. to U.S.	30 000 feet	60 000 feet

(a) State why the background radiation that gets to pilots cannot be alpha or beta. [1]

....

Examiner only

(b) Write down an equation as it appears on page 2 and use it with information from the table to find the distance from the U.K. to the U.S.

Equation: ....

.... [1]

Calculation [2]

Distance = ... km

(c) (i) State **one** reason why existing pilots are at less risk from cancer than Concorde pilots were in the past. [1]

....

(ii) State **one** reason why existing pilots are at greater risk from cancer than Concorde pilots were in the past. [1]

....

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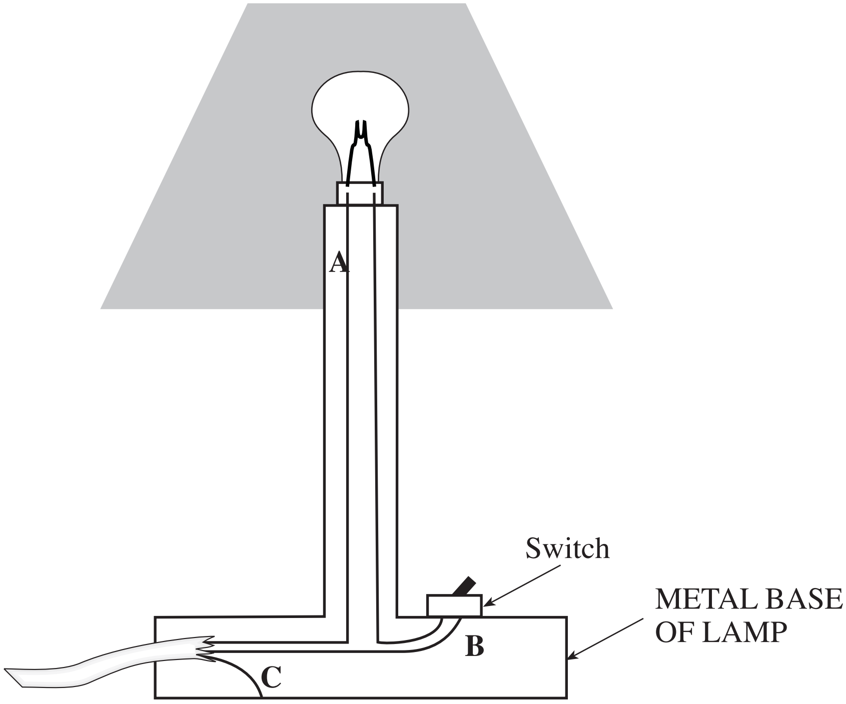
Examiner only

2. The diagram shows the wiring to a metal-based lamp.



(a) State why the lamp needs an earth lead. [1]

....

(b) The lead has a 3 pin plug on the end of it. Explain the job of the fuse in the plug. [2]

....

....

....

(c) If wire **B** becomes loose and touches the base, a residual current device (r.c.d.) breaks the circuit and stops the user from being electrocuted. Explain how an r.c.d. breaks the circuit. [2]

....

....

....

(d) The base of the lamp has the following label stuck to it.

A.C. only
230 V
100 W

(i) Write down an equation as it appears on page 2 and use it to find the current flowing through the lamp.

Equation: ....

.... [1]

Calculation [2]

Current = ... A

(ii) Given a choice of a 3 A, 5 A or 13 A fuse to fit in the plug, which one would you choose? [1]

....

(e) Write down an equation as it appears on page 2 and use it to find the resistance of the lamp.

Equation: ....

.... [1]

Calculation [2]

