CCEA GCSE DOUBLE AWARD SCIENCE

SCIENCE



EXAM QUESTION PACK

PHYSICS UNIT P1 HIGHER TIER GSD32 PAPERS

STEMUP

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Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2016–2017

Double Award Science: Physics

GSD32

Unit P1
Higher Tier

[GSD32]

FRIDAY 11 NOVEMBER 2016, AFTERNOON

TIME

1 hour.

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 nine** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 70.
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 **1** and **6**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total Marks	

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1 Describe an experiment you would carry out to measure the power output of an electric motor.

In your description you should include:

- the apparatus used;
- the measurements you take.

Do not include any formulas.

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

[6]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

2 **(a)** Explain why atoms are electrically neutral.

_____

_____ [1]

(b) Complete the table below to show the relative masses and charges of the particles that make up an atom.

Particle	Relative mass	Relative charge
	1	+1
Neutron		
Electron	$\frac{1}{1840}$	

[4]

(c) Explain in terms of nuclear particles the meaning of the term **isotope**.

_____

_____ [2]

(d) The lithium nucleus contains three protons and four neutrons.
Complete the symbol below for the lithium nucleus.

$$\begin{matrix}\square \\ \square\end{matrix}\ \mathrm{Li}$$

[2]

(e) Another atom has the same number of neutrons but a different number of protons.
Tick (✓) the box to show what this other atom is.

☐ An isotope of lithium

☐ An ion

☐ Another element [1]

Nuclear reactors are used in power stations to release energy through nuclear fission.



© MartinLisner / iStock / Thinkstock

(f) **(i)** What is meant by **nuclear fission**?

_____

_____ [2]

(ii) Name one fission fuel commonly used in nuclear reactors.

_____ [1]

(iii) State one disadvantage, not related to cost, of producing electricity using nuclear power.

_____ [1]

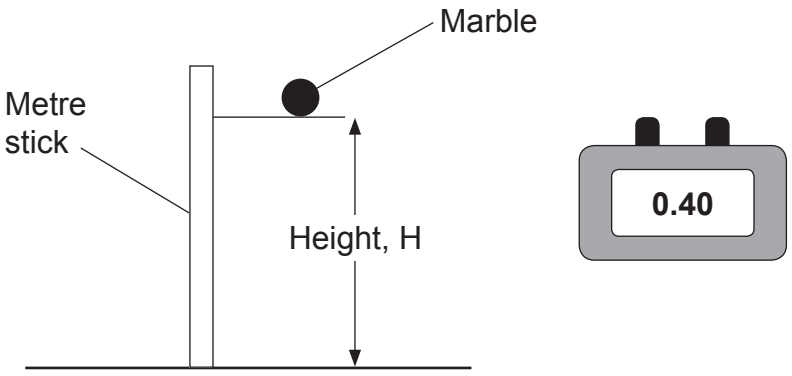
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

3 The acceleration due to gravity can be measured by finding the times, T, for a marble to fall through various heights, H, above the Earth's surface.



Source: Chief Examiner

According to theory, the relationship between the height, H and the time T, is given by:

$$H = k\,T^2 \qquad \textbf{Equation 3.1}$$

The following data was obtained.

Height/m	0.2	0.4	0.6	0.8	1.0
T^2/s^2	0.04	0.08	0.12	0.16	0.20

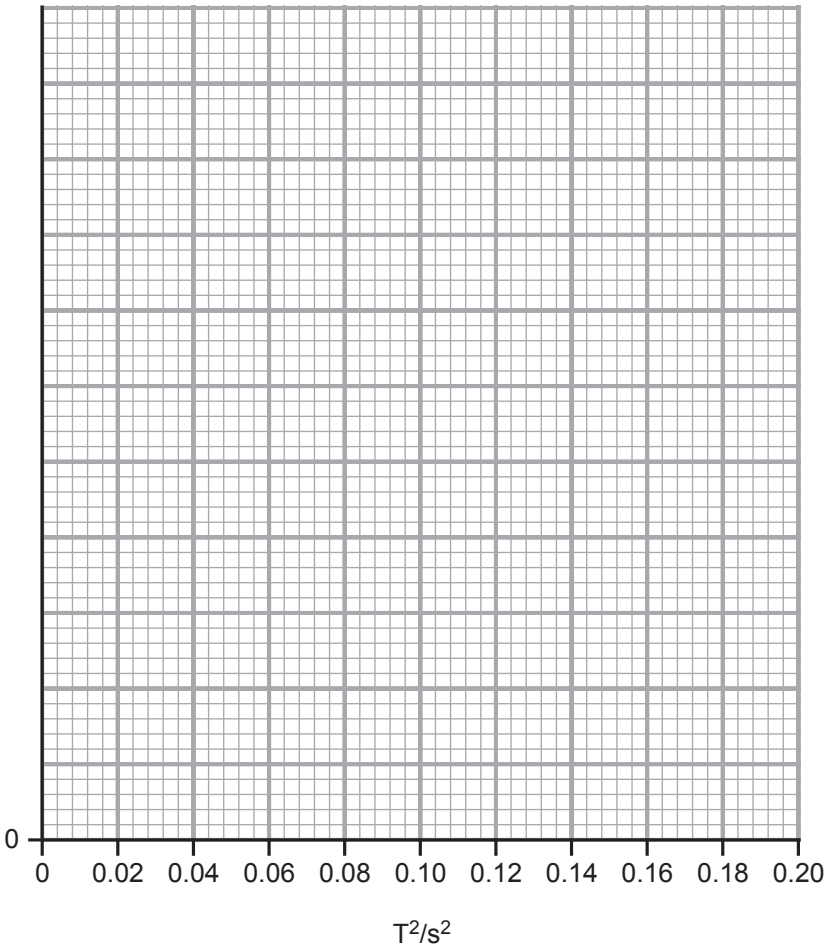
(a) On the grid opposite, draw a graph of height H on the vertical axis versus T^2 on the horizontal axis.

(i) Label the vertical axis and insert the appropriate scale. [2]

(ii) Plot the points. [2]

(iii) Draw a line of best fit. [1]

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(b) (i) Use your graph to find the value of k.
Remember to include the unit for k.

You are advised to show your working out.

k = _____ [2]

Unit of k = _____ [1]

(ii) Does your graph support the relationship between H and T^2 in equation 3.1?

YES NO **Circle the correct answer.**

Explain your answer.

_____

_____ [2]

Examiner Only

Marks	Remark

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4 The cheetah is the fastest land animal over a short distance.



© maros_bauer / iStock / Thinkstock

A cheetah is **travelling** at a constant velocity when it spots its prey. It then accelerates at 8 m/s^2 for 3 seconds.

(a) Calculate the cheetah's **change in velocity**.

You are advised to show your working out.

Change in velocity = _____ m/s [3]

Examiner Only

Marks	Remark

(b) The mass of the cheetah is 80 kg.

Examiner Only	
Marks	Remark

(i) State the resultant force on the cheetah, when it is travelling at a constant velocity.

Resultant force = _____ N [1]

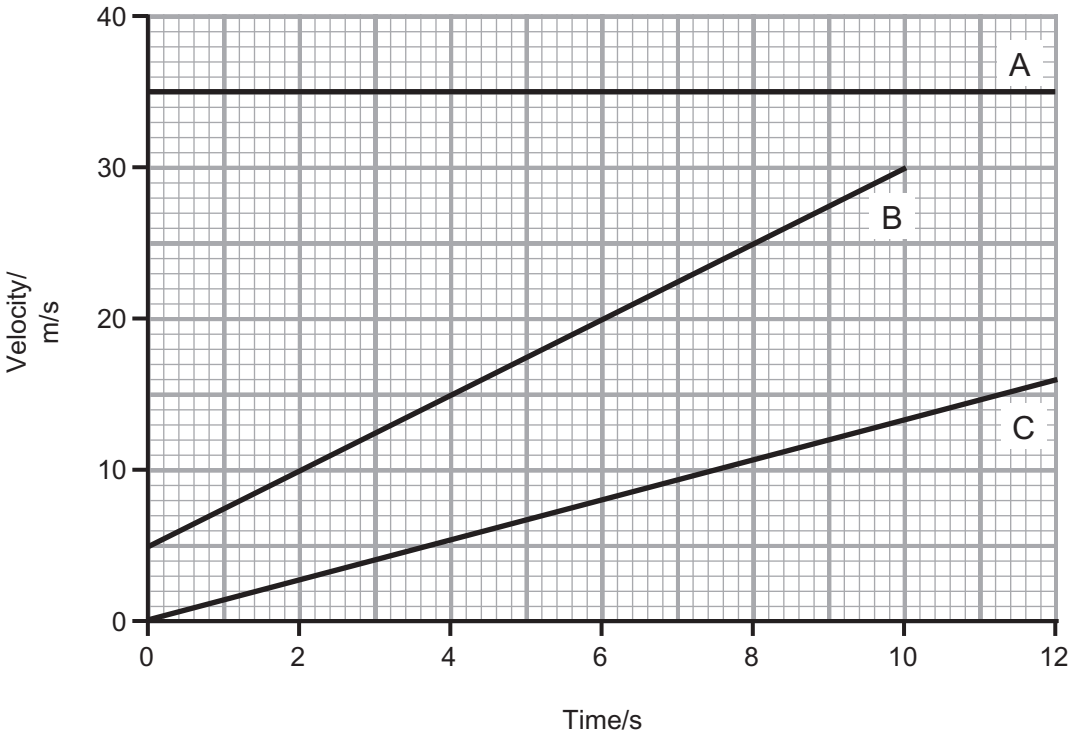
(ii) Calculate the resultant force on the cheetah while it is accelerating at 8 m/s^2.

You are advised to show your working out.

Resultant force = _____ N [3]

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5 The graphs below represent the motions of three different vehicles, A, B and C.



(a) (i) Which vehicle is not accelerating?

Vehicle/s = _____ [1]

(ii) Which vehicle is travelling with the greatest acceleration?

Vehicle = _____ [1]

(iii) Give a reason for your answer to **(ii)**.

_____ [1]

Examiner Only

Marks	Remark

(b) (i) Calculate the acceleration of vehicle B.

You are advised to show your working out.

Acceleration = _____ m/s^2 [3]

(ii) What does the area between line B and the horizontal axis represent?

_____ [1]

(iii) Find the displacement of vehicle B in the 10 seconds of its motion.

You are advised to show your working out.

Displacement = _____ [3]

Examiner Only	
Marks	Remark

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6 Write an account of the process of nuclear fusion.

Your account should include the following:

- the particles involved;
- the process itself;
- where fusion occurs naturally.

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

[6]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

7 An isotope of uranium (U) decays by emitting a beta (β) particle.

(a) Write the numbers in the boxes below to complete the equation.

$$^{239}_{92}\mathrm{U} \longrightarrow \square\!\!\square\,\mathrm{Np} + \square\!\!\square\,\beta$$

[4]

(b) A sample of neptunium-240 contains 1000 undecayed nuclei. After 21.9 minutes 875 neptunium-240 nuclei have decayed.

By first working out how many undecayed neptunium-240 nuclei remain, calculate the half-life of neptunium-240.

You are advised to show your working out.

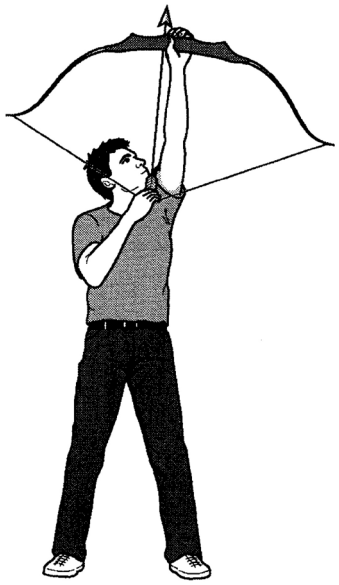
Number of undecayed neptunium-240 nuclei = _____ [1]

Half-life = _____ minutes [3]

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8 An archer shoots an arrow vertically into the air.

Examiner Only	
Marks	Remark



Source: Chief Examiner

The arrow has a mass of 200 g and its initial kinetic energy on release is 50 J. Later in its flight the arrow's kinetic energy has decreased to 20 J.

Use the Principle of Conservation of Energy to calculate the height of the arrow at this point. Assume no energy losses have occurred.

You are advised to show your working out.

Height = _____ m [4]

Examiner Only	
Marks	Remark

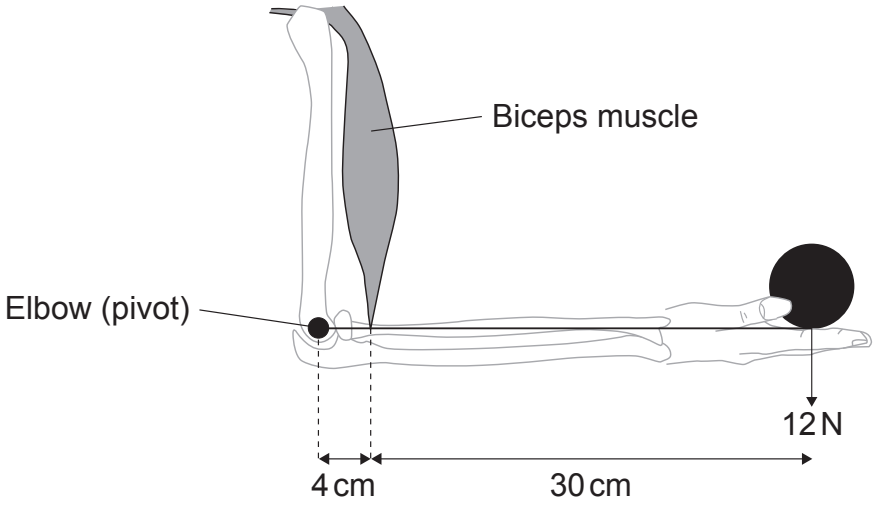
9 **(a)** State the Principle of Moments.

_____

_____

_____ [2]

(b) The diagram represents the forearm bone and the biceps muscle of the arm of an athlete holding a weight of 12 N.



Source: Chief Examiner

Calculate the upwards force exerted by the athlete's biceps muscle.

You are advised to show your working out.

Force = _____ N [3]

THIS IS THE END OF THE QUESTION PAPER

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Rewarding Learning

General Certificate of Secondary Education
2016–2017

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

FRIDAY 11 NOVEMBER 2016, AFTERNOON

MARK SCHEME

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General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

AVAILABLE MARKS

1 **(a)** stopwatch (or equiv.) [1]

(b) metre rule (or equiv.) [1]

(c) scales [1]

(d) measure the mass/weight [1]
Record/find the mass/weight

(e) measure height [1]

(f) record time [1]

Response	Mark
Candidates explain **5 or 6** of the above points. They use good spelling, punctuation and grammar. The form and style are of a high standard and specialist terms are used appropriately.	[5]–[6]
Candidates explain **3 or 4** of the above points. They use satisfactory spelling, punctuation and grammar. The form and style are of a satisfactory standard and they have made use of some specialist terms.	[3]–[4]
Candidates explain **1 or 2** of the above points. They use limited spelling, punctuation and grammar. The form and style are of a limited standard and they have made no use of specialist terms.	[1]–[2]
Response not worthy of credit.	[0]

[6] 6

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AVAILABLE MARKS

2 **(a)** **No.** of positive charges **= no.** of negative (charges)
or
no. of protons **= no.** of electrons [1]

(b)

Particle	Relative mass	Relative charge
Proton		
	1	0
		–1

[4]

(c) Same no. of protons, (**threshold** mark) [1]
different no. of neutrons [1] [2]

(d)

$$\begin{matrix}7\\3\end{matrix}\ \mathrm{Li}$$

[2]

(e) Another element [1]

(f) **(i)** Nucleus [1] is split [1] Independent marking [2]

(ii) Uranium or plutonium [1] [1]

(iii) **Waste** is **radioactive** [1] 14

3 **(a)** **(i)** Scale halfway or better [1] label and unit [1] [2]

(ii) 3 or 4 pts correct [1] 5 pts correct [1] Tolerance: ± 1 square [2]

(iii) Best fit line through their points [1]

(b) **(i)** k = grad. or k = $\frac{1}{0.2}$ (or equiv.) [1]

k = 5 [1] allow 4.9 to 5.1
Unit = m/s^2 [1] [3]

(ii) Yes (is circled) Forfeits [2] if "No" is circled!
straight line [1] through the origin [1] – Independent marks [2] 10

					AVAILABLE MARKS
4	**(a)**		$a = \Delta v \div t$ (or equiv.) [1] $= \frac{v - u}{t} = \frac{\text{change in velocity}}{\text{time}}$ $8 = \Delta v \div 3$ [1] $\Delta v = 24$ (m/s) [1] Note: be careful of substitution involving u = 0 (m/s)	[3]	
	(b)	**(i)**	0	[1]	
		(ii)	F = ma [1] or equivalent, e.g. RF = ma or F_R = ma = 80 × 8 [1] = 640 (N) [1]	[3]	7
5	**(a)**	**(i)**	A	[1]	
		(ii)	B	[1]	
		(iii)	Biggest gradient (**dependent** marking from **(ii)**)	[1]	
	(b)	**(i)**	a = grad [1] or equivalent $= \frac{\Delta v}{t} = \frac{v - u}{t} = \frac{\text{Rise}}{\text{Run}} = \frac{\Delta y}{\Delta x}$ = 25 ÷ 10 [1] = 2.5 (m/s^2) [1]	[3]	
		(ii)	Displacement	[1]	
		(iii)	(Area =) (5 × 10) [1] + (0.5 × 10 × 25) [1] = 175 [1] (m) Correct attempt at one area gets [1]/[2]	[3]	10

6 (Two) light/hydrogen nuclei [1]
Join (together) [1]
To form (more) stable/heavier [1]
(Helium) **nucleus** [1] atom ≠ nucleus
Producing energy [1]
The sun [1] or star

Reject: Fuse together

all independently marked

Response	Mark
Candidates explain **5 or 6** of the above points. They use good spelling, punctuation and grammar. The form and style are of a high standard and specialist terms are used appropriately.	[5]–[6]
Candidates explain **3 or 4** of the above points. They use satisfactory spelling, punctuation and grammar. The form and style are of a satisfactory standard and they have made use of some specialist terms.	[3]–[4]
Candidates explain **1 or 2** of the above points. They use limited spelling, punctuation and grammar. The form and style are of a limited standard and they have made no use of specialist terms.	[1]–[2]
Response not worthy of credit.	[0]

[6] 6

7 **(a)**

$$^{239}_{92}U \longrightarrow {}^{239}_{93}Np + {}^{0}_{-1}\beta$$

[1] each – Independent marking [4]

(b) 125 undecayed [1]

1000 ⟶ 500 ⟶ 250 ⟶ 125

One halving gets [1], all 3 halvings to 125 gets [2]

or 3 half-lives identified gets [2]

Half-life = 7.3 (minutes) [1] [4] 8

8 PE = mgh [1] **or** KE lost = PE gained [1]
[1] 30 = 0.2 × 10 × h [1]
h = 15 (m) [1] [4] 4

AVAILABLE MARKS

			AVAILABLE MARKS
9	**(a)** **cm = acm** or equivalent (threshold mark) [1] for a body in equilibrium/ balanced [1]	[2]	
	(b) [1] F × 4 = 12 × 34 [1] F = 102 (N) [1]	[3]	5
		Total	**70**

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Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2015–2016

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

GSD32

WEDNESDAY 25 MAY 2016, AFTERNOON

TIME

1 hour.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in blue or black ink only. **Do not write with a gel pen.**
Answer **all nine** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 70.
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 **2** and **6**.

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1 **(a)** The symbol for Thorium-234 is

$$^{234}_{90}\text{Th}$$

(i) State the total number of protons and neutrons in a nucleus of Thorium-234.

_____ [1]

(ii) How many protons does a nucleus of Thorium-234 contain?

_____ [1]

(iii) What name is given to the total number of protons and neutrons in the nucleus of Thorium-234?

_____ [1]

(iv) How many neutrons does a nucleus of Thorium-234 contain?

_____ [1]

(b) A radioactive isotope has a half-life of 30 days. Initially there are 64 000 undecayed nuclei. How many undecayed nuclei will remain after 90 days?

You are advised to show your working out.

Number of undecayed nuclei = _____ [3]

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2 The modern theory for the structure of the atom is quite different from the earlier theory which it replaced.

Write a brief account of both theories.

Your account should include:

- the name of each theory;
- a description of the structure of the atom in each theory.

You will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

[Turn over

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3 Theory shows that the gravitational potential energy (G.P.E.) of a body depends on its height (h) above the Earth's surface, according to the formula:

G.P.E. = k h **Equation 3.1**

where k is a constant.

The following table shows the results for the gravitational potential energy (G.P.E.) of an object at different heights above the Earth's surface.

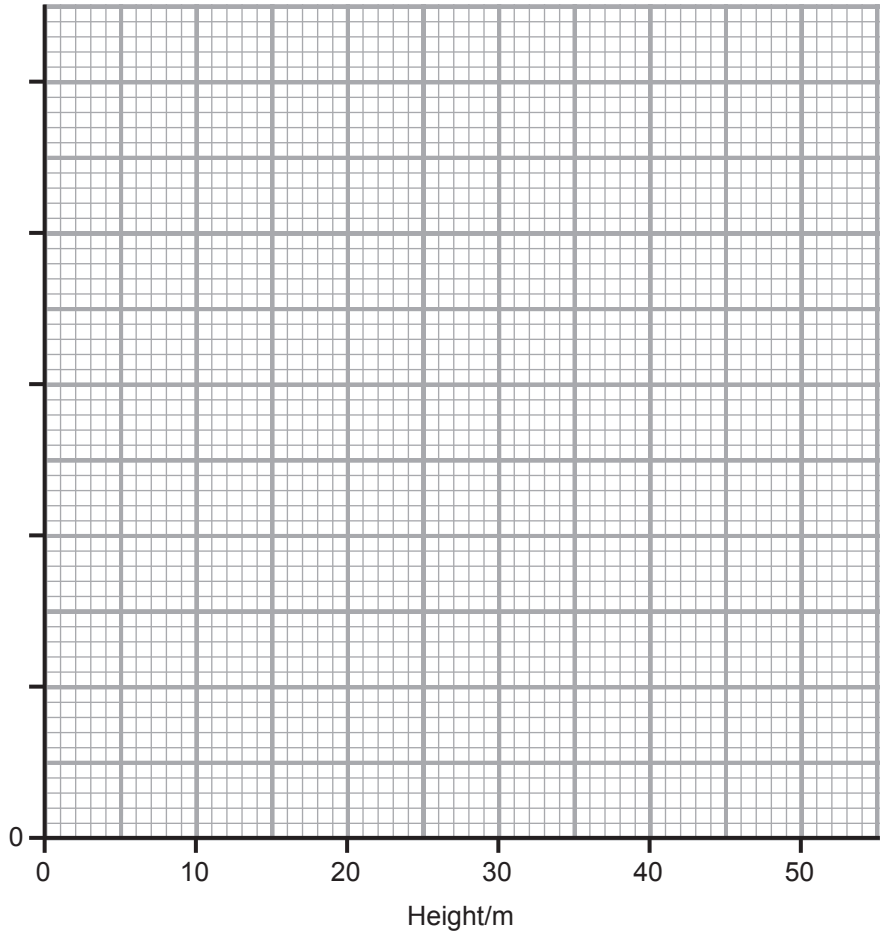
Height/m	0	10	20	30	40	50
G.P.E./J	0	50	100	150	200	250

You are asked to plot a graph of gravitational potential energy against height.

(a) Choose a suitable vertical scale and label its axis. [2]

(b) Plot the points on the grid of G.P.E. against height above the Earth's surface. [2]

(c) Draw a line of best fit. [1]



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(d) **(i)** From your graph state the relationship between G.P.E. and height above the Earth's surface.

_____

_____ [1]

(ii) Explain fully how the graph shows this.

_____

_____

_____ [1]

(e) From your graph find the gravitational potential energy when the height is 45 m.

_____ [1]

(f) Use your graph to determine the constant k, in **Equation 3.1**.
Remember to include the units for k.

You are advised to show your working out.

k = _____ Units = _____ [4]

[Turn over

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4 A boat crew passes the finishing line at a speed of 7 m/s and immediately stops rowing.



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(i) Calculate how long it takes the boat to slow from 7 m/s to 1 m/s if its retardation (deceleration) is 0.75 m/s^2.

You are advised to show your working out.

Time = _____ s [3]

The total mass of the boat, the crew and all the rowing kit is 540 kg.

(ii) Calculate the drag force acting on the boat during this time interval. Remember the retardation (deceleration) is 0.75 m/s^2.

You are advised to show your working out.

Drag force = _____ N [3]

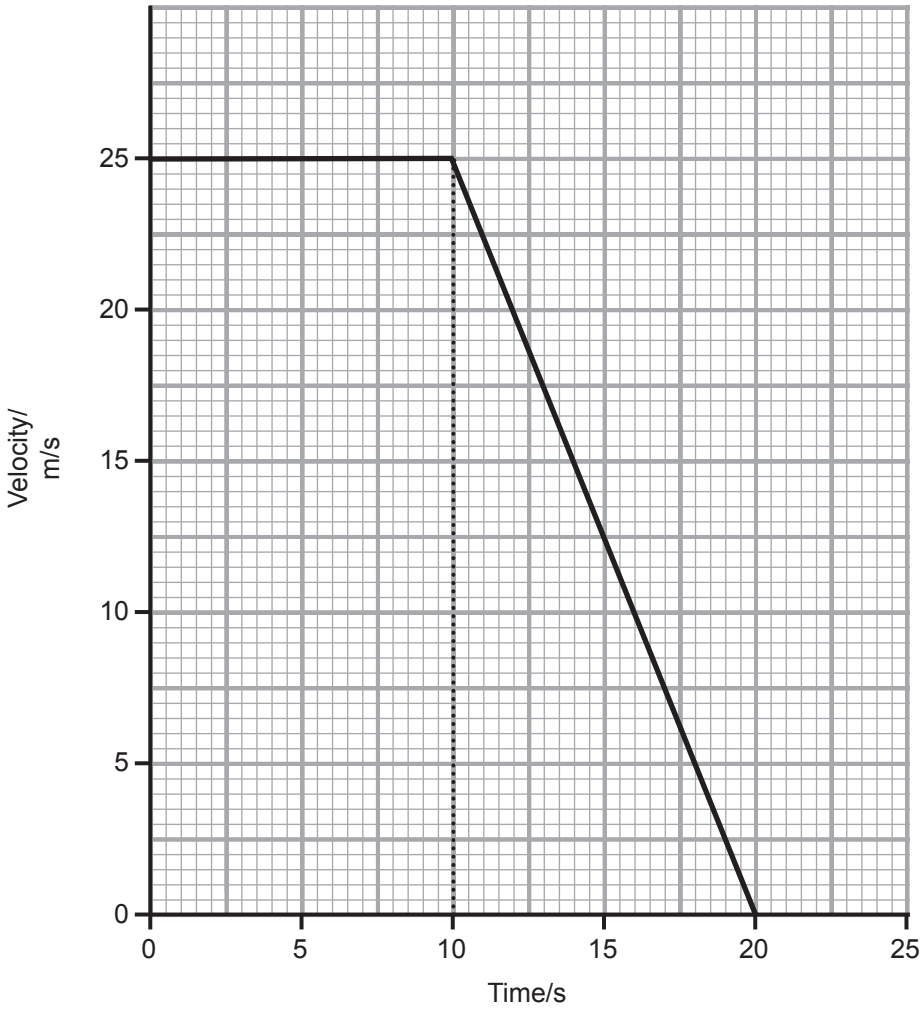
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20GSD3206

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(Questions continue overleaf)

5 A motorist travels at a constant speed when he spots danger ahead. Six seconds later he applies the brakes. He comes to rest 10 seconds after he applies the brakes.
The graph below illustrates the motion of the motorist.



(i) 1. At what time did the motorist first spot the danger?

Time = _____ s

2. What is the velocity when the motorist first spots the danger?

Velocity = _____ m/s [2]

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(ii) Calculate how far the vehicle travels in the 20 seconds of its motion.

You are advised to show your working out.

Distance = _____ m [4]

(iii) Use your graph to find the acceleration of the vehicle.

You are advised to show your working out.

Acceleration = _____ m/s^2 [3]

[Turn over

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20GSD3209

6 Give a brief description of nuclear fusion.

In part **(i)** below you should describe the fusion process including what particles are involved.

In part **(ii)** you should state where fusion occurs naturally and mention two technical difficulties which must be overcome if we are to use fusion to supply our energy needs.

You will be assessed on your written communication skills including the use of specialist scientific terms.

(i) _____

_____

_____

_____

_____

_____

(ii) _____

_____

_____

_____

_____

_____ [6]

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(Questions continue overleaf)

[Turn over

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20GSD3211

7 Americium is a radioactive substance which decays by emitting an alpha (α) particle to produce a different nucleus X.

(a) (i) Why is americium radioactive?

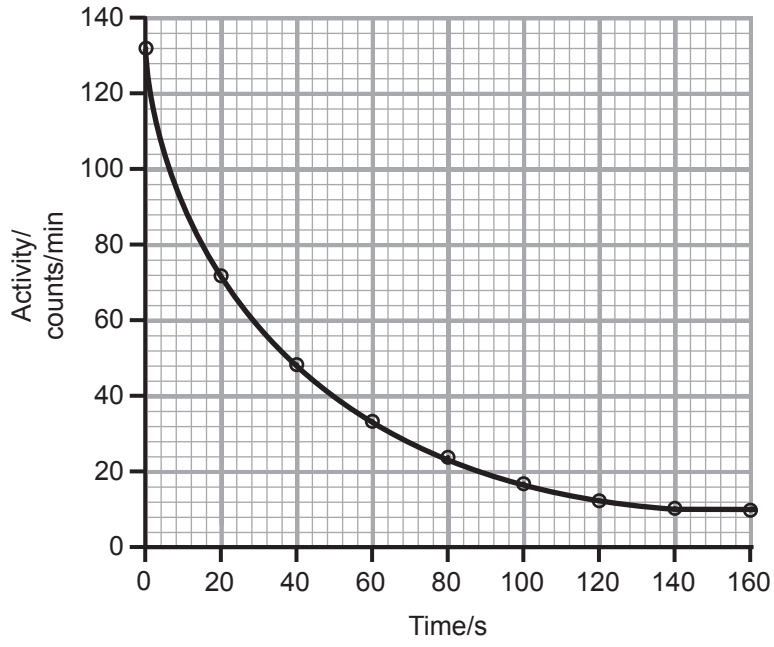
_____ [1]

The equation for the reaction is shown.

$$\square^{\square}_{\square}\text{Am} \rightarrow \square^{237}_{93}\text{X} + \square^{\square}_{\square}\alpha$$

(ii) Complete the equation above by filling in the boxes. [4]

The half-life of a radioactive substance is being measured. Activity measurements are taken every 20 seconds and a graph plotted.



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20GSD3212

(b) (i) What is the background radiation?

Background radiation = _____ counts/min [1]

(ii) Give a **major** source of background radiation, excluding medical sources.

_____ [1]

(c) (i) What is an ion?

_____ [1]

(ii) Describe how an alpha particle can cause ionisation of air molecules.

_____

_____ [2]

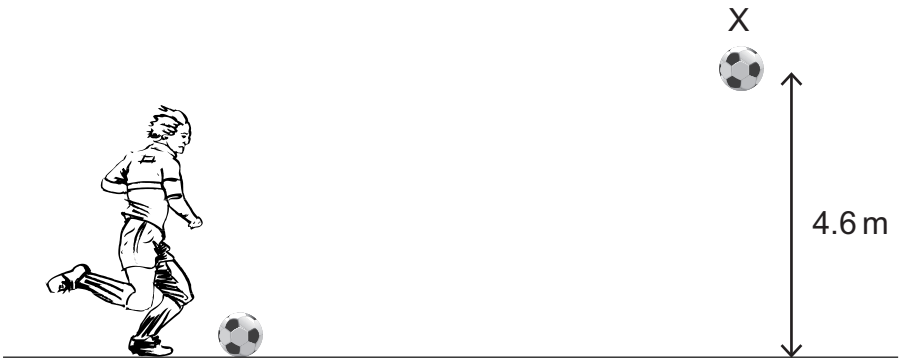
(d) State one precaution that users can take to protect themselves from ionising radiations.

_____ [1]

[Turn over

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8 Barnaby kicks a ball and gives 100 J of energy to it. When the ball has reached the point X shown in the diagram, the ball has lost 19 J of energy to the atmosphere because of air resistance.



© Principal Examiner

(i) State the total energy of the ball at X.

Total energy at X = _____ J [1]

The ball which has a mass of 1.5 kg, reaches a maximum height of 4.6 m at point X.

(ii) Calculate its gravitational potential energy at X.

You are advised to show your working out.

Gravitational potential energy = _____ J [3]

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At a certain point, the kinetic energy of the ball is 12 J.

(iii) Calculate the speed of the ball at that point.
Remember the mass of the ball is 1.5 kg.

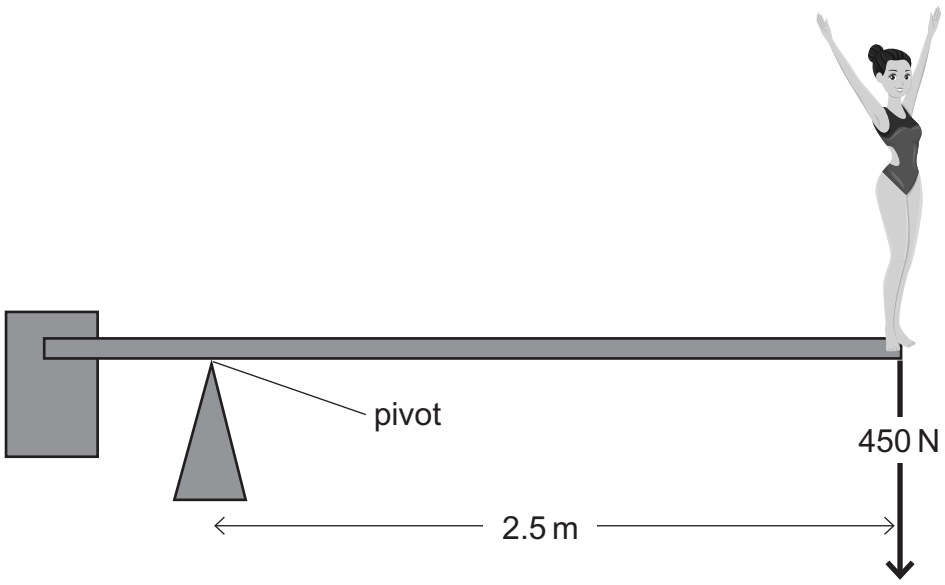
You are advised to show your working out.

Speed = _____ m/s [3]

[Turn over

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9 **(a)** Deirdre, who has a weight of 450 N, stands at the end of a diving board.



Source: Principal Examiner

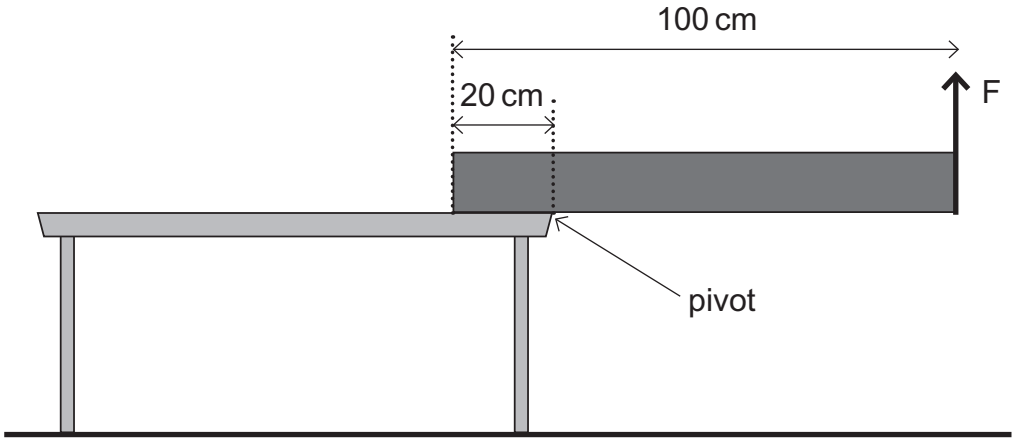
Calculate the moment of Deirdre's weight about the pivot when she stands at the end of the diving board.

You are advised to show your working out.

Moment = _____ Nm [3]

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(b) A uniform piece of wood is held at the edge of a bench by exerting an upward force, F. The wood has a weight of 8 N.



Calculate the upward force, F.

You are advised to show your working out.

Force = _____ N [3]

THIS IS THE END OF THE QUESTION PAPER

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Question Number	Marks
1	
2	
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7	
8	
9	
Total Marks	

Examiner Number

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Rewarding Learning

General Certificate of Secondary Education
2015–2016

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

WEDNESDAY 25 MAY 2016, AFTERNOON

MARK SCHEME

STEMUP.CO.UK

General Marking Instructions

Introduction

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			AVAILABLE MARKS
1	**(a)** **(i)** 234 [1]		
	(ii) 90 [1]		
	(iii) Mass Number [1]		
	(iv) 144 [1]		
	(b) (30 days) – 32 000 [1] (60 days) – 16 000 [1] (90 days) – 8000 [1]	[3]	7

2 Plum-pudding [1]
Positive charge spread throughout [1]
Electrons scattered/electrons like plums [1]

Rutherford-Bohr [1]
Positive/protons in nucleus [1]
Electrons orbit or electrons in shells [1] [6] 6

Response	Mark
Candidates explain **5 or 6** of the above points. They use good spelling, punctuation and grammar. The form and style are of a high standard and specialist terms are used appropriately.	[5]–[6]
Candidates explain **3 or 4** of the above points. They use satisfactory spelling, punctuation and grammar. The form and style are of a satisfactory standard and they have made use of some specialist terms.	[3]–[4]
Candidates explain **1 or 2** of the above points. They use limited spelling, punctuation and grammar. The form and style are of a limited standard and they have made no use of specialist terms.	[1]–[2]
Response not worthy of credit.	[0]

3 **(a)** 50 J = 2 cm is the only acceptable scale, [1]
axis labelled with unit [1] [2]

(b) At least 5 correct points [2] } ± 1 square
4 points correct [1] } [2]

(c) Best fit line [1]

(d) **(i)** (Direct) **proportion** [1]

(ii) Straight line
Through origin **dependent** on **(d)(i)** [1]

(e) 225 ± 5 (J) [1]

(f) grad = rise/run (or equiv.) [1] **or** k = **Grad**
= 250/50 [1] **or** $\frac{125}{25}$ etc.
= 5 [1] J/m [1] **or** N [4] 12

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			AVAILABLE MARKS
4	**(i)**	$a = \Delta v/t$ [1] **or** $a = \frac{v-u}{t}$ $a = \frac{v-u}{t}$, $t = -8$ } Gets 2/3 $a = \frac{v}{t}$, $= 8$ } gets 0/3 But "t = −8" on its own is 0/3 [3]	
	(ii)	F = ma [1] = 540 × 0.75 [1] = 405 (N) [1] } ignore –ve signs [3]	6
5	**(i)**	1. t = 4 (s) [1] 2. v = 25 (m/s) [1] [2]	
	(ii)	dist = area (under graph) [1] = (10 × 25) [1] + (25 × 10)/2 [1] and [1] = 375 (m) [1] [4]	
	(iii)	a = grad [1] **or** $a = \frac{v-u}{t}$ **or** $a = \frac{\text{Change in Velocity}}{\text{time}}$ = –25/10 [1] = –2.5 (m/s^2) [1] [3]	9
6	**(i)**	Two light or two hydrogen nuclei join (together) release energy or KE } Any 3 from 4 ideas, [1] each [3]	
	(ii)	sun (or stars) [1] problem of high temperature problem of containment high pressure/number density } any 2 for [1] mark each [3]	6

Response	**Mark**
Candidates explain **5 or 6** of the above points. They use good spelling, punctuation and grammar. The form and style are of a high standard and specialist terms are used appropriately.	[5]–[6]
Candidates explain **3 or 4** of the above points. They use satisfactory spelling, punctuation and grammar. The form and style are of a satisfactory standard and they have made use of some specialist terms.	[3]–[4]
Candidates explain **1 or 2** of the above points. They use limited spelling, punctuation and grammar. The form and style are of a limited standard and they have made no use of specialist terms.	[1]–[2]
Response not worthy of credit.	[0]

					AVAILABLE MARKS
7	**(a)**	**(i)**	(Nucleus) unstable	[1]	
		(ii)	Equation for the reaction is shown.		
			$^{241}_{95}Am \rightarrow {}^{237}_{93}X + {}^{4}_{2}\alpha$	[4]	
	(b)	**(i)**	8 → 12 [1] (cpm)	[1]	
		(ii)	Any **one** from: radon (gas), food, drink, cosmic rays, buildings, the ground. Reject: Medical sources	[1]	
	(c)	**(i)**	Charged atom/molecule/atom or molecule which has lost or gained an electron	[1]	
		(ii)	**Collision** [1] causes gain or loss of electrons [1] Dependent marking	[2]	
	(d)		Shielding/distance/time	[1]	11
8	**(i)**		Energy at X = 81 (J)	[1]	
	(ii)		Pe = mgh [1] Pe = 1.5 × 10 × 4.6 [1] Pe = 69 [1] (J)	[3]	
	(iii)		KE = ½ m v^2 [1] 12 = ½ × 1.5 × v^2 [1] v = 4 [1] (m/s)	[3]	7
			or $v = \sqrt{\frac{2 \times KE}{m}}$ [1] $= \sqrt{\frac{2 \times 12}{1.5}}$ [1] = 4 [1]		
9	**(a)**		Moment = force × distance (to pivot) [1] = 450 × 2.5 [1] = 1125 [1] (Nm)	[3]	
	(b)		cm = acm [1] **or** $F_1 \times d_1 = F_2 \times d_2$ **or** (M = M) 8 × 30 = F × 80 [1] F = 3 (N) [1]	[3]	6
				Total	**70**

Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2015–2016

Double Award Science: Physics

GSD32

Unit P1
Higher Tier

[GSD32]

FRIDAY 26 FEBRUARY 2016, MORNING

TIME

1 hour.

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 nine** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 70.
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 **2** and **7(a)**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total Marks	

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Examiner Only	
Marks	Remark

1 **(a)** Three types of radiation, alpha, beta and gamma, may be emitted from radioactive sources.

Complete the table below by writing alpha, beta or gamma in the second column.

Can penetrate several cm of lead	
Consists of four particles	
Is a wave	
Comes from the nucleus and has a negative charge	

[4]

(b) **(i)** Explain, in detail, what is meant by half-life.

