New Specification

Rewarding Learning

Centre Number

71

Candidate Number

General Certificate of Secondary Education
2012

Science: Physics

Unit P1

Higher Tier

[GPH12]

GPH12

FRIDAY 15 JUNE, AFTERNOON

TIME

1 hour 30 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all six** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 100.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Questions **3(b)(ii)** and **5(b)**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
Total Marks	

1 (a) The diagram shows a solar panel. This is made up of a number of photocells.
The photocells produce electricity directly from sunlight.
Solar panels are placed on the roof of a house.

© Zoonar / Thinkstock

On a cloudless summer day the solar energy shining on the panel every second is 6000 J. Of this amount 4800 J are reflected, the rest is converted to electricity.

(i) Calculate the output electrical energy every second from the solar panel.
You are advised to show clearly how you get your answer.

Output electrical energy = ____________________ J [1]

(ii) Calculate the efficiency of the solar panel.
You are advised to show clearly how you get your answer.

Efficiency = ____________________ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

(iii) On a certain summer day the panel generated electricity for 10 hours.
Calculate the number of kilojoules generated on this day by the solar panel.
You are advised to show clearly how you get your answer.

Number of kJ = ____________________ [2]

(iv) State **one** advantage and **one** disadvantage of the use of the solar panel.

Advantage ____

____

____

Disadvantage ____

____

____ [2]

(v) A family of four would use on average 54 000 kJ of electrical energy per day.
State **two** things they could do to make up the difference between what the solar panel produces and what they need.

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____ [2]

(b) The diagram shows weightlifting equipment found in most gyms.

© Polka Dot / Thinkstock

(i) When using the equipment John wants to do 300 J of work in each lift. He can vary the weight from 100 N to 500 N in steps of 50 N. He can also vary the distance he lifts the weights from 1.0 m to 2.0 m in steps of 0.5 m. State **three** weights and the corresponding distances that John can use to achieve this.

1. weight = ______________ N distance = ______________ m

2. weight = ______________ N distance = ______________ m

3. weight = ______________ N distance = ______________ m

[3]

(ii) John repeats the exercise. He does 10 complete lifts in a time of 30 seconds.
Calculate the power John produces during this time.
You are advised to show clearly how you get your answer.

Power = ____________________ W [3]

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(Questions continue overleaf)

Examiner Only	
Marks	Remark

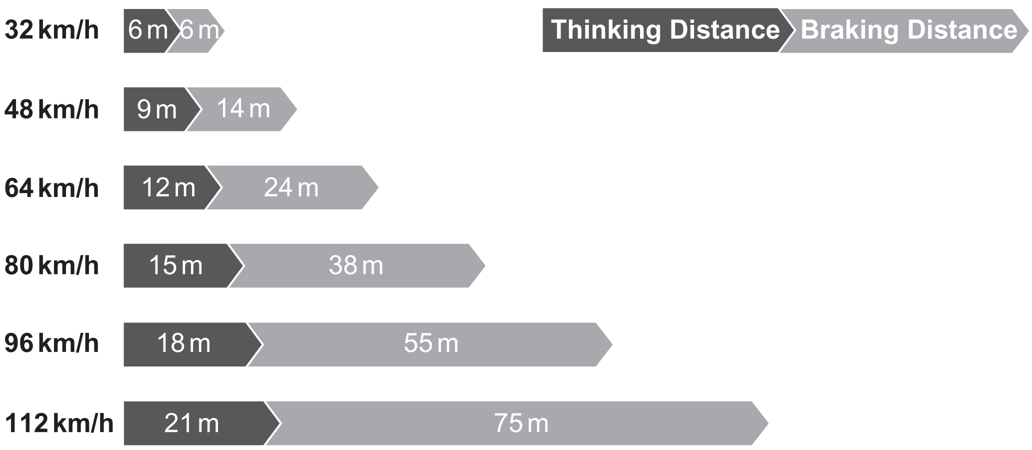
2 Speed limits in the Republic of Ireland are given in km/h.

(i) Show clearly that a speed of 80 km/h is equal to a speed of 22.2 m/s.
(Hint: 1 hour = 3600 seconds)

[3]

The **stopping distance** of a car is the **thinking distance** added to **the braking distance**. The thinking distance is the distance the car travels at constant speed before the driver reacts (reaction time) to a hazard on the road and applies the brakes. The braking distance is the distance the car travels from where the brakes were first applied to where the car stops.

The chart below shows the results of a study of stopping distance by an alert driver, on a dry day using a car with good tyres and brakes.



km/h means kilometres per hour

(ii) Using the data from the chart that applies to a speed of 80 km/h calculate the thinking time (reaction time) of the driver.
You are advised to show clearly how you get your answer.

