Centre No.						Paper Reference (complete below)								Surname	Initial(s)
Candidate No.										H	/	1	H	Signature	

Paper Reference(s)

5020H/1H 5048H/1H

Edexcel GCSE

Additional Science (5020H)

Physics (5048H)

P2 – Topics 9 to 12

Higher Tier

Wednesday 3 March 2010 – Morning

Time: 30 minutes

Materials required for examination
Calculator

Items included with question papers
Nil

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
Total	

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature, and complete the paper reference.
Check that you have the correct question paper.
Answer ALL the questions. Write your answers in the spaces provided in this question paper.
Do not use pencil. Use blue or black ink.
Show all stages in any calculations and state the units. Calculators may be used.
Include diagrams in your answers where these are helpful.

Information for Candidates

The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 6 questions in this question paper. The total mark for this paper is 30.
There are 16 pages in this question paper. Any blank pages are indicated.

Advice to Candidates

You are reminded of the importance of clear English and careful presentation in your answers.

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FORMULAE

You may find the following formulae useful.

$\text{average velocity} = \dfrac{\text{displacement}}{\text{time}}$	$v = \dfrac{s}{t}$
$\text{acceleration} = \dfrac{\text{change in velocity}}{\text{time}}$	$a = \dfrac{(v-u)}{t}$
force = mass × acceleration	$F = m \times a$
momentum = mass × velocity	$p = m \times v$
change in potential energy = mass × gravitational field strength × change in height	$PE = m \times g \times h$
kinetic energy = ½ × mass × (velocity)^2	$KE = ½ \times m \times v^2$
electrical energy = voltage × current × time	$E = V \times I \times t$
$\text{power} = \dfrac{\text{work done}}{\text{time taken}}$	$P = \dfrac{W}{t}$
work done = force × distance moved in the direction of the force	$W = F \times s$

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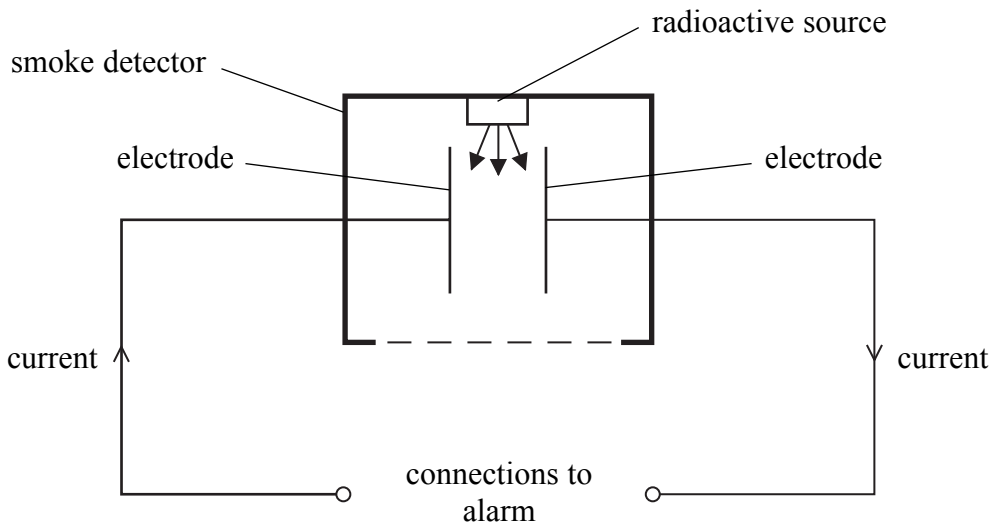
1. This smoke detector is an example of how radioactivity is used to good effect.



It uses americium-241.
Americium-241 emits alpha particles.

(a) The following sentences describe how a smoke alarm works.
The sentences are not in the correct order.
Put them into the correct order by numbering the boxes.
One has been done for you.

action	order
The alpha particles ionise the air.	
The circuit is broken and the alarm sounds.	
The ions complete a circuit.	
While this circuit is complete the alarm does not sound.	3
When smoke particles enter the cell, the ionisation is reduced.	

(3)

Leave blank

(b) Alpha, beta and gamma radiations are emitted by radioactive sources.

(i) What is beta radiation?

.....

(1)

(ii) Describe what gamma rays are.