_____

_____

_____ [3]

(ii) When a radioactive substance is delivered to a laboratory its activity is 6000 counts per minute.

Complete the table below.

Activity/counts per minute	Number of half-lives
6000 (arrives)	0
	1
1500	
	4

[3]

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2 Describe, in detail, the process of nuclear fission.

Your answer must include:

- the name of the fuel used;
- the name of the particle which starts the process;
- what happens in the fission process.

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

[6]

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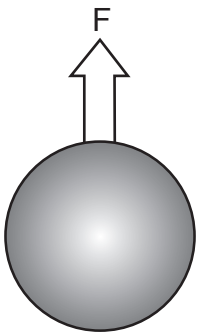
Marks	Remark

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3 When an object falls through the air a drag force, F, acts on the object.

Examiner Only

Marks	Remark



The size of the drag force, F, depends on the speed, v, of the falling object.
A scientist suggests that the drag force is proportional to the speed.

This suggestion may be written:

$$F = kv \qquad \text{Equation 3.1}$$

where k is a constant.

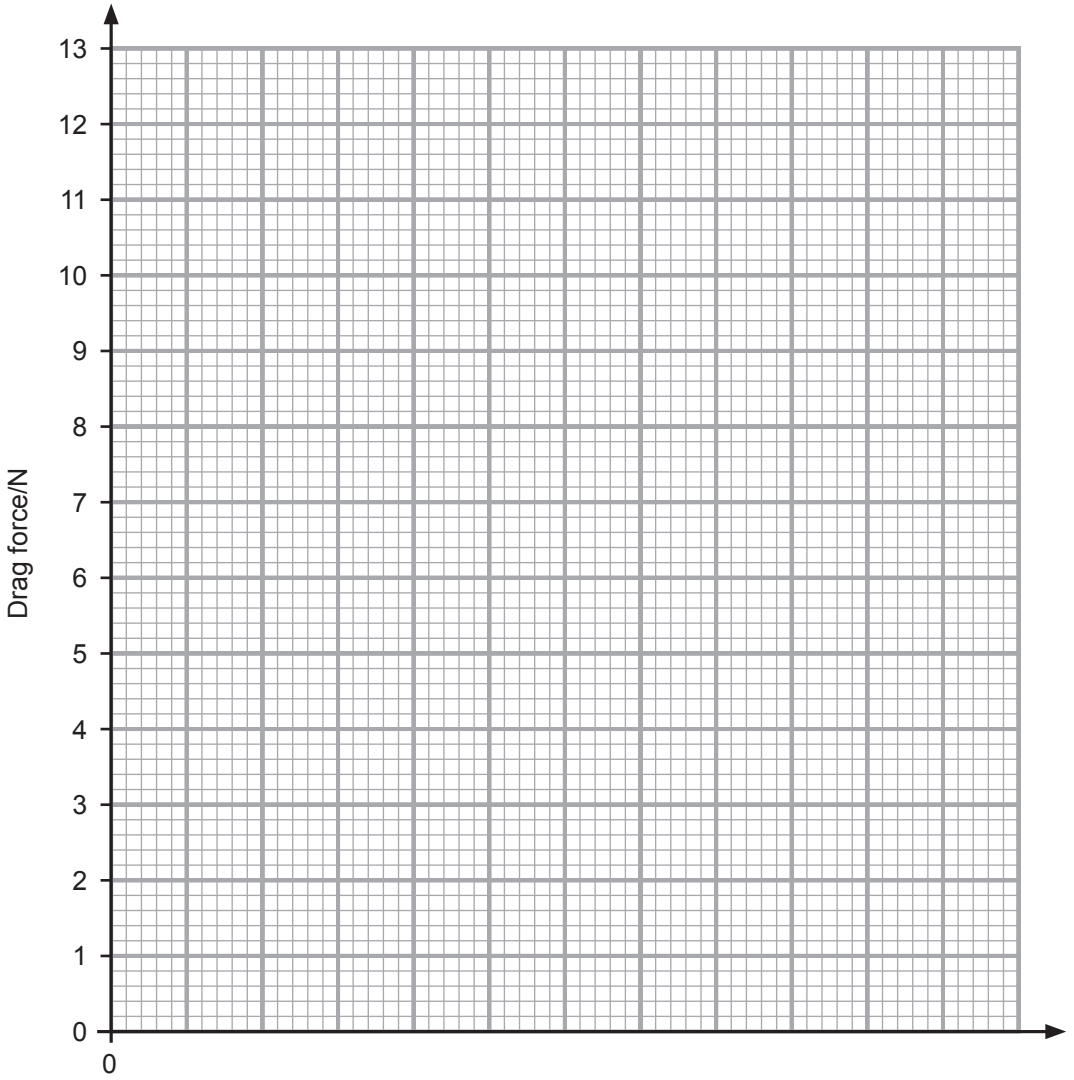
To test her theory she obtains a set of results and these are shown.

F/N	0.0	0.5	2.0	4.5	8.0	12.5
v/ m/s	0	1	2	3	4	5

You are asked to plot a graph of drag force F against speed, v.

(i) Choose a suitable horizontal scale and label the horizontal axis. [2]

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(ii) Plot a graph of force against speed. [3]

(iii) From your graph, estimate the drag force when the speed is 4.5 m/s.

Drag force = _____ N [2]

(iv) Is the scientist correct to say that the force and speed are directly proportional? Circle the correct answer.

YES NO

Give a reason for your answer.

_____ [1]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

4 Nuclear fusion could help solve our energy needs.

(a) **(i)** Give one technical difficulty which must be overcome if we are to make use of fusion to supply energy.

_____ [1]

(ii) Where does fusion occur naturally?

_____ [1]

This part of the question is about a nuclear disintegration involving alpha (α) decay.

(b) Thorium undergoes alpha decay to radium.

Complete the nuclear equation for this disintegration.

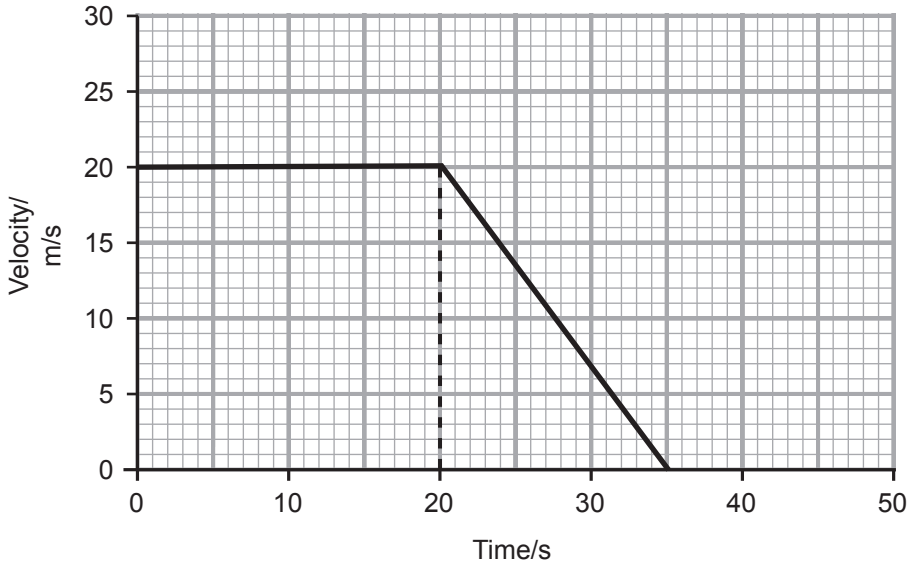
$$^{232}_{90}\text{Th} \xrightarrow{\text{Alpha decay}} \,^{\square}_{\square}\text{Ra} + \,^{\square}_{\square}\alpha$$

[4]

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Examiner Only	
Marks	Remark

5 Frank is driving a van at a constant velocity of 20 m/s and after 20 seconds he applies the brakes until the vehicle comes to rest.



(i) Calculate the displacement of the van from the instant the brakes are applied until it comes to rest.

You are advised to show your working out.

Displacement = _____ m [3]

(ii) State the acceleration of the van during the time interval 0 to 20 s.

_____ m/s^2 [1]

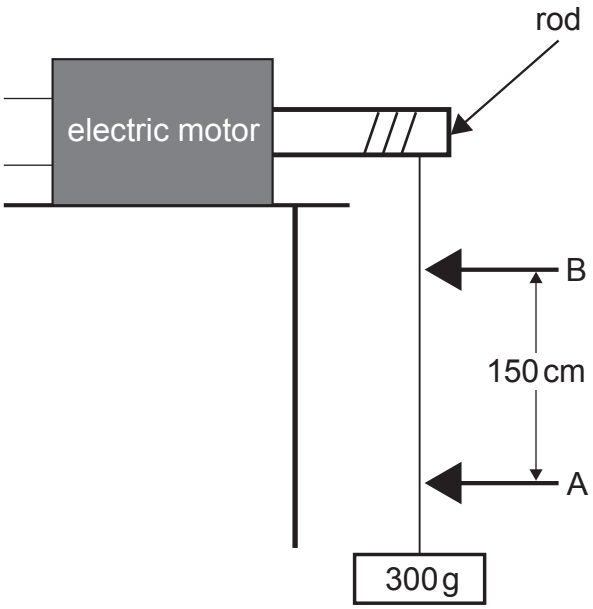
(iii) Calculate the acceleration of the van during the 20 to 35 s time interval.

You are advised to show your working out.

Acceleration = _____ m/s^2 [3]

Examiner Only	
Marks	Remark

6 In an experiment with an electric motor, the apparatus below was set up.



Source: CCEA

As the rod turns, a mass of 300 g moves upwards at a steady speed.

(a) Find the tension in the string.

You are advised to show your working out.

Tension = _____ N [2]

(b) (i) Calculate the change in the potential energy of the 300 g mass as it rises through 150 cm, from marker A to marker B.

You are advised to show your working out.

Change in potential energy = _____ J [4]

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(ii) How much work is done in raising this mass from marker A to marker B?

Work done = _____ J [1]

(c) The output power of a different motor is 0.9 W.

Calculate the time taken for this motor to do 36 J of work.

You are advised to show your working out.

Time = _____ s [3]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

7 **(a)** Describe an experiment to measure the density of a stone. In your description you must:

- list the apparatus you would use;
- state what you would do;
- state what measurements you need to take.

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

_____

_____

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_____

_____

_____

_____

_____

_____

_____

_____ [6]

(b) Calculate the mass of a 1.60 m^3 block of iron, the density of which is 7.95×10^3 kg/m^3.

You are advised to show your working out.

Mass = _____ kg [3]

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(Questions continue overleaf)

Examiner Only	
Marks	Remark

8 A skydiver falls from a very tall building and during the first 4 seconds his average speed is 19 m/s.

(a) How far does the skydiver fall during this 4 second interval?

You are advised to show your working out.

Distance = _____ m [3]

Examiner Only	
Marks	Remark

(b) The skydiver accelerates downwards. The forces on the skydiver are shown in the diagram below.



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(i) Why does the skydiver accelerate downwards?

_____ [1]

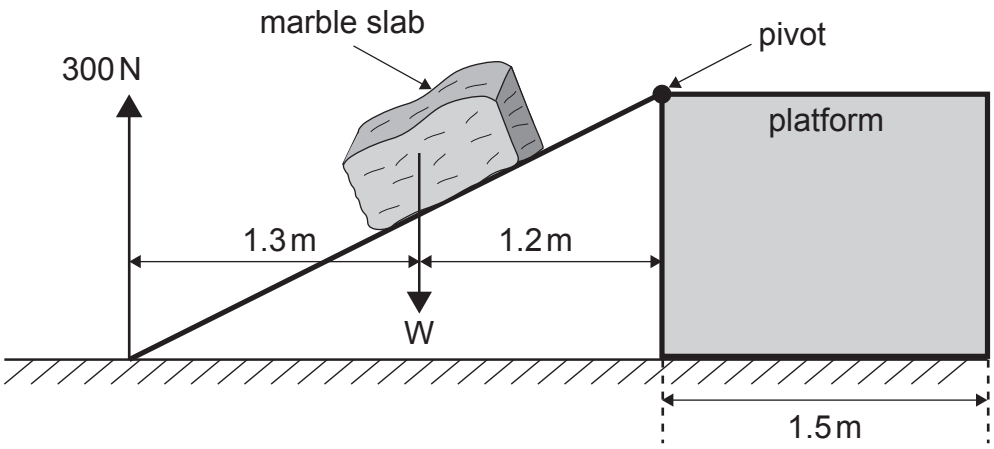
(ii) The skydiver, who has a mass of 60 kg, accelerates downwards at 8 m/s^2. Calculate the size of the drag force.

You are advised to show your working out.

Drag force = _____ N [4]

Examiner Only	
Marks	Remark

9 A quarry worker has to lift a marble slab of weight W, so that it is level with a platform.



Source: CCEA

The quarry worker can exert a maximum force of 300 N, as shown in the diagram above.

(a) Calculate the maximum moment, about the pivot, that the quarry worker can produce with this 300 N force. Include the unit in your answer.

You are advised to show your working out.

Maximum moment = _____ [3]

(b) Use the Principle of Moments to calculate the maximum weight of the marble slab that the quarry worker can lift, when it is in the position shown in the diagram.

You are advised to show your working out.

Maximum weight = _____ N [3]

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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Rewarding Learning

General Certificate of Secondary Education
2015–2016

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

FRIDAY 26 FEBRUARY 2016, MORNING

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AVAILABLE MARKS

1 **(a)** Gamma or γ
Alpha or α
Gamma or γ
Beta or β
[1] each [4]

(b) **(i)** Time/how long [1] [threshold mark] for radiation/(radio)activity/count rate [1]
to halve [1] [3]

(ii)

Activity/counts per minute	Number of half-lives
6000 (arrives)	0
3000	1
1500	**2**
375	4

[3]

10

2 neutron(s)
absorbed or taken in
(by) U/Pu
(fission) fragments produced or U/Pu **split**
neutron(s) produced
energy released
[1] each } Free-standing marks [6]

Response	**Mark**
Candidates explain **5 or 6** of the above points. They use good spelling, punctuation and grammar. The form and style are of a high standard and specialist terms are used appropriately.	[5]–[6]
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Candidates explain **1 or 2** of the above points. They use limited spelling, punctuation and grammar. The form and style are of a limited standard and they have made no use of specialist terms.	[1]–[2]
Response not worthy of credit.	[0]

6

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				AVAILABLE MARKS
3	**(i)**	Scale over halfway, [1] axis labelled with unit [1]	[2]	
	(ii)	At least 5 correct points [2] or 4 points for [1] ± 1 square = tolerance curve [1]	[3]	
	(iii)	Evidence from graph [1] Drag force = **10.1** (N) [± 0.2] [1] i.e. 9.9 to 10.3	[2]	
	(iv)	Not a straight line **or** not constant gradient	[1]	8
4	**(a)**	**(i)** (Very) high temperature/large number density/containment **or** ⩾ 1 million (°C)	[1]	
		(ii) Sun/star(s)	[1]	
	(b)	228 [1] 4 [1] 88 [1] 2 [1]	[4]	6
5	**(i)**	Displacement or distance = area (of triangle) [1] or area under graph = ½ 15 × 20 [1] = 150 [1] (m) **or** Displacement = **av**. vel. × time [1] = 10 × 15 [1] = 150 [1] (m)	[3]	
	(ii)	0 **or** zero	[1]	
	(iii)	a = grad [1] or $a = \frac{\Delta v}{t}$ or $a = \frac{v - u}{t}$ or $a = \frac{\text{Rise}}{\text{Run}}$ $= \frac{-20}{15}$ [1] = –1.3 (m/s^2) [1] or 1.33 or $1.\dot{3}$	[3]	7
6	**(a)**	Tension = 0.3 × 10 [1] or weight = 0.3 × 10 for Partial Credit = 3 [1] (N)	[2]	
	(b)	**(i)** G.P.E. = m × g × h [1] **or** W = f × d [1] = (0.3 × 10) × 1.5 [2] W = 3 × 1.5 [2] (**e.c.f from 6(a)**) = 4.5 [1] (J) = 4.5 [1] (J)	[4]	
		(ii) 4.5 (J) or e.c.f. from **(ii)**	[1]	
	(c)	Time = W.D./Power [1] or equivalent = 36/0.9 [1] = 40 (s) [1]	[3]	10

AVAILABLE MARKS

7 **(a)** (Top-pan) balance or scales or scale
Measuring cylinder
Find mass
Immerse stone or drop stone
Subtract the readings
To find the volume
or
Top-pan balance or scales or scale
Eureka vessel or displacement can or Eureka can
Find mass
Immerse stone
Find the volume
Measure in **graduated cylinder** or measuring cylinder [6]

Response	Mark
Candidates explain **5 or 6** of the above points. They use good spelling, punctuation and grammar. The form and style are of a high standard and specialist terms are used appropriately.	[5]–[6]
Candidates explain **3 or 4** of the above points. They use satisfactory spelling, punctuation and grammar. The form and style are of a satisfactory standard and they have made use of some specialist terms.	[3]–[4]
Candidates explain **1 or 2** of the above points. They use limited spelling, punctuation and grammar. The form and style are of a limited standard and they have made no use of specialist terms.	[1]–[2]
Response not worthy of credit.	[0]

(b) Mass = density × volume [1]
= $7.95 \times 10^3 \times 1.6$ [1]
= 12 720 [1] (kg) [3] 9

8 **(a)** Distance = (Av) speed × time [1]
= 19 × 4 [1]
= 76 (m) [1] [3]

(b) **(i)** Downward force (600 N) **greater** than drag force [1]

(ii) (R)F = ma [1] or $F = F_R$
[1] 600 – D = 60 × 8 [1]
D = 120 (N) [1]
or
R_f = ma [1]
= 60 × 8 [1]
= 480 [1] therefore D = 120 (N) [1] [4] 8

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			AVAILABLE MARKS
9	**(a)**	Moment = force × distance (to pivot) = 300 × 2.5 [1] award [1] for formula **or** substituted f'la = 750 [1] Nm [1] [3]	
	(b)	$F_1 \times d_1 = F_2 \times d_2$ (or equivalent) [1] AC**M** = C**M** or (M = M) W × 1.2 = 750 [1] (allow e.c.f. from **(a)**) W = 625 [1] (N) [3]	6
		Total	**70**

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Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2015–2016

Double Award Science: Physics

GSD32

Unit P1
Higher Tier

[GSD32]

FRIDAY 13 NOVEMBER 2015, MORNING

TIME

1 hour.

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 nine** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 70.
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 **2(a)** and **7**.

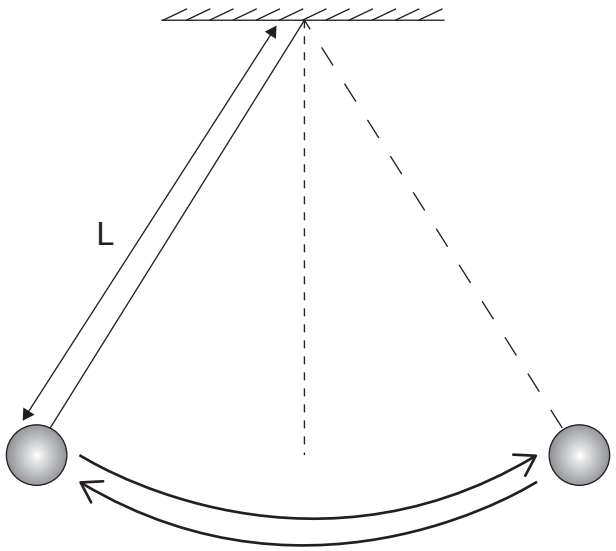
For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total Marks	

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Examiner Only	
Marks	Remark

1 A pendulum consists of a mass hanging on a string.
When the pendulum has a length (L), the time (T) for one complete back and forth swing of the mass is given by the relationship:

$$T^2 = kL \qquad \textbf{Equation 1.1}$$



To test this relationship the following results were recorded.

L/m	0.0	0.2	0.4	0.6	0.8	1.0
T/s	0.0	0.90	1.27	1.55	1.79	2.00
T^2/s^2			1.6			

(i) Complete the table by entering the values for T^2, **to 1 decimal place**.
One has been done for you. [2]

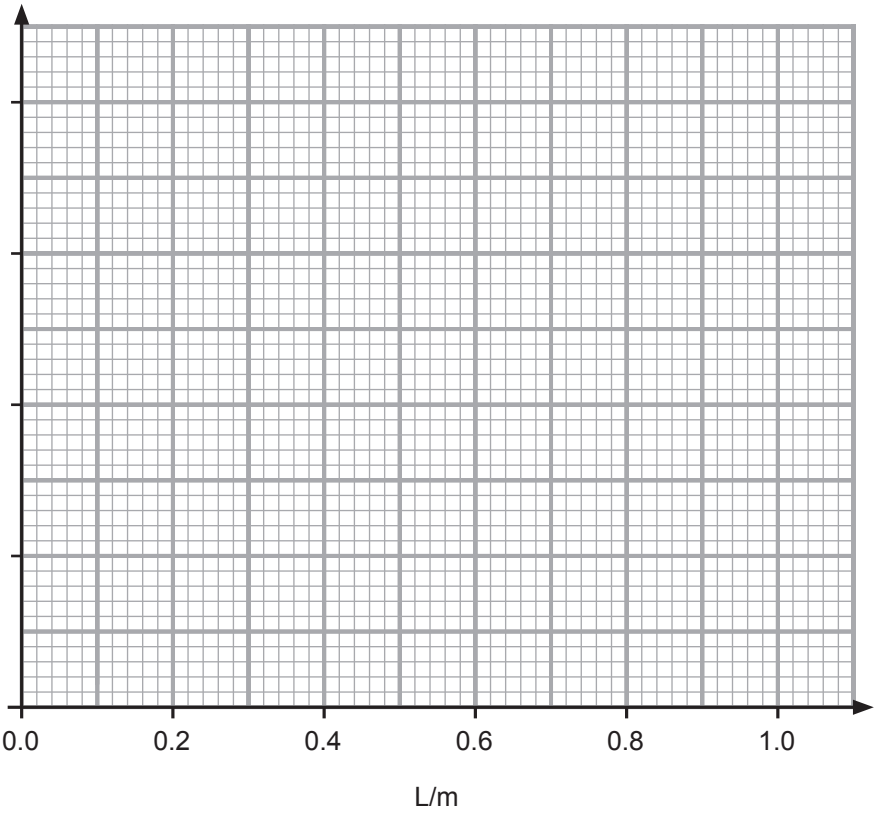
You are asked to plot a graph of T^2 against L.

(ii) Choose a suitable scale for the vertical axis and label it. [2]

(iii) Plot the points on the grid. [2]

(iv) Draw a line of best fit. [1]

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(v) Does your graph support the theory described by **Equation 1.1**?

YES / NO Circle your choice.

Explain your answer.

_____

_____ [2]

(vi) Find the value of k from your graph.

k = _____ s^2/m [2]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

2 **(a)** A force, called the centripetal force, causes a body to move in a circle. Give an account of the factors that the centripetal force depends on and how it depends on them.

Your account must:

- state the direction of the centripetal force;
- state the three factors affecting the size of the centripetal force;
- state how the centripetal force depends on each of these three factors.

You will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

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(b) A body of weight 2 N moves in a circle. At a given instant its velocity is 3 m/s.

Calculate its momentum in kg m/s.

You are advised to show your working out.

Momentum = _____ kg m/s [4]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

3 The symbol for uranium-238 is $^{238}_{92}U$.

(a) **(i)** How many protons does a nucleus of uranium-238 contain?

Number of protons = _____ [1]

(ii) How many neutrons does a nucleus of uranium-238 contain?

Number of neutrons = _____ [1]

(b) An **isotope** of sodium is **radioactive**.

Explain fully what is meant by the words in bold.

Isotope

_____

_____ [2]

Radioactive

_____

_____ [2]

(c) Thirty hours after a sample of radioactive sodium had been prepared, only 25% of it remained.

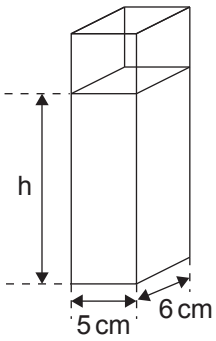
Calculate the half-life of this isotope.

You are advised to show your working out.

Half-life = _____ hours [3]

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4 A liquid has a density of 0.8 g/cm^3. 576 g of the liquid is poured into a glass container, the base of which measures 6 cm by 5 cm.



(a) (i) Calculate the volume of liquid in the container.

You are advised to show your working out.

Volume = _____ cm^3 [3]

(ii) Use your answer to **(a)(i)** to find the height, h, of the liquid.

You are advised to show your working out.

Height = _____ cm [2]

(b) How does the density of the glass compare with the density of the liquid?

Tick (✓) the correct box below.

Glass has a smaller density	☐	Glass has a larger density	☐	Glass has the same density	☐

Use the kinetic theory to explain your choice.

_____

_____

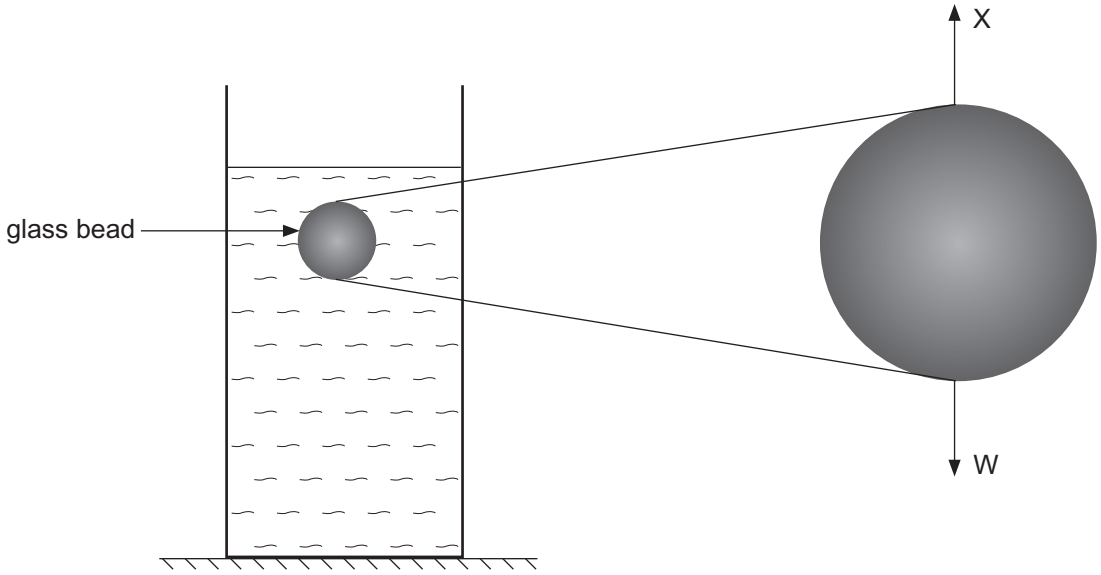
_____ [2]

Examiner Only

Marks	Remark

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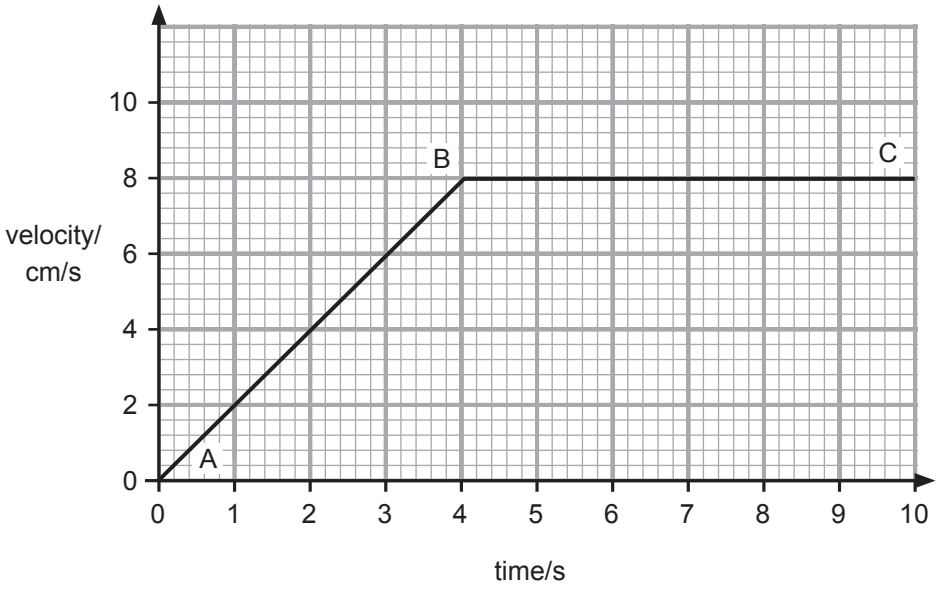
5 Gavin is interested in how quickly a glass bead falls through water.



(a) (i) Two forces, W and X, act on the glass bead as it falls. W is the weight. What is the name of the other force X?

X is _____ [1]

Gavin plots a velocity–time graph of the glass bead's motion from entry into the water until it hits the bottom of the container.



Examiner Only

Marks	Remark

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(ii) How do the sizes of these forces compare during the regions AB and BC? Give your answer by ticking (✓) the correct box in each case.

During AB,

W is less than X. ☐

the two forces are equal. ☐

X is less than W. ☐

During BC,

W is less than X. ☐

the two forces are equal. ☐

X is less than W. ☐ [2]

(b) (i) Use the graph to calculate the distance the glass bead falls in 10 seconds.

You are advised to show your working out.

Distance = _____ cm [4]

(ii) Find the acceleration of the glass bead during the first four seconds of its fall.

You are advised to show your working out.

Acceleration = _____ cm/s^2 [3]

Examiner Only

Marks	Remark

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6 The table below contains a number of statements. For each statement insert one tick (✓).

Tick T if the statement is true.
Tick F if the statement is false.
Tick I if it is impossible to decide.

	T	F	I
Atomic number is given the symbol A.			
In a neutral atom the number of protons equals the number of electrons.			
Beta particles are negatively charged electrons.			
An alpha particle is a helium atom.			
A beta particle comes from the nucleus of an atom.			
Radiation is stopped by a few mm of aluminium.			

[6]

Examiner Only

Marks	Remark

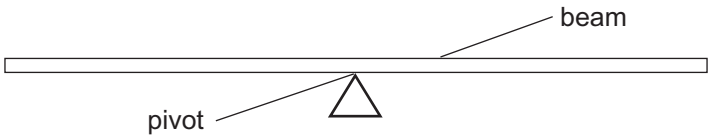
7 Describe an experiment to verify the Principle of Moments.

In your description you should:

- describe how you would carry out the experiment;
- state the measurements you would make;
- state how you would use these measurements to verify the Principle of Moments.

You will be assessed on your written communication skills including the use of specialist scientific terms.

The following diagram may help you.



[6]

Examiner Only

Marks	Remark

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8 An acrobat grips a rope loosely as he slides down it.



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A force acting on the acrobat leads to heat energy being produced.

(a) In the box draw an arrow to indicate the direction of this force. [1]

(b) The acrobat has a mass of 70 kg and slides down the rope with an acceleration of 4 m/s^2. Calculate the value of the force referred to in part **(a)**.

You are advised to show your working out.

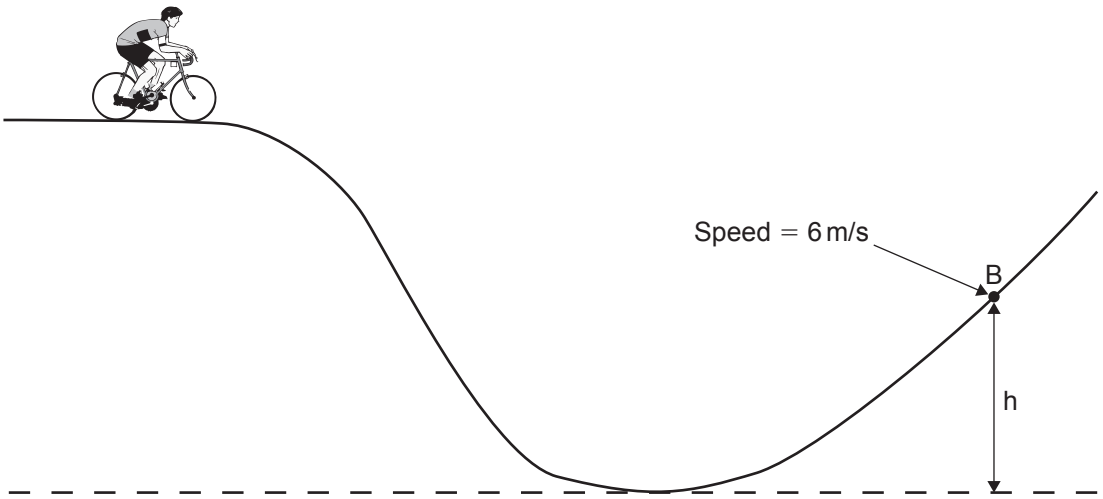
Force = _____ N [4]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

9 Jim and his cycle have a total mass of 80 kg. At the top of a hill they have a potential energy of 4640 J. Jim freewheels **from rest** down the hill and part of the way up a second hill. At point B he has a speed of 6 m/s.



(i) Calculate the kinetic energy of Jim and his cycle at point B.

You are advised to show your working out.

Kinetic energy = _____ J [3]

(ii) Use the Principle of Conservation of Energy to calculate the height, h. Assume no energy losses.

You are advised to show your working out.

Height = _____ m [3]

THIS IS THE END OF THE QUESTION PAPER

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112901

Rewarding Learning

General Certificate of Secondary Education
2015–2016

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

FRIDAY 13 NOVEMBER 2015, MORNING

MARK SCHEME

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General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

AVAILABLE MARKS

1 **(i)**

L/m	0.0	0.2	0.4	0.6	0.8	1.0
T/s	0.0	0.90	1.27	1.55	1.79	2.00
T^2/s^2	**0.0**	**0.8**	1.6	**2.4**	**3.2**	**4.0**

[$\frac{1}{2}$] each round down [2]

(ii) Scale $\frac{1}{2}$ way [1] label [1] [2]

(iii) At least 5 correct [2] minimum of 3 correct [1] tolerance ± 1 division [2]

(iv) Best fit line [1]

(v) Yes – straight line [1] through origin [1] [e.c.f. from **(iv)**] [2]

(vi) k = grad (or alternative, e.g. rise/run)
or = 4(.0)/1 (or alternative)
= 4(.0) [1] } [1] either line
[2] 11

2 **(a)** Centripetal force towards centre [1]
Force depends on: mass, speed, radius [3]
increases with mass [1] and speed [1]
decreases with radius [1] (max 6 points) [6]

Response	**Mark**
Candidates explain **at least 5** of the above points. They use good spelling, punctuation and grammar. The form and style are of a high standard and specialist terms are used appropriately.	[5]–[6]
Candidates explain **3 or 4** of the above points. They use satisfactory spelling, punctuation and grammar. The form and style are of a satisfactory standard and they have made use of some specialist terms.	[3]–[4]
Candidates explain **1 or 2** of the above points. They use limited spelling, punctuation and grammar. The form and style are of a limited standard and they have made no use of specialist terms.	[1]–[2]
Response not worthy of credit.	[0]

(b) Mom = mass × velocity [1]
Mom = 0.2 × 3 [2]
Mom = 0.6 (kg m/s) [1] [4] 10

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					AVAILABLE MARKS
3	**(a)**	**(i)**	92 [1]	[1]	
		(ii)	146 [1]	[1]	
	(b)		Same number of protons [1] and different number of neutrons [1] **or** same atomic number [1] but different mass number [1] (threshold mark for both) Unstable [1] nuclei [1] **and** nucleus decays [2] **or** emits alpha, beta or gamma [2]	[4]	
	(c)		After one half life – 50% remains [1] after two half lives – 25% remains [1] 15 (h) [1]	[3]	9
4	**(a)**	**(i)**	$\rho = m/v$ (or equiv) [1] $0.8 = 576/v$ [1] $v = 720$ [1]	[3]	
		(ii)	$h = 720/(6 \times 5)$ [1] **or** $V = l \times b \times h$ [1] = 24 (cm) [1] [allow e.c.f from **(a)(i)**]	[2]	
	(b)		larger [1] [dep. marking] molecules are closer together in glass [1]	[2]	7
5	**(a)**	**(i)**	Friction/drag/water resistance [1] reject: "resistance" on its own	[1]	
		(ii)	X is less than W [1] the two forces are equal [1]	[2]	
	(b)	**(i)**	Depth or distance = area (under graph) [1] $= (4 \times 8)/2 + (6 \times 8)$ [1] and [1] = 64 (cm) [1]	[4]	
		(ii)	a = grad [1] **or** $a = \frac{\triangle v}{t}$ = 8/4 [1] = 2 (cm/s^2) [1]	[3]	10

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6

	T	F	I
Atomic number is given the symbol A		✓	
In a neutral atom the number of protons equals the number of electrons	✓		
Beta particles are negatively charged electrons	✓		
An alpha particle is a helium atom		✓	
A beta particle comes from the nucleus of an atom	✓		
Radiation is stopped by a few mm of aluminium			✓

[6]

AVAILABLE MARKS

6

7 Place objects (on both sides) [1]
(Adjust to get) balance [1]
Record weights [1]
Record distances **to pivot** [1]
$F_1d_1 = F_2d_2$ [1] **or** Acm = cm [1]
Repeat [1]
$\circlearrowright M = M \circlearrowleft$
Reject: $F \times d = F \times d$ [6]

Response	Mark
Candidates explain **at least 5** of the above points. They use good spelling, punctuation and grammar. The form and style are of a high standard and specialist terms are used appropriately.	[5]–[6]
Candidates explain **3 or 4** of the above points. They use satisfactory spelling, punctuation and grammar. The form and style are of a satisfactory standard and they have made use of some specialist terms.	[3]–[4]
Candidates explain **1 or 2** of the above points. They use limited spelling, punctuation and grammar. The form and style are of a limited standard and they have made no use of specialist terms.	[1]–[2]
Response not worthy of credit.	[0]

6

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				AVAILABLE MARKS
8	**(a)**	Arrow vertically upwards [1]	[1]	
	(b)	$F_R = ma$ [1] $700 - F = 70 \times 4$ [1] and [1] $F = 420$ (N) [1] **or** $F_R = ma$ [1] $F_R = 70 \times 4$ [1] $F_R = 280$ [1] Force = 420 [1]	[4]	5
9	**(i)**	$ke = \frac{1}{2} mv^2$ [1] $= \frac{1}{2} .80 . 36$ [1] $= 1440$ [1]	[3]	
	(ii)	$Pe = mgh$ [1] $4640 - 1440 = 80 \times 10 \times h$ [1] [e.c.f. from **(i)**] $h = 4$ [1]	[3]	6
			Total	**70**

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Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2014–2015

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

GSD32

WEDNESDAY 20 MAY 2015, AFTERNOON

TIME

1 hour.

INSTRUCTIONS TO CANDIDATES

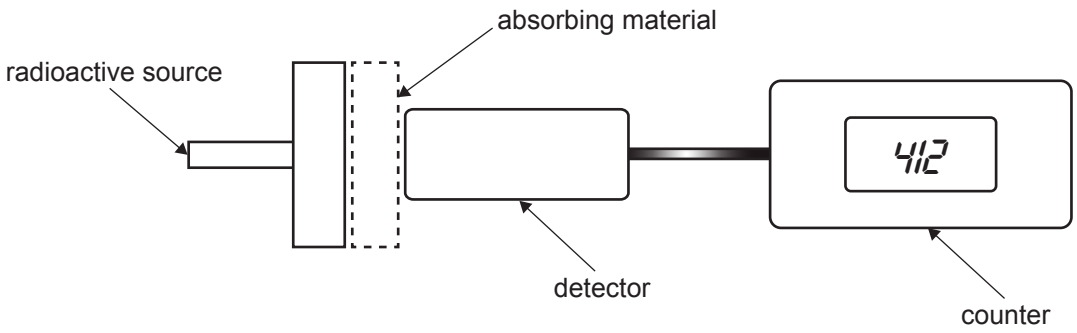
Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in blue or black ink only. **Do not write with a gel pen.**
Answer **all eight** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 70.
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 **2(a)** and **8(b)**.

9836

1 **(a)** The apparatus shown is used to investigate how different materials absorb gamma radiation.



The absorbing material is either aluminium, lead or air.

Examine the table below and insert the names of the material in the last column.

Count rate/ Counts per minute	Absorbing material (aluminium, lead or air)
802	
45	
412	

[3]

Technetium is an isotope widely used in medical imaging and has the symbol $^{99}_{43}Tc$.

(b) **(i)** How many particles are in the nucleus of technetium?

_____ [1]

(ii) How many of these particles are neutrons?

_____ [1]

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This isotope has a half-life of 211 000 years.

(iii) Beginning with 8 grams of technetium, calculate how long it would take before only 1 gram remains.

You are advised to show your working out.

_____ years [3]

[Turn over

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2 **(a)** Describe an experiment to measure your personal power.

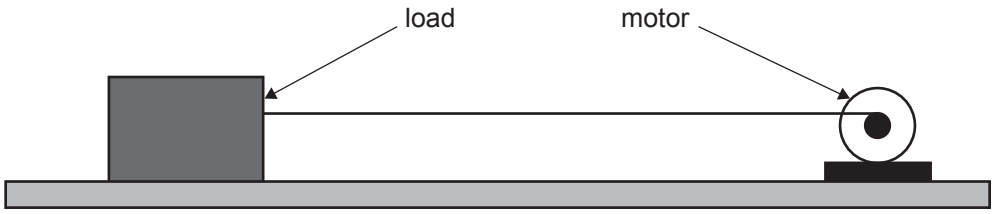
Your account should include:

- the apparatus you use;
- the measurements you make.

You will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

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An electric motor pulls a load across a rough surface at a constant speed. The motor exerts a resultant force of 30 N and moves the load a distance of 1.5 m in a time interval of 5 seconds.

(b) Calculate the power developed by the motor.

