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Candidate Number

General Certificate of Secondary Education
2012

Science: Physics

Unit P1

Foundation Tier

[GPH11]

GPH11

FRIDAY 15 JUNE, AFTERNOON

TIME

1 hour 15 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 80.
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 Question **3(a)(iii)**.

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

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Marks	Remark

1 **(a)** The diagram shows one solar panel consisting of a number of sections.
The solar panel 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 power shining on the panel is 6000 W.

(i) How much energy per second is shining on the solar panel?

Energy per second = _____ J [1]

(ii) The output electrical power from the solar panel is 1200 W.
Calculate the efficiency of the solar panel.
You are advised to show clearly how you get your answer.

Efficiency = _____ [2]

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

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(i) When using the equipment John lifts a weight of 200 N through a distance of 1.5 m.
Calculate the amount of work that John does.
You are advised to show clearly how you get your answer.

Work = _____ J [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.
Remember to include the unit for power.
You are advised to show clearly how you get your answer.

Power = _____ [4]

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

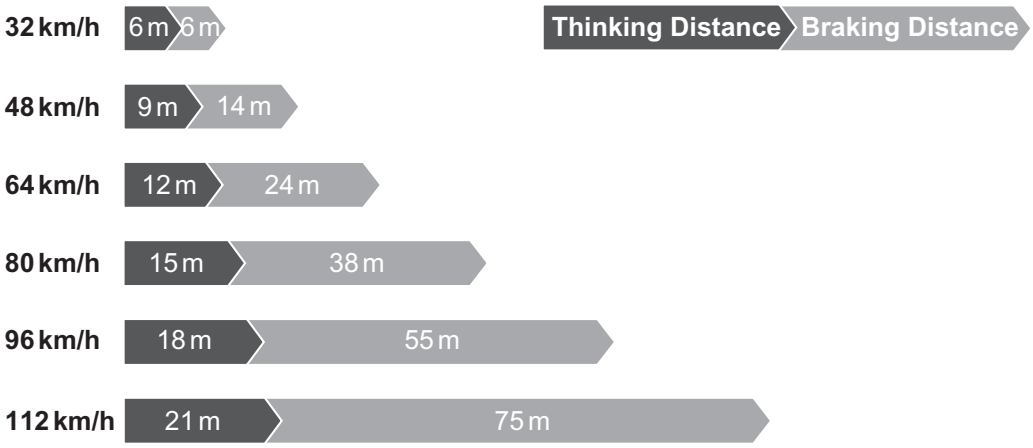
(i) Show that a speed of 80 km per hour is equal to a speed of 22.2 m/s.
(Hint: 1 hour = 3600 seconds)

[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 before the driver reacts (reaction time) to a hazard on the road and applies the brakes.

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 good brakes.



km/h means kilometres per hour

(ii) 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.

You are advised to show clearly how you get your answer.

Required gap = _____ car lengths [3]