Thinking time = __________ s [4]

Examiner Only	
Marks	Remark

The **thinking distance** is the distance the car travels before the driver reacts (reaction time) to a hazard on the road and applies the brakes.

(iii) On the grid below plot a graph of thinking distance in m (*y*-axis) against the speed in km/h (*x*-axis).

[4]

(iv) What conclusion can you come to about the relationship between the thinking distance and the speed of the car?
Explain your answer.

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____ [3]

(v) Write down an equation which allows you to calculate the thinking distance for a particular speed in km/h.

[2]

Examiner Only	
Marks	Remark

(vi) The speed of two cars following each other on a motorway is 112 km/h.
Should the car in front suddenly brake it is advisable for the following car to leave a gap. The average length of a car is 4 m. Use the data from the chart to calculate the size of the required gap.
Give your answer in complete car lengths.

Required gap = __________ car lengths [3]

(vii) A car travelling at 112 km/h is equivalent to a speed of 31.1 m/s.
Using the braking distance given in the chart calculate the deceleration of the car.
You are advised to show clearly how you get your answer.

Deceleration = __________ m/s^2 [4]

(viii) The car in part **(vii)** has a mass of 1500 kg.
Calculate the required braking force to bring the car to rest in this distance.
You are advised to show clearly how you get your answer.

Braking force = __________ N [2]

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(Questions continue overleaf)

3 (a) (i) State the Principle of Conservation of Momentum as it applies to collisions.

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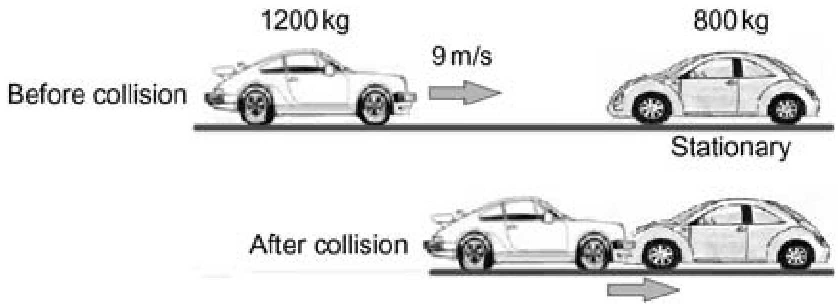
____ [1]

A car of mass 1200 kg is travelling with a velocity of 9 m/s when it collides head-on with a stationary car of mass 800 kg. The two cars stick together as a result of the collision.



(ii) Calculate the momentum of the 1200 kg car immediately before the collision.
You are advised to show clearly how you get your answer.

Momentum = ____________________ kg m/s [3]

(iii) Calculate the velocity of the two cars after collision.
Remember the two cars are stuck together after the collision.
You are advised to show clearly how you get your answer.

Velocity of the combined cars after collision = __________ m/s [4]

Examiner Only	
Marks	Remark

(iv) Calculate the kinetic energy of the combined cars after the collision.
You are advised to show clearly how you get your answer.

Kinetic energy = ____________________ J [3]

(b) The Transport Research Laboratory carries out research as to how to reduce the danger to drivers and passengers in road accidents.

(i) In one experiment, a car with a momentum of 1350 kg m/s collides head on with a brick wall. The car comes to rest in 0.6 s.
Calculate the average size of the force exerted on the car by the wall.
You are advised to show clearly how you get your answer.

Force on the car = ____________________ N [3]

Examiner Only	
Marks	Remark

(ii) Many modern cars are fitted with crumple zones. The diagram below shows what happens when a modern car crashes.

© Hemera / Thinkstock

Explain, **carefully**, how a crumple zone makes it safer for the people inside the car when it is brought to a stop during a collision.

In this question you will be assessed on your written communication skills including the use of specialist science terms.