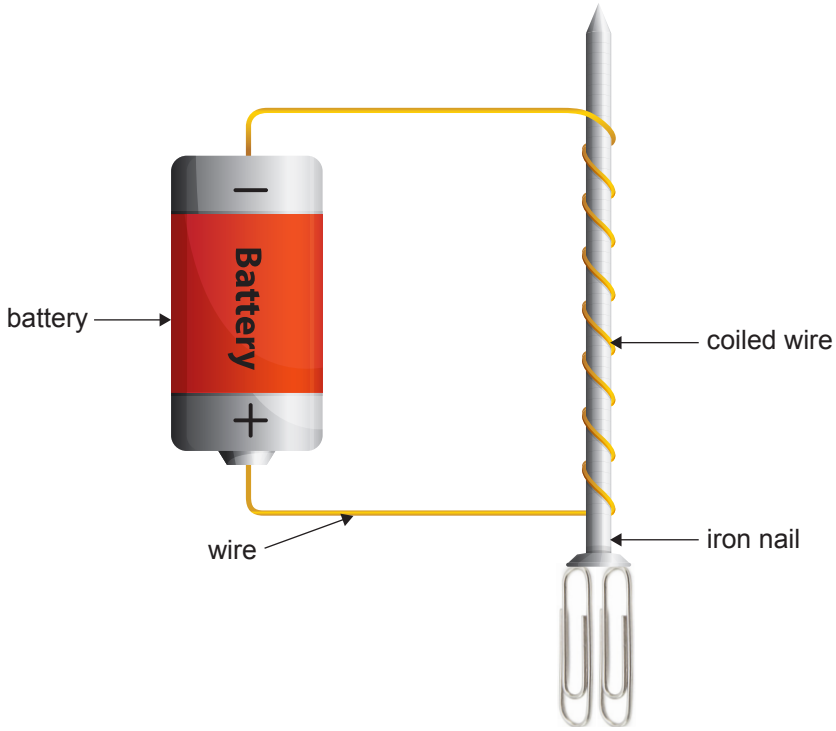
You are advised to show your working out.

Power developed = _____ W [3]

[Turn over

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20GSD3205

3 A large iron nail can be made into a magnet by wrapping a coil around it, as shown, and passing a current through the wire.

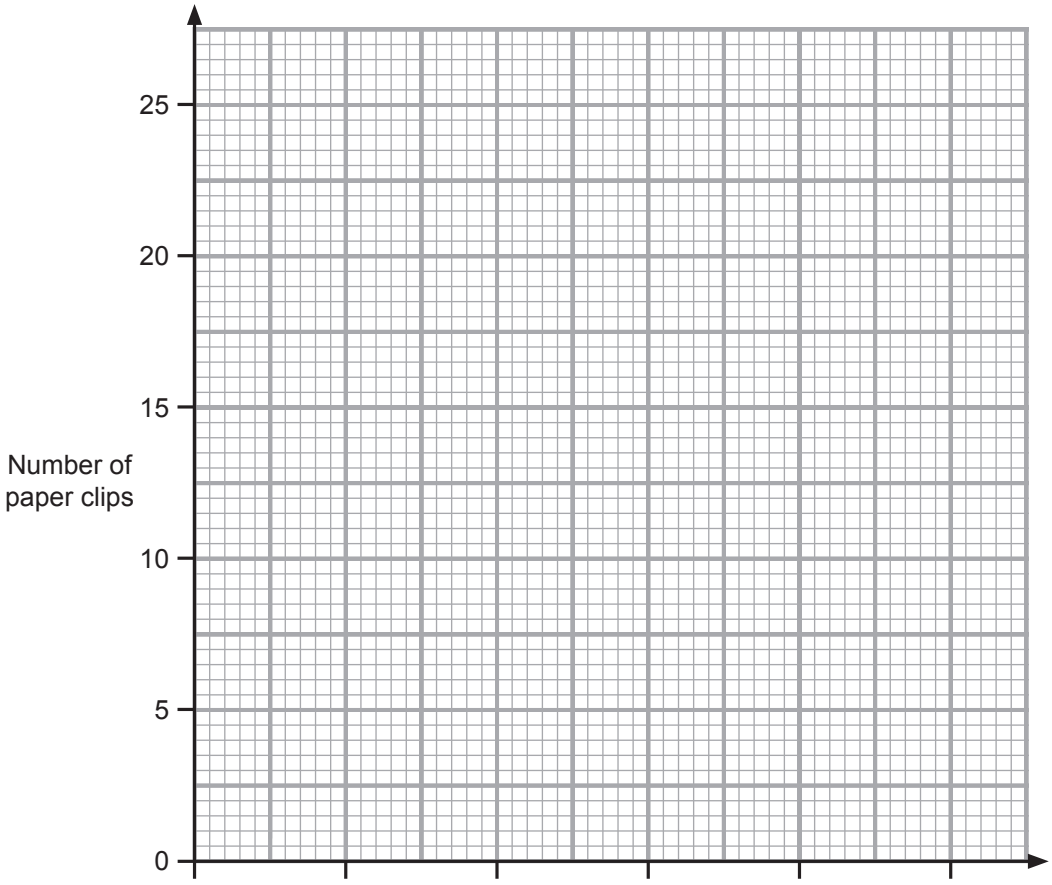


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© b-d-s/iStock/Thinkstock.com

A student wanted to see how the number of paper clips the magnet was able to pick up depended on the size of the current passing through the wire. The current was changed to different values and the number of paper clips counted each time.

A table of results is shown below.

Current/mA	Number of paper clips
0	0
200	5
400	10
600	15
800	20
1000	25



You are asked to plot a graph of 'number of paper clips' against current.

(i) Choose a suitable scale for the horizontal axis, label it and include the correct unit. [3]

(ii) Plot the points of 'number of paper clips' against current. [2]

(iii) Draw the best-fit line. [1]

[Turn over

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(iv) Is it true to say that the number of paper clips that can be lifted is directly proportional to the current? Circle your answer.

Yes No

Give **two** reasons for your answer.

1. _____

2. _____ [2]

(v) Use your graph to find the maximum number of paper clips that the magnet would lift when a current of 0.7 A is flowing.
(Hint: 1.0 A = 1000 mA)

You are advised to show your working out.

Number of paper clips = _____ [4]

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4 **(a)** Radium is a radioactive material which disintegrates, emitting alpha particles as it decays to form radon gas. This process is illustrated by the equation below.

$$^{226}_{88}\text{Ra} \rightarrow {}^{222}_{86}\text{Rn} + {}^{4}_{2}\alpha$$

Explain, in terms of nuclear **particles**, what has happened to the radium nucleus.

_____

_____ [2]

(b) Radium decays naturally but it is possible to force heavy nuclei, like those of uranium, to split into two lighter nuclei.

(i) What is the name of this process?

_____ [1]

(ii) Complete the equation below which represents the forced splitting of uranium.

$$^{235}_{92}\text{U} + {}^{1}_{0}\text{n} \rightarrow {}^{\square}_{52}\text{Te} + {}^{97}_{\square}\text{Zr} + 2\ {}^{1}_{0}\text{n}$$

[2]

[Turn over

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5 The blades of a helicopter exert an upwards force of 25 000 N. The mass of the helicopter is 2000 kg.



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(a) What is the weight of the helicopter?

Weight = _____ N [2]

(b) Calculate the acceleration of the helicopter.
Remember to include the unit.

You are advised to show your working out.

Acceleration = _____ [5]

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(c) On another occasion, the helicopter travels 1.5 km at an average speed of 3 m/s. Find the time taken for this journey.

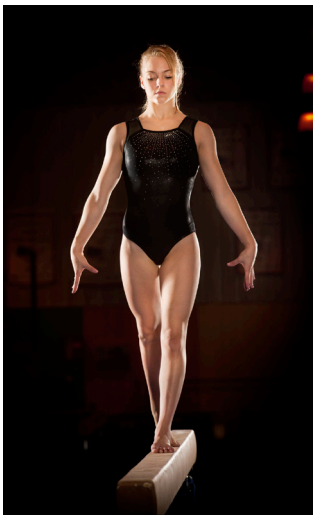
You are advised to show your working out.

Time = _____ s [3]

[Turn over

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6 The photograph shows a gymnast on a horizontal beam.



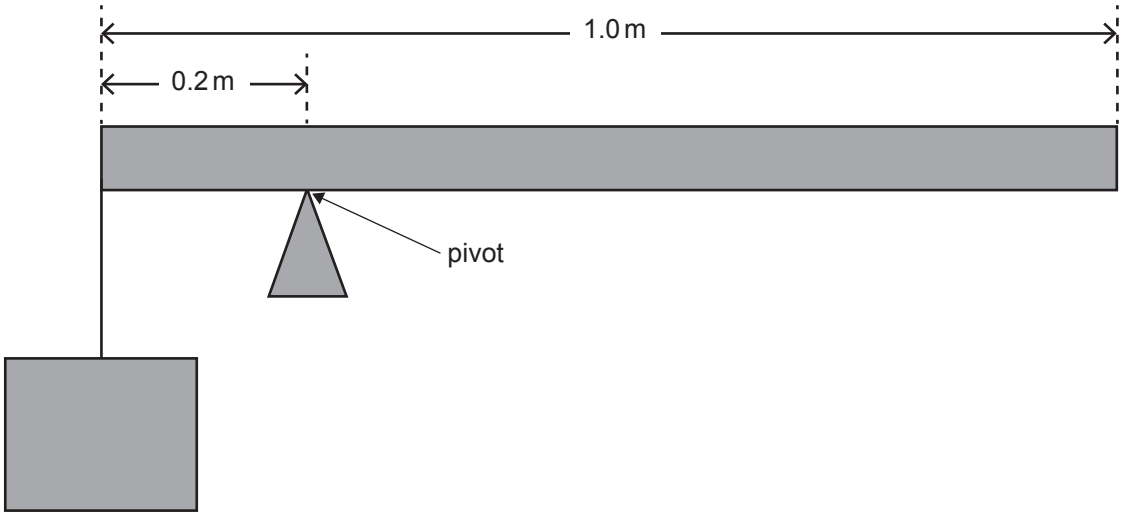
© Brian McEntire/iStock/Thinkstock.com

(a) Explain why the gymnast stays balanced.

_____

_____ [1]

(b) A uniform bar, of length 1.0 m, balances with a 15 N weight attached to the left hand end.



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(i) On the diagram draw and label arrows to show the positions and directions of the following forces:

- the 15 N weight;
- the weight of the bar labelled W;
- the force at the pivot labelled F. [3]

(ii) Calculate the distance between the centre of gravity of the bar and the pivot.

Distance = _____ m [1]

Now use the principle of moments to find the weight of the bar.

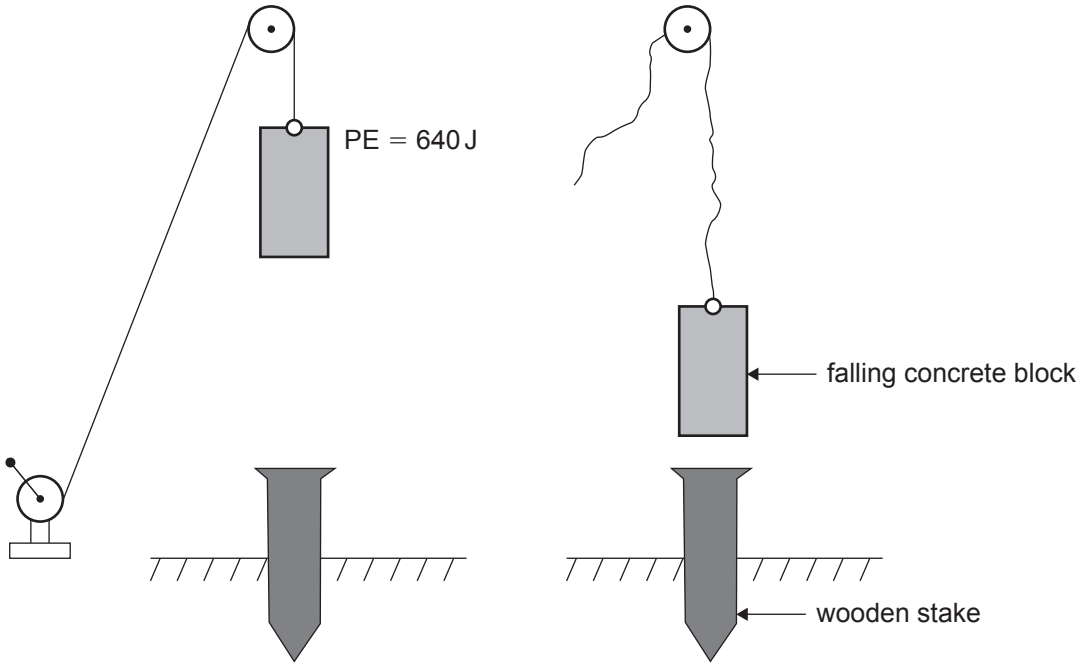
You are advised to show your working out.

Weight = _____ N [4]

[Turn over

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20GSD3213

7 A concrete block is used to drive a wooden stake into the ground.



Before being released the concrete block has 640 J of potential energy relative to the top of the wooden stake.

(i) Write down the kinetic energy of the concrete block as it hits the wooden stake.

Assume no energy losses.

Kinetic energy = _____ J [1]

(ii) The concrete block has a mass of 80 kg. Calculate the velocity of the concrete block as it hits the wooden stake.

You are advised to show your working out.

Velocity = _____ m/s [4]

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(iii) On another occasion, with a different concrete block, the momentum at impact is 510 kgm/s and the velocity is 6 m/s. Calculate the mass of this concrete block.

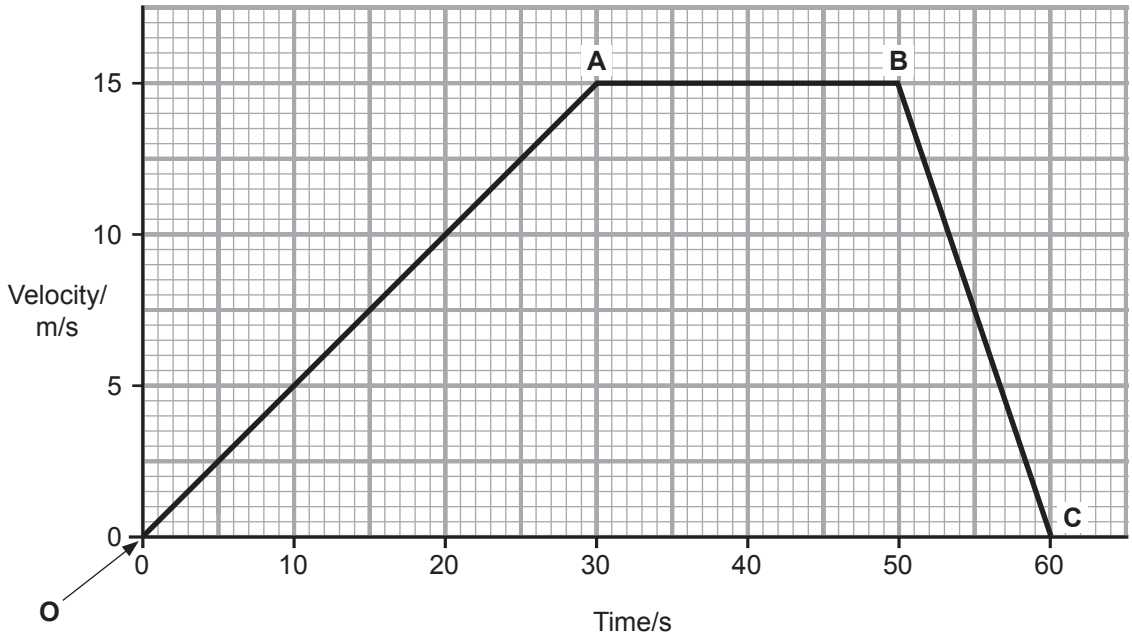
You are advised to show your working out.

Mass = _____ kg [3]

[Turn over

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8 A bus travels in a straight line. Its velocity-time graph is shown below.



(a) Use the graph to find the distance travelled in the first 30 s of the motion.

You are advised to show your working out.

Distance travelled = _____ m [3]

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

(b) With the aid of the graph describe, in detail, the movement of the bus.

OA _____

_____

_____

_____

_____

AB _____

_____

_____

_____

_____

BC _____

_____

_____

_____

_____ [6]

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Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
Total Marks	

Examiner Number

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Rewarding Learning

General Certificate of Secondary Education
2014–2015

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

THURSDAY 26 FEBRUARY 2015, MORNING

MARK SCHEME

STEMUP.CO.UK

General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

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The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

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AVAILABLE MARKS

1 **(a)** Measure volume of milk with graduated cylinder [1]
Measure mass of grad. cylinder [1]
Measure mass of grad. cylinder plus milk [1]
With top-pan balance [1]
Subtract to find mass of milk [1]
Use Density = mass/volume [1] [6]

Response	Mark
Candidates mention at least **5** of the above points. They use good spelling, punctuation and grammar. The form and style are of a high standard and specialist terms are used appropriately.	[5]–[6]
Candidates explain at least **3** of the above points. They use satisfactory spelling, punctuation and grammar. The form and style are of a satisfactory standard and they have made use of some specialist terms.	[3]–[4]
Candidates explain **1** of the above points. They use limited spelling, punctuation and grammar. The form and style are of a limited standard and they have made no use of specialist terms.	[1]–[2]
Response not worthy of credit.	[0]

(b) Density = 54/20 [1]
= 2.7 [1] (g/cm^3) [2] 8

2 **(a)**

Relative electrical charge	Location in the atom
0	(In the) nucleus
–1	Outside the nucleus/in shells/orbiting

[1] each [4]

(b) **(i)** 6 [1]

(ii) 6 [1]

(iii) 8 [1]

(c) **(i)** Beta or β [1]

(ii) Gamma or γ [1]

(iii) Gamma or γ [1] 10

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				AVAILABLE MARKS
3	**(a)**	Suitable scale > half of axis [1] labelled "Length/m" [1]	[2]	
	(b)	5 or 6 points correctly plotted [2], 4 points correct [1]	[2]	
	(c)	Line of best fit, consistent with plots of candidate	[1]	
	(d)	(0.8, 4.5), independent of plots	[1]	
	(e)	k = gradient or equivalent [1] = 6/1 or similar [1] = 6 [1] ohm/m [1]	[4]	10
4	**(a)**	momentum = mass × vel [1] or p = mv or equivalent = 1200 × 12 [1] = 14 400 [1] kgm/s [1] or Ns	[4]	
	(b)	a = gradient or $a = \frac{v-u}{t}$ [1] or $a = \frac{v}{t}$ $a = \frac{12}{8}$ [1] = 1.5 (m/s^2) [1] F = ma [1] = 1200 × 1.5 [1] = 1800 (N) [1]	[6]	10
5	**(a)**	**(i)** C	[1]	
		(ii) A and B show accelerations only or horizontal line shows const. velocity [dep. marking]	[1]	
	(b)	$a = \frac{v-u}{t}$ [1] or equivalent $4 = \frac{30-u}{5}$ **or** $20 = 30 - u$ [1] u = 10 (m/s) [1]	[3]	5

6 Two light nuclei [1] fused together [1]
to form a heavier nucleus [1]
release of energy [1] or heat
difficulties: high temp or containment [1]
occurs naturally in stars or sun [1] Any 5 points [6]

Response	Mark
Candidates mention at least **5** of the above points. They use good spelling, punctuation and grammar. The form and style are of a high standard and specialist terms are used appropriately.	[5]–[6]
Candidates explain at least **3** of the above points. They use satisfactory spelling, punctuation and grammar. The form and style are of a satisfactory standard and they have made use of some specialist terms.	[3]–[4]
Candidates explain **1** of the above points. They use limited spelling, punctuation and grammar. The form and style are of a limited standard and they have made no use of specialist terms.	[1]–[2]
Response not worthy of credit.	[0]

AVAILABLE MARKS

6

7 **(a)** Write the appropriate numbers in the boxes below.

$$\square_{11}\text{Na} \longrightarrow \square_{24}\text{Mg} + \square_{-1}\beta^{0}$$

[1] mark each, marked independently [4]

(b) $1.6 \times 10^6 \rightarrow 0.8 \times 10^6 \rightarrow 0.4 \times 10^6 \rightarrow 0.2 \times 10^6$
1 halving [1]
2 halvings [1]
Correct answer = 2×10^5 [1] [3]

7

8 **(i)** Downward arrow vertically (by eye) originating on trapdoor [1]
starting at centre [1] [2]

(ii) (Hook) 3 for one mark. [1]
Distance (to hinge) is smallest or least or shortest or equivalent [1]
[dep. marking] [2]

(iii) CM = ACM or $F_1d_1 = F_2d_2$ [1]
$F \times 40 = 8 \times 25$ [1] and [1]
F = 5 (N) [1] [4]

8

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			AVAILABLE MARKS
9	ke = ½ mv^2 [1] = ½ × 0.8 × 64 [1] = 25.6 [1] pe = mgh [1] 25.6 = 0.8 × 10 × h [1] h = 3.2 (m) [1]	[6]	6
		Total	**70**

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Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2014–2015

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

GSD32

FRIDAY 14 NOVEMBER 2014, MORNING

TIME

1 hour.

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 ten** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 70.
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 **2(a)** and **6**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total Marks	

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Examiner Only	
Marks	Remark

1 When radiation travels through air it causes ionisation.

(a) What is ionisation?

_____

_____ [1]

(b) People who work with radioactive materials must take steps to protect themselves.

State two ways that workers can protect themselves.

1. _____

2. _____ [2]

Cobalt-60 is the name of a radioactive substance. The number 60 refers to the number of particles in the nucleus of the cobalt.

(c) **(i)** What do we call this number?

_____ [1]

(ii) Cobalt-60 has a half-life of 5 years. After how many years will its count-rate fall from 240 counts per minute to 30 counts per minute?

You are advised to show your working out.

Time = _____ years [3]

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2 **(a)** Describe an experiment you would carry out to measure personal power. Your description should include:

- the apparatus you would use;
- the measurements you would take.

You will be assessed on your written communication skills including the use of specialist terms.

[6]

Examiner Only

Marks	Remark

An electric motor lifts a load of 400 N through a distance of 6.0 m in 3 seconds.

Examiner Only	
Marks	Remark

(b) (i) Calculate the power of the motor in watts.

You are advised to show your working out.

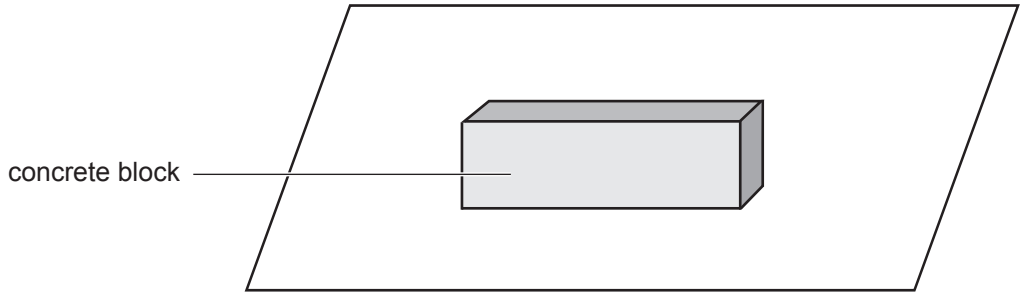
Power = _____ W [3]

(ii) Give your answer to **(b)(i)** in kilowatts.

Power = _____ kW [1]

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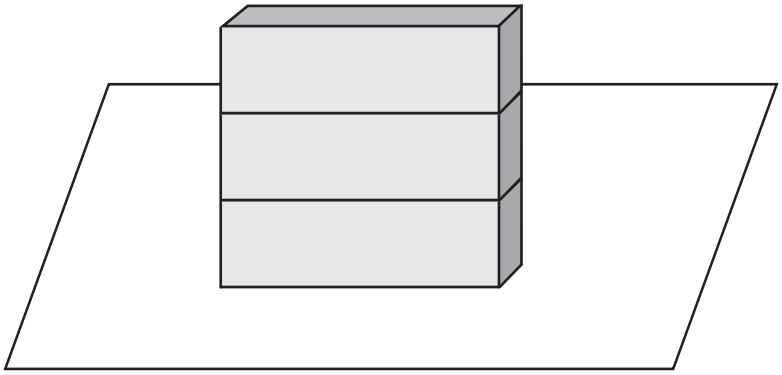
3 When a block of concrete sits on a surface it exerts a pressure.



The pressure exerted is given by the equation:

$$\text{pressure} = \frac{\text{weight}}{\text{area}}$$

The weight is changed by adding similar blocks on top as shown below.



The weight of each block is 20 N and the area in contact with the surface is 1.5 m^2.

Examiner Only

Marks	Remark

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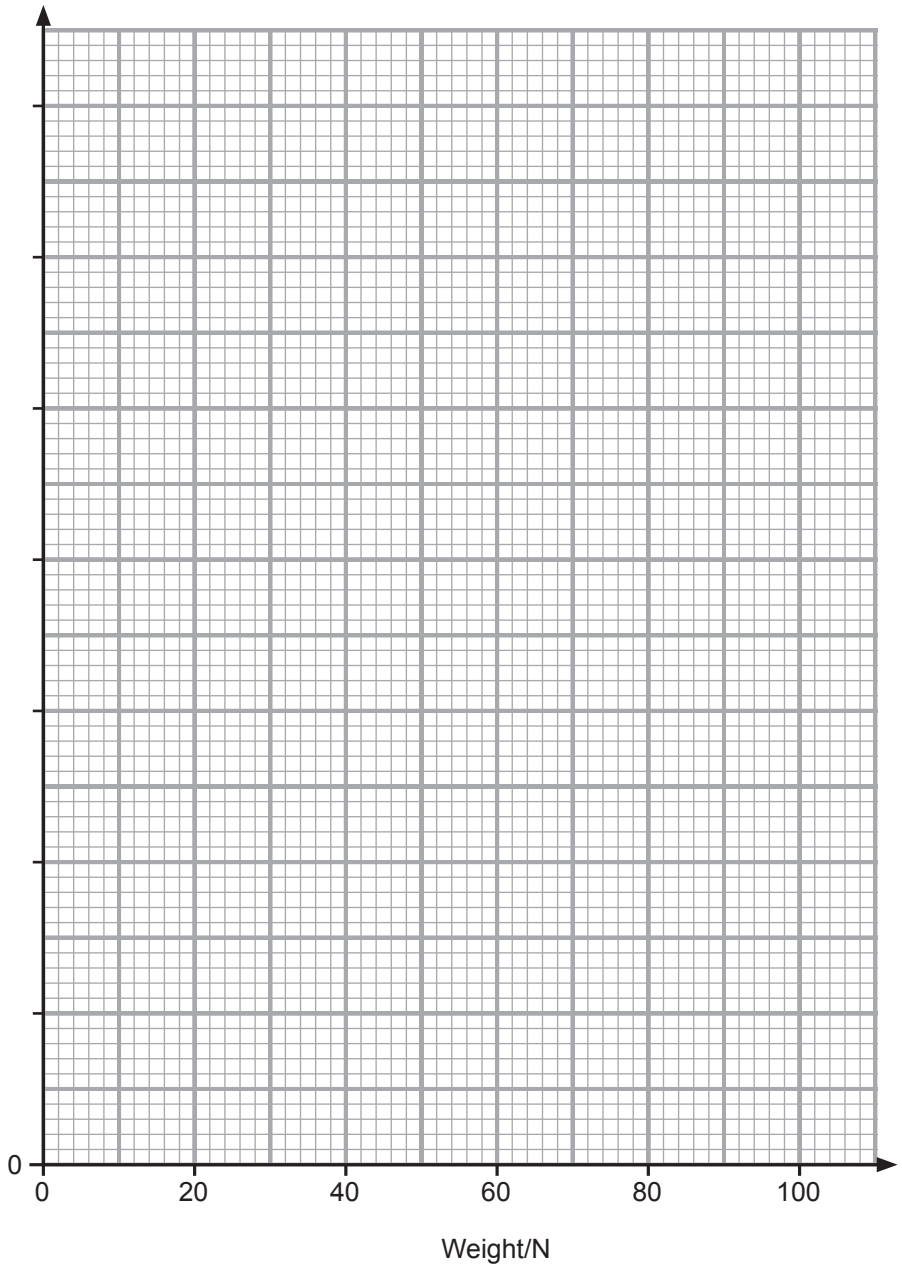
Examiner Only	
Marks	Remark

(i) Use the equation $\text{pressure} = \frac{\text{weight}}{\text{area}}$

to complete the table below.
Your values of pressure should be correct to the nearest whole number.

No. of blocks	1	2	3	4	5
Weight/N	20	40	60	80	100
Area/m^2	1.5	1.5	1.5	1.5	1.5
Pressure/ N/m^2	13				

[2]



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(ii) Choose a suitable scale for the pressure on the vertical axis of the graph (page 6) and label it. [2]

(iii) Plot a graph of pressure against weight. [2]

(iv) Draw the best fit line. [1]

The surface that the blocks are resting on will be damaged if the pressure is greater than 45 N/m^2.

(v) Use your graph to find the smallest number of blocks that will damage the surface.

Number of blocks = _____ [2]

(vi) Find the gradient of your graph.

You are advised to show your working out.

Gradient = _____ $/m^2$ [2]

Examiner Only

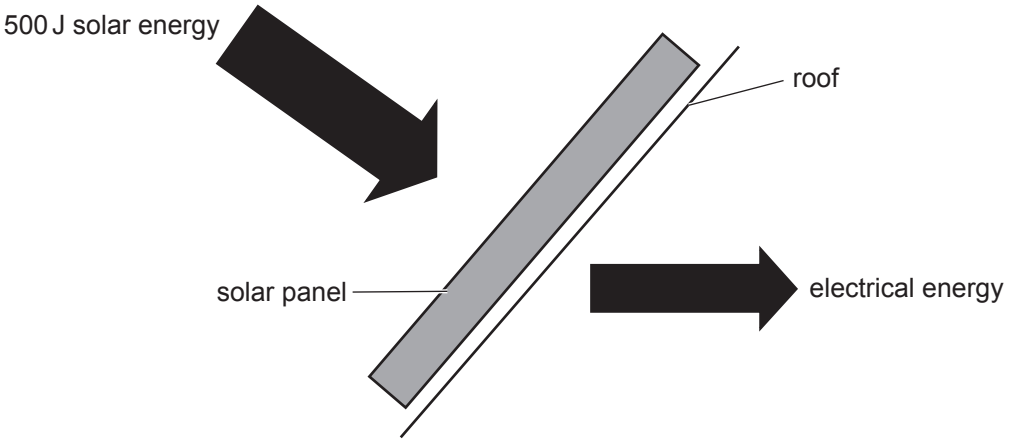
Marks	Remark

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Examiner Only	
Marks	Remark

4 A solar panel is designed to generate electricity directly from the Sun. Its efficiency is 0.8.

(i) This panel receives 500 J of solar energy. Calculate how much electrical energy it produces.



You are advised to show your working out.

Electrical energy produced = _____ J [3]

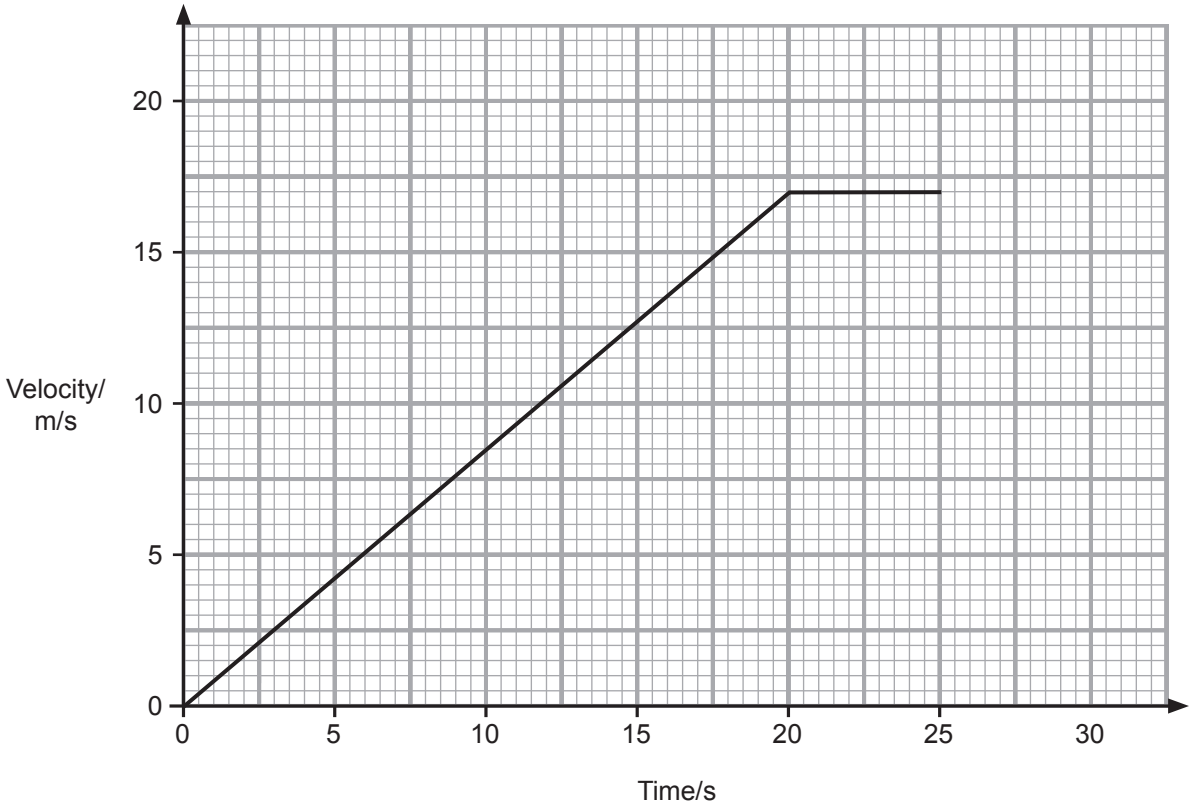
(ii) State two advantages of the use of solar panels.

1. _____

2. _____ [2]

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5 The graph below shows how the velocity of a car changes with time.



(a) Describe the motion of the car during the following times.

0 to 20 s _____

20 s to 25 s _____ [2]

(b) Calculate the total displacement of the car.

You are advised to show your working out.

Total displacement = _____ m [4]

(c) Use your answer to part **(b)** to find the average velocity of the car.

You are advised to show your working out.

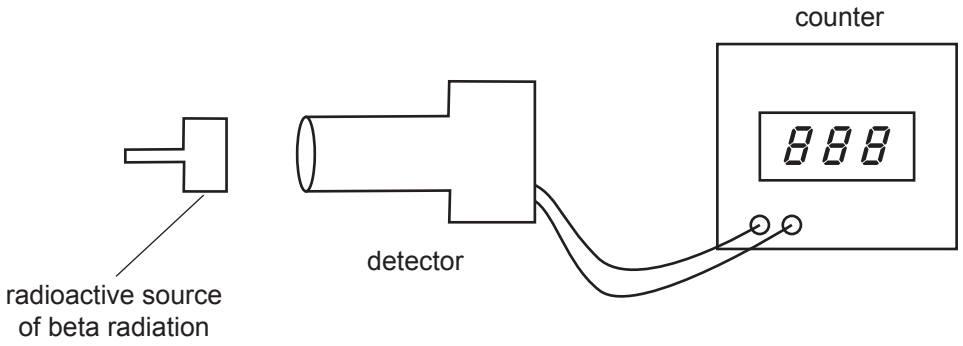
Average velocity = _____ m/s [3]

Examiner Only

Marks	Remark

6 Describe a demonstration or a computer simulation to find the range of beta radiation in aluminium.

Examiner Only	
Marks	Remark



In your description you should include:

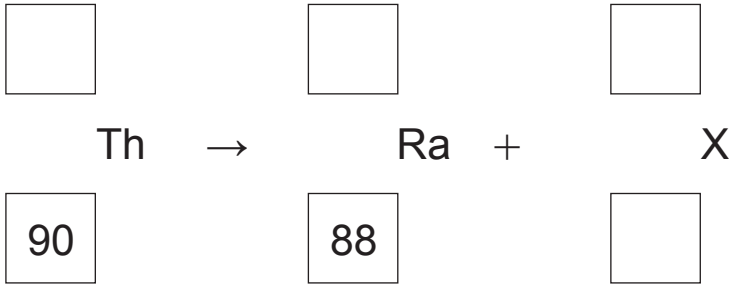
- the method used;
- the measurements taken.

You will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

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7 Thorium (Th) has 140 neutrons in its nucleus. It decays to radium (Ra), as shown below.



(i) Complete the equation by writing numbers in the boxes. [4]

(ii) X is one of the radiations emitted by radioactive substances.
Name this radiation.

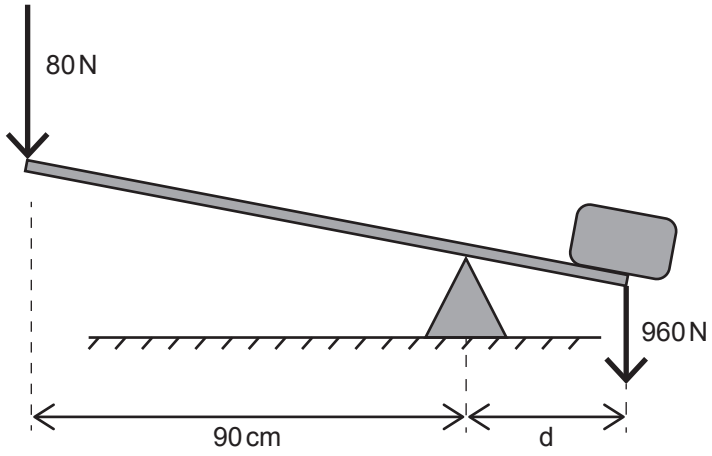
X is _____ [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

8 A workman exerts a force of 80 N and just manages to lift the concrete block of weight 960 N.



(i) Calculate the distance d, in cm.

You are advised to show your working out.

d = _____ cm [4]

(ii) Suggest how the workman could lift the concrete block with a smaller force.

_____

_____ [1]

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Examiner Only	
Marks	Remark

9 When travelling at a **steady velocity**, the engine of a boat of mass 2500 kg exerts a force of 15 000 N.



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(a) What is the size of the frictional force on the boat?

Frictional force = _____ N [1]

(b) The boat has a mass of 2500 kg. Calculate the total force exerted by the engine to give the boat an acceleration of 3 m/s^2, assuming the frictional force remains the same as that in part **(a)**.

You are advised to show your working out.

Total force = _____ N [4]

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10 Rory hits a golf ball of mass 160 g.



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(a) The golf ball has a kinetic energy of 72 J when it leaves the clubhead.
Calculate the initial velocity of the golf ball.

You are advised to show your working out.

Initial velocity = _____ m/s [4]

(b) On another occasion, Rory hits a ball of mass 0.15 kg.
He gives it a momentum of 3 kg m/s.
Calculate the initial velocity of the golf ball.

You are advised to show your working out.

Initial velocity = _____ m/s [3]

Examiner Only

Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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Rewarding Learning

General Certificate of Secondary Education
2014–2015

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

FRIDAY 14 NOVEMBER 2014, MORNING

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			AVAILABLE MARKS
1	**(a)**	loss or gain electron(s) [1]	
	(b)	Any **two** from: • shielding (e.g. use gloves/goggles/glass shield) • keep at a distance (e.g. use tongs/robotic arms) • keep exposure time small/work quickly **Reject** radiation badge **or** store in lead boxes [1] × 2 [2]	
	(c) **(i)**	Mass number **or** Atomic Mass number **or** Nucleon number [1]	
	(ii)	240 → 120 → 60 → 30 One halving [1] mark, 3 half-lives identified/halving to 30 but **no** further [1] 15 (y) [1] [3]	7
2	**(a)**	Weight of person measured (or mass × 10) with scale(s)/balance/newtonmeter Height of one step measured and multiplied by no. of steps/total height with metre rule **or** ruler **or** metre stick Time to run up steps **or** go up steps with stopwatch/stopclock timer [6]	

Response	**Mark**
Candidates describe **5 or 6** of the above points. They use good spelling, punctuation and grammar. The form and style are of a high standard and specialist terms are used appropriately.	[5]–[6]
Candidates describe **3 or 4** of the above points. They use satisfactory spelling, punctuation and grammar. The form and style are of a satisfactory standard and they have made use of some specialist terms.	[3]–[4]
Candidates describe **1 or 2** of the above points. They use limited spelling, punctuation and grammar. The form and style are of a limited standard and they have made no use of specialist terms.	[1]–[2]
Response not worthy of credit.	[0]

	(b) **(i)**	P = w/t [1] = (400 × 6)/3 [1] = 800 (W) [1] [3]	
	(ii)	0.8(kW) e.c.f. from **(b)(i)** [1]	10

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3 **(i)**

No. of blocks	1	2	3	4	5
Weight/N	20	40	60	80	100
Area/m^2	1.5	1.5	1.5	1.5	1.5
Pressure/N/m^2	13	**27**	**40**	**53**	**67**

$[\frac{1}{2}] \times 4$ (round up) [2]

(ii) Scale at least half [1] axis labelled with units [1] N/m^2 = Pa [2]

(iii) At least four points [2] Three points [1] [2]

(iv) Best fit line [1]

(v) Evidence from graph [1] 4 blocks [1] (4 blocks get 2/2 immediately)
Min. evidence = 1 horizontal or vertical line or point on graph [2]

(vi) Gradient = $\Delta y/\Delta x$ or similar [1]
= any value between 0.6–0.7 [1] [2] 11

4 **(i)** Eff = Useful output energy/input energy [1]
0.8 = o/p / 500 (or equivalent) [1]
o/p = 400 (J) [1] [3]

(ii) Less (fossil) fuel consumption [1]
Less atmospheric pollution **or** reduces carbon footprint [1]
Resource free
Renewable
Reject economic arguments [2] 5

5 **(a)** 0–20 s: Acceleration **or** uniformly increasing velocity
Not deceleration [1]

20–25 s: Constant (or uniform or steady) **velocity** [1]

(b) Total displacement = area under graph [1]
= $(0.5 \times 17 \times 20)$ [1] + (17×5) [1]
= 255 (m) [1] [4]

(c) (Av.) Vel. = (total) displac./(total time) [1]

$= \frac{255}{25}$ (allow e.c.f. from (b)) [1]

= 10.2 (m/s) [1] [3] 9

AVAILABLE MARKS

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	AVAILABLE MARKS

6
- Measure background count/radiation
- Put a sheet of aluminium between the source and detector (or implied)
- Take reading from counter **or** measure count rate **or** measure counts/second
- Repeat with more aluminium sheets
- Until count reading is equal to background count
- Record thickness of aluminium [6]

Response	**Mark**
Candidates describe **5 or 6** of the above points. They use good spelling, punctuation and grammar. The form and style are of a high standard and specialist terms are used appropriately.	[5]–[6]
Candidates describe **3 or 4** of the above points. They use satisfactory spelling, punctuation and grammar. The form and style are of a satisfactory standard and they have made use of some specialist terms.	[3]–[4]
Candidates describe **1 or 2** of the above points. They use limited spelling, punctuation and grammar. The form and style are of a limited standard and they have made no use of specialist terms.	[1]–[2]
Response not worthy of credit.	[0]

6

7 **(i)** 230 [1] 226 [1] 4 [1]
2 [1] [4]

(ii) Alpha **or** α **or** helium nucleus **or** He nucleus [1] 5

8 **(i)** ACM = CM [1] **or** F_1d_1 **or** F_2d_2
$960 \times d = 80 \times 90$ [2]
d = 7.5 (cm) [1] [4]

(ii) Move pivot closer to load [1] 5

9 **(a)** 15 000 (N) [1]

(b) R.F. = ma [1] **or** F = ma
(F – 15 000) [1] = 2500×3 [1] (Allow e.c.f. from **(a)**)
= 22 500 (N) [1] [4]

or R.F. = ma [1]
= 2500×3 [1] = 7500 [1]
F = 22 500 (N) [1] 5

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10 **(a)** K.E. = ½ m v^2 [1]

72 = ½ 0.16 v^2 [1] **or** $v^2 = \frac{2\,K.E.}{m}$ [1] or $v = \sqrt{\frac{2\,K.E.}{m}}$

Any re-arrangement with one unknown [1] $v^2 = \frac{2 \times 72}{0.16}$ [2] (1 for each sub line)

v = 30 (m/s) [1] v = 30 (m/s) [1] [4]

(b) Momentum = mass × velocity [1]

vel = $\frac{3}{0.15}$ [1] or equivalent

vel = 20 (m/s) [1] [3]

Total

AVAILABLE MARKS
7
70

Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2013–2014

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

MONDAY 19 MAY 2014, AFTERNOON

TIME

1 hour.