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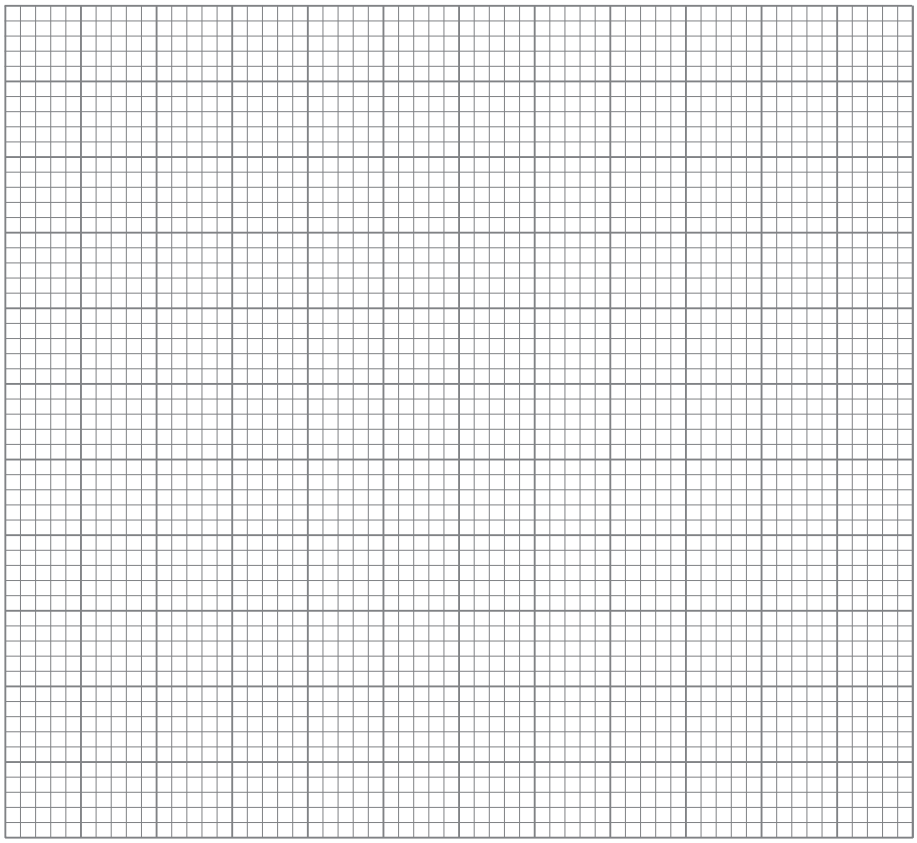
The **thinking distance** is the distance the car travels before the driver reacts (reaction time) to a hazard on the road and applies the brakes.

(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.

_____

_____

_____ [3]

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

[2]

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3 (a) (i) Write down the equation you would use to find the momentum of an object.

[1]

(ii) When a force acts on an object it causes a change in the object's momentum. Write down an equation you would use to find the change in momentum if you knew the size of the force and time for which it acts on the object.

[1]

(iii) 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.**

[6]

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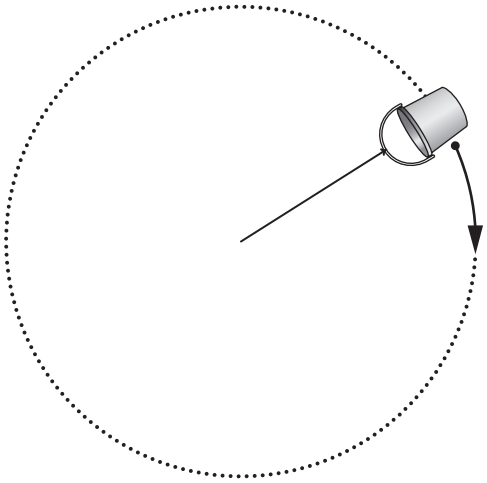
(b) The diagram shows a bucket tied to a length of rope. The bucket is swung in a circle.



(i) On the diagram mark the direction of the centripetal force which makes the bucket move in this circle. [1]

(ii) Describe carefully what happens to the bucket, if the rope should break.

_____

_____ [2]

(iii) The size of the centripetal force needed to make an object move in a circle depends on a number of factors. For each of the factors listed below state if the centripetal force is affected by it. Write your answer in the box provided.
Use **Y** if the centripetal force is affected and **N** if it is not.

Factor	Affected Y/N
The mass of an object	
Radius of the circle	
The speed of the object	
The direction of motion	

[4]

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4 **(a)** The terms mass and weight are often used in everyday speech as having the same meaning.

(i) John says “My weight is 75 kg”. Explain what is wrong with this statement.

_____

_____ [1]

(ii) John’s friend David stands on bathroom scales which give a reading of 65 kg. Find David’s weight.