Resistance = ... Ω

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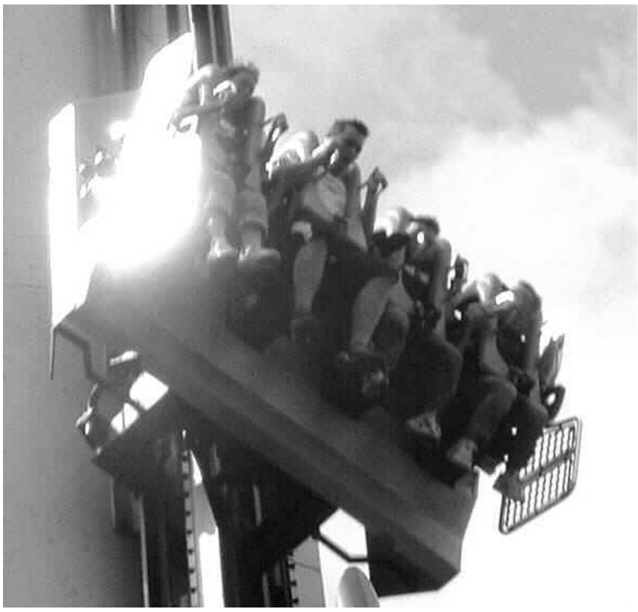
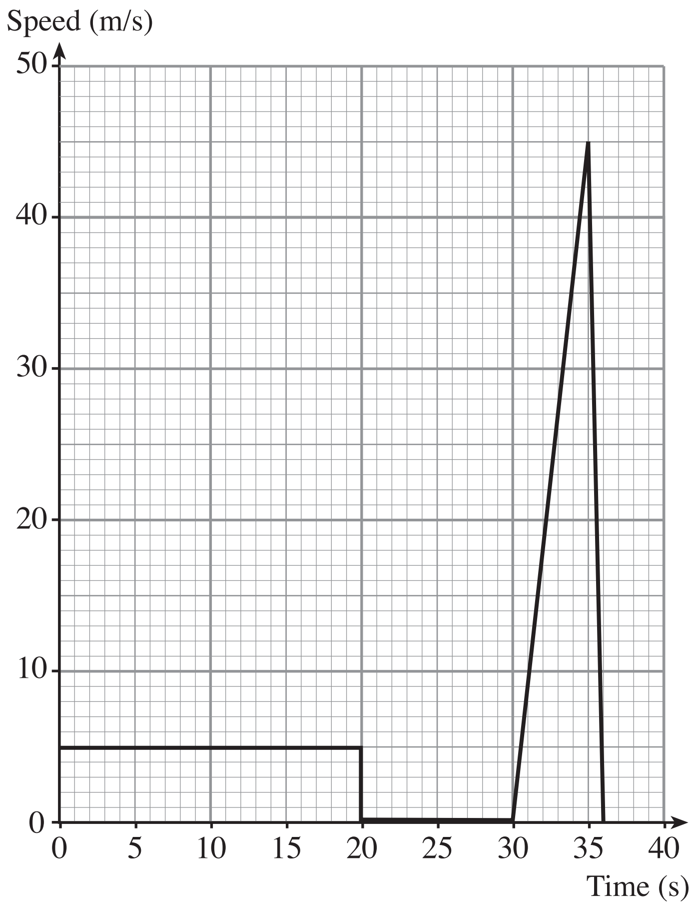
3. A theme park ride involves a group of people being lifted in a carriage and then dropped from a height.



[Source: Drayton Manor]

The graph shows the motion of such a ride.



Examiner only

(a) Describe the motion of the carriage in the first 20 s. [1]

....

....

(b) Use the equation

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

to find the acceleration of the carriage between 30 s and 35 s. [2]

Calculation

Acceleration = ... m/s^2

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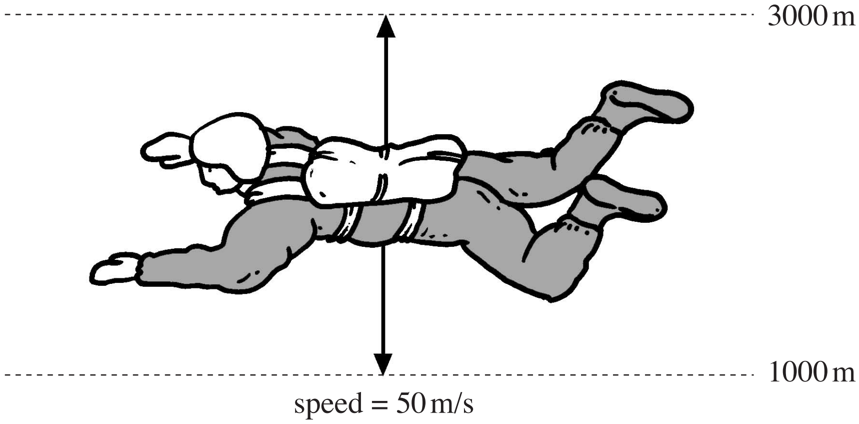
Examiner only

4. A skydiver of mass 80 kg falls from a height of 3000 m to a height of 1000 m before the parachute is opened. The terminal speed of 50 m/s is achieved **long before** the skydiver reaches the height of 1000 m.



(a) Write down an equation as it appears on page 2 and use it to calculate the loss of potential energy of the parachutist as he falls from 3000 m to 1000 m.
[Earth's gravitational field strength is 10 N/kg]

Equation: ....