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 nine** questions.

INFORMATION FOR CANDIDATES

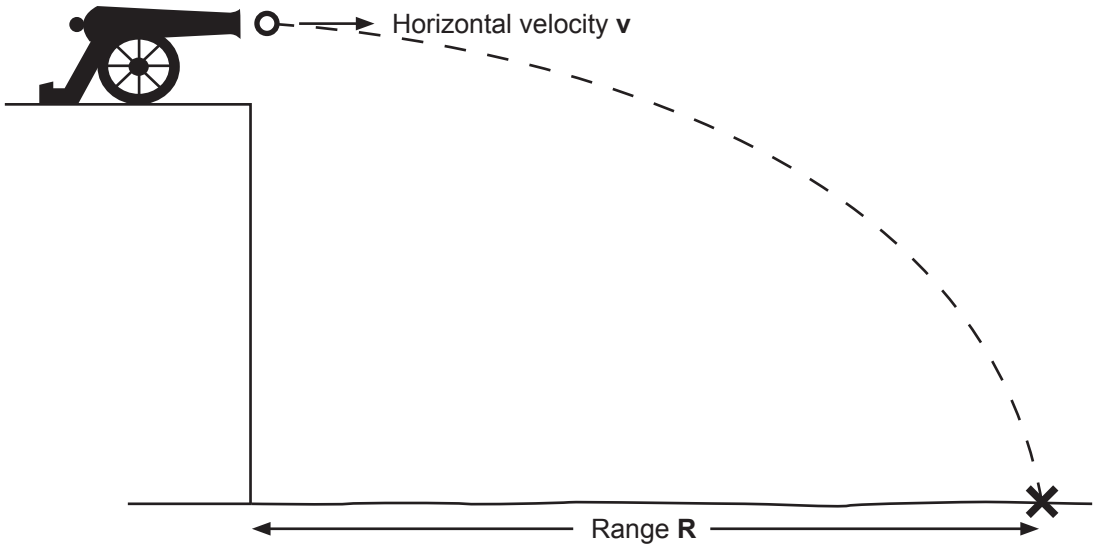
The total mark for this paper is 70.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Questions **2(a)** and **5**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total Marks	

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Examiner Only	
Marks	Remark

1 According to theory, the range **R** of a cannonball depends on the horizontal velocity **v** when fired from the top of a cliff.



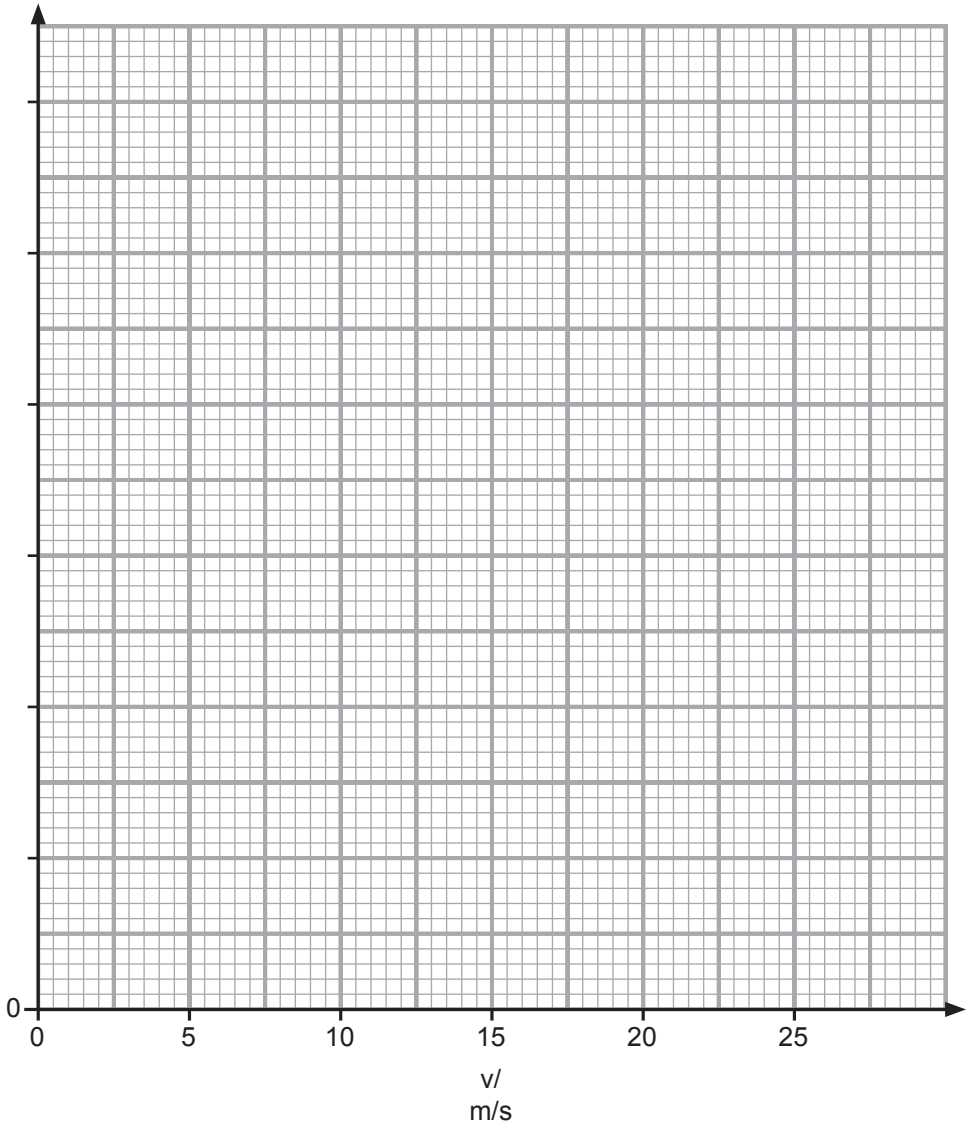
A series of readings is shown in the table.

v/ m/s	0	5	10	15	20
R/m	0	30	60	90	120

(a) (i) Label and choose a suitable scale for the vertical axis. [2]

(ii) Plot the points on the grid and draw the straight line of best fit. [3]

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Marks	Remark

(b) Find the gradient of the graph.

Remember to include the unit for the gradient.

You are advised to show your working out.

Gradient = _____

Unit = _____ [4]

(c) Use the graph to find the range, **R**, of the cannonball when its horizontal velocity is 12 m/s.

Range = _____ m [1]

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Examiner Only	
Marks	Remark

2 **(a)** Describe the process of nuclear **fusion**.

Your description should include:

- the particles involved
- what happens when nuclear fusion takes place
- where nuclear fusion occurs naturally

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

[6]

(b) A great deal of money is being invested on research into nuclear **fusion**.

(i) Suggest a reason why.

[1]

(ii) Give two practical difficulties which must be overcome before fusion reactors become viable.

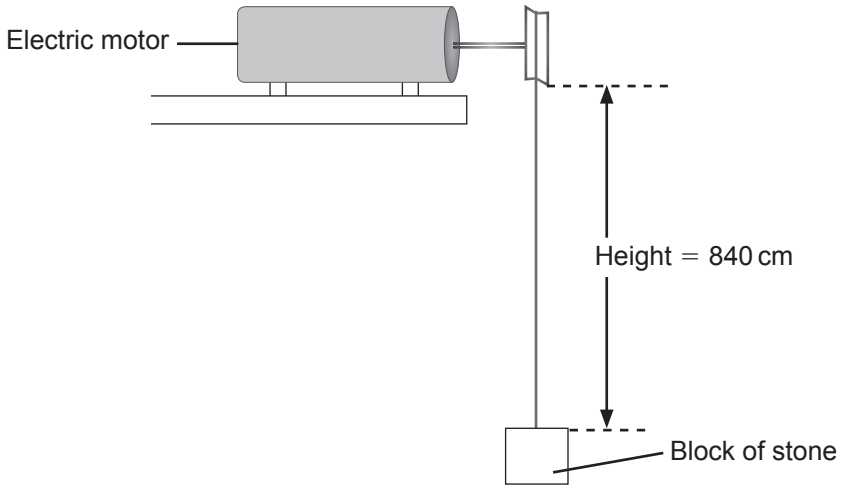
1.

2. [2]

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Examiner Only	
Marks	Remark

3 An electric motor lifts a block of stone, of weight 150 N, through a vertical distance of 840 cm.



(i) Calculate the work done.

You are advised to show your working out.

Work done = _____ J [4]

(ii) Into what energy form has this work been changed?

Work has become _____ [1]

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(iii) If the motor uses 2100 J of electrical energy, calculate the efficiency of the motor.

You are advised to show your working out.

Efficiency = _____ [3]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

4 An aluminium block has the dimensions shown.

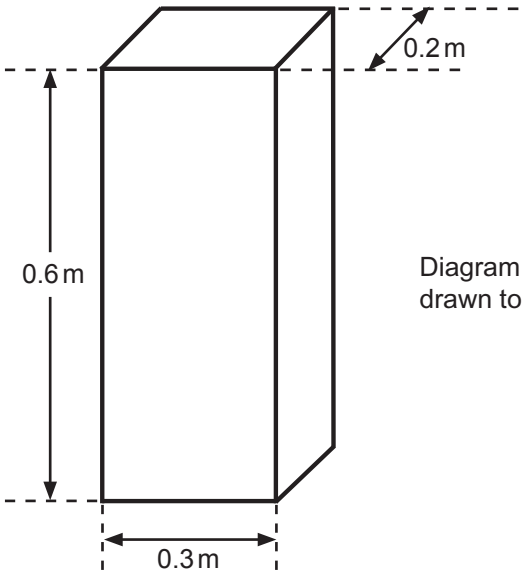


Diagram not drawn to scale

(i) Find the volume of the aluminium block, in m^3.

You are advised to show your working out.

Volume = _____ m^3 [2]

The density of aluminium is 2700 kg/m^3.

(ii) Calculate the mass of the block.

You are advised to show your working out.

Mass = _____ kg [3]

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5 Describe an experiment you would carry out in the laboratory to test how the acceleration of an object depends on the accelerating force. You should include the following:

- the readings you take,
- how the readings are used to get a relationship,
- the outcome of your experiment.

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

[6]

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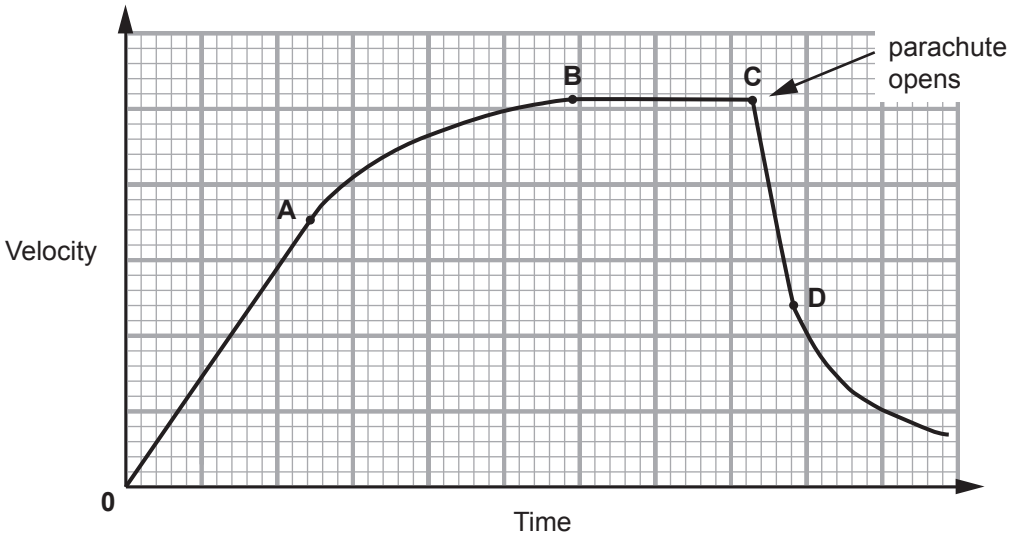
Marks	Remark

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Examiner Only	
Marks	Remark

6 A skydiver jumps from an aircraft and for a time falls through the air without his parachute open. After a time he opens his parachute.

The diagram shows the velocity–time graph of his fall.



Use the letters on the graph to answer the following questions.

(a) (i) During what time interval is he falling at constant velocity?

From _____ to _____ [1]

(ii) During what time interval are the forces acting on the skydiver balanced?

From _____ to _____ [1]

(iii) During what time interval is the force acting upward on the skydiver greater than the weight of the skydiver?

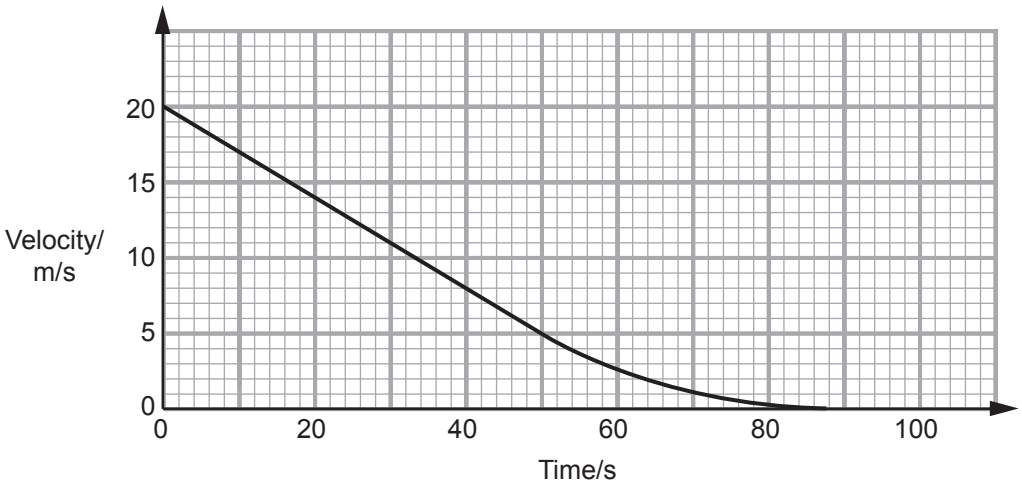
From _____ to _____ [1]

(iv) Give the name of the upward force in part **(iii)**.

_____ [1]

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A velocity–time graph for a different skydiver is shown below **from the instant that the parachute opens.**



(b) Calculate how far the skydiver falls in the first 50 seconds.

You are advised to show your working out.

Height = _____ m [4]

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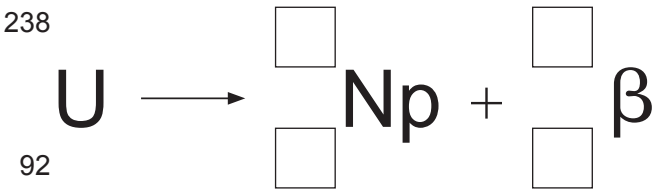
Marks	Remark

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Examiner Only	
Marks	Remark

7 A radioactive nucleus of uranium decays by emitting a beta particle.

(a) Complete the equation below by writing the correct numbers in the boxes.



[4]

(b) **(i)** Neptunium (Np) has a half-life of 46 days.

Explain fully what is meant by the term 'half-life'.

_____

_____ [2]

(ii) Starting with 50.00 grams of neptunium, calculate how long it takes for 43.75 grams of it to decay.

You are advised to show your working out.

Time = _____ days [4]

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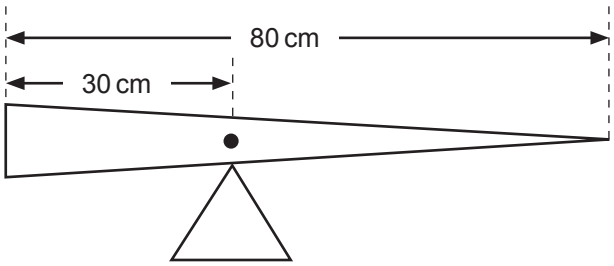
Examiner Only	
Marks	Remark

8 **(a)** State the Principle of Moments.

_____

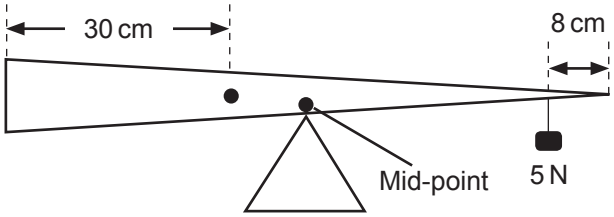
_____ [2]

(b) **(i)** A non-uniform plank of wood of length 80 cm is balanced on a pivot as shown.



We now know that the position of the centre of gravity of the plank is 30 cm from the left-hand end and this is indicated by a dot as shown.

The plank is now moved and **rebalanced at its mid-point** using a 5 N weight placed 8 cm from the right-hand end.



Calculate the weight of the plank.

You are advised to show your working out.

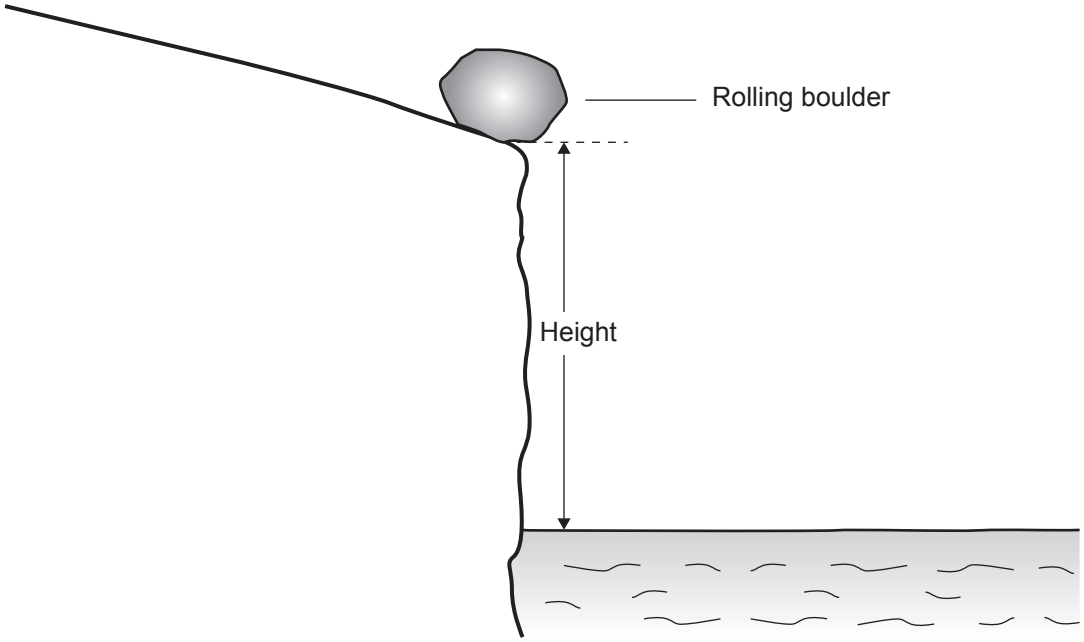
Weight of plank = _____ N [3]

(ii) Calculate the upward force which is now exerted by the triangular support.

Upward force = _____ N [1]

Examiner Only	
Marks	Remark

9 A boulder, of mass 440 kg, rolls down a slope and into the sea.



In the position shown at the edge of the cliff the boulder has a kinetic energy of 3520 J and a potential energy of 52 800 J.

(a) Calculate the height of the cliff.

You are advised to show your working out.

Height of cliff = _____ m [3]

(b) (i) Calculate the kinetic energy of the boulder as it strikes the water. Assume no energy losses.

Kinetic energy = _____ J [1]

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(ii) Calculate the velocity of the boulder when it hits the water.

You are advised to show your working out.

Velocity = _____ m/s [4]

Examiner Only	
Marks	Remark

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Rewarding Learning

General Certificate of Secondary Education
2013–2014

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

MONDAY 19 MAY 2014, AFTERNOON

MARK SCHEME

STEMUP.CO.UK

General Marking Instructions

Introduction

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The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

		AVAILABLE MARKS
1	**(a)** **(i)** Correct scale for y axis [1] Correct label for y axis [1] [2]	
	(ii) 4 points correctly plotted [2] 3 points [1] line of best fit [1] [3]	
	(b) grad $= \frac{\text{rise}}{\text{run}}$ or $\frac{R}{v}$ [1] or equivalent $= \frac{120}{20}$ [1] or equivalent $= 6$ [1] s [1] [4]	
	(c) $R = 72(m) \pm 4$ [1]	10
2	**(a)** Two light small hydrogen [1] nuclei [1] Combine/join/fuse (together) [1] To form (a more stable helium) nucleus [1] or heavier nucleus new nucleus Producing energy [1] In the stars/in the sun [1] [6]	

Response	**Mark**
Candidates explain **5** or **6** of the above points. They use good spelling, punctuation and grammar. The form and style are of a high standard and specialist terms are used appropriately.	[5–6]
Candidates explain **3** or **4** of the above points. They use satisfactory spelling, punctuation and grammar. The form and style are of a satisfactory standard and they have made use of some specialist terms.	[3–4]
Candidates explain **1** or **2** of the above points. They use limited spelling, punctuation and grammar. The form and style are of a limited standard and they have made no use of specialist terms.	[1–2]
Response not worthy of credit.	[0]

	(b) **(i)** solve world's energy needs/saves fossil fuels/less air pollution [1]	
	(ii) difficulty of containment/stability [1] or reference to container or particle density or time or pressure (sufficiently) high temperature [1] [2]	9

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	AVAILABLE MARKS

3 **(i)** W.D. = Force × distance [1]
= 150 [1] × 8.4 [1]
= 1260 (J) [1] [4]

(ii) G.P.E or P.E. or potential [1]

(iii) Eff. = O/p energy / i/p energy [1] or equivalent f'la
= 1260/2100 [1] Allow e.c.f. from part **(i)**
= 0.6 [1] [3] — 8

4 **(i)** Vol = l × b × h or 0.6 × 0.3 × 0.2 [1]
= 0.036 or 0.04 [1] [2]

(ii) m = density × v [1] or equivalent
= 2700 × 0.036 [1]
= 97.2 (kg) [1] [3] — 5

5 Applied force and
Acceleration noted (e.g light gates) [1]
Repeat [1]
Calculate ratio F/a **or** Plot a against F [1]
Straight line through origin [1]
Conclusion: a ∝ F [1] [6] — 6

Response	**Mark**
Candidates explain **5 of** the above points. They use good spelling, punctuation and grammar. The form and style are of a high standard and specialist terms are used appropriately.	[5–6]
Candidates explain **3 or 4** of the above points. They use satisfactory spelling, punctuation and grammar. The form and style are of a satisfactory standard and they have made use of some specialist terms.	[3–4]
Candidates explain **1 or 2** of the above points. They use limited spelling, punctuation and grammar. The form and style are of a limited standard and they have made no use of specialist terms.	[1–2]
Response not worthy of credit.	[0]

6 **(a)** **(i)** B to C [1]

(ii) B to C [1]

(iii) C to D [1]

(iv) Drag/Friction or Air resistance [1] [4]

(b) Height = area under graph [1]
= (50 × 5) + (50 × 15)/2 [1] each
= 625 (m) [1] [4] — 8

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				AVAILABLE MARKS
7	**(a)**	$^{238}_{93}Np + ^{0}_{-1}\beta$ [4]		
	(b)	**(i)** time taken or how long [1] for the count rate to decrease by half [1]	[2]	
		(ii) 50 → 25 → 12.5 → 6.25		
		or [1]		
		[1]		
		3 half lives [1]		
		(3 × 46 =) 138 days [1]	[4]	10
8	**(a)**	CM = ACM [1] for a body in equilibrium [1]	[2]	
	(b)	**(i)** W × 10 = 5 × 32 [1] each side W = 16 (N)	[3]	
		(ii) 21 (N) e.c.f. from **(b)(i)** e.c.f. i.e. "their weight" + 5(N)	[1]	6
9	**(a)**	pe = mgh [1] 440 × 10 × h = 52 800 [1] h = 12 (m) [1]	[3]	
	(b)	**(i)** KE = 56 320	[1]	
		(ii) e.c.f. from **(b)(i)**		
		$KE = \frac{1}{2} mv^2$ [1]		
		$56\,320 = \frac{1}{2} \times 440 \times v^2$ [2]		
		v = 16 (m/s) [1]	[4]	8
			Total	**70**

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Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2013–2014

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

GSD32

WEDNESDAY 26 FEBRUARY 2014, MORNING

TIME

1 hour.

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 eight** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 70.
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 **1(a)** and **6(c)**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
Total Marks	

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Examiner Only	
Marks	Remark

1 **(a)** You are given a number of steel objects. Describe an experiment you would carry out to find the density of steel.



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Your answer should include,

- the apparatus used,
- the readings you take,
- how the readings are used.

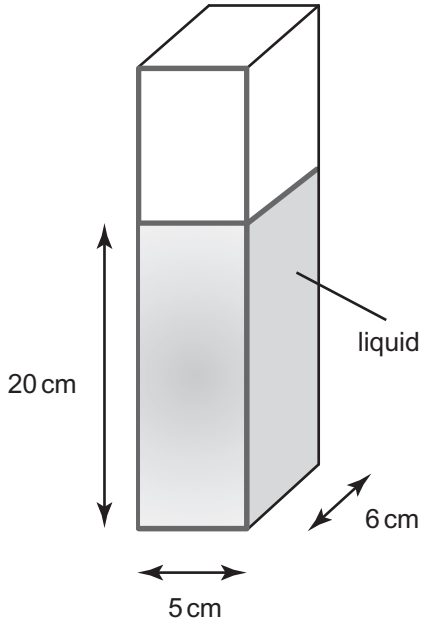
In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

(b) A student wants to find the density of a liquid. Use the information below to find the density of the liquid in g/cm^3.

Examiner Only	
Marks	Remark

Mass of container + liquid	= 1540 g
Mass of container	= 1000 g



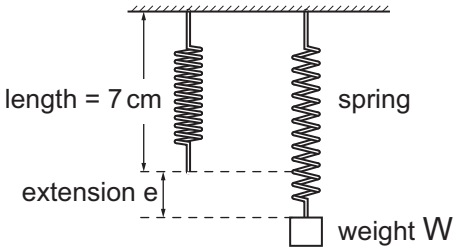
You are advised to show your working out.

Density = _____ g/cm^3 [3]

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Examiner Only	
Marks	Remark

2 A student investigates how the extension of a spiral spring depends on the weight hung on it.



The equation connecting the extension, e and weight, W is given by:

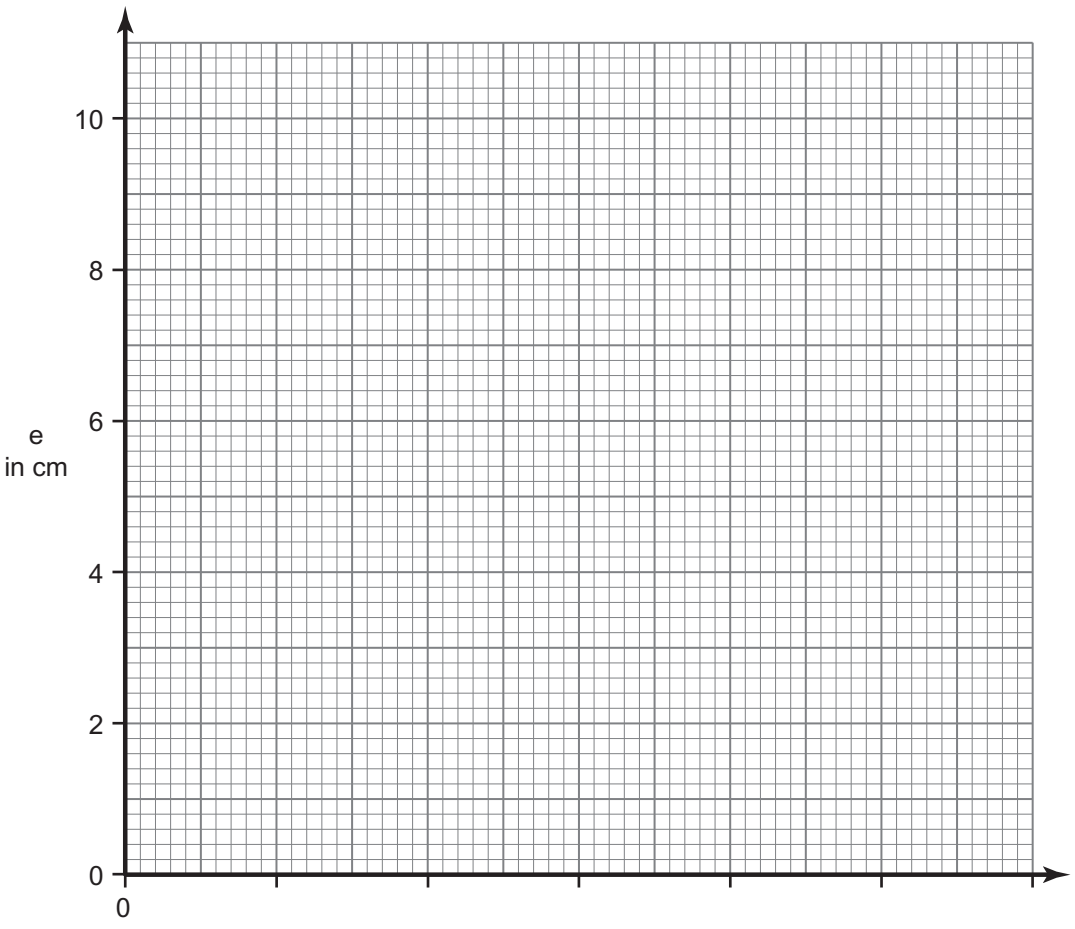
$$\mathbf{e = kW}$$

The table shows some of the results of the investigation.

W in N	0.5	1.0	1.5	2.0	2.5
e in cm	2	4	6	8	10

You are asked to plot a graph of e against W.

(i) Choose a suitable scale for W and label the horizontal axis. [2]



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Examiner Only	
Marks	Remark

(ii) Plot the points on the graph and draw the best fit line. [3]

(iii) Find the gradient of your graph and give its unit.

You are advised to show your working out.

Gradient = _____ [3]

Unit = _____ [1]

The original length of the spring shown opposite is 7 cm.

(iv) Use your graph to find the load needed to stretch the spring to a total length of 12 cm.

You are advised to show your working out.

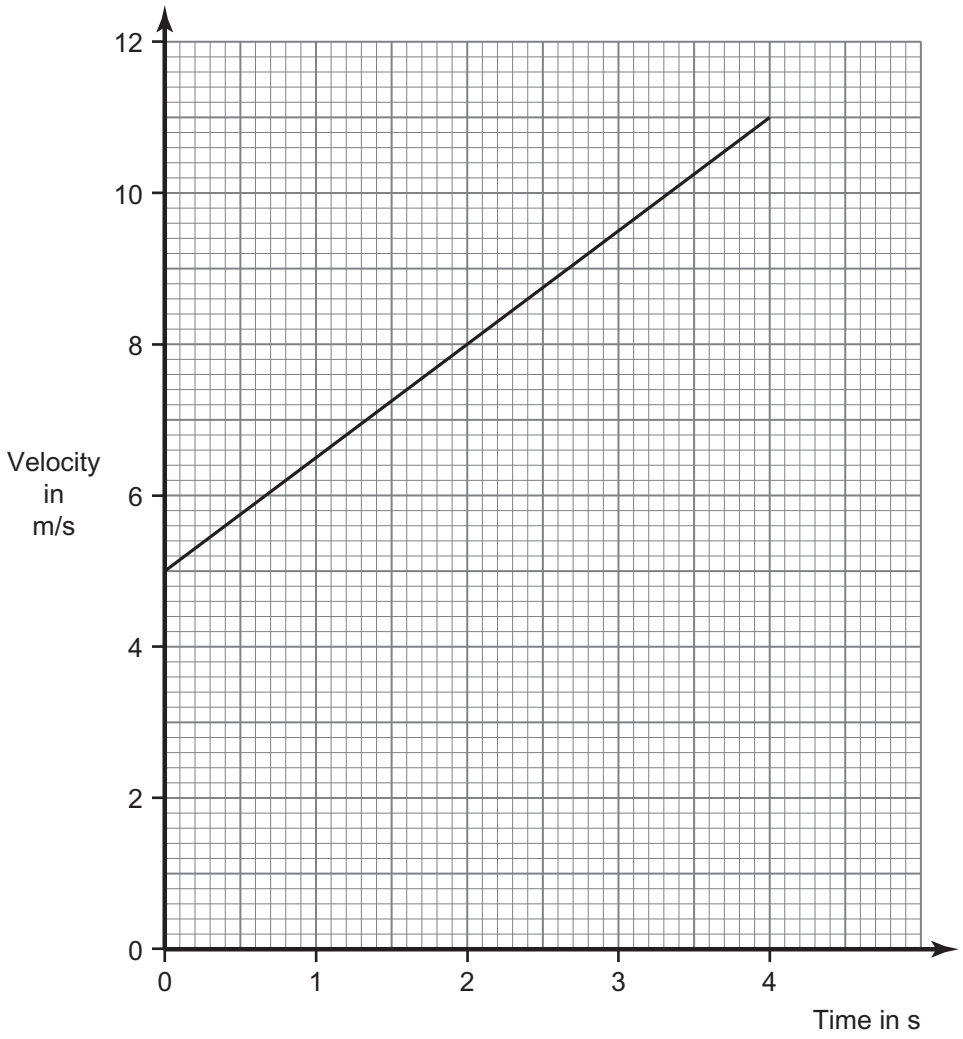
Load = _____ N [2]

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Examiner Only	
Marks	Remark

3 A steel ball was thrown downwards from a height above the surface of the Moon.

The graph shows part of the motion of the steel ball.



Use the graph to answer the following questions.

(a) (i) What is the initial velocity of the ball?

_____ m/s [1]

(ii) Describe the motion of the steel ball between times t = 0 s and t = 4 s.

_____ [1]

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(b) Calculate the acceleration of the steel ball.

You are advised to show your working out.

Acceleration = _____ m/s^2 [3]

(c) How far did the steel ball fall between times t = 0 s and t = 4 s?

You are advised to show your working out.

Distance = _____ m [4]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

4 An isotope of iron has a half-life of 46 days.

(a) (i) Explain what is meant by a half-life of 46 days.

_____

_____ [2]

A sample of this isotope has an activity of 512 disintegrations per second.

(ii) What length of time must pass before its activity falls to 32 disintegrations per second?

You are advised to show your working out.

Time = _____ days [3]

A source of radioactivity emits all three types of radiation: alpha, beta and gamma.

(b) (i) Which radiation(s) will pass through 3 cm of lead?

_____ [1]

(ii) Which radiation(s) will pass through a thick piece of cardboard?

_____ [1]

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Examiner Only	
Marks	Remark

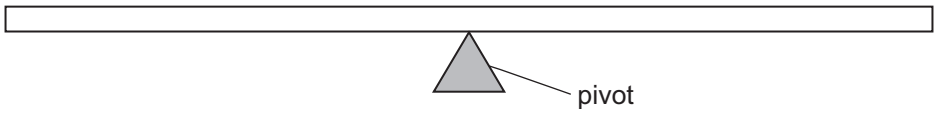
5 **(a)** Write, in words, the Principle of Moments.

_____

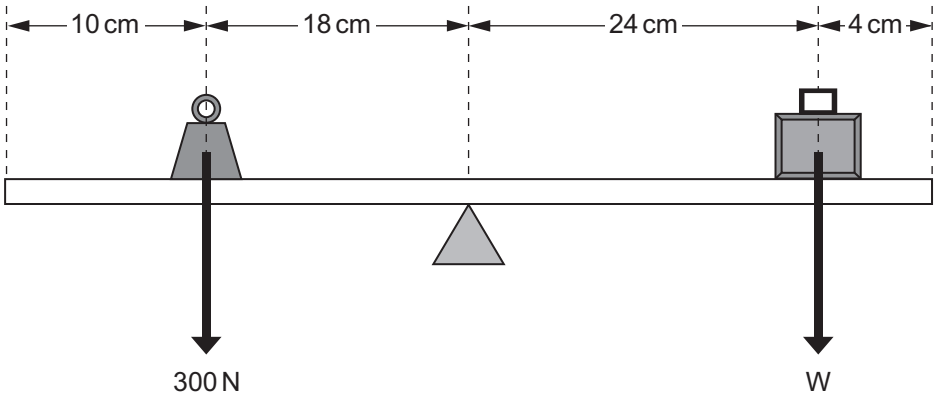
_____ [3]

John must find the weight of his suitcase before going on holiday.

He balanced a uniform plank of wood as shown in the diagram below.



He then placed a weight of 300 N on the left hand side of the plank and his suitcase on the other side.



John adjusted the positions of the 300 N weight and the suitcase until the plank was in balance again.

(b) Calculate the weight of the suitcase.

You are advised to show your working out.

Weight = _____ N [4]

Examiner Only	
Marks	Remark

6 **(a)** Explain in terms of mass number and atomic number the meaning of the word isotope.

_____

_____ [2]

This part of the question is about a nuclear disintegration of an isotope of potassium by beta decay.

(b) Potassium, K, undergoes beta decay to calcium, Ca.

Complete a balanced nuclear equation for this reaction.

$$\begin{matrix}40\\19\end{matrix}\mathrm{K} \xrightarrow{\text{Beta decay}} \begin{matrix}\square\\\square\end{matrix}\mathrm{Ca} + \begin{matrix}\square\\\square\end{matrix}\beta$$

[4]

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(c) In nuclear power stations, nuclei can be forced to disintegrate by incident neutrons.

Describe this process.

Your description should include:

- name of process,
- details of the process,
- the outcome of the process.

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

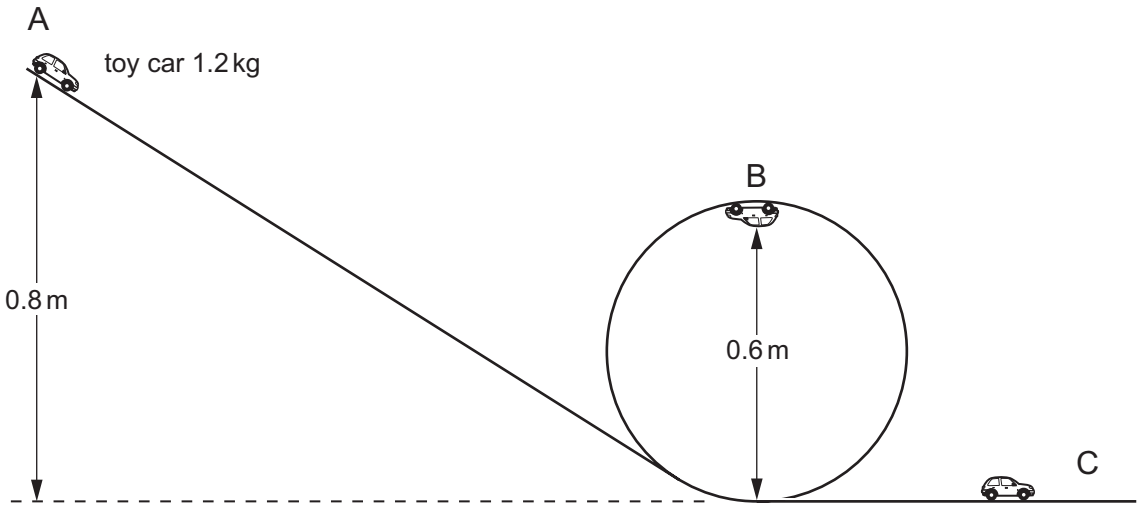
[6]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

7 A toy car of mass 1.2 kg is released from rest at point A, before it loops the loop.



(i) Calculate the **difference** in potential energy of the toy car at points A and B.

You are advised to show your working out.

Difference in potential energy = _____ J [4]

(ii) Calculate the velocity of the toy car at point C, if its kinetic energy at C is 3.75 J.

You are advised to show your working out.

Velocity = _____ m/s [4]

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Examiner Only	
Marks	Remark

8 A racing car, of mass 2500 kg, accelerates from rest on the starting grid. The engine exerts a force of 1.5×10^4 N.



© Gustoimages/Science Photo Library

(a) Calculate the acceleration of the racing car.

You are advised to show your working out.

Acceleration = _____ m/s^2 [3]

(b) The racing car accelerates for 10 s and covers a distance of 300 m.

Calculate the work done by the engine of the racing car.

Give your answer in megajoules.

You are advised to show your working out.