Weight = _____ [1]

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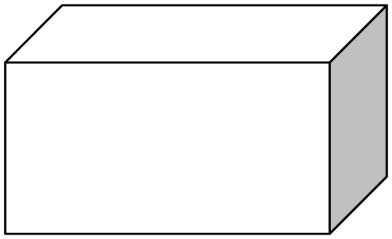
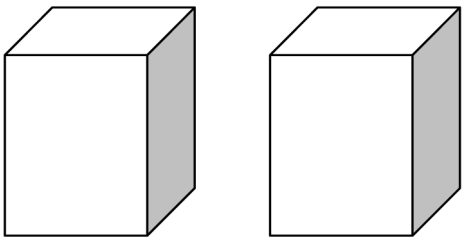
(b) The block of ice shown below has a mass of 320 g and a volume of 360 cm^3.



(i) Calculate a value for the density of ice.
You are advised to show clearly how you get your answer.

Density = _____ g/cm^3 [2]

(ii) The block of ice is now cut into two halves.
What effect will this have on the density of each half?



_____ [1]

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Marks	Remark

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(c) 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.

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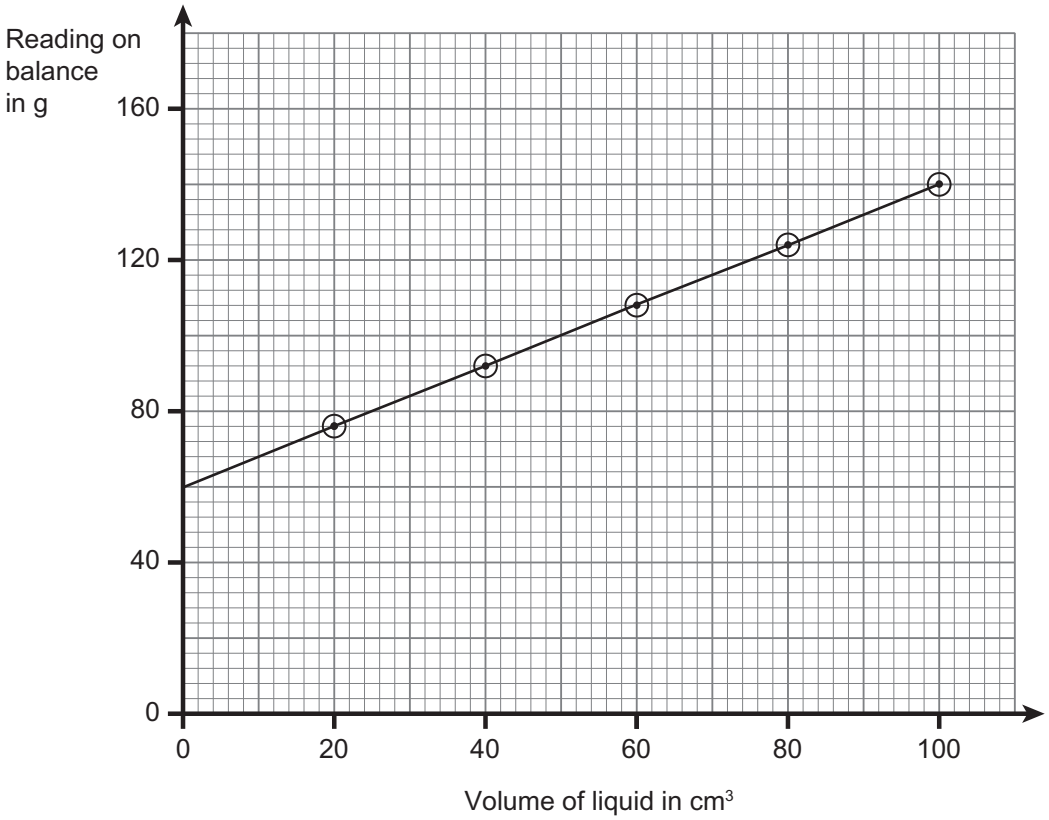

(i) What is the mass of the empty measuring cylinder?