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____ [6]

Examiner Only	
Marks	Remark

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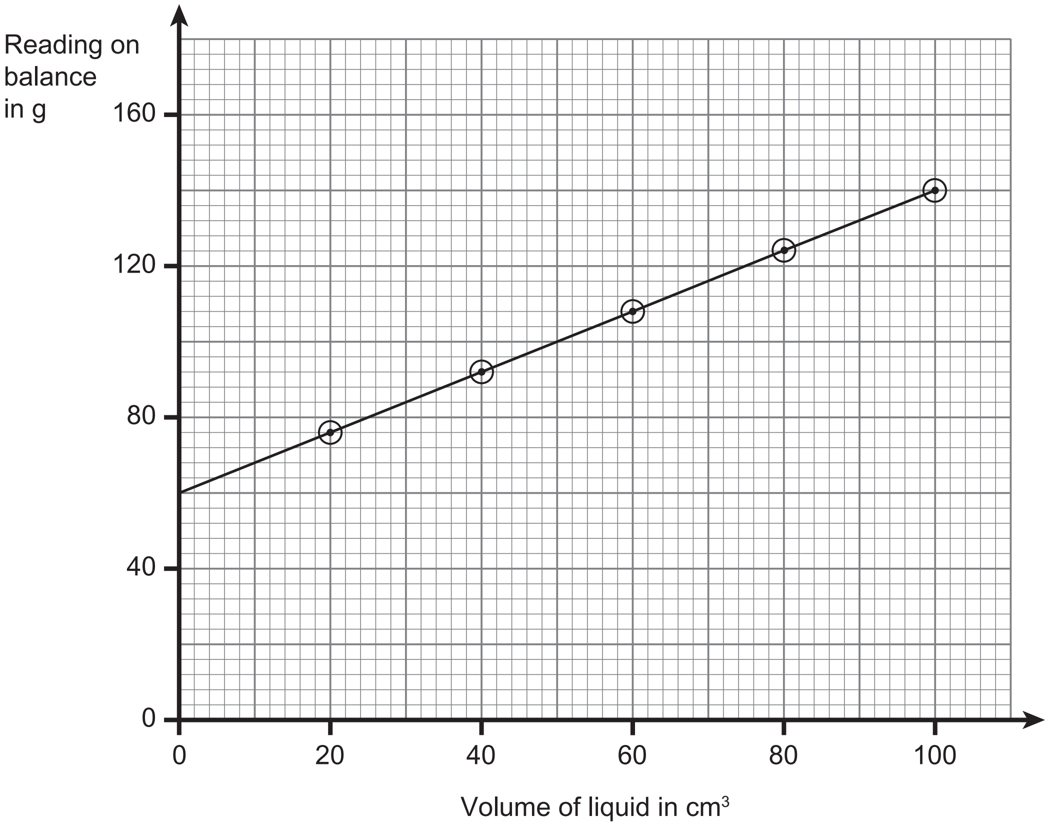
(Questions continue overleaf)

4 Linda is given a measuring cylinder and an electronic balance. She places the empty measuring cylinder on the electronic balance and adds different volumes of liquid. Each time she measures the volume of the liquid she also records the reading on the electronic balance. She plots her results as a graph as shown below.

Examiner Only	
Marks	Remark



(i) What is the mass of the empty measuring cylinder?

_____________ g [1]

The table shows four different liquids and their densities.

Liquid	Density in g/cm^3
Petrol	0.7
Castor Oil	0.9
Water	1.0
Ethanol	0.8

(ii) Using the data from the graph and your answer to part **(i)** identify the liquid Linda used.
You **must** show clearly how you get your answer.

Liquid = ____________________ [4]

(iii) She repeats the same procedure using the **same** measuring cylinder but using a **liquid of lower density** than the first liquid.
On the grid draw the straight line she would expect to obtain. [2]

(iv) Water has a density of 1.0 g/cm^3. Calculate the reading Linda would obtain if she had placed 60 cm^3 of water in the measuring cylinder and placed it on the electronic balance.

Reading = ____________________ g [2]

(v) Ice has a density of 0.9 g/cm^3 and water has density of 1.0 g/cm^3.
What does this tell you about the spacing of the molecules in the two states?

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____

____ [1]

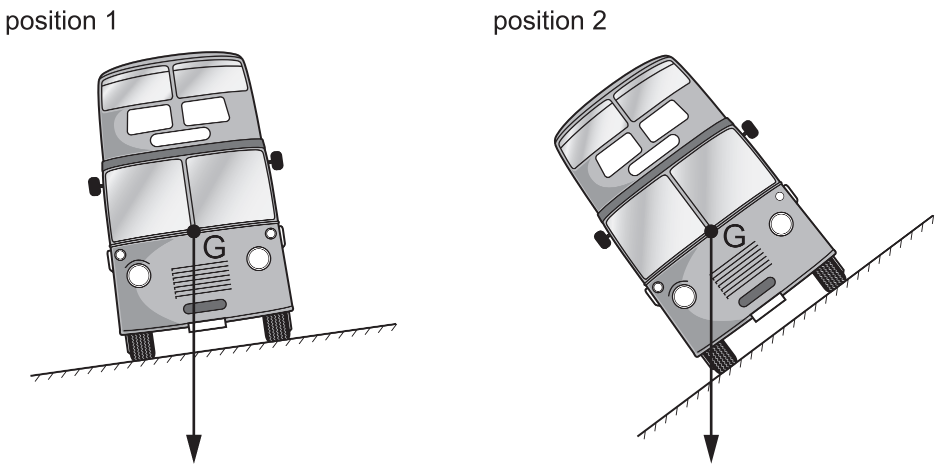
Examiner Only	
Marks	Remark

5 (a) The photograph shows how the stability of a double decker bus is tested.
The angle of the platform is gradually increased until the bus topples.