.... [1]

Calculation [2]

Loss of potential energy = ... J

(b) Write down an equation as it appears on page 2 and use it to calculate the kinetic energy of the parachutist at the height of 1000 m.

Equation: ....

.... [1]

Calculation [2]

Kinetic energy = ... J

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(c) (i) Given that

Loss of P.E. = Gain in K.E. + Work done against air resistance

find the work done against air resistance. [1]

Work done against air resistance = ... J

(ii) Write down an equation as it appears on page 2 to find the average force of air resistance during the fall.

Equation: ....

.... [1]

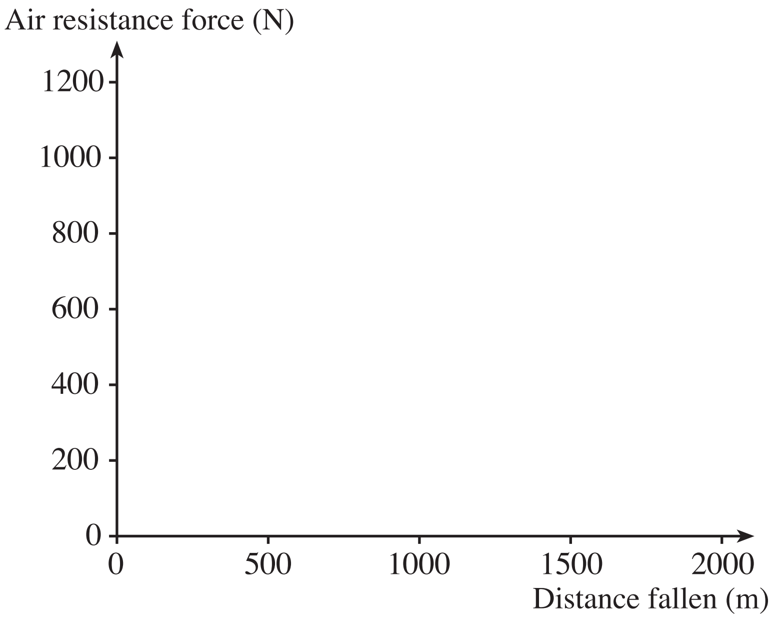
Calculation [2]

Average force = ... N

(d) Given that on Earth 1 kg weighs 10 N, calculate the weight of the skydiver. [1]

Weight of skydiver = ... N

(e) Sketch how the air resistance force changes with distance over the 2000 m free fall. [2]



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Turn over.

Examiner only

5. *(a)* Explain what is meant by the half life of a radioactive substance. [2]

....

....

....