_____ g [1]

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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]

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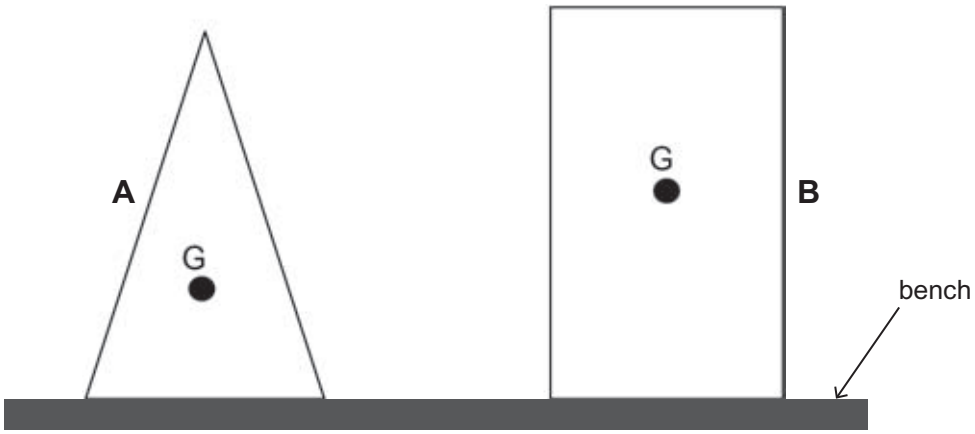
5 **(a)** **(i)** What is meant by the centre of gravity of an object?

_____

_____

_____ [2]

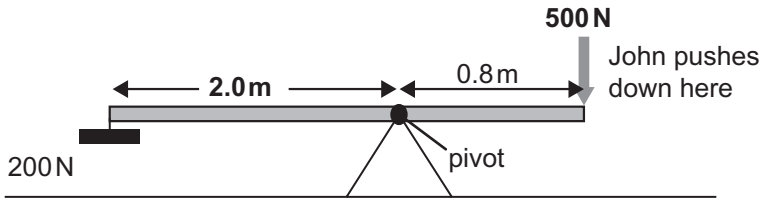
(ii) The two objects shown below have bases of the same width.
The position of the centre of gravity of each is marked G.
Which is the more stable?
Explain your answer.



_____

_____ [2]

(b) John builds a simple weightlifting device as shown below.
The pivot can be moved along the metal bar.



(i) For the arrangement shown above calculate the moment of the force that John exerts.

You are advised to show clearly how you get your answer.

Moment = _____ Nm [3]

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(ii) To reduce the force that John exerts but keep the same moment he moves the pivot.
In what direction should he move it?
Explain **fully** your answer.