Examiner Only	
Marks	Remark

"Image of bus undergoing stability test"

The diagram below shows a bus in two positions.
The centre of gravity of the bus is marked with a G.



For each position describe **and** explain what happens to the bus.

Position 1 ____

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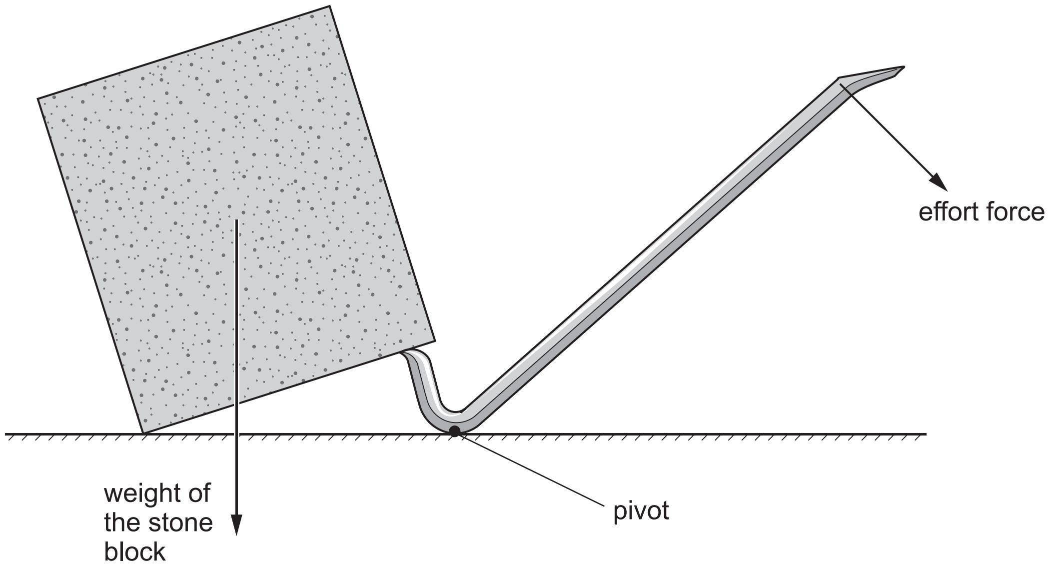
Position 2 ____

____

____ [4]

(b) The diagram shows a long pole being used as a lever to raise a heavy stone block.



The stone block weighs much more than the force the man uses to raise it. Explain carefully how the lever allows him to raise the stone block.

In this question you will be assessed on your written communication skills including the use of specialist science terms.