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(2)

Q1

(Total 6 marks)

Turn over

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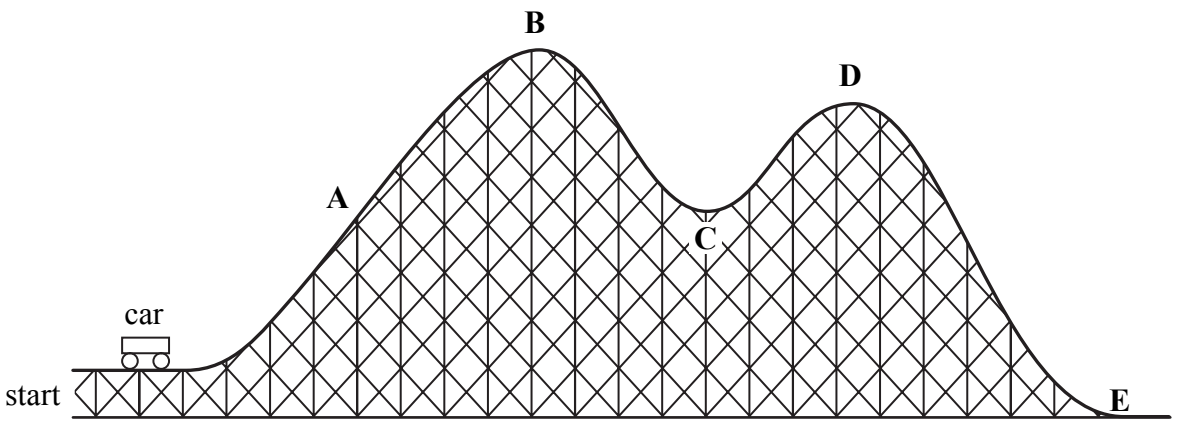
2. The diagram shows a roller-coaster ride.
The car is pulled from the start to point **B** and is then released.



(a) An electric motor is used to pull the car from the start to point **B**.
It takes 25 s for the car to reach point **B**.
The motor works at a voltage of 1400 V and a current of 4.5 A.

Calculate the electrical energy supplied to the motor.

electrical energy = ... J
(2)

Leave blank

(b) The mass of the car is 900 kg.
The maximum speed of the car is 15 m/s.

Calculate the maximum kinetic energy of the car.

maximum kinetic energy = ... J

(2)

(c) Explain why the maximum kinetic energy is much less than the electrical energy transferred by the motor.

.....

.....

(1)

Q2

(Total 5 marks)

Leave blank

3. John was doing some revision.
He produced this table to compare fusion, fission and radioactive decay.
Complete the table by ticking all of the boxes for which each statement applies.

statement	fusion of hydrogen	fission of uranium	radioactive decay of uranium
releases energy			
only occurs at very high temperature			
involves atoms of high mass			
produces ionising radiation			
needs a high density of particles			

(Total 3 marks)

Q3

Leave blank

4. (a) Explain what is meant by a **thought experiment**.

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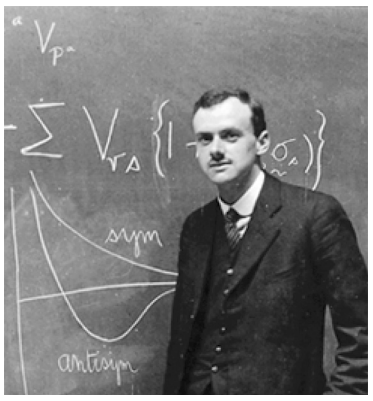
.....

(1)

(b) In 1928, the English scientist Paul Dirac published an equation which describes the electrons in an atom.



He predicted that antimatter electrons existed.
He called them positrons.
In 1933, Carl Anderson found experimental proof of positrons.

Explain why Paul Dirac's work is an example of a thought experiment.

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(1)

(c) Give another example of a thought experiment.

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(1) **Q4**

(Total 3 marks)