Work done = _____ MJ [4]

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Rewarding Learning

General Certificate of Secondary Education
2013–2014

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

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Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

1 **(a)** Find mass [1] using scale(s) [1]
Measuring cylinder/eureka vessel [1]
Reading of volume [1], immerse [1]
density = mass/volume [1]

AVAILABLE MARKS

Response	Mark
Candidates explain **5 or 6** of the above points. They use good spelling, punctuation and grammar. The form and style are of a high standard and specialist terms are used appropriately.	[5]–[6]
Candidates explain **3 or 4** of the above points. They use satisfactory spelling, punctuation and grammar. The form and style are of a satisfactory standard and they have made use of some specialist terms.	[3]–[4]
Candidates explain **1 or 2** of the above points. They use limited spelling, punctuation and grammar. The form and style are of a limited standard and they have made no use of specialist terms.	[1]–[2]
Response not worthy of credit.	[0]

[6]

(b) Mass = 540 (g) [1] Volume = 600 (cm^3) [1]
Density = 0.9 [1] [3] 9

2 **(i)** Suitable scale [1] Correct label with units [1] [2]

(ii) 5 points correct [2] (only 4 points [1]) within ± $\frac{1}{2}$ square
Best fit line [1] [3]

(iii) gradient = $\frac{e}{W}$ [1]

= $\frac{10}{2.5}$ [1]

= 4 [1]

cm/N [1] [4]

(iv) (12 – 7) = 5 [1] (cm) or sight of 5
W = 1.25 ± 0.05 [1] (N) [2] 11

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					AVAILABLE MARKS
3	**(a)**	**(i)**	5 (m/s)	[1]	
		(ii)	(Uniform) acceleration or velocity increasing (steadily)	[1]	
	(b)		Acceleration = gradient or a = (v–u)/t	[1]	
			= (11 – 5)/4	[1]	
			= 1.5 (m/s^2)	[1]	
	(c)		Height = area (under) or	[1]	
			= $\underline{1/2(4 \times 6)}$ [1] + $\underline{(5 \times 4)}$ [1]	[2]	
			([1] for each complete substitution)		
			= 32 (m)	[1]	9
4	**(a)**	**(i)**	(After) 46 days/after this time [1] or it is the time taken the activity/count rate halves [1] – dependent marking or radioactivity or radiation	[2]	
		(ii)	Evidence of halving. 512 → 256 (→ 128) [1] 4 half-lives [1] 184 (days) [1]	[3]	
	(b)	**(i)**	gamma	[1]	
		(ii)	beta and gamma [both required]	[1]	7

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			AVAILABLE MARKS
5	**(a)**	(The sum of) clockwise moment(s) = (the sum of) anticlockwise moment(s) (threshold) [1] when a body is in equilibrium dependent marking on 1st point [1] about any point or **a** point [1]	
	(b)	CM = ACM or $F_1d_1 = F_2d_2$ [1] [1] $W \times 24 = 300 \times 18$ [1] [2] $W = 225$ (N) [1]	7
6	**(a)**	The same atomic number [1], different mass number [1] [2]	
	(b)	$^{40}_{20}Ca + ^{0}_{-1}\beta$ [4]	
	(c)	• Fission • Uranium or plutonium nucleus **or** heavy **or** bigger/big/large (radioactive) nuclei • Neutron **absorbed** (insist on this word) • **(**Splits into) **two** (lighter) **nuclei** insist on **2** nuclei or **2** fragments • **(**2 or 3) (fast) neutrons produced • Energy [or heat] produced/mass defect	

Response	**Mark**
Candidates explain **5 or 6** of the above points. They use good spelling, punctuation and grammar. The form and style are of a high standard and specialist terms are used appropriately.	[5]–[6]
Candidates explain **3 or 4** of the above points. They use satisfactory spelling, punctuation and grammar. The form and style are of a satisfactory standard and they have made use of some specialist terms.	[3]–[4]
Candidates explain **1 or 2** of the above points. They use limited spelling, punctuation and grammar. The form and style are of a limited standard and they have made no use of specialist terms.	[1]–[2]
Response not worthy of credit.	[0]

[6] 12

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				AVAILABLE MARKS
7	**(i)**	GPE = m × g × h [1]	[1]	
		= 9.6 (J) at A [1] and 7.2 (J) at B [1]	[2]	
		= 2.4 (J) [1]	[1]	
	(ii)	K.E. = $\frac{1}{2}$ m v^2	[1]	
		3.75 = $\frac{1}{2}$ × 1.2 × v^2 [1 mark for RHS, 1 mark for LHS]	[2]	
		v = 2.5 (m/s)	[1]	8
8	**(a)**	F = m × a or equivalent	[1]	
		a = 15 000/2500	[1]	
		= 6 (m/s^2)	[1]	
	(b)	Work done = Force × distance	[1]	
		= 15 000 × 300	[1]	
		= 4 500 000 (J)	[1]	
		= 4.5 (M J)	[1]	7
			Total	**70**

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Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2013–2014

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

GSD32

FRIDAY 15 NOVEMBER 2013, AFTERNOON

TIME

1 hour.

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 nine** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 70.
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 **2** and **7**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total Marks	

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Examiner Only	
Marks	Remark

1 **(a)** The symbol for Uranium-235 is

$$^{235}_{92}U$$

(i) How many protons does a nucleus of Uranium-235 contain?

_____ [1]

(ii) What name is given to this number of protons?

_____ [1]

(iii) How many neutrons does a nucleus of Uranium-235 contain?

_____ [1]

(iv) What name is given to the total number of protons and neutrons in the nucleus of Uranium-235?

_____ [1]

(b) Radioactive materials emit radiations which have particular natures and properties.

Complete the table below, linking the radiations to their natures and properties. One arrow has been inserted for you.

Use only **five** straight arrows.

Nature of radiation	Name of radiation	Property of radiation
Helium nuclei	• alpha •	Is absorbed by a few cm of air
High frequency electromagnetic radiation	• beta •	Can penetrate 3 cm of lead
High speed electrons	• gamma •	Can penetrate a thick piece of card, but not 3 cm of lead

[5]

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(c) Nuclear reactors rely on the fission of Uranium-235.

Examiner Only	
Marks	Remark

(i) What is the first stage of the nuclear fission process?

_____

_____

_____ [2]

(ii) What happens during the nuclear fission process?

_____

_____

_____ [2]

(iii) What is the name of the particle which sustains the chain reaction?

_____ [1]

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2 The modern theory for the structure of the atom is quite different from the earlier theory which it replaced.

Write a brief account of both theories.

Your discussion should include:

- the name of each theory; and
- a description of how the particles are arranged in each theory.

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

[6]

Examiner Only	
Marks	Remark

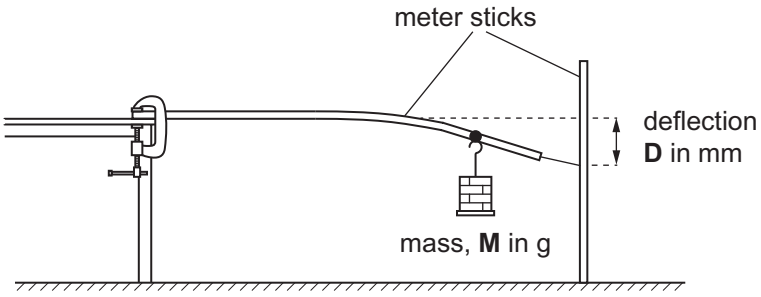
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(Questions continue overleaf)

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Examiner Only	
Marks	Remark

3 Gillian is investigating “bending beams”. She uses the apparatus shown below.



According to theory, the mathematical relationship between the deflection (**D**) of the beam and the mass (**M**) hung from the beam is given by

$$\mathbf{D = k\,M} \qquad \textbf{Equation 3.1}$$

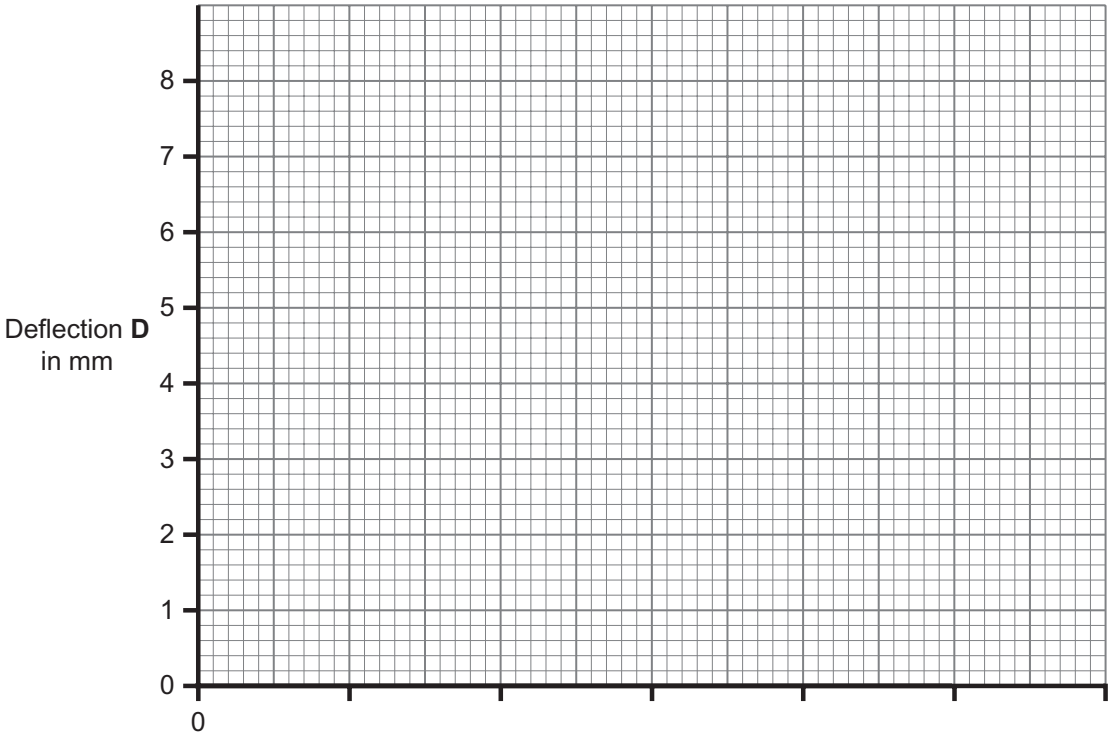
The results Gillian collected are as follows.

Mass M in g	Deflection D in mm
50	1.5
100	3.0
150	4.5
200	6.0
250	7.5

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Examiner Only	
Marks	Remark

(a) Choose a suitable horizontal scale and label the horizontal axis. Plot a graph of **D** on the vertical axis versus **M** on the horizontal axis on the grid below.



[4]

(b) Draw a line of best fit. [1]

(c) **(i)** Use your graph to determine the constant k, in **Equation 3.1**.

Remember to include the unit for k.

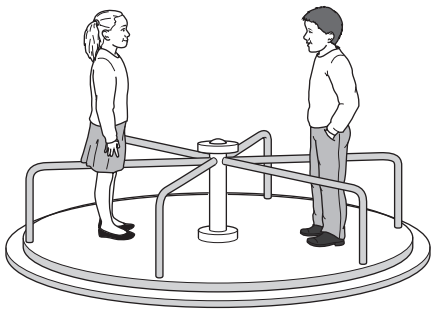
k = _____: Unit = _____ [4]

(ii) Use your graph to find the deflection for a mass of 125 g.

Deflection = _____ mm [1]

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4 The diagram shows a playground roundabout.



Holly and Brian stand the same distance from the centre of a revolving roundabout.

Brian has a mass of 35 kg and Holly a mass of 20 kg.

(a) (i) How does the centripetal force acting on Brian compare with that acting on Holly?

Place a tick (✓) in the correct box.

The centripetal force acting on Brian is:

greater than that acting on Holly. ☐

equal to that acting on Holly. ☐

less than that acting on Holly. ☐ [1]

Examiner Only

Marks	Remark

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Brian now stands at the outer edge of the roundabout where his radius is larger. However, his speed is the same as it was in part **(i)**.

(ii) How does the centripetal force acting on Brian now compare with that in part **(i)**?

Place a tick (✓) in the correct box.

The centripetal force acting on Brian is:

greater than in part **(i)**. ☐

equal to that in part **(i)**. ☐

less than that in part **(i)**. ☐ [1]

(b) At a given instant Holly is travelling with a velocity of 0.75 m/s. Calculate her momentum in kg m/s. Remember Holly's mass is 20 kg.

You are advised to show your working out.

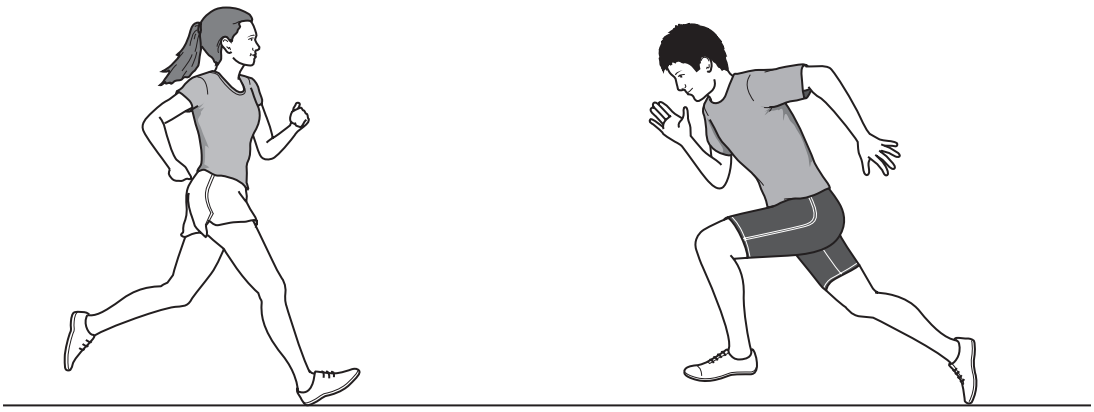
Momentum = _____ kg m/s [3]

Examiner Only	
Marks	Remark

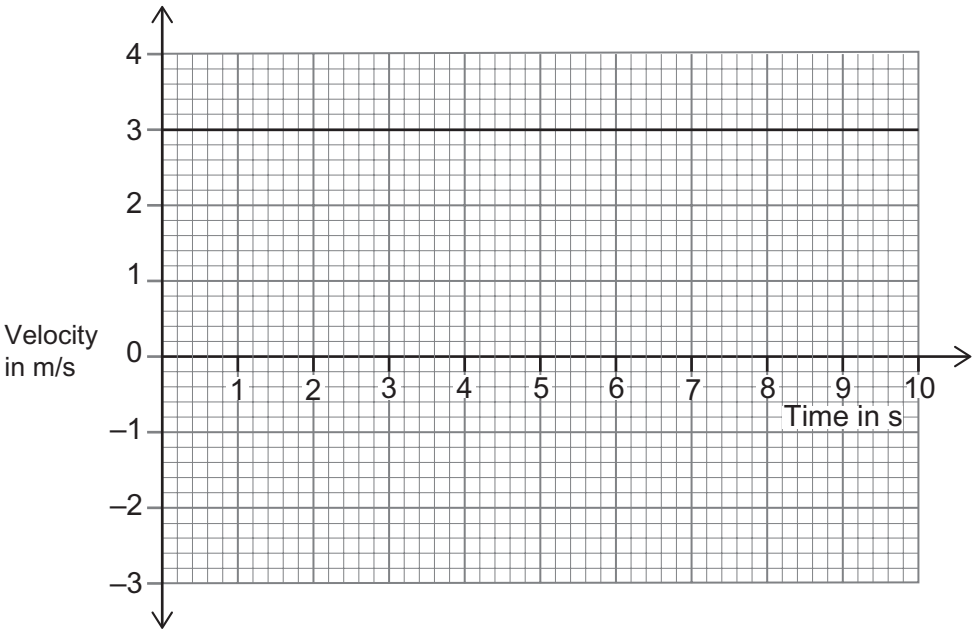
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Examiner Only	
Marks	Remark

5 Mary and Neil run towards each other. Mary runs with a constant speed of 3 m/s and Neil with a constant speed of 2 m/s.



Mary's velocity–time graph is shown below.



(a) (i) Draw Neil's velocity–time graph on the axes above. [2]

The runners pass each other when Mary has run a distance of 21 m.

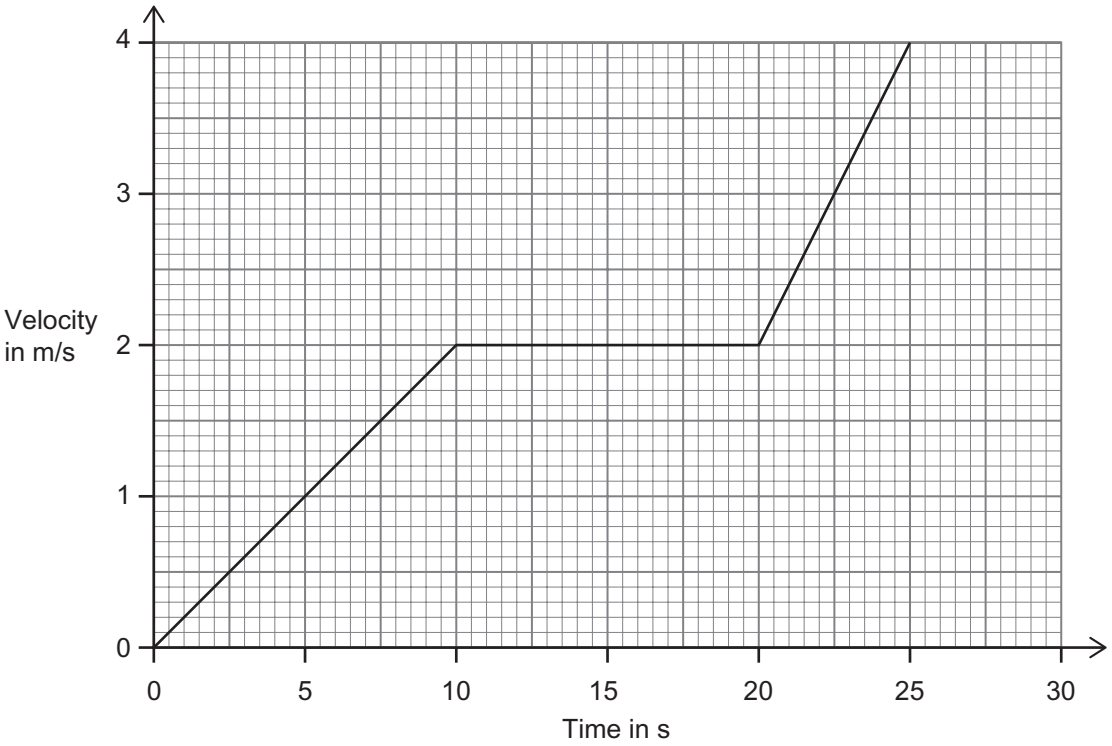
(ii) At what time do they pass?

You are advised to show your working out.

Time = _____ s [3]

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On another occasion Mary's velocity–time graph is as shown below.



(b) Use the graph to find Mary's **maximum** acceleration.

You are advised to show your working out.

Maximum acceleration = _____ m/s^2 [4]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

6 Nuclear fusion is an energy source.

(a) Where, in our solar system, does fusion occur naturally?

_____ [1]

This part of the question is about a nuclear disintegration involving alpha decay.

(b) Uranium undergoes alpha (α) decay to Thorium.

Complete a balanced nuclear equation for this reaction.

$$^{238}_{92}\mathbf{U} \xrightarrow{\text{Alpha decay}} \square\ \mathbf{Th} + \square\ \alpha$$

[4]

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7 Write an account on background radiation. Your account should make reference to the following:

- what background radiation is,
- two sources of background radiation,
- how it is measured in the laboratory,
- how it is taken into account when measuring the count rate of another radioactive source.

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

[6]

Examiner Only

Marks	Remark

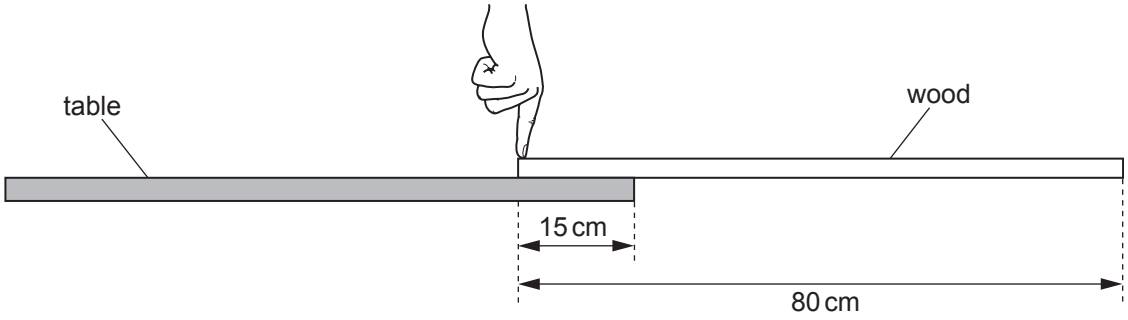
Examiner Only	
Marks	Remark

8 **(i)** State the Principle of Moments.

_____

_____ [2]

Donal places a uniform piece of wood of mass 120 g on a table and keeps it from falling off the table by pressing down as shown.



(ii) Draw an arrow, acting from the correct point, to show the direction of the weight of the piece of wood. Label this arrow with the weight of the wood, in N. [2]

(iii) Calculate the moment of the weight of the wood, in Ncm, about the right edge of the table.

You are advised to show your working out.

Moment = _____ Ncm [3]

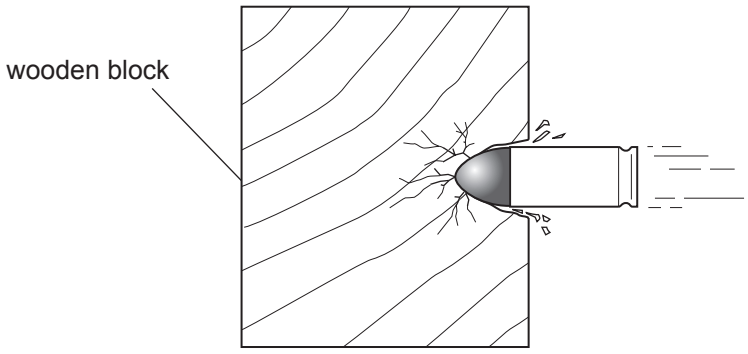
(iv) Calculate the downward force Donal exerts.

You are advised to show your working out.

Force = _____ N [2]

Examiner Only	
Marks	Remark

9 A bullet is fired into a piece of wood in a forensic testing laboratory.



The average resistive force acting on the bullet as it becomes embedded in the wood is 1960 N. The bullet stops a distance of 15.0 cm into the wood.

(i) Show that the work done in stopping the bullet is 294 J.

You are advised to show your working out.

[2]

(ii) The bullet has a mass of 0.03 kg. Calculate the entry velocity of the bullet. Ignore energy losses.

You are advised to show your working out.

Velocity = _____ m/s [4]

THIS IS THE END OF THE QUESTION PAPER

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Rewarding Learning

General Certificate of Secondary Education
2013–2014

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

FRIDAY 15 NOVEMBER 2013, AFTERNOON

MARK SCHEME

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Subject-specific Instructions

In numerical problems, the marks for the intermediate steps shown in the mark scheme are for the benefit of candidates who do not obtain the final correct answer. A correct answer and unit, if obtained from a valid starting-point, gets full credit, even if all the intermediate steps are not shown. It is not necessary to quote correct units for intermediate numerical quantities.

Note that this "correct answer" rule does not apply for formal proofs and derivations, which must be valid in all stages to obtain full credit.

Do not reward wrong physics. No credit is given for consistent substitution of numerical data, or subsequent arithmetic, **in a physically incorrect equation**. However, answers to subsequent stages of questions that are consistent with an earlier incorrect numerical answer, and are based on physically correct equation, must gain full credit. Designate this by writing **ECF** (Error Carried Forward) by your text marks.

The normal penalty for an arithmetical and/or unit error is to lose the mark(s) for the answer/unit line. Substitution errors lose both the substitution and answer marks, but 10^n errors (e.g. writing 550 nm as 550×10^{-6} m) count only as arithmetical slips and lose the answer mark.

		AVAILABLE MARKS
1	**(a)** **(i)** 92 [1] [1]	
	(ii) Atomic number [1] [1]	
	(iii) 143 [1] [1]	
	(iv) Mass number [1] [1]	
	(b) 5 correct arrows, award [1] each [5]	
	(c) **(i)** (slow) neutron [1] is absorbed [1] [2]	
	(ii) • Fragments are formed or U235 splits or nucleus splits • (2/3)(fast) neutrons are emitted (per fission) • Energy is released/produced/given out Any two points for [1] each [2]	
	(iii) Neutron [1] [1]	14

2 "Plum-pudding" [1] and Rutherford-Bohr [1]
Positive charge spread throughout atom [1] and electrons are plums scattered or dotted [1]
Positive charge in nucleus [1] and electrons orbit nucleus [1]

Response	**Mark**
Candidates explain **5 or 6** the above points. They use good spelling, punctuation and grammar. The form and style are of a high standard and specialist terms are used appropriately.	[5]–[6]
Candidates explain **3 or 4** of the above points. They use satisfactory spelling, punctuation and grammar. The form and style are of a satisfactory standard and they have made use of some specialist terms.	[3]–[4]
Candidates explain **1 or 2** of the of the above points. They use limited spelling, punctuation and grammar. The form and style is of a limited standard and they have made no use of specialist terms.	[1]–[2]
Response not worthy of credit.	[0]

6

3 **(a)** Horizontal axis labelled – with unit [1], scale more than half [1]
Plotting points: 3 or 4 correct answers [1]
All correct [2] [4]

(b) Best fit line [1] [1]

(c) **(i)** $k = \text{grad or } k = \frac{\Delta y}{\Delta x}$ [1]
$= 6/200$ e.g. [1] or any other values from graph
$= 0.03$ [1] mm/g [1] [4]

(ii) 3.7 ± 0.2 [1] [1]

10

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		AVAILABLE MARKS
4	**(a)** **(i)** Greater [1] [1]	
	(ii) Less [1] [1]	
	(b) p = mv [1] = 20 × 0.75 [1] = 15 [1] [3]	5
5	**(a)** **(i)** Horizontal line at 2 m/s [1] Underneath time axis [1] [2]	
	(ii) dist = area under v/t graph [1] 21 = 3 × t [1] t = 7 (s) [1] [3]	
	(b) a = (max) grad [1] or a = $\frac{(v-u)}{t}$ or $\frac{\Delta v}{t}$ = 2/5 [2] = 0.4 (m/s^2) [1] [4]	9
6	**(a)** Sun [1]	
	(b) $^{234}_{90}\mathbf{U} \longrightarrow {}^{}_{}\mathbf{Th} + {}^{4}_{2}\alpha$ [4]	5

7 Radiation (count) when all other radioactive sources are removed [1]
buildings, ground, radon, space any two [2]
use of ratemeter or GM tube/GM counter [1]
subtract background (count rate) [1]

Response	**Mark**
Candidates explain **5** the above points. They use good spelling, punctuation and grammar. The form and style are of a high standard and specialist terms are used appropriately.	[5]–[6]
Candidates explain **3 or 4** of the above points. They use satisfactory spelling, punctuation and grammar. The form and style are of a satisfactory standard and they have made use of some specialist terms.	[3]–[4]
Candidates explain **1 or 2** of the of the above points. They use limited spelling, punctuation and grammar. The form and style is of a limited standard and they have made no use of specialist terms.	[1]–[2]
Response not worthy of credit.	[0]

6

				AVAILABLE MARKS
8	**(i)**	CM = ACM [1] or in words for a body in equilibrium [1] } dependent marking	[2]	
	(ii)	Downward arrow at CoG [1] 1.2 (N) [1] at a downward arrow acting through beam	[2]	
	(iii)	$M = F \times d$ [1] $= 1.2 \times 25$ [1] (allow e.c.f. for F) = 30 (Ncm) [1]	[3]	
	(iv)	$F \times 15 = 30$ [1] (allow e.c.f. from **(iii)**) F = 2.0 (N) [1]	[2]	9
9	**(i)**	$W = F \times d$ [1] $= 1960 \times 0.15$ [1] = (294 J)	[2]	
	(ii)	$Ke = \frac{1}{2} m v^2$ [1] 294 [1] $= \frac{1}{2} \times 0.03 v^2$ [1] v = 140 [1] (m/s)	[4]	6
		or $v = \sqrt{\frac{2ke}{m}}$ [1] $v = \frac{2 \times 294}{0.03}$ [2] $v = 140$ [1]		
			Total	**70**

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Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2012–2013

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

GSD32

THURSDAY 23 MAY 2013, MORNING

TIME

1 hour.

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 nine** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 70.
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 **1(a)**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total Marks	

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Examiner Only	
Marks	Remark

1 **(a)** Describe an experiment you would carry out to measure the power output of an electric motor.

In your description you should include:

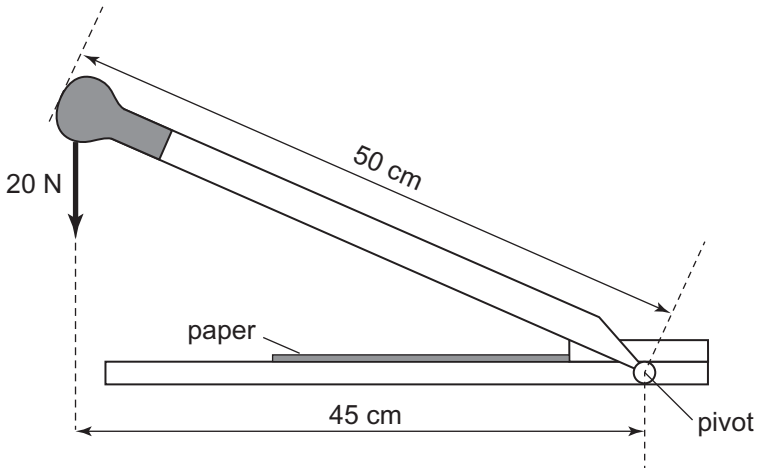
- the apparatus used,
- the measurements you take,
- the formula you would use to find the power.

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

[6]

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(b) A guillotine is used to cut sheets of paper. A constant downward force of 20 N is exerted on the handle.



Calculate the moment of the 20 N force about the pivot.

Remember to include the unit in your answer.

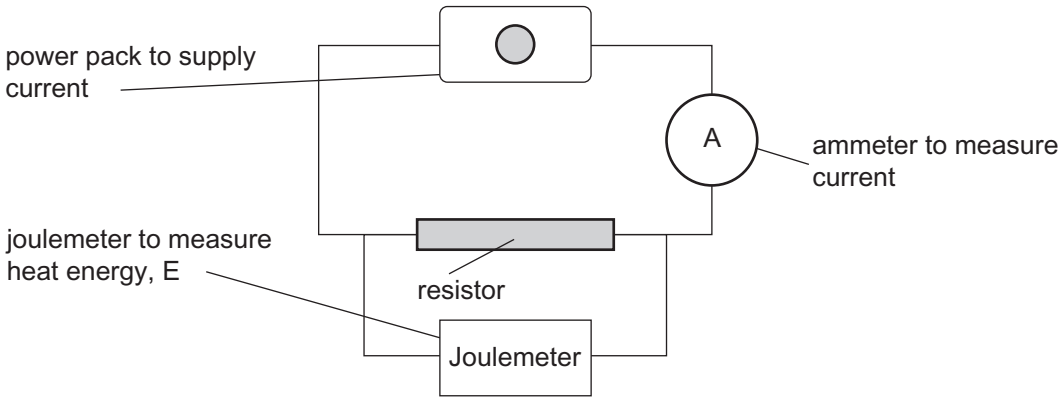
You are advised to show your working out.

Moment = _____ [4]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

2 When a battery passes a current through a resistor then heat energy is produced in the resistor.



David suspects that the heat energy, E, produced depends on the square of the current, I. This relationship could be written as:

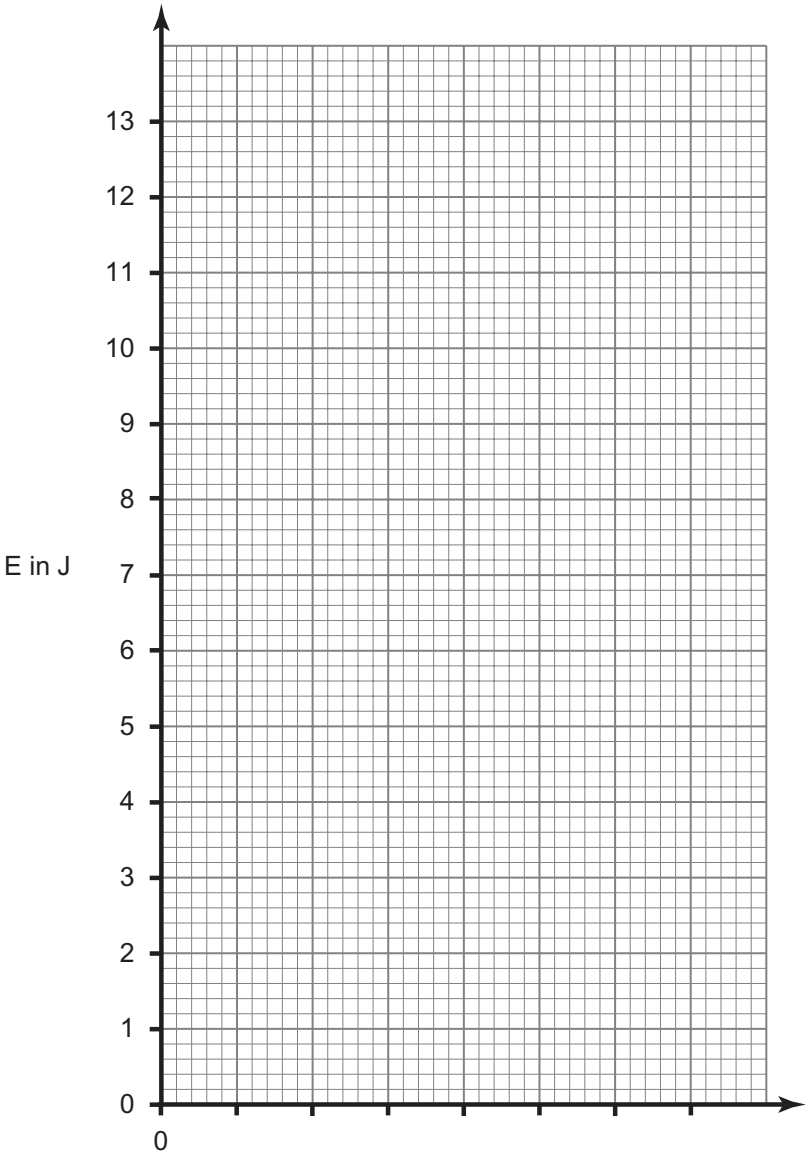
$$E = k\,I^2$$

He obtains a series of readings of current and energy and these are shown in the table.

I in A	0.0	0.5	1.0	1.5	2.0	2.5
I^2 in A^2					4.0	
E in J	0.0	0.5	2.0	4.5	8.0	12.5

(a) Complete the table by entering the values of I^2, correct to 1 decimal place. One entry has been recorded for you. [2]

(b) Choose a suitable scale and label the *x*-axis. Plot a graph of energy, E, on the vertical axis versus I^2 on the horizontal axis. [4]



(c) Draw the line of best fit. [1]

(d) Use your graph to find the constant k.

Remember to include the unit for k.

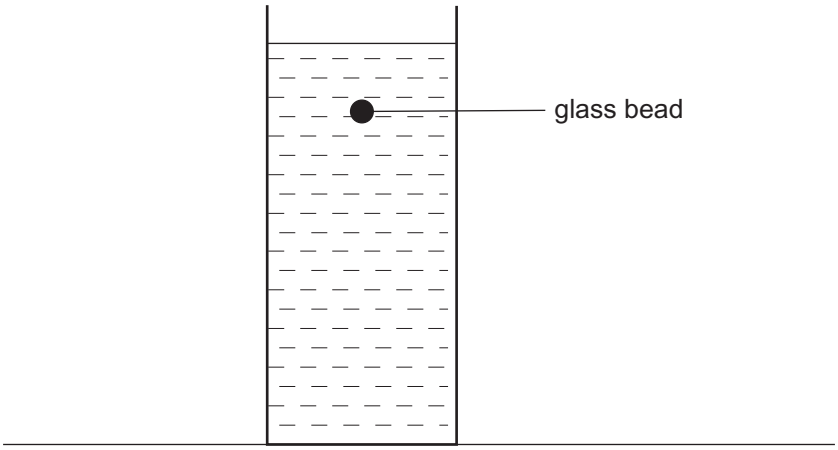
You are advised to show your working out.

k = _____

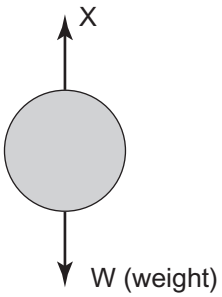
Unit = _____ [4]

Examiner Only	
Marks	Remark

3 Kyle is interested in how quickly a glass bead falls through water.



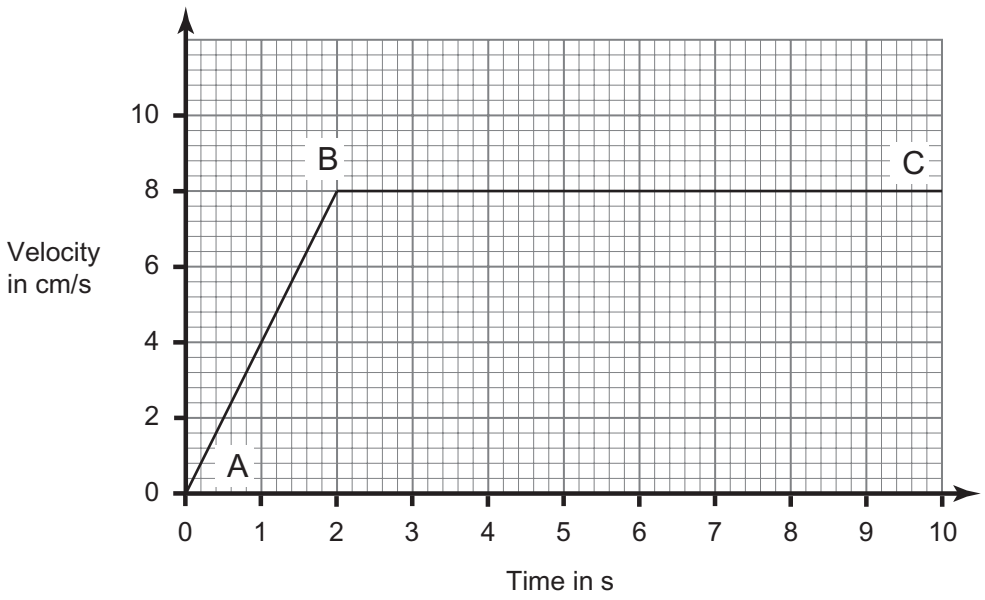
(a) Two forces, W and X, act on the bead as it falls. W is the weight.



(i) What is the name of the other force X?

Force X is called _____ [1]

Kyle plots a velocity–time graph of the bead's motion.



Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

(ii) How do the sizes of these forces compare during the regions AB and BC? Give your answer by ticking (✓) the correct box in each case.

During AB,

W is less than X. ☐

The two forces are equal. ☐

X is less than W. ☐

During BC,

W is less than X. ☐

The two forces are equal. ☐

X is less than W. ☐ [2]

The bead hits the bottom of the cylinder after 10 s.

(b) (i) Use the graph on page 6 to calculate the depth of water in the container.

You are advised to show your working out.

Depth of water = _____ cm [3]

(ii) The bead has a mass of 0.2 g. Calculate its maximum momentum in g cm/s.

You are advised to show your working out.

Maximum momentum = _____ g cm/s [3]

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Examiner Only	
Marks	Remark

4 **(a)** 1 g of water has a volume of 1 cm^3.

There are 1 000 000 cm^3 in 1 m^3 of water.

(i) What is the mass, in g, of 1 m^3 of water?

Mass = _____ g [1]

(ii) What is the mass, in kg, of 1 m^3 of water?

Mass = _____ kg [1]

(iii) What is the density of water in kg/m^3?

Density = _____ kg/m^3 [1]

(b) A balloon is made from a material which has a mass of 150 kg. Its volume when filled with helium is 500 m^3.

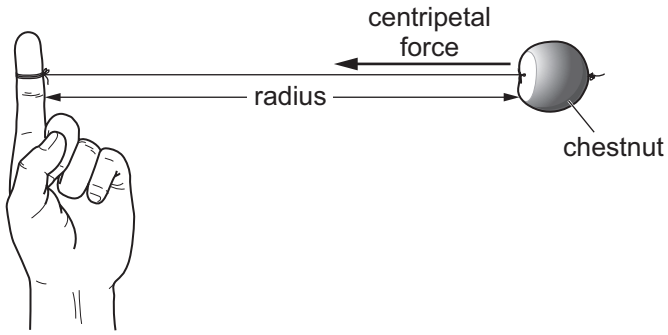
The density of helium is 0.18 kg/m^3.

Calculate the total mass of the helium-filled balloon.

You are advised to show your working out.

Total mass = _____ kg [4]

5



(a) A chestnut is whirled in a horizontal circle.

How is the centripetal force acting on the chestnut affected by the changes to the following physical quantities?

Complete the table by inserting a tick (✓) in the correct boxes.

Physical Quantity	Centripetal force		
	Decreases	**Increases**	**Unaffected**
Increasing Mass			
Decreasing Radius			
Increasing Speed			
Reversing the Direction of rotation			

[4]

(b) Explain, fully, how the centripetal force acting on the chestnut causes the chestnut to move in a curved path.

_____

_____

_____

_____

_____ [2]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

6 **(a)** Describe how the electrons are arranged:

(i) in the "Plum-Pudding" model of the atom.

_____

_____ [1]

(ii) in the Rutherford–Bohr model of the atom.

_____

_____ [1]

(b) Which of the following, if any, could change the rate of decay of a radioactive substance?

Tick (✓) the correct box.

Increase the temperature of the radioactive substance.	☐
Decrease the temperature of the radioactive substance.	☐
Immerse in water.	☐
The rate of decay cannot be changed.	☐

[1]

(c) To monitor a patient's thyroid gland, the patient is injected with 96 µg of radioactive iodine. The half-life of iodine is 8 days.

(i) Calculate the mass of iodine remaining after 32 days.

You are advised to show your working out.

Mass remaining = _____ µg [3]

(ii) What mass of iodine has decayed in 32 days?

Mass decayed = _____ µg [1]

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Examiner Only	
Marks	Remark

7 **(a)** The symbols for two of the isotopes of hydrogen are:

$$^{2}_{1}H \qquad ^{3}_{1}H$$

(i) What do both nuclear isotopes have in common?

_____ [1]

(ii) How do the two nuclear isotopes differ?

_____ [1]

(b) Complete the equation for the following fusion reaction.

$$^{2}_{1}H + ^{3}_{1}H \rightarrow \square\!\!\square He + ^{1}_{0}n$$

[2]

(c) State a technological difficulty associated with the production of electricity using the fusion process.