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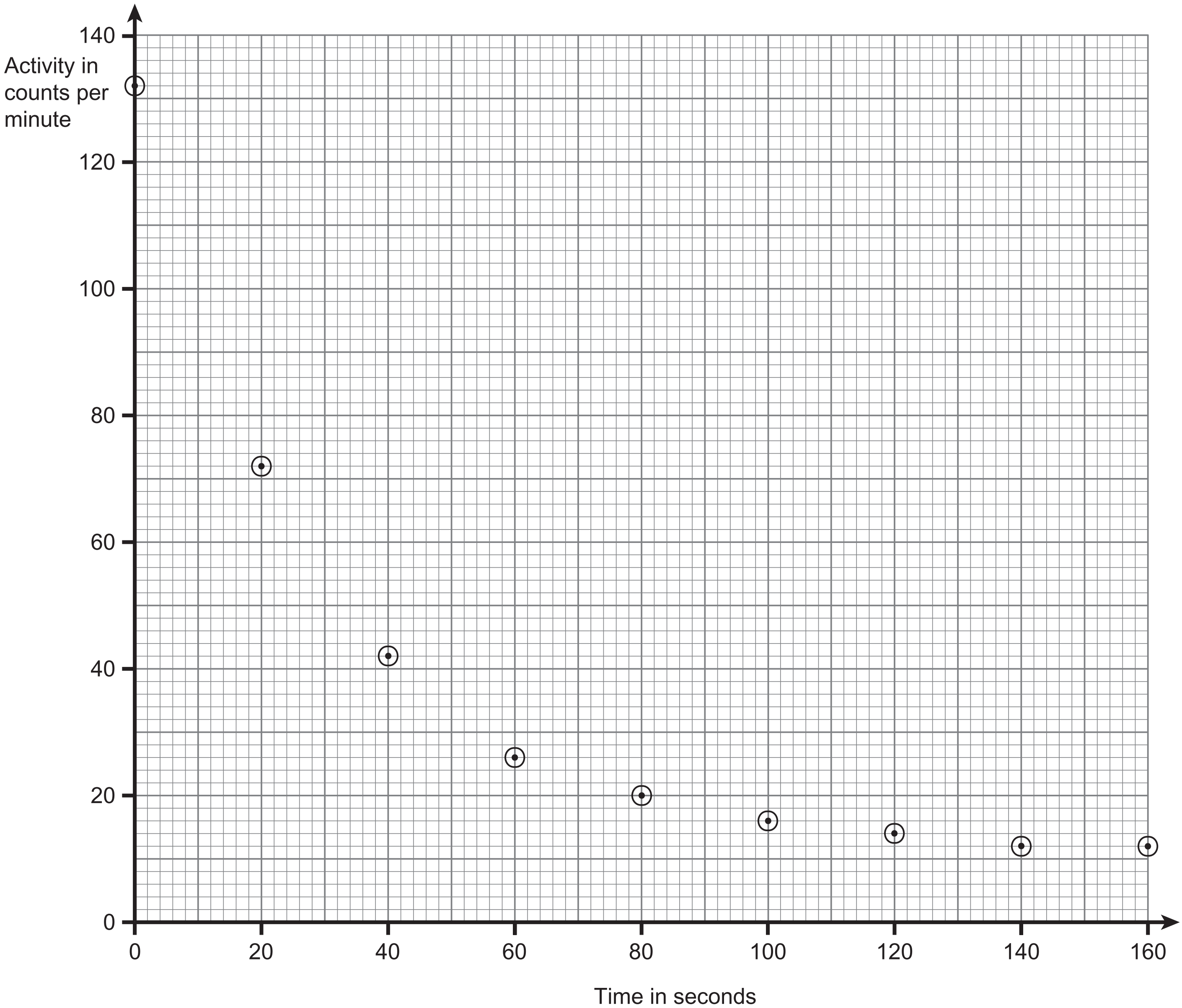
____ [6]

Examiner Only	
Marks	Remark

6 **(a)** When measuring the half-life of a radioactive substance, measurements of the activity were taken every 20 seconds.
These measurements are shown plotted on the grid below.



(i) Complete the graph by drawing the best fit curve. Use it to find the background activity.
Explain how you arrive at your answer.

Background activity = ____________________ counts per minute

____

____ [3]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

(ii) Using your value for the background activity, determine the activity due **only** to the radioactive substance at the **start of the experiment**.

Activity = ___________________ counts per minute [2]

(b) Fission and fusion are nuclear reactions, which release large amounts of energy. The table below is intended to show a number of significant differences between the two reactions. Complete the table using the list of phrases/words below.

1. building of larger nuclei from small nuclei
2. the splitting of large nuclei
3. nuclear power station
4. requires very high temperatures to start
5. the sun
6. hydrogen
7. uranium
8. will start at room temperature

Write the number corresponding to the statement in the appropriate box in the table below.

Nuclear Reaction	**Fusion**	**Fission**
Where the process can be found happening		
Fuel used		
Description of the reaction		
Conditions required to start		

[4]

Examiner Only	
Marks	Remark

(c) Cobalt-60 is a beta emitter which decays to nickel.
The nickel produced is a gamma emitter.

(i) Complete the decay equation below for the complete decay process by writing the correct values in the boxes.

$$^{60}_{27}\mathrm{Co} \rightarrow\ ^{60}_{28}\mathrm{Ni}^{*} +\ ^{\square}_{\square}\beta$$

$$\downarrow$$

$$^{\square}_{\square}\mathrm{Ni} + \gamma$$

[4]

After 15 years the measured activity of a cobalt-60 source is found to have fallen from 120 counts per minute to 15 counts per minute.

(ii) What is the half-life of cobalt-60?
You are advised to show clearly how you get your answer.

Half-life = __________ years [3]

(iii) State two possible uses of gamma radiation.

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____ [2]

(d) Describe how the electrons are arranged in the "Plum Pudding" model of the atom and the present Rutherford-Bohr model.

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____ [2]

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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