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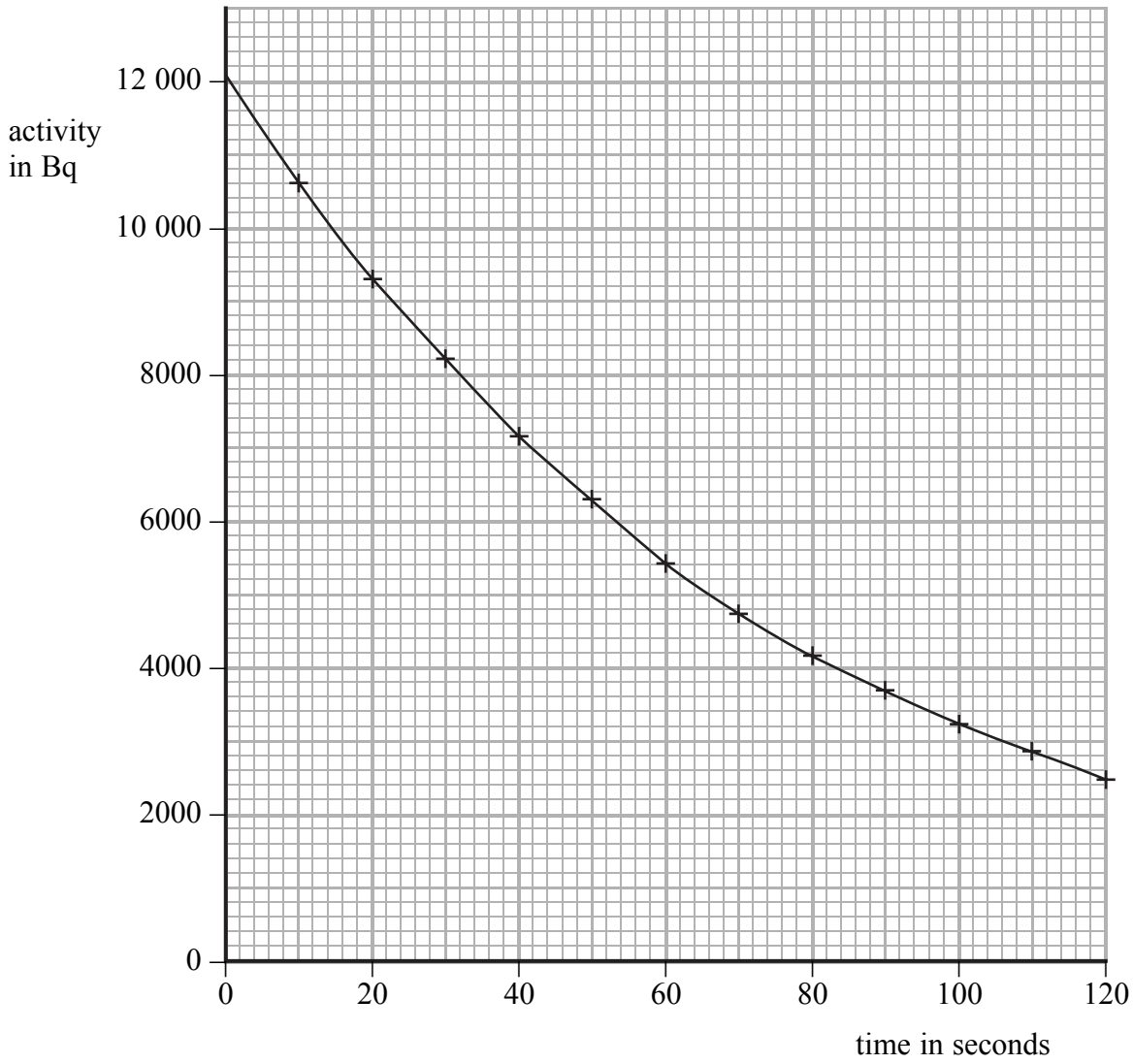
5. (a) The graph shows the radioactive decay curve for a sample of radon-220.
The curve can be used to find the half-life of radon-220.



(i) What is meant by the term **half-life**?

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(1)

(ii) Use the graph to determine the half-life of radon-220.
Show clearly on the graph how you obtain your answer.

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(2)

Leave blank

(b) Hayley is a Year 11 student.
She uses dice to model radioactive decay.
She rolls 200 dice and removes all the dice that land on six.
She rolls the remaining dice and again removes all the sixes.
She carries on doing this until she has only a few dice left.

Her results are shown in the table.

throw	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
number of dice left	200	169	139	114	97	77	70	55	47	42	32	24	20	19	19	12	11	6	6	2

Hayley's teacher says that:

- it is a very good model for radioactive decay when the number of dice left is more than 80
- it is a very poor model when the number left is less than 20.

(i) How might you test these statements using Hayley's results?

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(1)

(ii) What evidence from your test would show that the teacher was correct?

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(1)

Q5

(Total 5 marks)

Leave blank

6. Bruno enjoys roller-coaster rides such as the one shown in the photograph.
The advertisement for this ride calls it 'the scariest ride in the park'.
Some of his friends think it is too risky.

(a) Suggest why Bruno still takes the risk.

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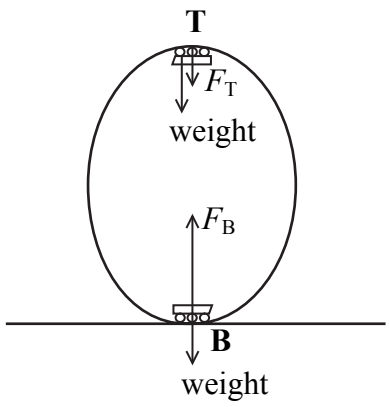
(1)

(b) The diagram below shows the forces acting on a roller-coaster car at the top (**T**) and the bottom (**B**) of a loop.
There is no motor driving the car round this loop. Assume there are no frictional forces acting on this part of the ride.



(i) State the direction of the acceleration of the car in each of these two positions.

at **T** = ...

at **B** = ...

(1)

Leave blank

(ii) The mass of the car is 800 kg and the resultant force on the car at **B** is 19200 N.
Calculate the acceleration of the car at **B**.

acceleration = ... m/s^2

(2)

(c) (i) F_B is the reaction force of the track on the car at **B**.
Show that $F_B = 27\,200$ N.
Gravitational field strength is 10 N/kg.

(2)

(ii) The reaction force at the top F_T is 4800 N.
Suggest why F_T is less than F_B.

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(2) **Q6**

(Total 8 marks)

TOTAL FOR PAPER: 30 MARKS

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