Direction _____

Explanation _____

_____

_____

_____

_____ [3]

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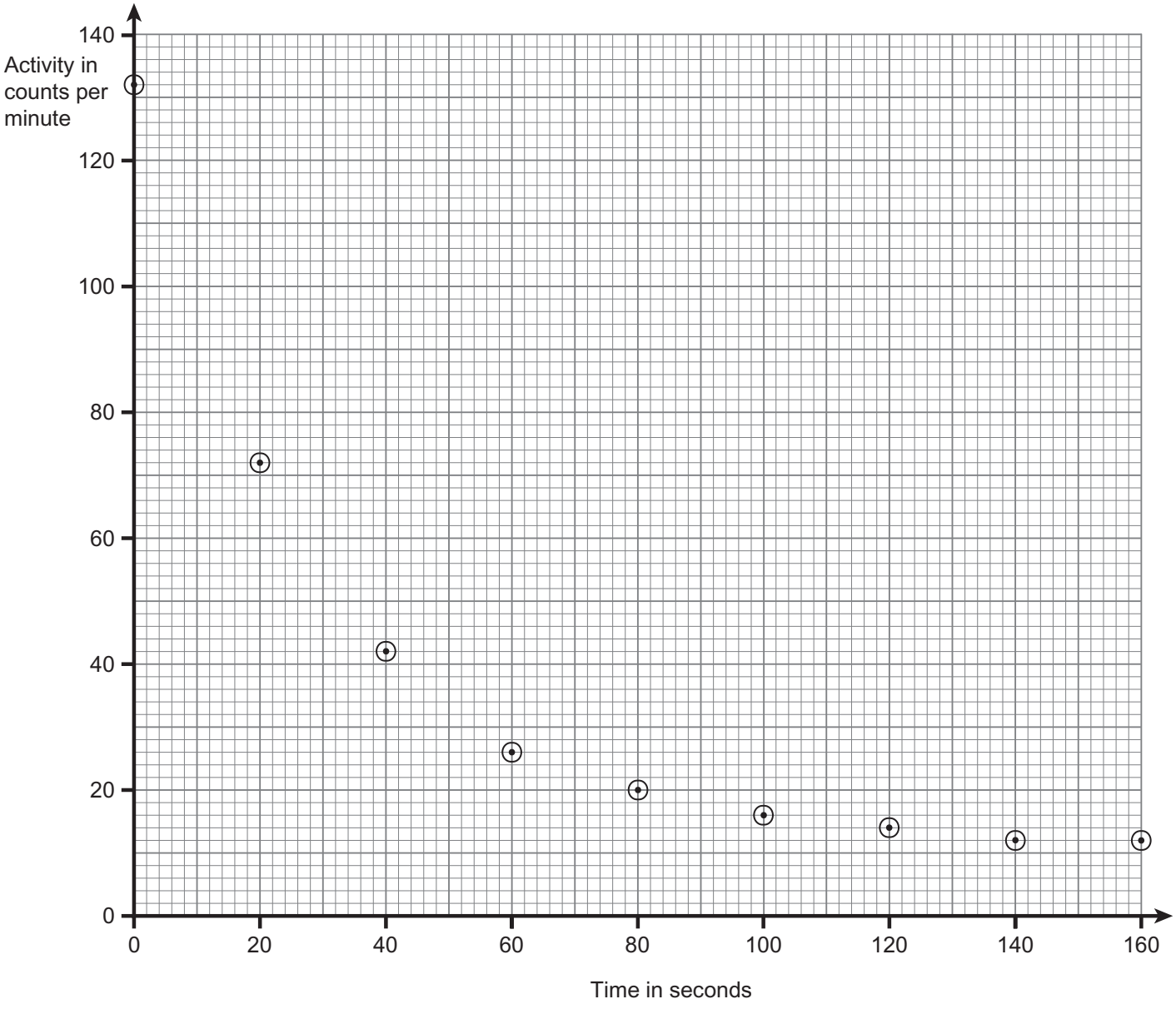
6 **(a)** Complete the table below by naming the three different radiations emitted by radioactive substances and state the nature of each.

Name of radiation emitted	Nature of radiation (electromagnetic wave or particle)

[6]

(b) 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.



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(i) Complete the graph by drawing the best fit **curve**. [1]

(ii) Using the measurements shown on the graph, find the value of the background activity.
Explain how you arrive at your answer.

Background activity = _____ counts per minute

_____

_____ [2]

(iii) 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]

(c) A radioactive substance has a half-life of **12 years**.

Which of the following statements is/are true?

Using **T** for true and **F** for false write your answer in the space provided.

For a sample of this substance **after 12 years**;

Statement	True or False
Its activity will be half of what it was at the start.	
Its activity will be double what it was at the start.	
Its activity will be zero.	

For a sample of this substance **after 24 years**;

Statement	True or False
All of the radioactive nuclei will have decayed.	
Its activity will be zero.	
Its activity will be $\frac{1}{4}$ of what it was at the start.	

[3]

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(d) The full symbol for a particular nucleus of carbon is $^{14}_{6}C$

Complete the table below naming the particles in this nucleus of carbon and give the number of each in the nucleus.

Particle	Number in the nucleus

[4]

(e) Four unknown nuclei are labelled W, X, Y and Z.
Their full symbols are given below.

$^{30}_{15}W$ $^{30}_{16}X$ $^{32}_{17}Y$ $^{33}_{16}Z$

(i) Which, if any, of these nuclei are isotopes of the same element?

_____ [1]

(ii) Explain your answer.

_____

_____ [1]

THIS IS THE END OF THE QUESTION PAPER

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