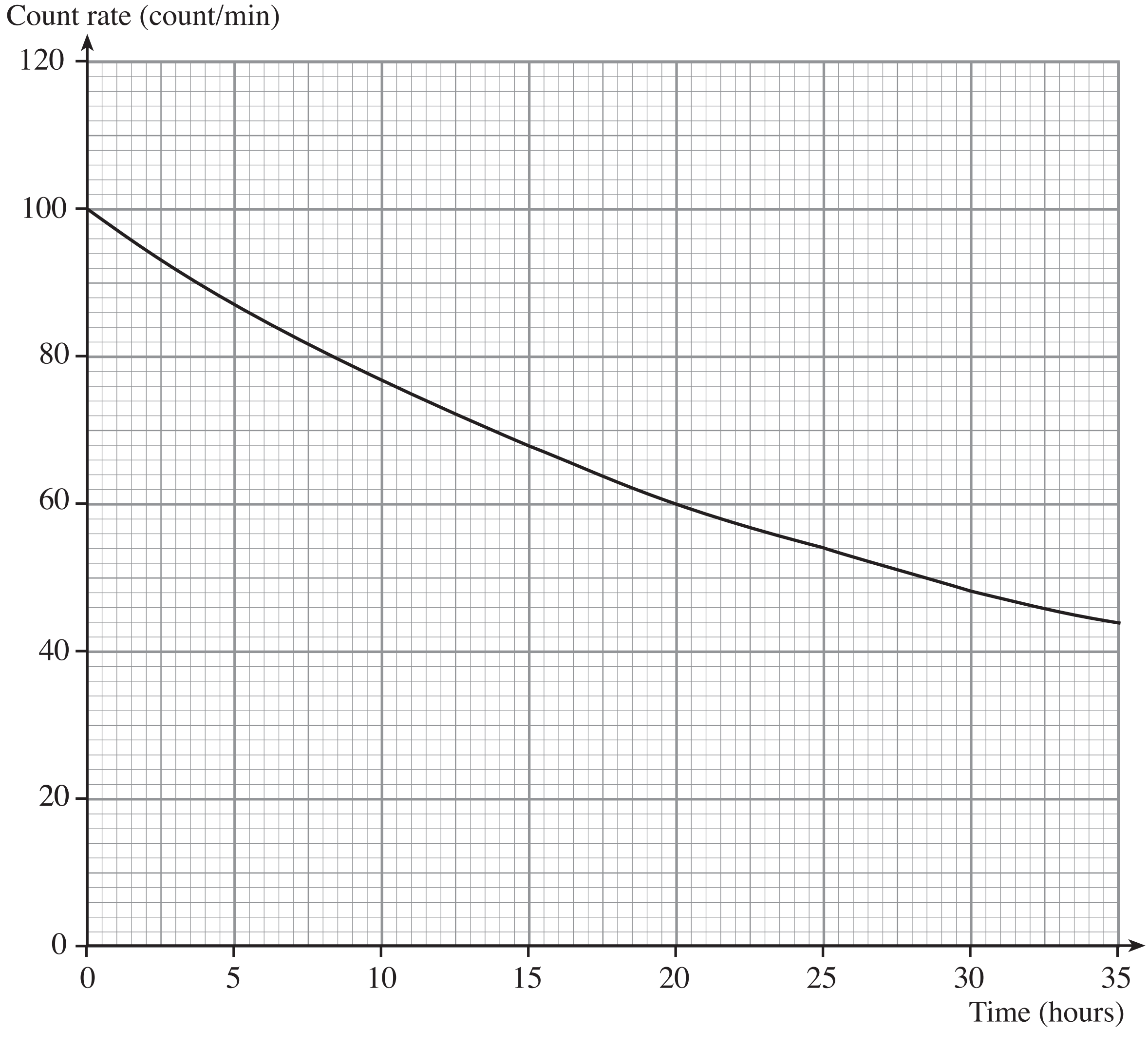
(b) When a Geiger counter was left out in the laboratory it showed a count rate of **20 counts per minute**.

(i) What was the cause of the 20 counts per minute? [1]

....

(ii) The Geiger counter was then placed in front of a particular beta-emitting radioactive source.

The count rate changed in the way shown in the graph below:



Examiner only

When the source was taken away, the Geiger counter still showed a count rate of 20 counts per minute.

I. Use the graph on the previous page to complete the table for the count rate that would have been produced by the source alone. [1]

Time (hours)	0	5	15	25	30	35
Count rate from source alone(counts per minute)						

II. Use the count rates from the table to draw the graph of the activity of the source alone. Use the same grid. [2]

III. Use the graph to find a value for the half life of the radioactive source.

Draw lines on your graph to show how you arrive at your answer. [2]

Half life = ... hours

(c) State **one** industrial use of beta sources and explain whether this beta source would be suitable to use in the chosen application. [2]

....

....

....

....

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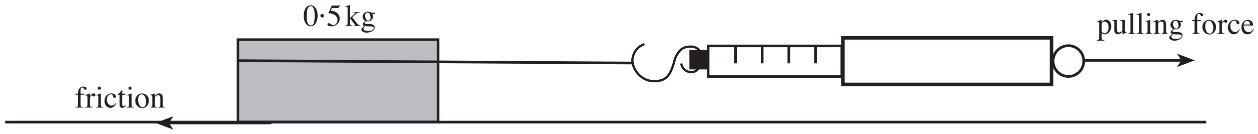
6. A wooden block of mass 0·5 kg is pulled along a laboratory bench by a student using a newtonmeter. The student keeps the newtonmeter reading steady and the block moves with an acceleration of 0·6 m/s^2.



(a) Use the equation:

Resultant force = mass × acceleration

to calculate the resultant force that gives the block an acceleration of 0·6 m/s^2.

Calculation [2]

Resultant force = ... N

(b) A pulling force of 2·8 N is needed to produce an acceleration of 0·6 m/s^2.

Use the equation:

Resultant force = pulling force – friction

along with your answer from part *(a)* to calculate a value for the friction acting on the block. [2]

Friction = ... N

Examiner only

(c) Another block of twice the mass now replaces the one in the diagram.

(i) Calculate the resultant force needed to give it an acceleration of 0·6 m/s^2. [1]

Calculation

Resultant force = ... N

(ii) The friction on this block is 4·5 N; calculate the pulling force needed now. [1]

Calculation

Pulling force = ... N

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