_____ [1]

Examiner Only	
Marks	Remark

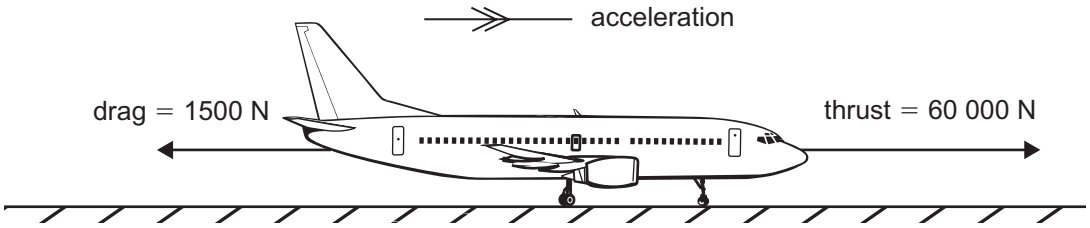
8 **(a)** A Boeing 737 accelerates **from rest** to a velocity of 50 m/s in 25 s, just before take-off.

Calculate its acceleration.

You are advised to show your working out.

Acceleration = _____ m/s^2 [3]

(b) Some of the forces acting on the Boeing 737 before take-off are shown in the diagram below.



Use your answer to part **(a)**, to find the mass of the Boeing 737.

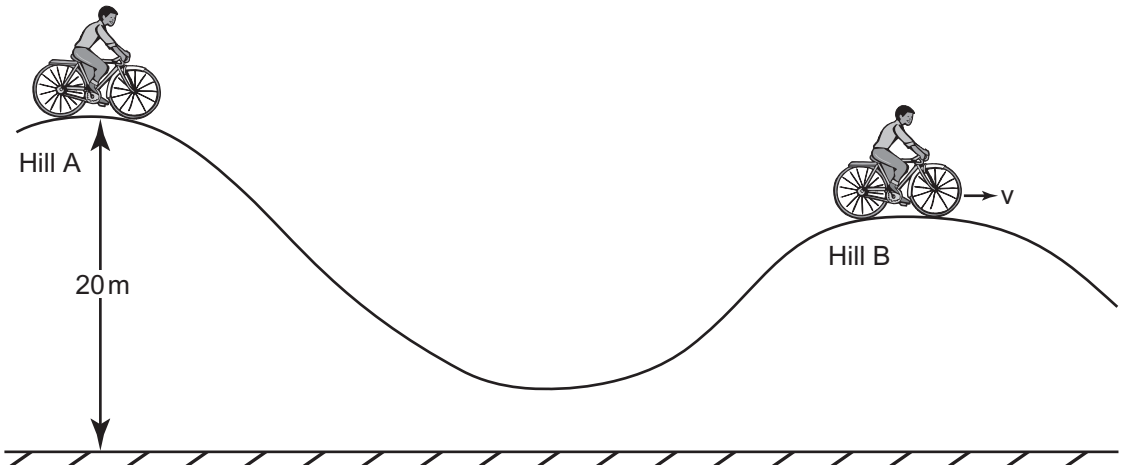
You are advised to show your working out.

Mass = _____ kg [4]

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Examiner Only	
Marks	Remark

9 Part of the journey of a cyclist is shown below.



(a) The total mass of the cyclist and his bicycle is 50 kg. The cyclist is initially at rest on hill A.

Calculate the potential energy of the cyclist at the top of hill A which is 20 m above sea level.

You are advised to show your working out.

Potential energy = _____ J [3]

(b) The potential energy of the cyclist at the top of hill B is 5100 J.

(i) Assuming that all of the loss of potential energy is converted into kinetic energy, use your answer to part **(a)** to calculate the velocity of the cyclist at the top of hill B.

You are advised to show your working out.

Velocity = _____ m/s [4]

(ii) In practice, not all of the loss in potential energy is converted into kinetic energy.
Explain why this is so.

_____ [1]

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Rewarding Learning

General Certificate of Secondary Education
2012–2013

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

THURSDAY 23 MAY 2013, MORNING

MARK SCHEME

STEMUP.CO.UK

Subject-specific Instructions

In numerical problems, the marks for the intermediate steps shown in the mark scheme are for the benefit of candidates who do not obtain the final correct answer. A correct answer and unit, if obtained from a valid starting-point, gets full credit, even if all the intermediate steps are not shown. It is not necessary to quote correct units for intermediate numerical quantities.

Note that this “correct answer” rule does not apply for formal proofs and derivations, which must be valid in all stages to obtain full credit.

Do not reward wrong physics. No credit is given for consistent substitution of numerical data, or subsequent arithmetic, **in a physically incorrect equation**. However, answers to subsequent stages of questions that are consistent with an earlier incorrect numerical answer, and are based on physically correct equation, must gain full credit. Designate this by writing **ECF** (Error Carried Forward) by your text marks.

The normal penalty for an arithmetical and/or unit error is to lose the mark(s) for the answer/unit line. Substitution errors lose both the substitution and answer marks, but 10^{n} errors (e.g. writing 550 nm as 550×10^{-6} m) count only as arithmetical slips and lose the answer mark.

AVAILABLE MARKS

1 **(a)**
- Watch or timer (Stop) clock/tape (measure) or ruler or metre stick/ scales or newton meter or balance (1 each to max. of 2)
- Measure: height raised, time taken, weight to be lifted (1 each to a max. of 2)
- Power $= \frac{\text{work}}{\text{time}}$

Response	Mark
Candidates mention at least **5** of the above points. They use good spelling, punctuation and grammar. The form and style are of a high standard and specialist terms are used appropriately.	[5–6]
Candidates explain at least **3** of the above points. They use satisfactory spelling, punctuation and grammar. The form and style are of a satisfactory standard and they have made use of some specialist terms.	[3–4]
Candidates explain **1** of the above points. They use limited spelling, punctuation and grammar. The form and style is of a limited standard and they have made no use of specialist terms.	[1–2]
Response not worthy of credit.	[0]

[6]

(b) M = force × distance [1]
M = 20 × 45 [1] or M = 20 × 0.45 [1]
= 900 [1] = 9 [1]
= N cm [1] = Nm [1] [4] 10

2 **(a)** 5 entries – [$\frac{1}{2}$] each round down:
0.0, 0.3, 1.0, 2.3, 6.3 [2]

(b) Choice of scale [1] and label [I^2 in A^2] [1]
Points plotted – 5 or 6 correct [2], 4 correct [1] ± 1 small square for points [4]

(c) Best fit line – curve can get ecf [1]

(d) k = grad [1] or equivalent
= 8/4 (or other) [1] or picks pair of co-ord's from table or graph
= 2 [1] Tolerance ±0.1
Unit: J/A^2 [1] [4] 11

3 **(a)** **(i)** Friction/drag. Reject: resistance. Accept: water friction [1]

(ii) During AB – X less than W [1]
During BC – two forces are equal [1] [2]

(b) **(i)** Depth = area (under line) [1] or A = $\frac{1}{2}$ (a + b) h [1]
= (2 × 8)/2 + (8 × 8) [1] = $\frac{1}{2}$ (8 + 10) 8 [1]
= 72 (cm) [1] [3]

(ii) Momentum = m × v [1]
= 0.2 × 8 [1]
= 1.6 (g cm/s) [1] No ecf for v [3]

AVAILABLE MARKS: 9

4 **(a)** **(i)** 1 000 000 (g) [1]

(ii) 1 000 (kg) ecf from (i) [1]

(iii) 1 000 (kg/m^3) ecf from (ii) [1]

(b) M = D × V [1] or equivalent formula
= 0.18 × 500 [1]
= 90 (kg) [1]
Total mass = 240 (kg) [1] [4]

AVAILABLE MARKS: 7

5 **(a)**

Physical Quantity	Centripetal force		
	Decreases	Increases	Unaffected
Mass		✓	
Radius		✓	
Speed		✓	
Direction of rotation			✓

[4]

(b) direction changes [1]
because there is an acceleration or velocity changes [1]
Force is perpendicular to velocity
Mark as independent points
} Any 2 points from 3 for full marks
[2]

AVAILABLE MARKS: 6

					AVAILABLE MARKS
6	**(a)**	**(i)**	Electrons are scattered Accept: Currants in a bun or Diagram Spread throughout the atom.	[1]	
		(ii)	(Electrons) orbit/in circles/shells. Reject: "round" on its own	[1]	
	(b)		Rate of decay cannot be changed	[1]	
	(c)	**(i)**	32 days = 4 half-lives [1] $\frac{1}{16}$ remaining [1] 6 (μg) [1] 96, 48 – 1st mark. 24, 12 – 2nd mark. 6 – 3rd mark	[3]	
		(ii)	90 (μg) [1] ecf from **(c)(i)**	[1]	7
7	**(a)**	**(i)**	(Same) atomic no. Or (same) no. of protons or both have 1 proton	[1]	
		(ii)	(Different) mass no. Or (different) no. of neutrons	[1]	
	(b)		A = 4 [1] Z = 2 [1]	[2]	
	(c)		(Very) high temperatures Or very high number densities Or extracting energy, keeping temperature high Or containment problems Any one [1] Accept: sustaining the reaction for long enough	[1]	5
8	**(a)**		a = (v − u)/t [1] or $a = \frac{\Delta v}{\Delta t}$ = (50 − 0)/25 [1] = 2 (m/s^2) [1]	[3]	
	(b)		(R)F = m × a [1] [1] 58 500 = 2 × m [1] allow ecf from **(a)** m = 29 250 (kg) [1]	[4]	7

			AVAILABLE MARKS
9	**(a)** PE = mgh [1] = 50 × 10 × 20 [1] = 10 000 (J) [1]	[3]	
	(b) **(i)** K.E. = $\frac{1}{2}$ m v^2 [1] 4900 [1] = $\frac{1}{2}$ × 50 × v^2 [1] v = 14 (m/s) [1] Allow ecf provided answer to part **(a)** > 5100	[4]	
	OR $v = \sqrt{\frac{2 \times KE}{m}}$ [1] $= \sqrt{\frac{2 \times 4900\,[1]}{50 \quad [1]}} = \sqrt{\frac{4900}{25}} = \sqrt{\frac{4900}{\frac{1}{2}x50}}$ v = 14 (m/s) [1]		
	(ii) Lost heat/sound or resistive forces/friction	[1]	8
	Total		**70**

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Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2012–2013

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

GSD32

WEDNESDAY 27 FEBRUARY 2013, MORNING

TIME

1 hour.

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 nine** questions.

INFORMATION FOR CANDIDATES

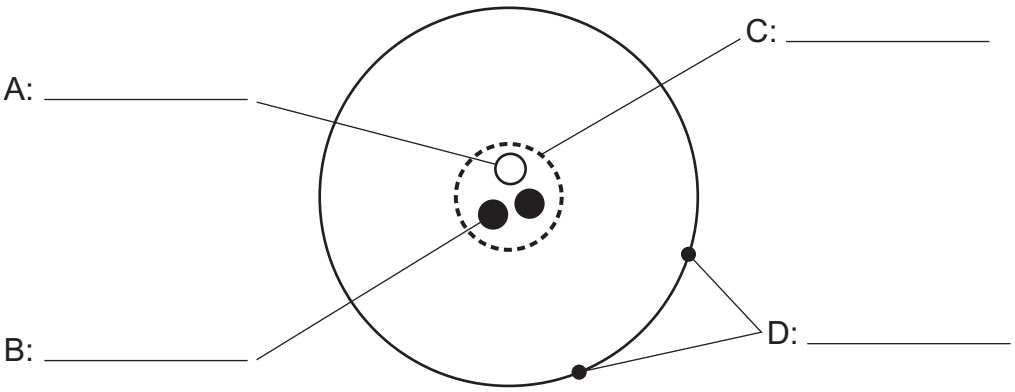
The total mark for this paper is 70.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Question **2**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total Marks	

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Examiner Only	
Marks	Remark

1 **(a)** The diagram illustrates a neutral atom.



(i) Complete the diagram by writing in the spaces above, the four missing labels. [4]

(ii) Explain why atoms are neutral.

_____

_____ [1]

(iii) Give two differences between the atom drawn above and an alpha particle.

1. _____

2. _____ [2]

(b) Nuclear reactors are used in power stations to release energy through nuclear fission.



© Dr Jeremy Burgess / Science Photo Library

(i) What is meant by nuclear fission?

_____

_____

_____ [3]

(ii) Name two fissionable substances commonly used in nuclear reactors.

1. _____

2. _____ [2]

Examiner Only

Marks	Remark

2 Describe, in detail, an experiment to verify the Principle of Moments.

In your description you should include:

- the apparatus used;
- how the apparatus is used to test the Principle of Moments; and
- the formula you would use to test the Principle of Moments.

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

[6]

Examiner Only	
Marks	Remark

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(Questions continue overleaf)

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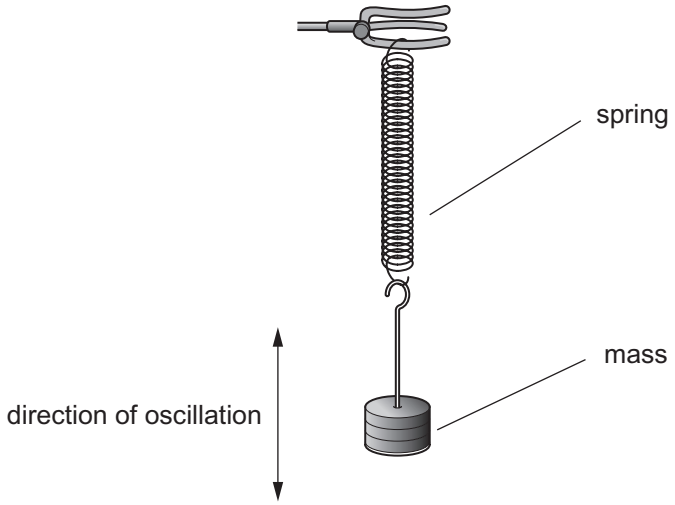
Examiner Only	
Marks	Remark

3 A mass hangs on the end of a spring. When the mass is pulled down and released then it will oscillate up and down.

When the spring carries a mass (m), the time taken (T) for one complete up and down movement is given by the relationship:

$$\mathbf{T^2 = K\,m} \qquad \textbf{Equation 3.1}$$

where **K** is a constant.



To test the relationship, the following experimental results were recorded.

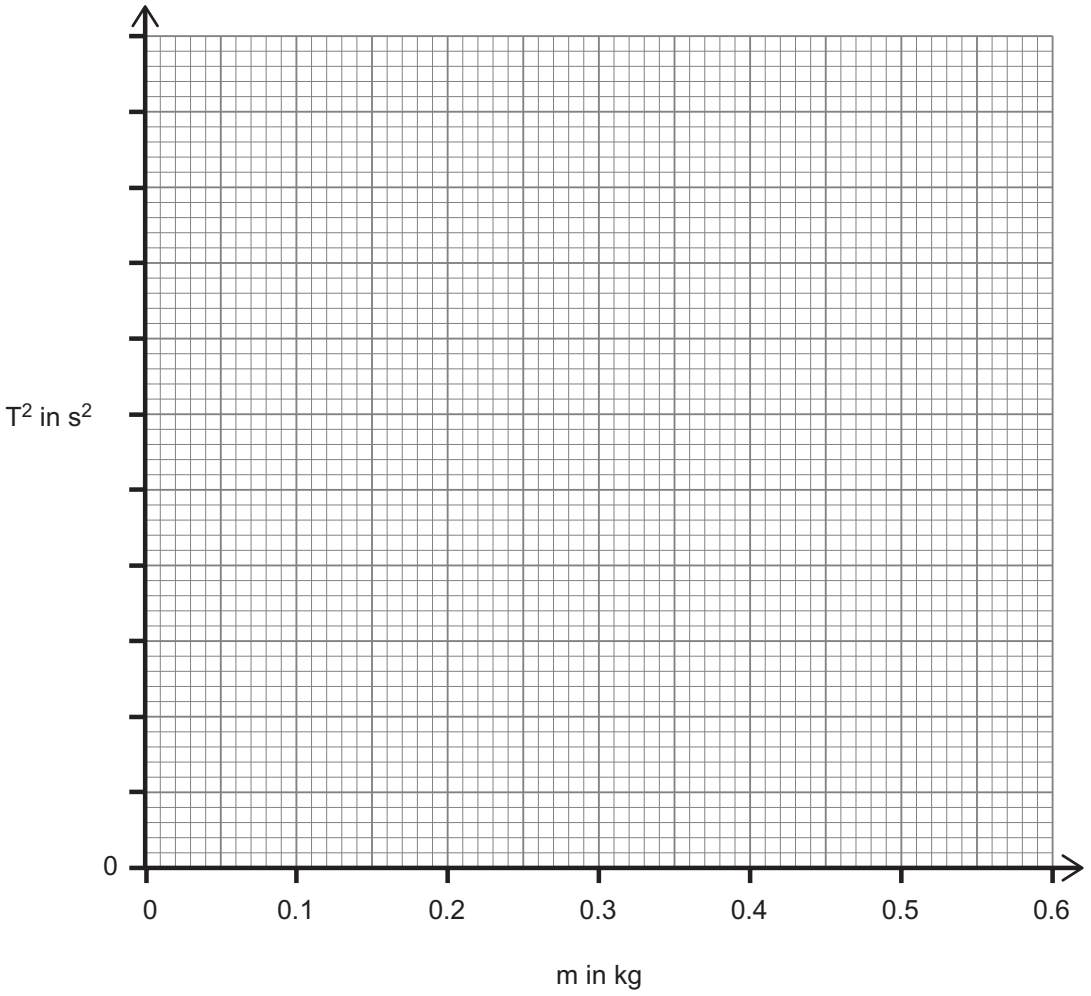
m in kg	0	0.1	0.2	0.3	0.4	0.5
T in s	0	0.63	0.90	1.10	1.26	1.41
T^2 in s^2	0			1.2		

(i) Complete the table by entering the values for T^2, to 1 decimal place.

One has been done for you. [2]

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(ii) Choose a suitable scale for the vertical axis and plot a graph of T^2 on the vertical axis versus m on the horizontal axis. [3]



(iii) Draw the best fit line. [1]

(iv) Does your graph support the theory described by **Equation 3.1**?

Explain your answer.

_____

_____

_____ [2]

(v) Find the value of K from the graph.

You are advised to show your working out.

K = _____ s^2/kg [2]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

4 **(i)** Governments continue to invest large sums of money to solve the technological difficulties associated with nuclear fusion.

Give two reasons for this investment.

1. _____

2. _____ [2]

(ii) Complete the fusion equation below.

$$\square H + \square H \longrightarrow {}^{4}_{2}He + \square n$$

[6]

Examiner Only	
Marks	Remark

5 **(a)** **(i)** Name the three types of radiation which may be emitted from radioactive nuclei.

1. _____ 2. _____ 3. _____ [3]

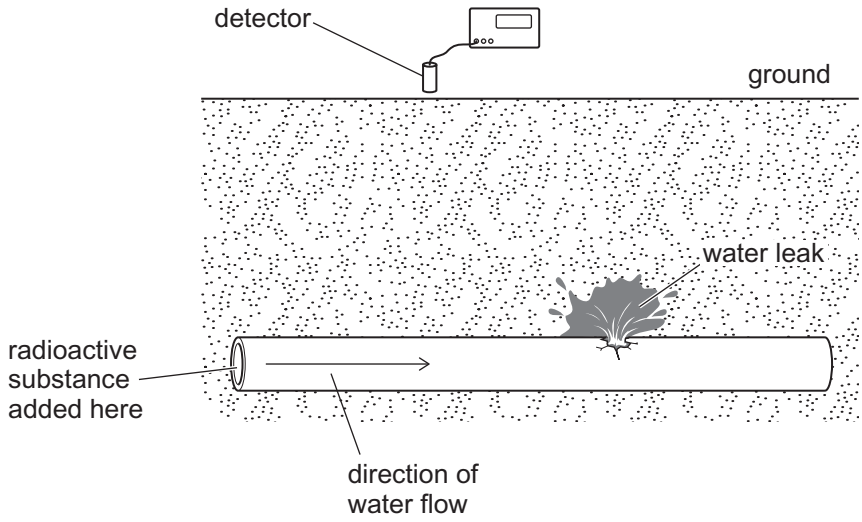
(ii) One of these radiations is not a particle. What is its nature?

_____ [1]

(iii) Why does a radioactive nucleus decay?

_____ [1]

(b) Engineers want to locate a leak in an underground water pipe. A radioactive substance is added to the water in the pipe and a detector is moved over the ground as shown.



(i) Which of the three types of radiation **must** be emitted by the radioactive substance?

_____ radiation [1]

(ii) Give a reason for your choice in **(b)(i)**.

_____ [1]

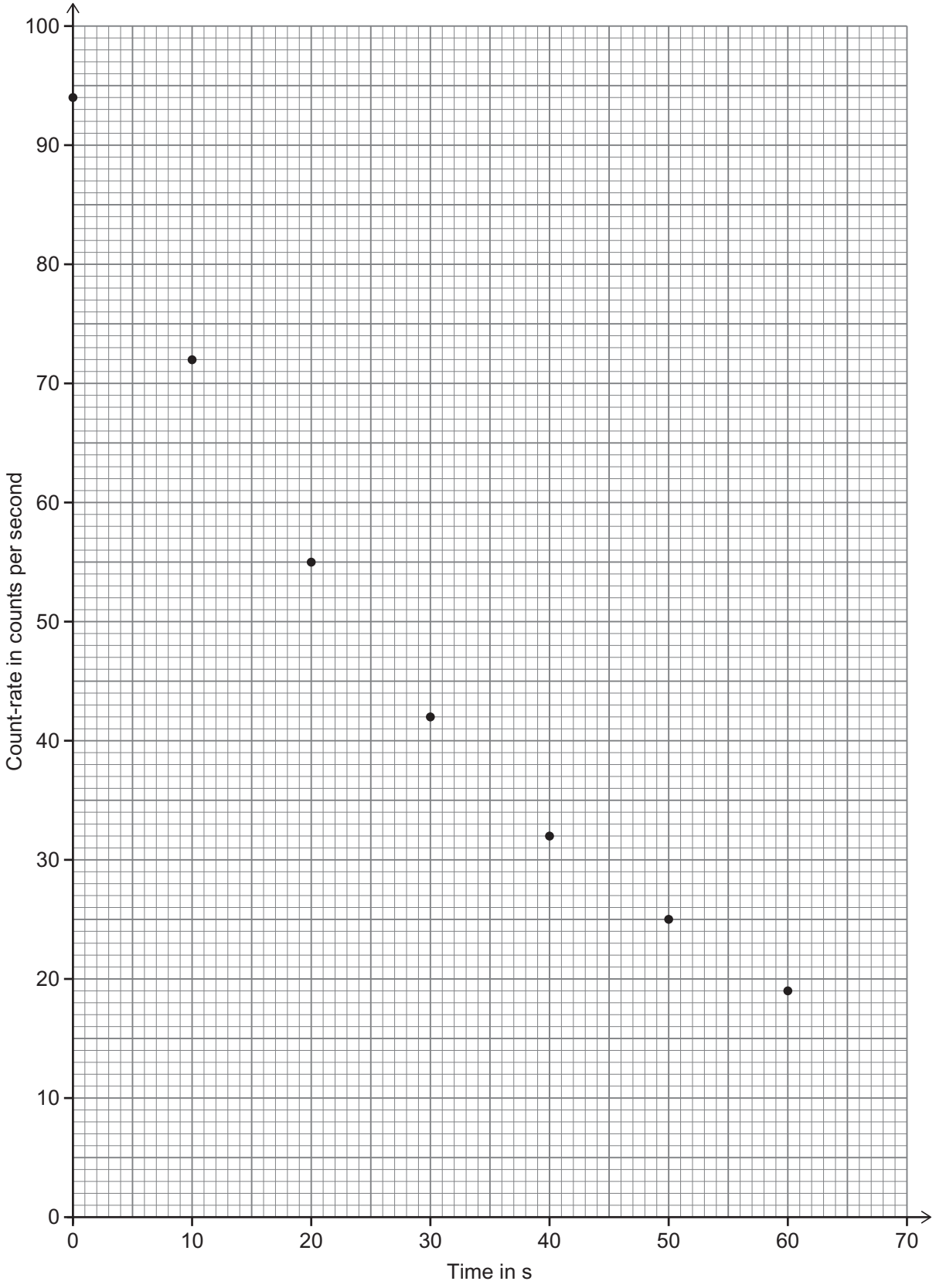
(iii) How will the engineers know when they have located the leak?

_____ [1]

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6 The count-rate from a radioactive material was measured using a GM tube and a counter.

A graph of the results obtained is shown below.



Examiner Only	
Marks	Remark

(i) Draw a curve of best fit. [1]

(ii) Use the graph to find the half-life of the radioactive material.

You are advised to show your working out.

Half-life = _____ s [3]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

7 Christopher rows a boat at a steady speed of 3 m/s. He stops rowing and the boat comes to rest.



(i) Name the force in the water that causes the boat to slow down.

Name of force is _____ [1]

(ii) The deceleration of the boat is 0.25 m/s^2. Calculate the time for the boat to come to rest.

You are advised to show your working out.

Time = _____ s [3]

(iii) Calculate the size of the force which causes the deceleration of 0.25 m/s^2 if the total mass of Christopher and the boat is 120 kg.

You are advised to show your working out.

Force = _____ N [3]

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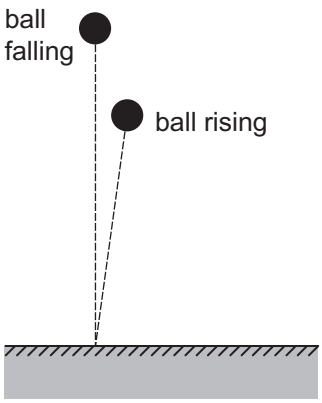
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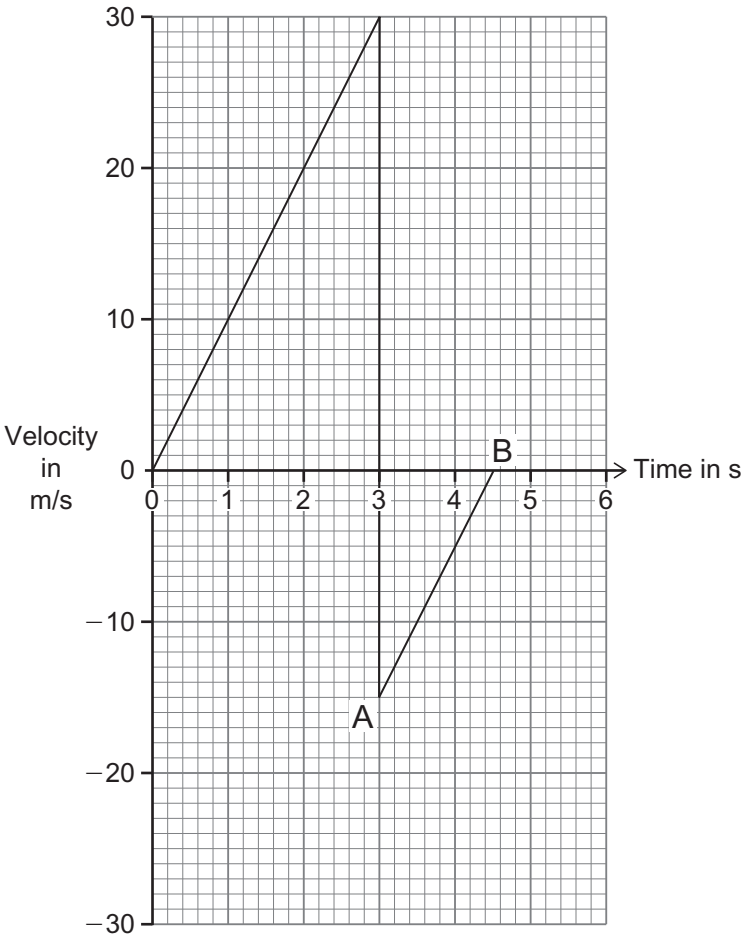
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Examiner Only	
Marks	Remark

8 A sponge ball is allowed to drop from rest and hits the ground after 3.0 seconds. It rebounds to a new height after a further 1.5 seconds.

The velocity–time graph of the motion is shown.





The part of the graph AB represents the ball rebounding.

(i) Why is this part of the graph drawn below the time axis?

_____ [1]

(ii) Use the graph to find the height of rebound.

You are advised to show your working out.

Height of rebound = _____ m [3]

(iii) When a ball falls freely under the force of gravity then its acceleration is known as the acceleration of free fall.
Use the graph to calculate the acceleration of free fall.

To get full credit you **must** show your working out.

Acceleration of free fall = _____ m/s^2 [3]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

9 A crane uses a wrecking ball to demolish an old building as shown in diagram A. The crane moves the ball from its rest position X up to position Y where it comes momentarily to rest, as shown in diagram B.

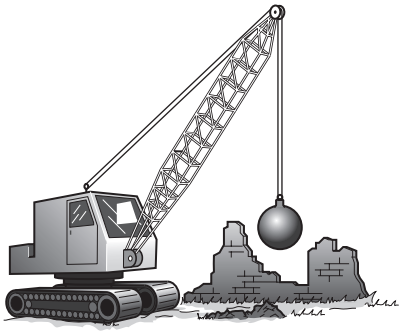


diagram A

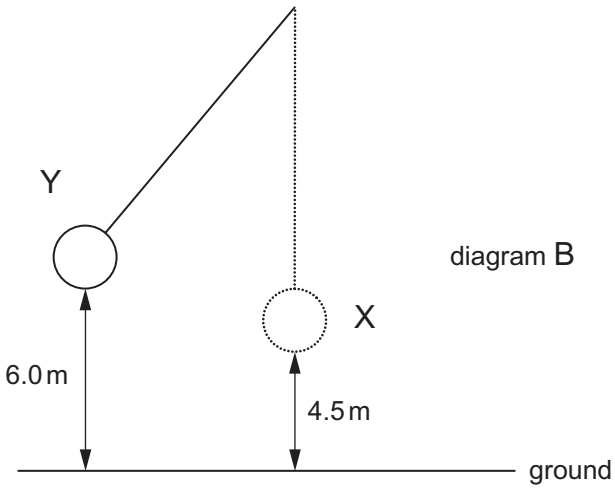


diagram B

(a) Calculate the work done on the ball to move it from its rest position X to position Y. The ball has a mass of 800 kg.

You are advised to show your working out.

Work done = _____ J [4]

(b) What is the loss in potential energy of the ball as it swings from position Y to position X?

Loss in potential energy = _____ J [1]

(c) Calculation shows that for the ball to be effective it must have a minimum kinetic energy of 4900 J. Calculate the velocity of impact for this energy.

You are advised to show your working out.

Velocity = _____ m/s [3]

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Rewarding Learning

General Certificate of Secondary Education
2012–2013

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

WEDNESDAY 27 FEBRUARY 2013
9.30 am–10.30 am

MARK SCHEME

STEMUP.CO.UK

General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

					AVAILABLE MARKS
1	**(a)**	**(i)**	A = Neutron [1] B = Protons [1] C = Nucleus [1] D = Electrons [1]		
		(ii)	Total of positive charge = total of negative charge or number of protons = number of electrons [1]		
		(iii)	Alpha has no electrons Alpha is (doubly) positively charged Alpha has two neutrons Alpha has a bigger mass Any two [1] each [2]		
	(b)	**(i)**	Heavy nucleus splits [1] into two light nuclei energy released fission neutrons produced [3]	any 2 from 3 points	
		(ii)	Uranium [1] Plutonium [1]		12
2	**Apparatus:**		Metre stick, pivot, (hanging) masses (any 2) [1]		
	Use:		Balance ruler on pivot Place masses on either side Balance again Measure distances to pivot from masses Table of results [4]	any 4 points for 4 marks	
	Formula:		CM = ACM [1]		

Response	**Mark**
Candidates explain **5 or 6** of the above points. They use good spelling, punctuation and grammar. The form and style are of a high standard and specialist terms are used appropriately.	[5–6]
Candidates explain **3 or 4** of the above points. They use satisfactory spelling, punctuation and grammar. The form and style are of a satisfactory standard and they have made use of some specialist terms.	[3–4]
Candidates explain **1 or 2** of the above points. They use limited spelling, punctuation and grammar. The form and style are of a limited standard and they have made no use of specialist terms.	[1–2]
Response not worthy of credit.	[0]

6

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			AVAILABLE MARKS

3 **(i)**

m in kg	0	0.1	0.2	0.3	0.4	0.5
T in s	0	0.63	0.90	1.10	1.26	1.41
T^2 in s^2	**(0)**	***0.4***	***0.8***	***(1.2)***	***1.6***	***2.0***

All values of T^2 correct
3 values only correct [1] [2]

(ii) Scale more than half [1]
5 or 6 points correct [2]
3 or 4 points [1] [3]

(iii) Best fit line through candidate's points [1]

(iv) (Yes), Graph is a straight line [1] through origin [1] [2]

(v) K = 1.6/0.4 (or other) [1]
= 4 (s^2/kg) [1] 10

4 **(i)** Meet (world) energy demands
fossil fuels are running out/conserve fossil fuel [2]

(ii) $^{3}_{1}H + {}^{2}_{1}H \rightarrow {}^{4}_{2}He + {}^{1}_{0}n$ (each bold number 1 mark) [6] 8

5 **(a)** **(i)** alpha, beta, gamma or α, β, γ [3]

(ii) (e.m.) wave [1]

(iii) It is unstable [1]

(b) **(i)** gamma or γ [1]

(ii) the only one which will penetrate to detector [1]

(iii) detector reading (high) or detector reading changes or count change [1] 8

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				AVAILABLE MARKS
6	**(i)**	Smooth curve through all points MUST include (0,94) on curve	[1]	
	(ii)	Selection of suitable points e.g. 94 and 47 [1] Drawing parallel and vertical lines [1] or 1 vertical/horizontal line if y-axis is used. Half-life = 26 + or – 1 (s) [1] If straight line drawn instead of curve [0]/[3] BUT <u>allow ecf for a CURVE</u>.	[3]	4
7	**(i)**	Drag/Friction	[1]	
	(ii)	$a = \Delta v/t$ or equivalent [1] or $a = \frac{v - u}{t}$ $0.25 = 3/t$ [1] $t = 12$ (s) [1]	[3]	
	(iii)	$F = ma$ [1] $= 120 \times 0.25$ [1] = 30 (N) [1]	[3]	7
8	**(i)**	Ball is going in opposite direction [1]	[1]	
	(ii)	height = area under graph [1] $= (15 \times 1.5)/2$ [1] = 11.25 (m) [1]	[3]	
	(iii)	a = gradient or $a = \Delta v/t$ [1] $a = 30/3$ [1] $a = 10$ [1] Allow [1]/[3] ONLY for answer if no work shown	[3]	7
9	**(a)**	$W = F \times d$ [1] $= 8000 \times 1.5$ [2] = 12 000 (J) [1]	[4]	
	(b)	12 000 (ecf from (a)) [1]	[1]	
	(c)	$ke = \frac{1}{2} m v^2$ [1] $4900 = \frac{1}{2} 800 v^2$ [1] $v = 3.5$ (m/s) [1]	[3]	8
			Total	**70**

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New Specification

Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2012–2013

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

GSD32

WEDNESDAY 14 NOVEMBER 2012, AFTERNOON

TIME

1 hour.

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 nine** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 70.
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 **2(a)**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total Marks	

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Examiner Only	
Marks	Remark

1 Radioactive substances emit up to three types of radiations, alpha, beta, and gamma. These radiations can travel different distances in air. A source of radiation is placed at one end of a laboratory bench.

A detector is placed at points A, B and C in turn.



(a) (i) At which point A, B or C, will the detector record only gamma radiation?

Answer = _____ [1]

(ii) At which point A, B or C, will the detector record alpha, beta, and gamma radiation?

Answer = _____ [1]

(iii) At which point A, B or C, will the detector record only beta and gamma radiation?

Answer = _____ [1]

(b) (i) When alpha or beta particles pass through air they collide with the air molecules, causing them to become charged. What is the name of this process?

Name of this process is _____ [1]

(ii) How do the air molecules become charged?

_____ [1]

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(c) Workers who use radioactive sources must take steps to protect themselves. Give two ways in which they can do this.

1. _____

2. _____ [2]

(d) The half-life of a radioactive source is a measure of how quickly it decays. What do we mean by “half-life”?

_____

_____ [2]

Examiner Only	
Marks	Remark

2 **(a)** Describe, in detail, how you would measure your personal power.

In your account you should include:

- the measurements you make and the measuring instruments;
- how you use your measurements to measure your personal power.

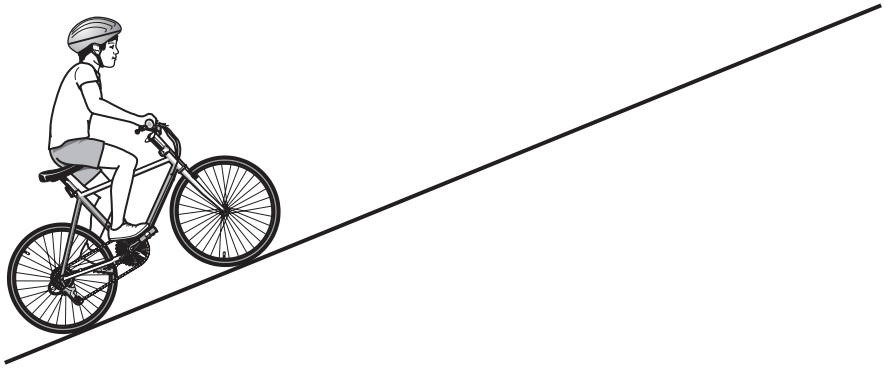
In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

Examiner Only

Marks	Remark

(b) Jim does 3800 J of work when riding his bicycle up a hill as shown.



It takes 5 seconds to travel from the bottom of the hill to the top.

Calculate the power developed by Jim.

Give your answer in kW.

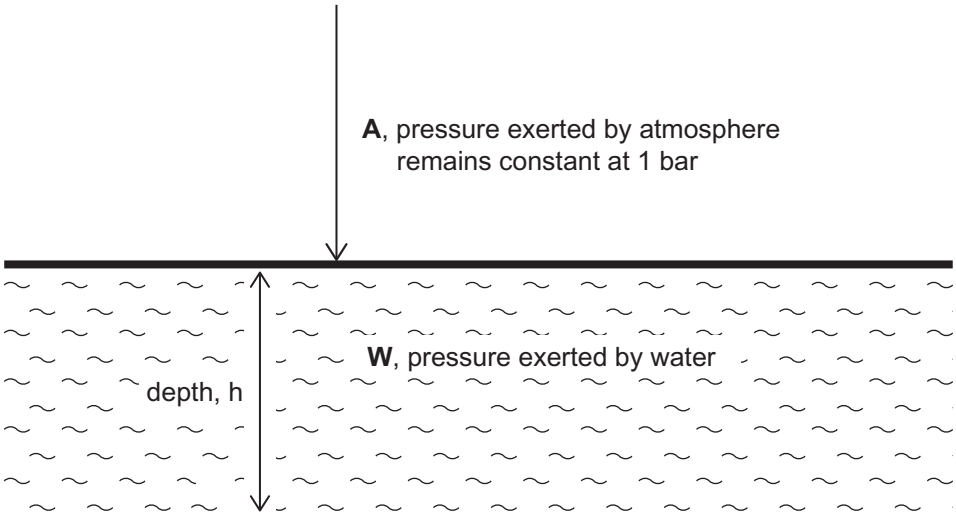
You are advised to show your working out.

Power = _____ kW [3]

Examiner Only

Marks	Remark

3 When divers go underwater the pressure exerted on them changes with depth.



The total pressure exerted at a depth h is equal to the pressure exerted by the water, W, plus the pressure exerted by the atmosphere, A. This means:

Total pressure at a depth h = A + W

The pressure exerted by the atmosphere, A, **remains constant at 1 bar**. The bar is a unit of pressure.

Each 10 m depth of water adds 1 bar of pressure as shown in the second row of the table.

(i) Complete the table below to show the total pressure. One value has been entered for you.

Depth h in m	**0**	**10**	**20**	**30**	**40**	**50**
W in bar	**0**	**1**	**2**	**3**	**4**	**5**
Total pressure in bar				**4**		

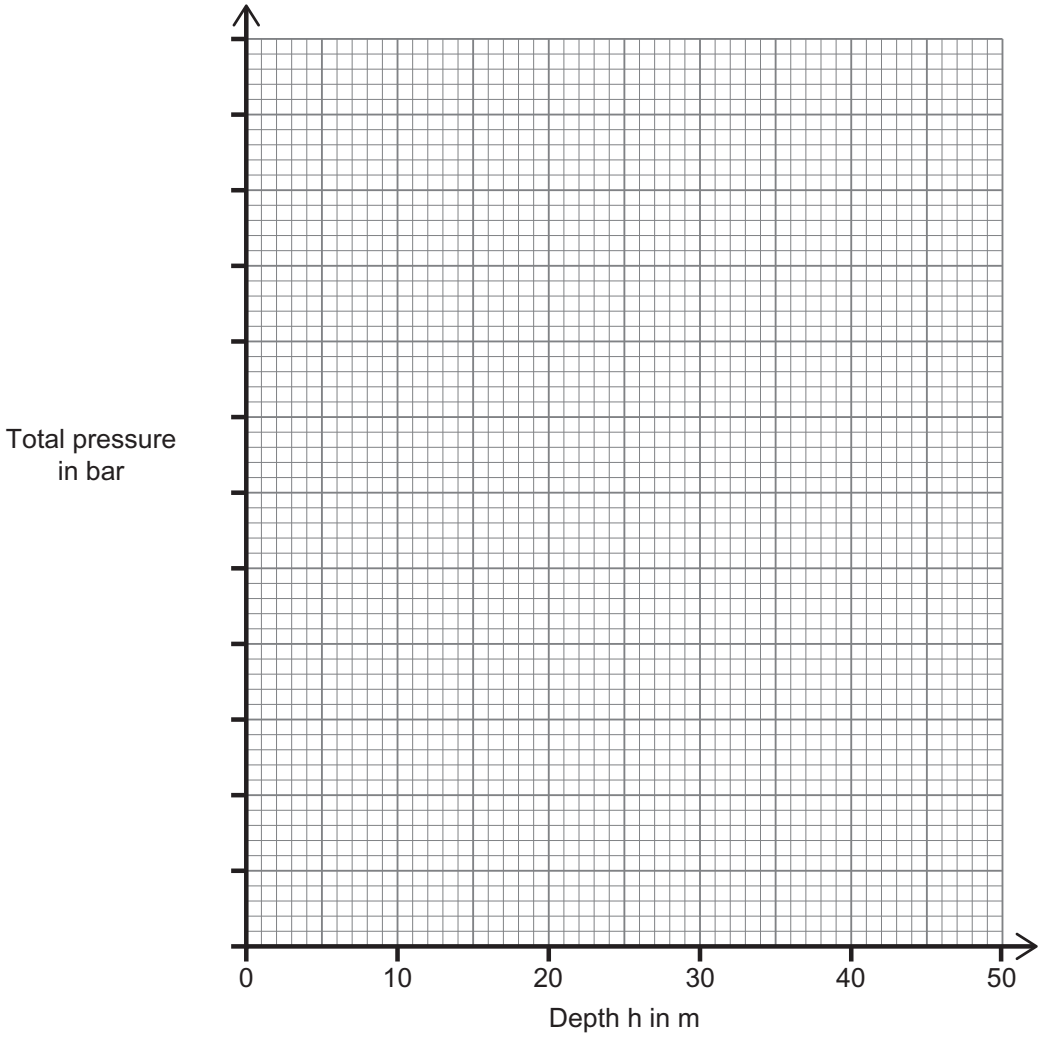
[2]

(ii) Choose a suitable scale on the graph opposite for the vertical axis. Plot a graph of total pressure against the depth h. [4]

Examiner Only

Marks	Remark

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(iii) Draw a straight line of best fit. [1]

(iv) What feature **of the graph** indicates that the pressure exerted by the atmosphere alone is 1 bar?

_____ [1]

(v) A diver is at a depth of 35 m. Use the graph to find the total pressure acting on the diver.

_____ [1]

(vi) What feature of the graph tells us that total pressure is **not** directly proportional to depth?

_____ [1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

4 $^{13}_{6}C$ and $^{14}_{6}C$ are both isotopes of carbon.

(a) (i) Write down one similarity in the nuclei of these isotopes.

_____ [1]

(ii) Write down one difference between the nuclei of these isotopes.

_____ [1]

(b) $^{14}_{6}C$ is radioactive. It decays to nitrogen by emitting a beta particle.

Complete the equation below which describes the decay.

$$^{14}_{6}C \rightarrow \square\!\!\square N + \square\!\!\square \beta$$

[4]

(c) The activity of a sample of wood from a freshly cut tree is measured to be 80 disintegrations per second.

Calculate the **decrease** in activity of the sample after 3 half-lives.

You are advised to show your working out.

Decrease in activity = _____ disintegrations per second [3]

5 In recent years, scientists have been researching nuclear fusion.

(i) Explain fully what is meant by nuclear fusion.

_____

_____

_____ [2]

(ii) Give **one** advantage that nuclear fusion may have over nuclear fission, for the generation of electricity.

_____

_____ [1]

(iii) Where does nuclear fusion occur naturally?

_____ [1]

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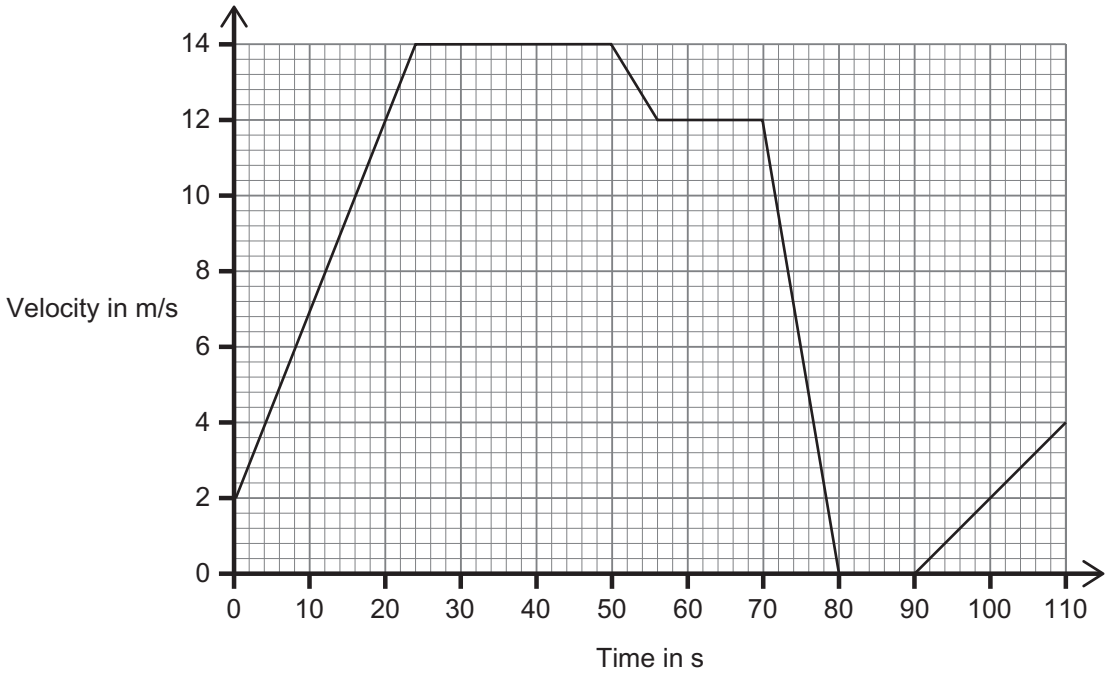
Marks	Remark

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Examiner Only	
Marks	Remark

6 The graph below shows how the velocity of a car changes as it drives through the village of Ballyclare.

At time t = 0 s, it enters Ballyclare.



(a) (i) How long after entering Ballyclare did the car reach its maximum velocity?

Time = _____ s [1]

(ii) Calculate the distance travelled by the car at this maximum velocity.

You are advised to show your working out.

Distance = _____ m [4]

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(b) Describe the motion of the car during the following time intervals:

(i) 0–24 seconds,

_____ [1]

(ii) 56–70 seconds,

_____ [1]

(c) The driver realises he has taken a wrong turn.

He turns round and drives in the opposite direction down the same road at a constant **speed** of 6 m/s in a straight line.

What is his new velocity?

New velocity = _____ m/s [1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

7 A car is travelling on a level road at a constant velocity of 20 m/s. The driver brakes suddenly and comes to rest in a time of 8.0 s.

(i) Calculate the acceleration of the car.

You are advised to show your working out.

Acceleration = _____ m/s^2 [3]

(ii) If the mass of the car is 950 kg, calculate the braking force on the car.

You are advised to show your working out.

Braking force = _____ N [3]

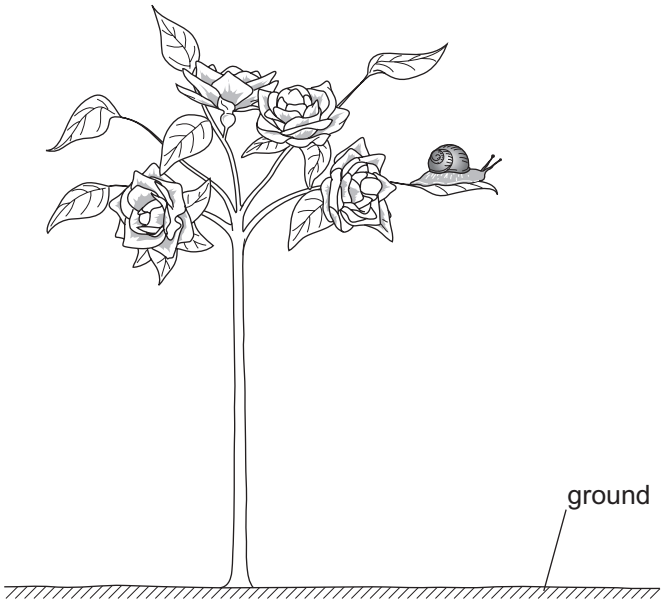
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(Questions continue overleaf)

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8 A snail of mass 12 g climbs up a vertical rose bush. It then sits at rest on a leaf.



(i) Find the weight of the snail.

You are advised to show your working out.

Weight = _____ N [2]

(ii) The potential energy of the snail is 0.30 J. Calculate how high it is above the ground.

You are advised to show your working out.

Height = _____ m [3]

Examiner Only

Marks	Remark

(iii) The snail falls off the leaf towards the ground.

Calculate the velocity of the snail just before it hits the ground.

Assume no energy losses as it falls.

You are advised to show your working out.

Velocity = _____ m/s [4]

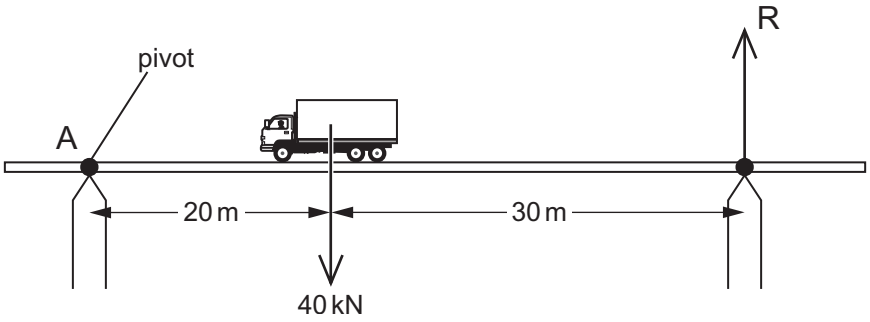
Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

9 **(a)** What is meant by the term, a lever is in equilibrium?

_____ [1]

(b) A lorry travels across a bridge. At a particular instant, the forces acting are shown in the diagram below.



(i) Use the principle of moments to determine the size of the upwards force R. (Hint: Take moments about the point A)

You are advised to show your working out.

Upwards force R = _____ kN [4]

(ii) The lorry approaches point A. What effect, if any, will this have on the size of force R?

_____ [1]

THIS IS THE END OF THE QUESTION PAPER

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112985

New Specification

Rewarding Learning

General Certificate of Secondary Education
2012–2013

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

WEDNESDAY 14 NOVEMBER 2012
1.30 pm–2.30 pm

MARK SCHEME

STEMUP.CO.UK

AVAILABLE MARKS

1 **(a)** **(i)** C [1] **(ii)** A [1] **(iii)** B [1]

(b) **(i)** Ionisation [1]

(ii) Lose or gain electron/s [1]

(c) e.g. Any two from:
Use tongs/keep distance large [1]
Keep exposure time low [1]
Use shielding/wear protection [1]/safety badge/film badge

(d) Time [1] for activity to halve [1] [dept. marking] 9

2 **(a)** Find weight (or mass and multiply by 10) [1]
Find total height of stairs [1]
Time to climb stairs [1]
Power = (weight × height)/time; [1]
Any two instruments from scales/metre stick/stop clock [2]
[1 mark each]

Response	**Mark**
Candidates give **5 or 6** of the above points. They use good spelling, punctuation and grammar. The form and style are of a high standard and specialist terms are used appropriately.	[5–6]
Candidates explain **3 or 4** of the above points. They use satisfactory spelling, punctuation and grammar. The form and style are of a satisfactory standard and they have made use of some specialist terms.	[3–4]
Candidates explain **1 or 2** of the above points. They use limited spelling, punctuation and grammar. The form and style is of a limited standard and they have made no use of specialist terms.	[1–2]
Response not worthy of credit.	[0]

[6]

(b) P = Work done/time taken (no marks)
= (3800)/5 [1]
= 760 [1]
= 0.76 (kW) [1] [3] 9

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AVAILABLE MARKS

3 (i)

Depth h in m	0	10	20	30	40	50
W in bar	0	1	2	3	4	5
Total pressure in bar	**1**	***2***	***3***	*4*	***5***	***6***

3 or 4 correct [1]
All correct [2] [2]

(ii) Vertical axis numbered with uniform scale [1], scale more than half [1]
3 or 4 correct [1]
5 or 6 points [2] [4]

(iii) Best fit line [1]

(iv) Intercept (on vertical axis) OR when h = 0 pressure is 1 bar [1]

(v) 4.5 bar [1]

(vi) Line does not go through origin [1] 10

4 (a) (i) (Same) number of protons or charge [1]

(ii) (Different) number of neutrons or mass number [1]

(b) 14 [1] 0 [1] 7 [1] −1 [1] [4]

(c) 3 half-lives 1/8 remains [1]
Activity = 10 dis/s [1]
Decrease = 70 (dis/s) [1] [3] 9

5 (i) Two light or small nuclei [1] (must have)
form a heavier or new nucleus [1] [2]

(ii) Enormous fuel supplies (from oceans)
Or (virtually) no radioactive waste [1]

(iii) Stars/Sun [1] 4

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			AVAILABLE MARKS
6	**(a)** **(i)** 24 (s)	[1]	
	(ii) Distance = area	[1]	
	= 14 [1] × 26 [1]	[2]	
	= 364 (m) e.c.f. from **(a) (i)**	[1]	
	(b) **(i)** Accelerating, speed increasing	[1]	
	(ii) Constant velocity, constant speed	[1]	
	(c) −6 (m/s) the minus is essential	[1]	8
7	**(i)** $a = (v - u)/t$ or equivalent formula or $a = \frac{\Delta v}{t}$ $\left(\frac{\text{change in v}}{t}\right)$	[1]	
	$= (0 - 20)/8$	[1]	
	$= -2.5\ (m/s^2)$	[1]	
	(ii) $F = m \times a$	[1]	
	$= 950 \times 2.5$ allow e.c.f. from **part (i)**	[1]	
	$= 2375$ (N)	[1]	6
8	**(i)** Mass = 0.012 (kg)	[1]	
	= 0.12 (N)	[1]	
	(ii) P.E. = m g h	[1]	
	$h = \frac{0.3}{0.012 \times 10}$	[1]	
	= 2.5 (m)	[1]	
	(iii) PE = KE [1]		
	$0.3 = \frac{1}{2} \times 0.012 \times v^2$ [1] or $v = \sqrt{\frac{2KE}{m}}$ [1] $v = \sqrt{2gh}$ [1]		
	$v^2 = \frac{0.30}{0.006}$ [1] $= \sqrt{\frac{2 \times 0.3}{0.012}}$ [1] $= \sqrt{2 \times 10 \times 2.5}$ [2]		
	v = 7.1 [1] (m/s) or 7.07 = 7.1 [1] = 7.1	[4]	9
9	**(a)** Object does not rotate about a point		
	Or body is balanced		
	Or ACWM = CWM or no resultant moment	[1]	
	(b) **(i)** ACM = CM or $F_1d_1 = F_2d_2$	[1]	
	40×20 [1] $= R \times 50$ [1]	[2]	
	R = 16 (kN)	[1]	
	(ii) (R) decreases	[1]	6
		Total	**70**

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New Specification

Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2011–2012

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

GSD32

THURSDAY 24 MAY 2012, MORNING

TIME

1 hour.

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 ten** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 70.
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 **2(b)**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total Marks	

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Examiner Only	
Marks	Remark

1 This question is about isotopes.

(a) Explain the meaning of the term isotopes.

_____

_____ [2]

(b) Describe the structure of an atom in terms of protons, neutrons and electrons.

_____

_____ [2]

2 **(a)** **(i)** What is the symbol for the Mass Number of an atom?

_____ [1]

(ii) What is the symbol for the Atomic Number of an atom?

_____ [1]

(iii) Complete the following table for an atom of uranium, $^{238}_{92}U$.

Mass number	
Number of protons	
Number of neutrons	

[3]

(iv) An atom of uranium, $^{238}_{92}U$, decays to form an atom of thorium, $^{234}_{90}Th$.

1. What type of radiation, alpha, beta or gamma, is emitted by the uranium nucleus?

_____ [1]

2. Why does a nucleus that decays by emitting alpha or beta radiation become a nucleus of a different element?

_____

_____ [1]

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(b) Discuss the social, environmental and ethical issues relating to the use of nuclear energy.

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

Social: _____

_____

_____

Environmental: _____

_____

_____

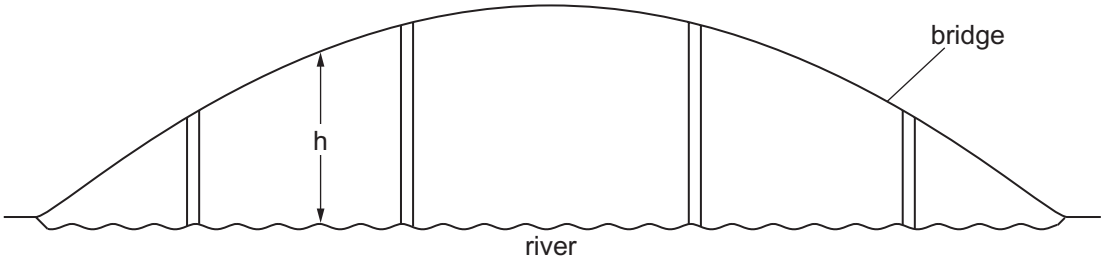
Ethical: _____

_____

_____ [6]

Examiner Only	
Marks	Remark

3



Examiner Only

Marks	Remark

Jamie thinks that the height (h) fallen by a stone off a curved bridge depends on the square of the time (t) between releasing the stone and hitting the water, according to the formula:

$$h = kt^2$$

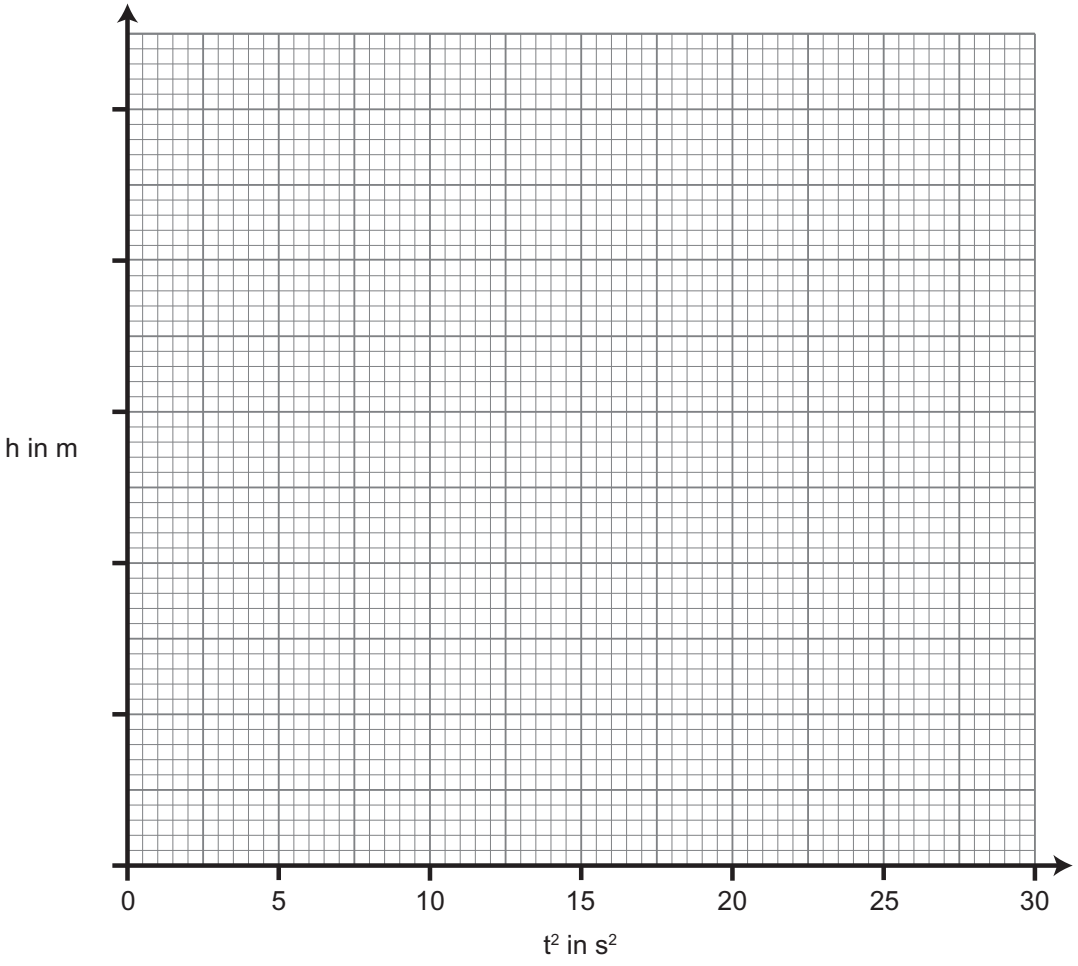
He obtains a set of results and these are shown below.

t in s	0	1	2	3	4
t^2 in s^2	0	1	4		
h in m	0	5	20	45	80

(a) Complete the table by entering the values of t^2. [2]

(b) Choose a suitable scale and plot a graph of h on the vertical axis versus t^2 on the horizontal axis on the grid opposite. [3]

(c) Draw a line of best fit. [1]



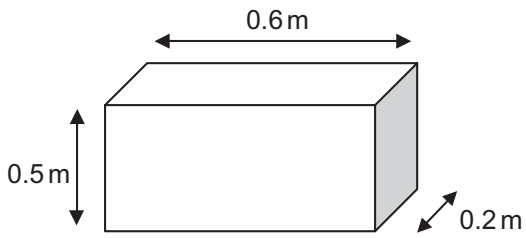
(d) Use your graph to determine the constant k.
Remember to include the units for k.

You are advised to show your working out.

k = _____ : Unit = _____ [4]

Examiner Only	
Marks	Remark

4 A brass ingot (block) has the dimensions shown.



(i) Find the volume of the brass ingot.

You are advised to show your working out.

Volume of ingot = _____ m^3 [2]

Brass has a density of 8400 kg/m^3.

(ii) Calculate the mass of the ingot.

You are advised to show your working out.

Mass of ingot = _____ kg [3]

Examiner Only

Marks	Remark

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(Questions continue overleaf)

5 Velocity–time graphs are shown below for a ball which is either:

Examiner Only	
Marks	Remark

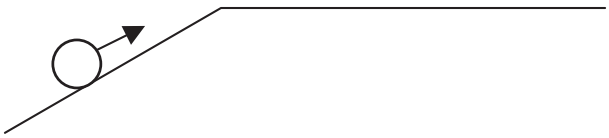
A running on a horizontal surface,



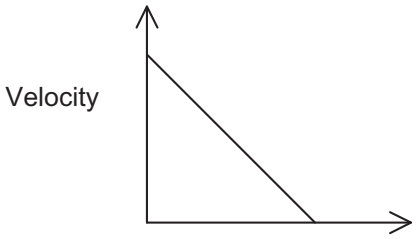
B running down a slope onto a horizontal surface,



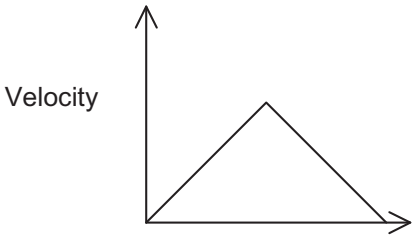
C running up a slope onto a horizontal surface.



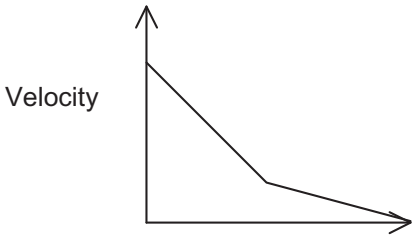
(a) Match the diagrams A, B or C to the correct graphs below.
Remember friction is acting in all situations.



Letter _____

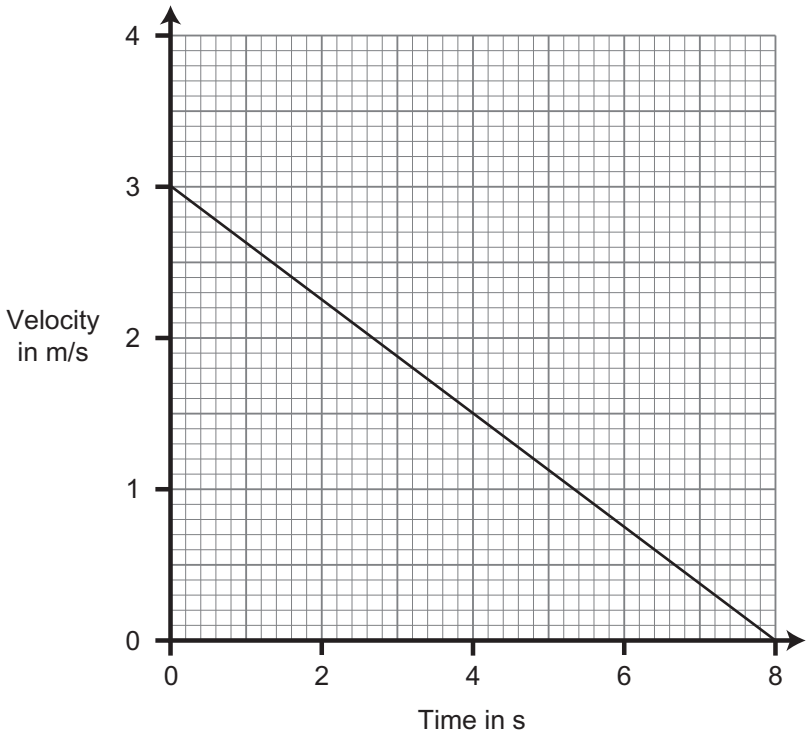


Letter _____



Letter _____ [3]

A velocity–time graph for a moving ball is shown below.



(b) Use the graph to find the distance travelled by the ball.

You are advised to show your working out.

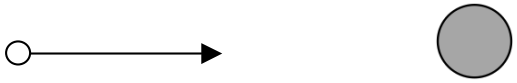
Distance = _____ m [3]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

6 Huge amounts of energy can be produced by certain types of nuclear reaction. One such reaction is represented by the diagram below where a subatomic particle strikes a much larger particle.



(i) What is the name of this nuclear reaction?

_____ [1]

(ii) What is the name of the small particle?

_____ [1]

The larger particle is a type of nuclear fuel.

(iii) Name a type of nuclear fuel used in this type of reaction.

_____ [1]

(iv) Other than producing energy, state **two** things that happen when the smaller particle is absorbed by the larger particle.

1. _____ [1]

2. _____ [1]

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(Questions continue overleaf)

Examiner Only	
Marks	Remark

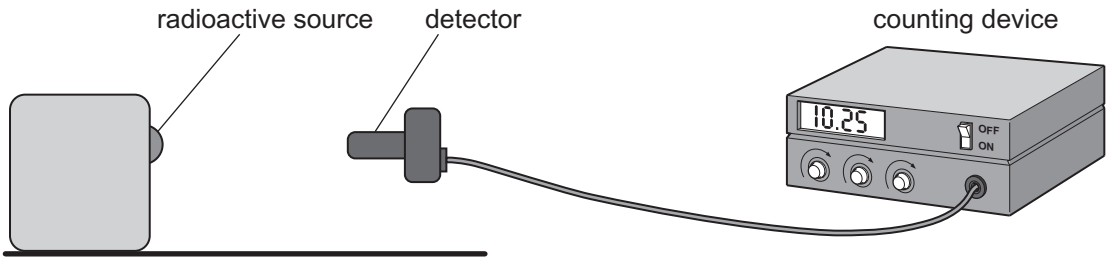
7 **(a)** Radium has a half-life of 3.6 days.

Explain what this means.

_____

_____ [2]

Marilyn carries out an experiment to measure the half-life of a radioactive substance.

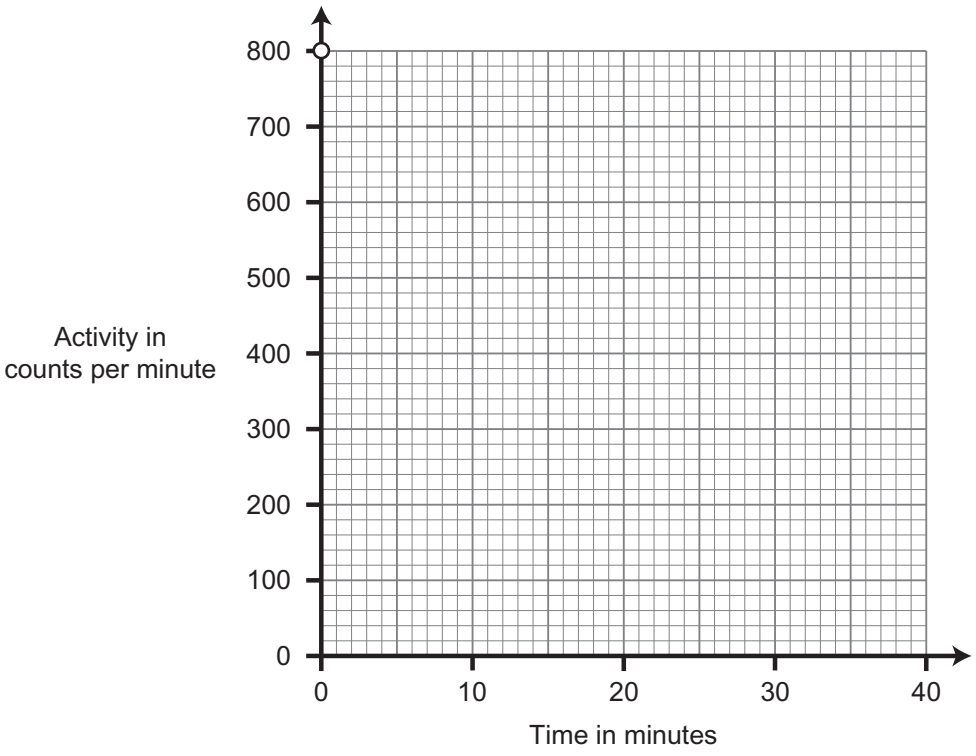


She suspects that the substance has a half-life of 10 minutes and so she measures the activity, in counts per minute, every 10 minutes.

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Examiner Only	
Marks	Remark

(b) (i) On the graph below the initial activity of 800 counts per minute is marked for you. Plot four more points, at ten minute intervals, if the half-life is exactly 10 minutes.



[2]

(ii) Draw a smooth curve through the points. [1]

(iii) Use your graph to find the activity at 15 minutes.

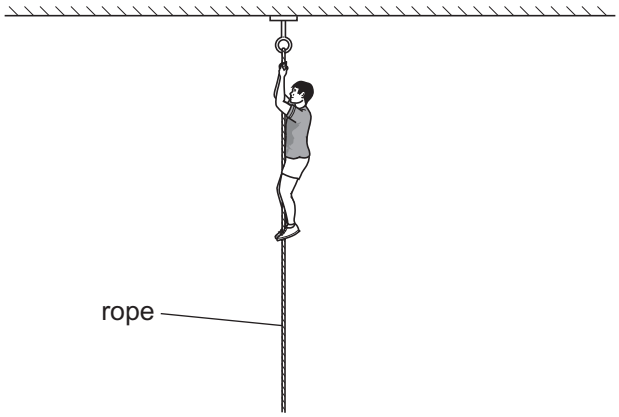
Activity = _____ counts per minute [1]

(iv) What would the activity of this substance have been 10 minutes before Marilyn began the investigation?

Activity = _____ counts per minute [1]

Examiner Only	
Marks	Remark

8 A gymnast pulls himself up a rope and at the instant shown he is stationary.



(a) (i) What is the name of the upward force exerted on the gymnast?

Upward force _____ [1]

(ii) The gymnast now slides down the rope at a **constant velocity**. What can you now say about the upward force? Choose your answer by placing a tick (✓) in the correct box.

The upward force is now zero. ☐

The upward force is now equal to the gymnast's weight. ☐

The upward force is greater than the gymnast's weight. ☐

[1]

(b) On another occasion the gymnast, who has a mass of 70 kg, climbs to the top of the rope, **partially releases his grip,** and falls to the ground with an acceleration of 8 m/s^2.
Calculate the resistive force acting on the gymnast.

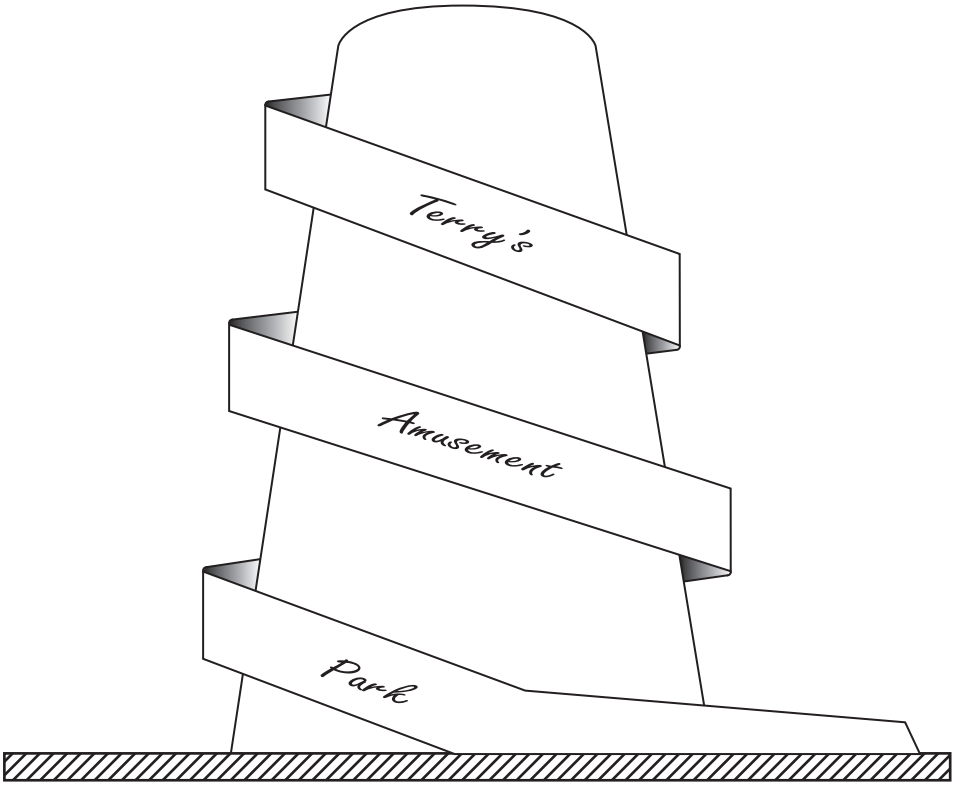
You are advised to show your working out.

Resistive force = _____ N [5]

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9 Frank climbs to the top of a helter-skelter and does 6000 J of useful work.

Examiner Only	
Marks	Remark



(a) How much potential energy does Frank have at the top of the helter-skelter?

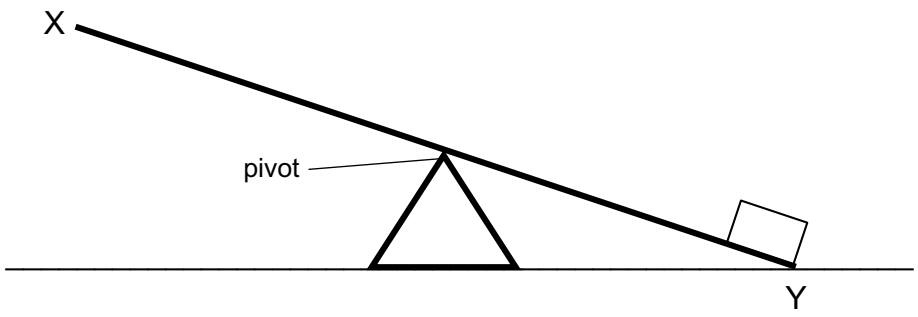
Potential energy = _____ J [1]

(b) Frank has a mass of 80 kg and he loses 2000 J of his energy as heat and sound as he slides down the helter-skelter.
Calculate his speed at the bottom of the helter-skelter.

You are advised to show your working out.

Speed = _____ m/s [4]

10 Julie sets up a uniform lever with the mid-point of the lever sitting on the pivot. She places one weight on end Y of the lever as shown.



Carefully, she puts an equal weight at end X.

(a) (i) What will happen to the lever?
Choose your answer by putting a tick (✓) in the correct box.

The lever will not move. ☐

The lever will move to the horizontal position. ☐

The lever will move past the horizontal position and then return to the horizontal position. ☐

The lever will come to rest with the end Y on the horizontal surface. ☐

[1]

(ii) Explain your choice.

_____ [1]

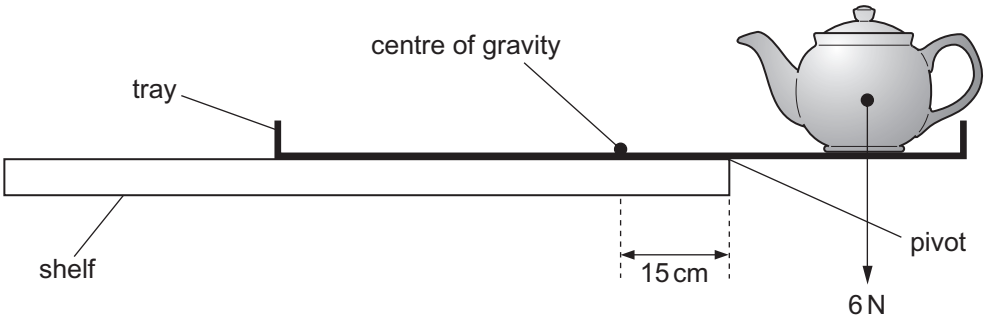
(iii) Give a unit for the moment of a force.

Unit = _____ [1]

Examiner Only

Marks	Remark

(b) A teapot is placed on a tray and the tray is set on a shelf as shown. The tray has a weight of 10 N.



The centre of gravity of the tray is 15 cm from the edge of the shelf.

(i) Use an arrow to show the direction of the weight of the tray. [1]

The teapot weighs 6 N.

(ii) Use the principle of moments to find the greatest distance the teapot can be placed from the edge of the shelf without toppling the tray.

You are advised to show your working out.

Distance = _____ cm [4]

Examiner Only

Marks	Remark

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Rewarding Learning

General Certificate of Secondary Education
2011–2012

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

THURSDAY 24 MAY 2012, MORNING

MARK SCHEME

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		AVAILABLE MARKS
1	**(a)** [Atoms with] same Z no. [1] but different A nos [1] [2]	
	(b) *Nucleus* contain protons + neutrons [1] Orbiting electrons [1]	4
2	**(a)** **(i)** A [1]	
	(ii) Z [1]	
	(iii) 238 [1] 92 [1] 146 [1]	
	(iv) 1. Alpha or α [1] 2. Different atomic number or different place on periodic table [1]	
	(b) N.I.M.B.Y. Long term necessity of N fuel/conserve fossil fuel Treatment of cancers Waste argument No polluting gases Safety/causes cancer Proliferation of N. weapons [5–6]	

Response	**Mark**
Candidates must use appropriate specialist scientific terms throughout to describe fully and in a logical sequence the problems of nuclear power stating **5–6** of the points shown in the indicative content above. They use good spelling, punctuation and grammar throughout and the form and style are of a high standard.	**[5–6]**
Candidates use some appropriate specialist scientific terms throughout to partially describe and in a logical sequence the problems of nuclear power stating **3 or 4** of the points shown in the indicative content above. They use satisfactory spelling, punctuation and grammar throughout and the form and style are of satisfactory standard.	**[3–4]**
Candidates must use limited specialist scientific terms to describe fully and in a logical sequence the problems of nuclear power stating **1 or 2** of the points shown in the indicative content above. Their spelling, punctuation and grammar throughout and the form and style are of a limited standard.	**[1–2]**
Response not worthy of credit.	**0**

13

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				AVAILABLE MARKS
3	**(a)**	9 16	[1] [1]	
	(b)	Scale $> \frac{1}{2}$ of h axis 4 or 5 points correct [2] 2 or 3 points correct [1] } tolerance $\pm$ 1 square	[1] [2]	
	(c)	Line of best fit [1]	[1]	
	(d)	Grad $= \frac{Y_2 - Y_1}{x_2 - x_1}$ [1] Appropriate values [1] $= 5 \pm 0.2$ [1] m/s^2 [1]	[4]	10
4	**(i)**	Volume $= 0.6 \times 0.5 \times 0.2$ $= 0.06\ (m^3)$	[1] [1]	
	(ii)	Mass $=$ Density $\times$ Volume $= 8400 \times 0.06$ e.c.f. from (a)(i) $= 504$ (kg)	[1] [1] [1]	5
5	**(a)**	A B C	[3]	
	(b)	Distance $=$ Area $= (3 \times 8)/2$ $= 12$ (m)	[1] [1] [1]	6
6	**(i)**	Fission	[1]	
	(ii)	Neutron	[1]	
	(iii)	Uranium or plutonium	[1]	
	(iv)	Any 2 from: smaller nuclei formed or nucleus splits *neutrons* produced	[2]	5
7	**(a)**	Every 3.6 days, [1] OR the *time* taken The activity halves or count rate halves [1]	[2]	
	(b)	**(i)** $\frac{1}{2}$ mark each, round down	[2]	
		(ii) Curve through (0,800) and points plotted [e.c.f. from (i)]	[1]	
		(iii) 282 [300 $-$ 260] allow e.c.f. from (ii)	[1]	
		(iv) 1600	[1]	7

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						AVAILABLE MARKS
8	**(a)**	**(i)**	Friction		[1]	
		(ii)	Middle box ticked		[1]	
	(b)	F = ma	*or*	RF = ma [1]	[1]	
		= 70 × 8		W – FF = ma [1]	[1]	
		= 560 (N)		700 – FF = 70 × 8 [1]	[1]	
		R = 700 – 560		FF = 700 – 560 [1]	[1]	
		= 140 (N)		= 140 [1]	[1]	7
9	**(a)**	6000 (J)			[1]	
	(b)	Ke = $\frac{1}{2}$ m v^2 [1]			[1]	
		4000 = $\frac{1}{2}$ × 80 × v^2 [1], [1]			[2]	
		v = 10 (m/s) [1]			[1]	5
10	**(a)**	**(i)**	The lever will not move (box ticked)	} dependent marking	[1]	
		(ii)	Moments are balanced	} dependent marking	[1]	
		(iii)	Nm or Ncm		[1]	
	(b)	**(i)**	Force correctly marked at c. of g.		[1]	
		(ii)	CM = ACM		[1]	
			6 × d = 10 × 15 [1] + [1]		[2]	
			d = 25 (cm)		[1]	8
				Total		**70**

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New Specification

Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2012–2013

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

GSD32

WEDNESDAY 29 FEBRUARY 2012
9.30 am–10.30 am

TIME

1 hour.

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 ten** questions.

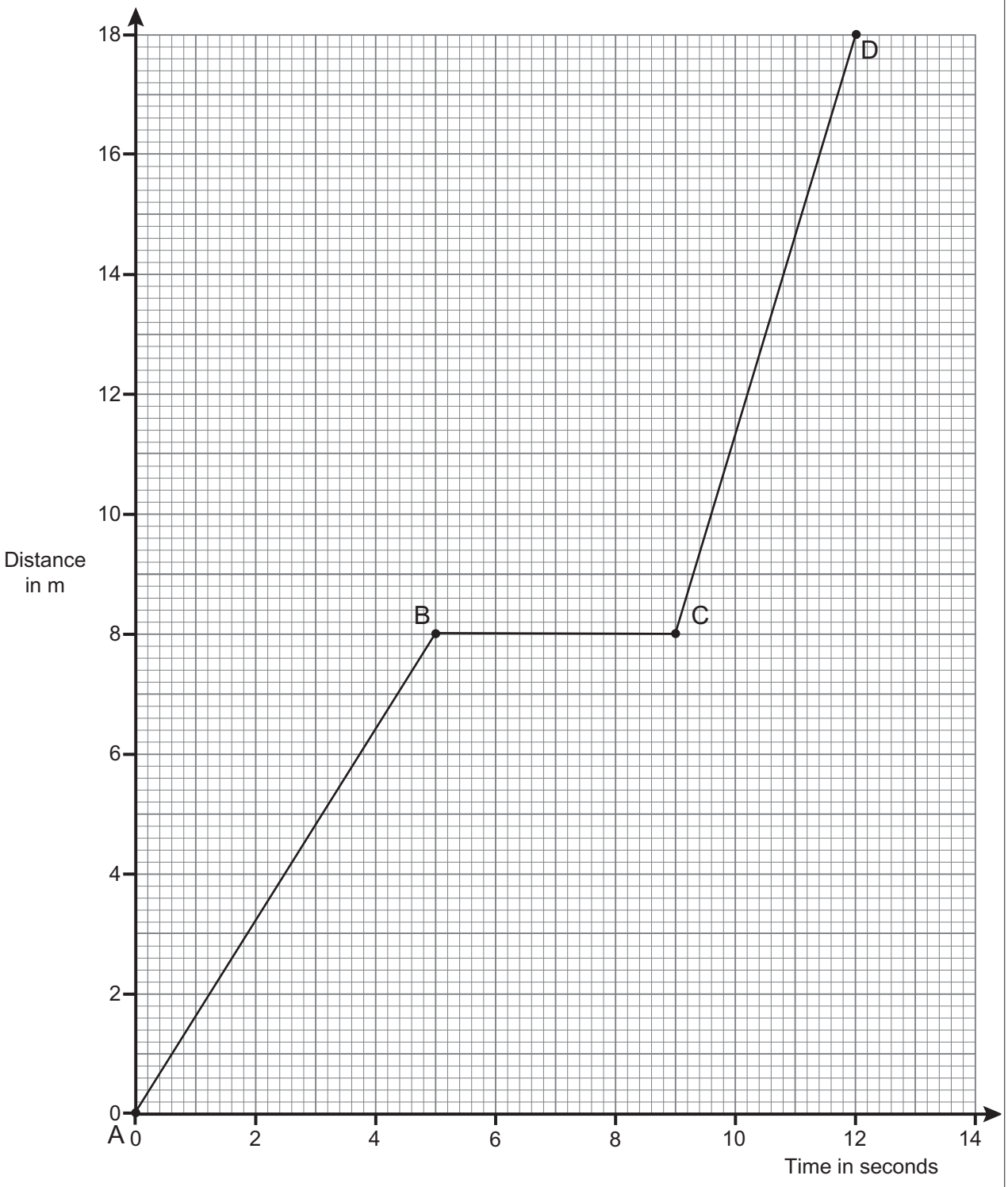
INFORMATION FOR CANDIDATES

The total mark for this paper is 70.
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 requiring extended answers**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total Marks	

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1 A distance-time graph for a cyclist is shown below.



Examiner Only	
Marks	Remark

(a) (i) Describe the motion of the cyclist during BC.

_____ [1]

(ii) What feature of the graph tells you that the speed is greatest during CD?

_____ [1]

(b) State the distance travelled during the first seven seconds.

Distance = _____ m [1]

(c) Use the graph to calculate the average speed of the cyclist over the entire journey.

You are advised to show your working out.

Average speed = _____ m/s [3]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

2 A lorry of mass 7500 kg travelling at a velocity 20 m/s decelerates to 0 m/s.

(i) Write down the formula for kinetic energy in the box.

[1]

(ii) Calculate the kinetic energy lost by the lorry as it brakes.

You are advised to show your working out.

Kinetic energy lost = _____ J [2]

(iii) State the work done by the brakes of the lorry.

Work done = _____ J [1]

The lorry comes to rest in 20 s.

(iv) Calculate the power of the brakes.

You are advised to show your working out.

Power = _____ W [3]

(v) State the power of the brakes in kilowatts (kW).

Power = _____ kW [1]

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3 A star's energy is generated by the process of nuclear fusion.

Describe, in detail, what happens in nuclear fusion.

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

Examiner Only

Marks	Remark

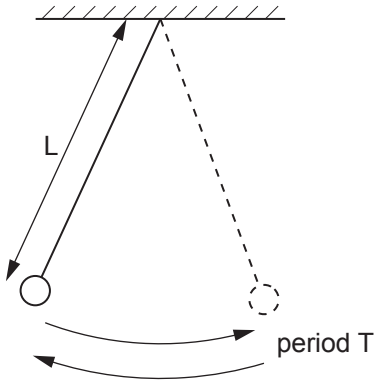
[6]

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Examiner Only	
Marks	Remark

4 The period of a pendulum is the time it takes to swing to the right and back again. Maureen thinks that the period T of a simple pendulum depends on the length L of the string according to the formula:

$$T^2 = k\,L$$



She obtains a set of results and these are shown below.

L in m	0.2	0.3	0.4	0.6	0.7
T in s	0.9	1.1	1.3	1.6	1.7
T^2 in s^2	0.8		1.7		2.9

(a) Complete the table by entering the other values of T^2, rounded to one decimal place. [2]

(b) Choose a suitable scale and plot a graph of T^2 on the vertical axis against L on the horizontal axis. [4]

(c) **(i)** Draw the line of best fit. [2]

(ii) Does the graph support Maureen's theory?

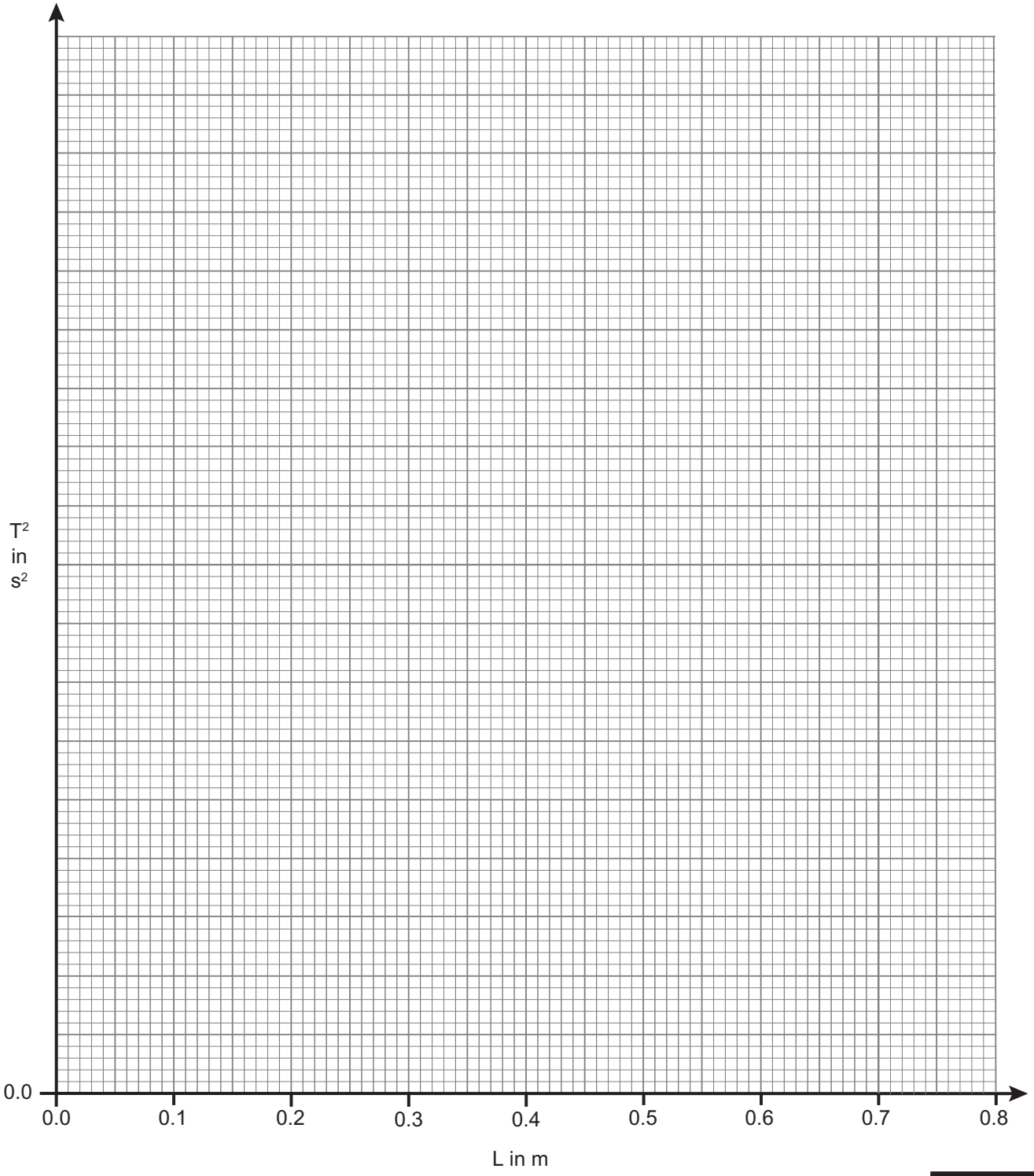
Explain your answer.

_____

_____

_____ [2]

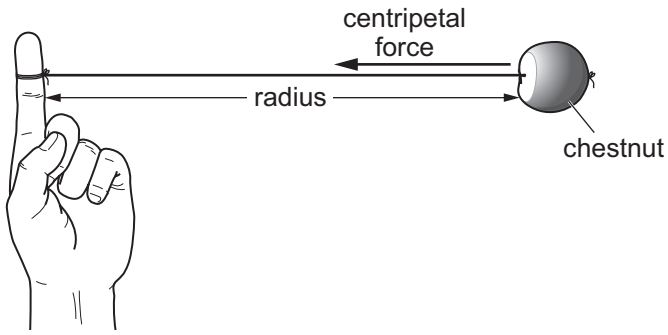
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Examiner Only	
Marks	Remark

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5



When a chestnut is whirled in a circle, the tension in the string provides the centripetal force.

(a) Complete the following sentences to describe the relationships between the centripetal force, the radius of the string and the speed of the chestnut.

(i) As the speed ___increases___, the centripetal force

_____ . [1]

(ii) As the radius _____, the centripetal force

___increases___. [1]

(b) Explain why the speed of the chestnut remains the same, but the velocity of the chestnut changes.

_____

_____ [1]

(c) The mass of the chestnut is 0.2 kg and its momentum is 2.4 kg m/s at a certain instant in its rotation. Find the velocity of the chestnut.

You are advised to show your working out.

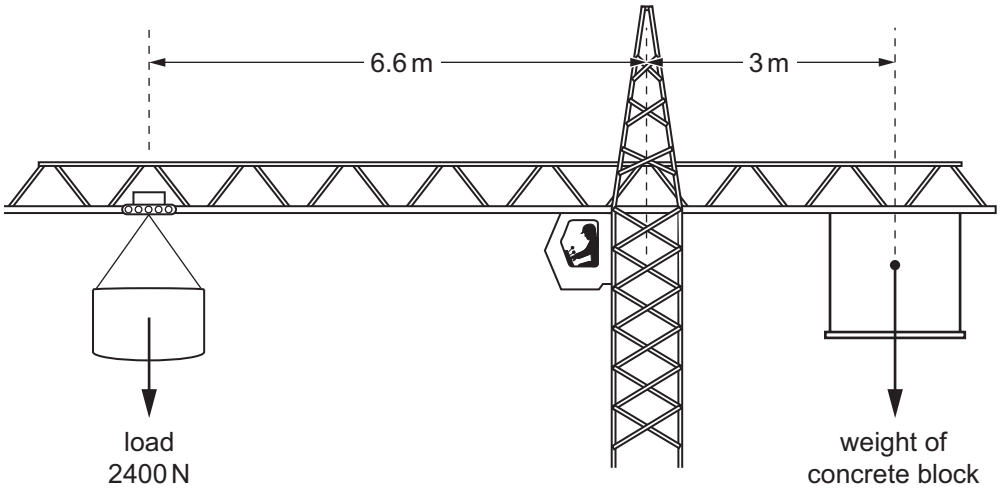
Velocity = _____ m/s [3]

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Marks	Remark

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6 The diagram shows a crane on a building site.



The load weighs 2400 N. Use the Principle of Moments to calculate the weight of the concrete block.

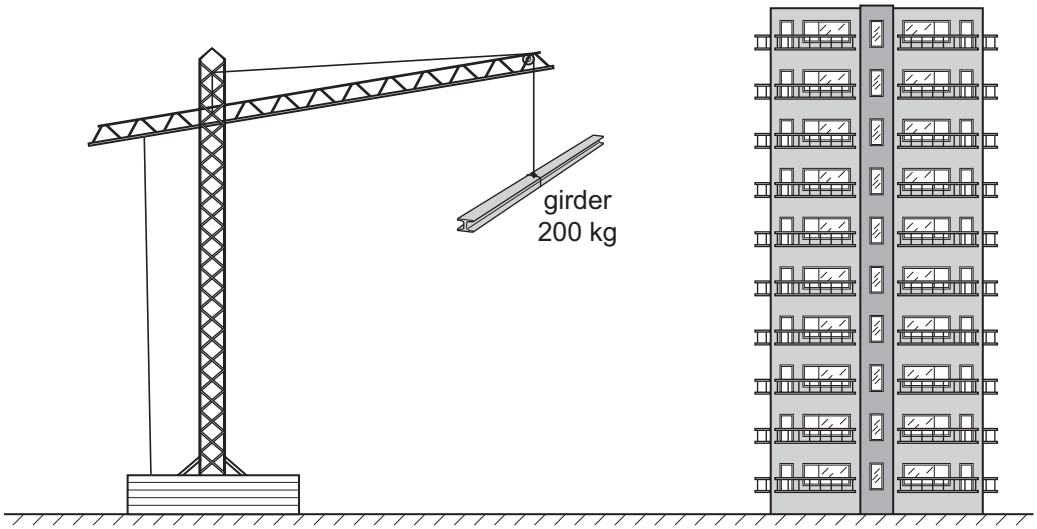
You are advised to show your working out.

Weight = _____ N [4]

Examiner Only

Marks	Remark

7 A crane is used to lift a steel girder of mass 200 kg to the top of a high building.



When it is lifted by the crane, the girder accelerates from 0.1 m/s to a speed of 0.7 m/s in the first 3 seconds. It then rises at a steady speed.

(i) Calculate the acceleration of the girder.

You are advised to show your working out.

Acceleration = _____ m/s^2 [3]

(ii) Use your answer to **(i)** to calculate the resultant force acting on the girder.

You are advised to show your working out.

Resultant force = _____ N [3]

Examiner Only

Marks	Remark

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8 There is a radioactive isotope of carbon known as $^{14}_{6}C$

(i) Explain fully what is meant by the word radioactive.

_____

_____ [2]

(ii) Explain what is meant by isotopes in terms of the particles in the nucleus.

_____

_____ [2]

(iii) Complete the table below to show the numbers of the particles in the **nucleus** of $^{14}_{6}C$

Particle	Number
Electrons	
Neutrons	
Protons	

[3]

The nucleus of $^{14}_{6}C$ emits beta (β) particles and gamma (γ) radiation.

(iv) What are beta particles?

_____ [1]

(v) What is gamma radiation?

_____ [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

9 One of the earliest models for the structure of the atom was the plum-pudding model.

(a) Describe the Plum Pudding model.

_____

_____

_____ [2]

(b) What does the Rutherford-Bohr model tell us about:

(i) the electrons in an atom?

_____ [1]

(ii) the size of the nucleus of an atom?

_____ [1]

(iii) the mass of the nucleus of an atom?

_____ [1]

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10 **(a)** Explain what is meant by half-life.

Examiner Only

Marks	Remark

_____

_____ [2]

(b) **(i)** A certain radioactive material has a half-life of 20 minutes.

What fraction of that material would be present 1 hour later?

You are advised to show your working out.

Fraction = _____ [2]

(ii) A detector of radiation is placed close to a radioactive source that has a very long half-life. In four consecutive 10-second intervals, the following numbers of counts were recorded:

502 497 501 499

Why were the four counts different?

_____ [1]

(c) The isotope of thorium is unstable and disintegrates by alpha decay. Complete the decay equation for this by writing the appropriate numbers and symbol in the empty boxes.

$$\square_{90}\text{Th} \rightarrow {}^{228}_{\square}\text{Ra} + \begin{matrix}\square \\ \square\end{matrix}\square$$

[5]

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Rewarding Learning

General Certificate of Secondary Education
2012–2013

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

WEDNESDAY 29 FEBRUARY 2012
9.30 am–10.30 am

MARK SCHEME

STEMUP.CO.UK

			AVAILABLE MARKS
1	**(a)** **(i)** At rest [1]	[1]	
	(ii) Bigger or steeper gradient [1]	[1]	
	(b) Distance = 8 (m)	[1]	
	(c) Average Speed = Gradient [1] $= \frac{18}{12}$ [1] = 1.5 (m/s) [1]	[3]	6
2	**(i)** KE $= \frac{1}{2}mv^2$ [1]	[1]	
	(ii) $= \frac{1}{2} \times 7500 \times 20^2$ [1] = 1500000 (J) [1]	[2]	
	(iii) Work = 1500000 (J) [1] e.c.f. from (ii)	[1]	
	(iv) Power = Work done/time [1] = 1500000/20 [1] = 75000 (W) [1] Allow e.c.f. from (ii) or (iii).	[3]	
	(v) 75 (kW) allow e.c.f. from (iv) [1]	[1]	8

3
- Two light nuclei [1]
- Join together or combine or fuse [1]
- To form a different nucleus [1]
- Energy is released [1]
- Decrease in mass [1]
- High temperature [1]

Response	**Mark**
Candidates must use appropriate specialist scientific terms throughout to describe fully and in a logical sequence the process of fission in a nuclear reactor using **all** the points shown in the indicative content above. They use good spelling, punctuation and grammar throughout and the form and style are of a high standard.	**[5-6]**
Candidates use some appropriate specialist scientific terms to partially describe, in a logical sequence, **3 or 4** points relating to nuclear fission shown in the indicative content above. They use satisfactory spelling, punctuation and grammar and the form and style are of satisfactory standard.	**[3-4]**
Candidates use limited specialist scientific terms to describe **1 or 2** of the points relating to fission shown in the indicative content above. Their spelling, punctuation, grammar, form and style are of a limited standard.	**[1-2]**
Response not worthy of credit.	**[0]**

6

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			AVAILABLE MARKS
4	**(a)**	1.2, 2.6 2 correct = [2], 1 correct = [1] [2]	
	(b)	Scale > half of axis [1] } if non linear scale Deduct [1] for each incorrect point } then 0/4 within ± 1 square [4]	
	(c)	**(i)** Straight line [1], including origin [1] dependent marking ± 1 square [2]	
		(ii) Yes [1] Straight line through origin [1] allow e.c.f. from (c)(i) [2]	10
5	**(a)**	**(i)** Increases [1] [1]	
		(ii) Decreases [1] [1]	
	(b)	Direction (of vel.) changes/velocity is a vector [1] [1]	
	(c)	$v = \frac{mom}{mass}$ or mom = mass × velocity or p = mv [1] = 2.4/0.2 [1] = 12 (m/s) [1] [3]	6
6	**(i)**	ACM = CM [1] or $F_1d_1 = F_2d_2$ W × 3[1] = 2400 × 6.6 [1] W = 5280 (N) [1] [4]	4
7	**(i)**	a = (v − u)/t [1] = 0.6/3 [1] = 0.2 (m/s^2) [1] [3]	
	(ii)	F = ma [1] F = 200 × 0.2 [1] allow e.c.f. from (i) F = 40 (N) [1] [3]	6
8	**(i)**	Nuclei (unstable) [1] Emit radiations (spontaneously) or disintegrates/decays [1] [2]	
	(ii)	same number of protons [1] but different numbers of neutrons [1] [2]	
	(iii)	0 [1] 8 [1] 6 [1] [3]	
	(iv)	Fast moving electrons [1] [1]	
	(v)	(High freq.) e.m. (radiation) [1] [1]	9

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				AVAILABLE MARKS
9	**(a)**	Electrons dotted like currants [1], positive charge was to be spread throughout [1]	[2]	
	(b)	**(i)** Electrons in orbit [1] or in shells		
		(ii) Nuclei were tiny [1] or small		
		(iii) Most mass is in the nucleus [1]	[3]	5
10	**(a)**	It is the time taken [1] for the activity to decrease by half [1] (dependent marking) only gets access to activity mark if first mark given	[2]	
	(b)	**(i)** 3 (half-lives) [1]		
		$\frac{1}{8}$ (th) [1]	[2]	
		(ii) Random (decay) [1]	[1]	
	(c)	232 for Thorium [1] 88 for Ra [1] $^{4}_{2}$He or $^{4}_{2}\alpha$ [3] } all free-standing marks	[5]	10
			Total	**70**

New Specification

Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2011–2012

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

GSD32

MONDAY 14 NOVEMBER 2011
1.30 pm–2.30 pm

TIME

1 hour.

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 ten** questions.

INFORMATION FOR CANDIDATES

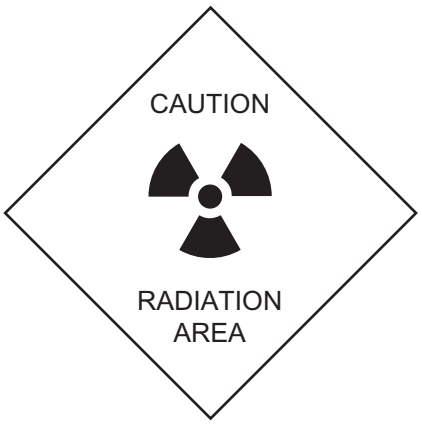
The total mark for this paper is 70.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in **questions requiring extended answers**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total Marks	

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Examiner Only	
Marks	Remark

1 Certain substances such as uranium are said to be radioactive.



(a) (i) What does the word "radioactive" mean?

_____

_____ [2]

In the study of radioactivity we learn of three different types of radiation.

(ii) Identify these radiations from the information given below.

This type of radiation is an electromagnetic wave.

Type of radiation _____ [1]

This type of radiation is a particle made up from four smaller particles.

Type of radiation _____ [1]

This type of radiation is a single particle.

Type of radiation _____ [1]

We are all exposed to a certain minimum amount of radiation called "background radiation".

(b) Give two sources of background radiation.

1. _____

2. _____ [2]

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People who work in nuclear power stations must take certain precautions to minimise the amount of radiation they receive.

Examiner Only	
Marks	Remark

(c) (i) Why must they keep the radiation they receive to a minimum?

_____ [1]

(ii) Give two methods that they can use to keep the radiation to a minimum.

1. _____

2. _____ [2]

Examiner Only	
Marks	Remark

2 Nuclear fission reactors make use of a fuel called uranium. Uranium may be written in the following way:

$$^{235}_{92}U$$

(a) (i) What is the number 92 called?

_____ [1]

(ii) What information about the uranium nucleus is given by the number 92?

_____ [1]

(iii) What is the number 235 called?

_____ [1]

(iv) What information about the uranium nucleus is given by the number 235?

_____ [1]

(b) Some scientists believe that we should make greater use of nuclear fission.

Describe what happens in the fission of $^{235}_{92}U$ in a nuclear reactor.

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

_____

_____

_____

_____

_____

_____

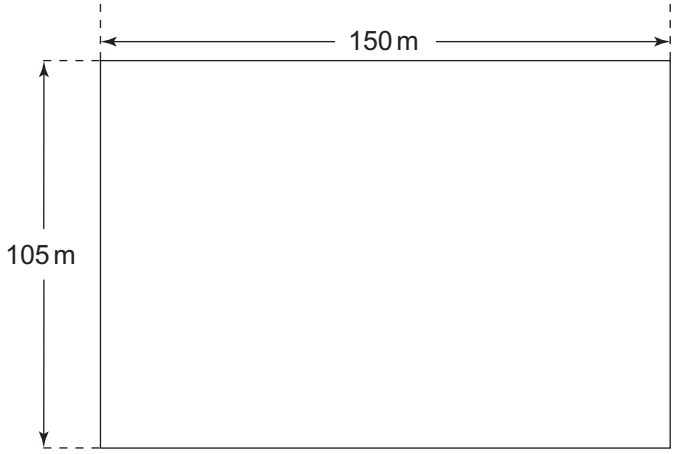
_____

_____ [6]

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Examiner Only	
Marks	Remark

3 Kevin runs around a rectangular track of length 150 m and breadth 105 m, as shown in the diagram below.



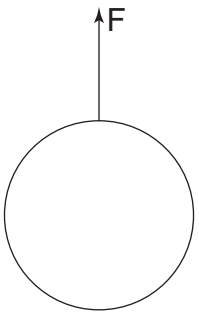
If his average speed is 3 m/s, how long does it take him to run once around the track?

You are advised to show your working out.

Time = _____ s [5]

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4 When an object falls through the air a drag force, F, acts on the object.



The size of the drag force, F, depends on the speed, v, of the falling object.

A scientist suggests a theory that the drag force is proportional to the square of the velocity. Another way of writing this relationship is:

$$F = kv^2 \qquad \textbf{Equation 4.1}$$

where k is a constant.

He obtains a set of results and these are shown.

F in N	0.5	2.0	4.5	8.0	12.5
v in m/s	1	2	3	4	5
v^2 in m^2/s^2					

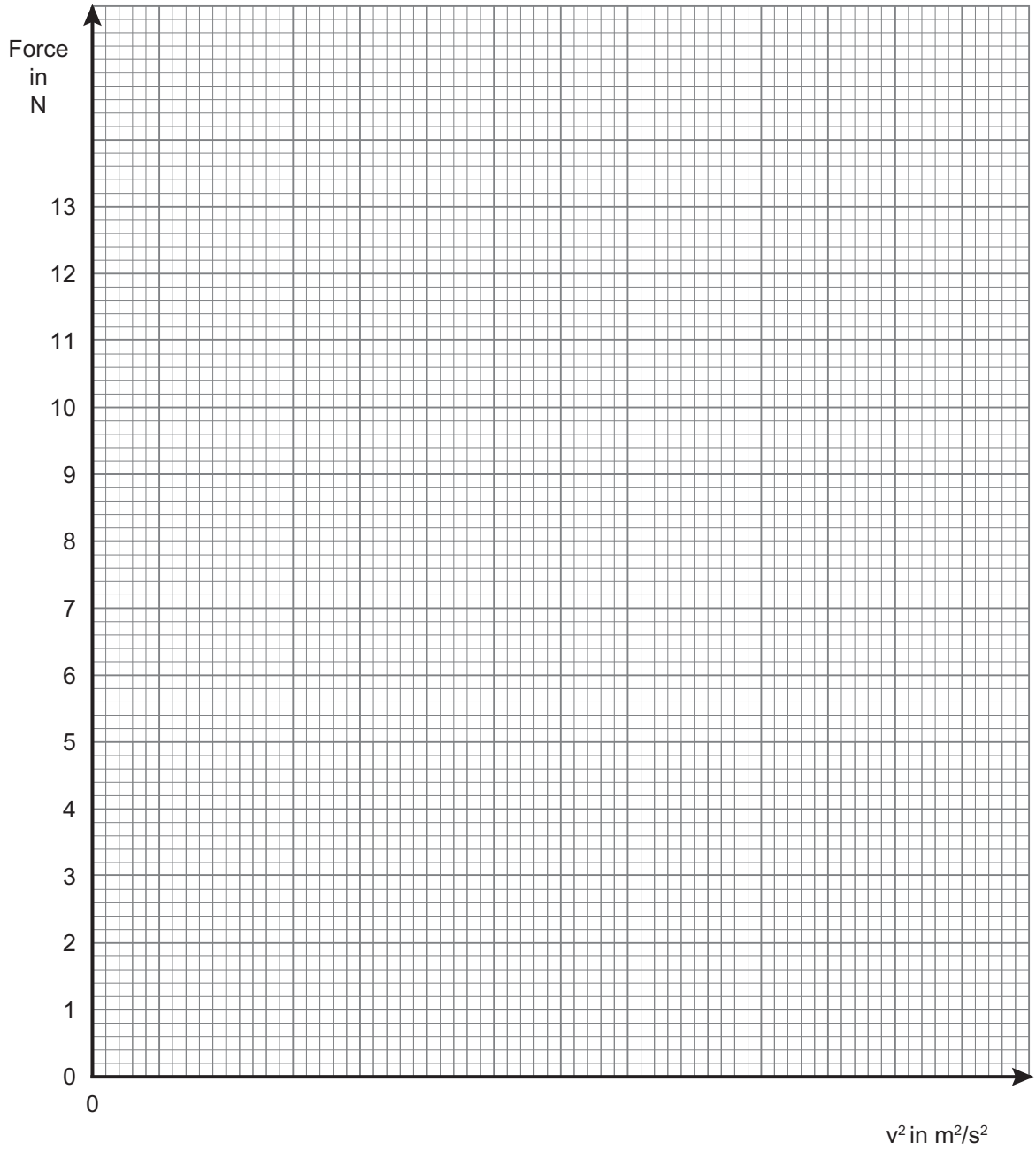
(i) Complete the table by entering the values of v^2. [2]

(ii) Choose a suitable scale for the horizontal axis and plot a graph of F against v^2. [3]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

(iii) Draw the best fit line. [1]

(iv) Does your graph support the theory described by **Equation 4.1**? Explain your answer.

_____

_____ [3]

(v) How would you find the value of k from the graph?

_____ [1]

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5 When the forward force on a car of mass 1200 kg is 1600 N, its acceleration is 1.2 m/s^2. Calculate the force of friction acting on the car.

You are advised to show your working out.

Force of friction = _____ N [4]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

6 A helicopter accelerates vertically from an initial upwards velocity of 2 m/s to a final upwards velocity of 24 m/s. If its acceleration is 5.5 m/s^2, calculate the time taken.



You are advised to show your working out.

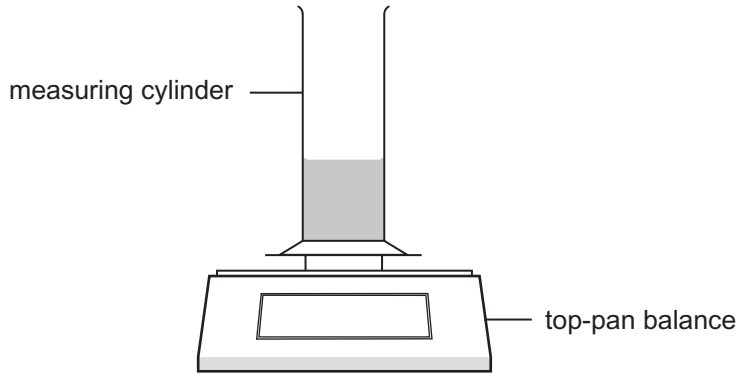
Time = _____ s [4]

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Examiner Only	
Marks	Remark

7 Patricia wants to find the density of a liquid.

She puts some of the liquid into a measuring cyclinder and records the volume of the liquid. She then places the measuring cylinder of liquid on a top-pan balance to find the total mass of the measuring cylinder plus liquid.



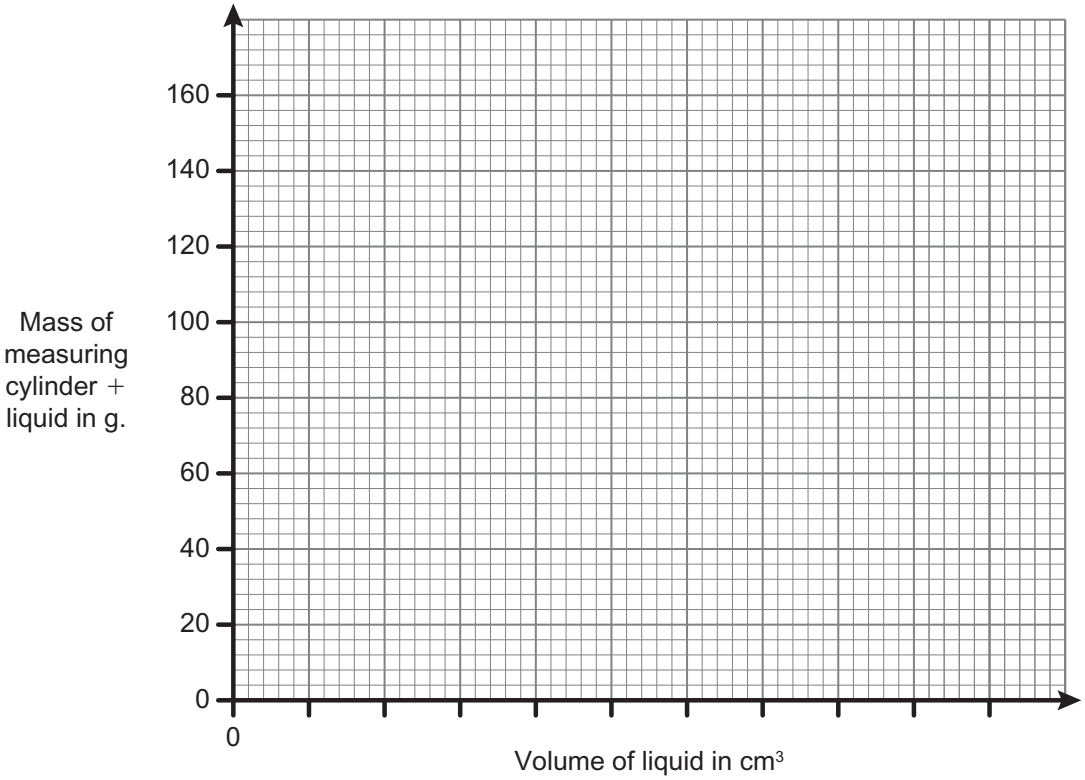
She repeats this procedure for different amounts of liquid. Her results are recorded below.

Mass of measuring cylinder + liquid in g	80	100	120	140	160
Volume of liquid in cm^3	20	40	60	80	100

(a) (i) On the grid on the opposite page, choose a suitable scale for the horizontal axis. Plot a graph of "Mass of measuring cylinder + liquid" against "Volume of liquid". [3]

(ii) Draw the best fit line. [1]

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(iii) Use your graph to find the mass of the measuring cylinder.

Mass of measuring cylinder = _____ g [1]

(iv) **Use your graph** to find the density of the liquid. Remember to include the units.

You are advised to show your working out.

Density of liquid = _____ [4]

If a less dense liquid had been used in this experiment how would this affect

(b) **(i)** the value of the intercept on the vertical axis?

_____ [1]

(ii) the slope of the line?

_____ [1]

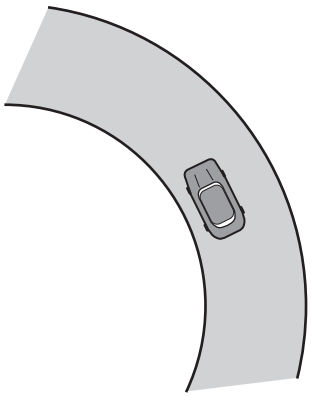
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

8 The diagram shows a plan view (bird's eye view) of a car on a circular track.



(a) (i) State the direction of the centripetal force on the car.

_____ [1]

(ii) What practical effect does this force have on the motion of the car?

_____ [1]

The car now travels at a higher speed.

(iii) How will this affect the size of the centripetal force?

Underline the correct answer.

INCREASES STAYS THE SAME DECREASES [1]

The car now moves to the outside of the track but moves at the same speed.

(iv) How will this affect the size of the centripetal force?

Underline the correct answer.

INCREASES STAYS THE SAME DECREASES [1]

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A moving car has momentum.

(b) Information about this car is given in the box.

Weight = 15 000 N Mass = 1500 kg Kinetic energy = 363 000 J Velocity = 22 m/s

Calculate the momentum of the car.
Remember to include the units.

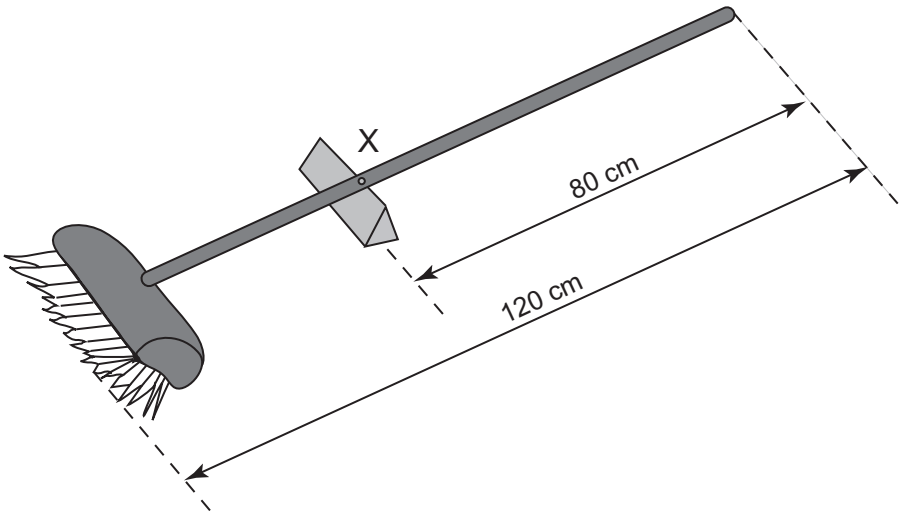
Show clearly your working out.

Momentum = _____ [4]

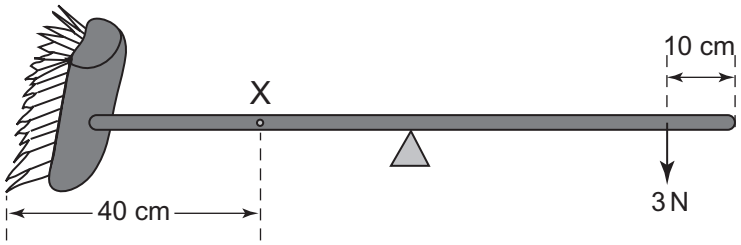
Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

9 A brush, 120 cm in length, is placed on top of pivot and is found to balance at a point X which is 80 cm from one end as shown.



The brush is moved so that its **mid-point** is on the pivot. The brush is now kept in a horizontal position by a 3 N force acting a distance of 10 cm from the end.



Use the principle of moments to calculate the weight of the brush.

You are advised to show your working out.

Weight of brush = _____ N [4]

10 An archer shoots an arrow vertically into the air. The arrow has a mass of 200 g and its initial kinetic energy is 50 J.



Later in its upward flight the kinetic energy of the arrow is only 20 J.

Calculate the height of the arrow when its kinetic energy is 20 J. Assume no energy losses.

You are advised to show your working out.

Height of arrow = _____ m [4]

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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111990

New Specification

Rewarding Learning

General Certificate of Secondary Education
2011–2012

Double Award Science: Physics

Unit P1

Higher Tier

[GSD32]

MONDAY 14 NOVEMBER 2011
1.30 pm–2.30 pm

MARK SCHEME

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				AVAILABLE MARKS
1	**(a)**	**(i)**	Unstable nuclei OR nuclei disintegrate [1] emit particles or radiation or gamma rays [1] [2]	
		(ii)	gamma, alpha, beta [1] each [3]	
	(b)		Any **two** from: e.g., radon gas from earth's crust, from space/cosmic rays building materials, food (e.g. bananas) etc. [2]	
	(c)	**(i)**	e.g. avoid cancer, radiation sickness/burns [1]	
		(ii)	Any **two** from: keep exposure time to a minimum work at a distance/use forceps or tools use shielding/special clothing [2]	10
2	**(a)**	**(i)**	Atomic number [1] [1]	
		(ii)	No. of protons [1] [1]	
		(iii)	Mass number [1] [1]	
		(iv)	No. of protons + neutrons OR number of particles in the nucleus [1] [1]	
	(b)		**Indicative Content** • Absorbs neutron or neutron strikes (U^{235} nucleus) • Splits nucleus • (2 or 3) (fission) neutrons produced • (Possible) chain reaction • Energy Released [6]	

Response	**Mark**
Candidates must use appropriate specialist scientific terms throughout to describe fully and in a logical sequence the process of fission in a nuclear reactor using **all** the points shown in the indicative content above. They use good spelling, punctuation and grammar throughout and the form and style are of a high standard.	**[5–6]**
Candidates use some appropriate specialist scientific terms to partially describe, in a logical sequence, **3 or 4** points relating to nuclear fission shown in the indicative content above. They use satisfactory spelling, punctuation and grammar and the form and style are of satisfactory standard.	**[3–4]**
Candidates use limited specialist scientific terms to describe **1 or 2** of the points relating to fission shown in the indicative content above. Their spelling, punctuation, grammar, form and style are of a limited standard.	**[1–2]**
Response not worthy of credit.	**0**

10

			AVAILABLE MARKS
3	distance = 2 (150 + 105) [1] = 510 m [1] time = dist/vel (or equivalent formula) [1] = 510/3 [1] = 170(s) [1]	[5]	5
4	**(i)** $\frac{1}{2}$ mark each round down	[2]	
	(ii) v^2 scale must be 0.5 or more of axis. [1] Plot points: 5 correct [2], 4 correct [1]	[3]	
	(iii) Best fit line [1]	[1]	
	(iv) Yes [1] Graph is a straight line [1] passing thro' origin [1]	[3]	
	(v) k is the grad [1]	[1]	10
5	F = ma [1] F = 1200 × 1.2 [1] F = 1440 N [1] Friction = 160 N [1]	[4]	4
6	$t = \frac{\Delta v}{t}$ [1] $t = \frac{24 - 2}{5.5}$ [2] t = 4(s) [1]	[4]	4
7	**(a)** **(i)** All points correctly plotted [2] (4 points – [1]) Vol scale to use 0.5 or more of axis [1]	[3]	
	(ii) best fit line [1]	[1]	
	(iii) Intercept on y-axis = 60(g)	[1]	
	(iv) density = gradient [1] $= \frac{160 - 80}{80}$ [1] = 1 [1] = g/cm^3 [1]	[4]	
	(b) **(i)** No effect [1]	[1]	
	(ii) Lesser slope [1]	[1]	11

			AVAILABLE MARKS
8	**(a)** **(i)** Towards the centre (of the curve) [1]		
	(ii) Keeps the car going in a curve (circle) [1]		
	(iii) INCREASE [1]		
	(iv) DECREASE [1]	[4]	
	(b) Mom = mass × velocity [1] Mom = 1500 × 22 [1] Mom = 33 000 [1] kgm/s [1]	[4]	8
9	CWM = ACWM [1] 3 × 50 [1] = W × 20 [1] W = 7.5(N) [1]	[4]	4
10	pe = mgh [1] 30 [1]= 0.2 × 10 × h [1] h = 15(m) [1]	[4]	4
		Total	**70**

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