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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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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]

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Marks	Remark

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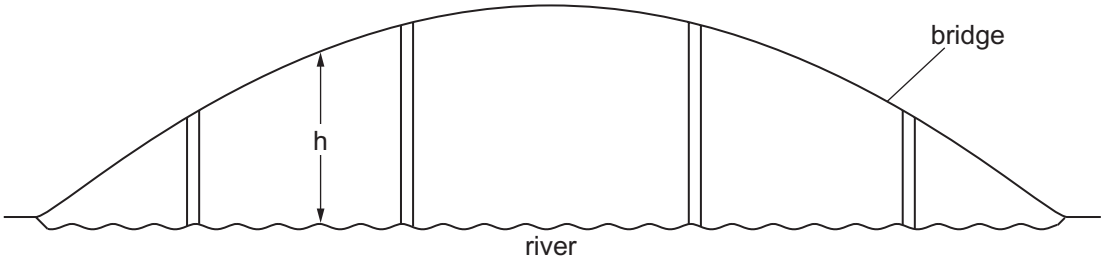
3



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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]

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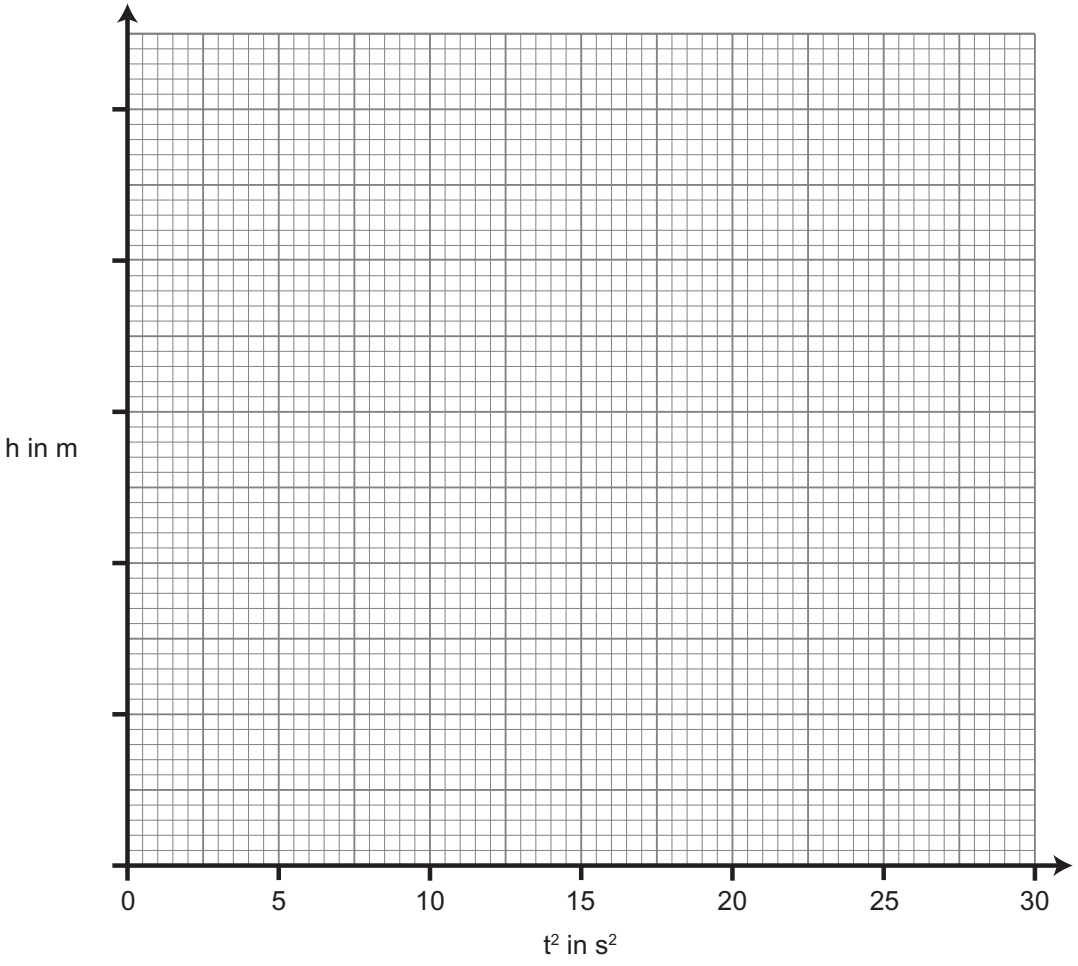

(d) Use your graph to determine the constant k.
Remember to include the units for k.

You are advised to show your working out.

k = _____ : Unit = _____ [4]

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Marks	Remark

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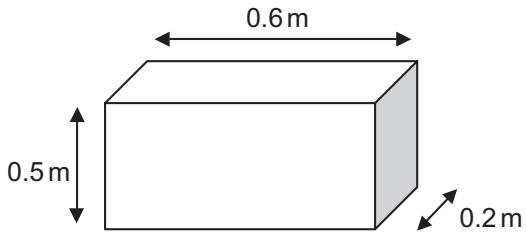
4 A brass ingot (block) has the dimensions shown.



(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]

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5 Velocity–time graphs are shown below for a ball which is either:

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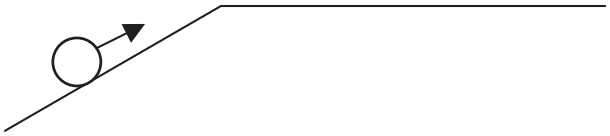
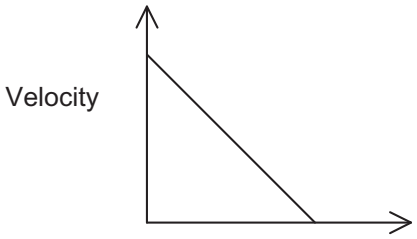
A running on a horizontal surface,

B running down a slope onto a horizontal surface,

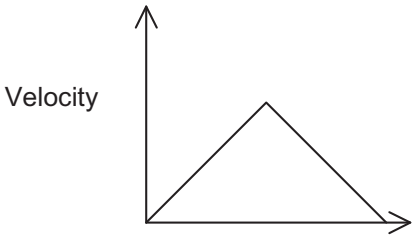
C running up a slope onto a horizontal surface.



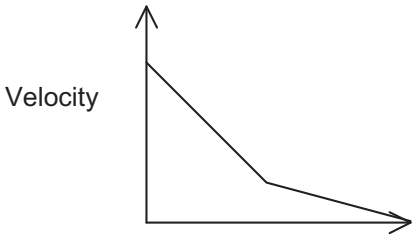
(a) Match the diagrams A, B or C to the correct graphs below.
Remember friction is acting in all situations.



Letter _____



Letter _____



Letter _____ [3]

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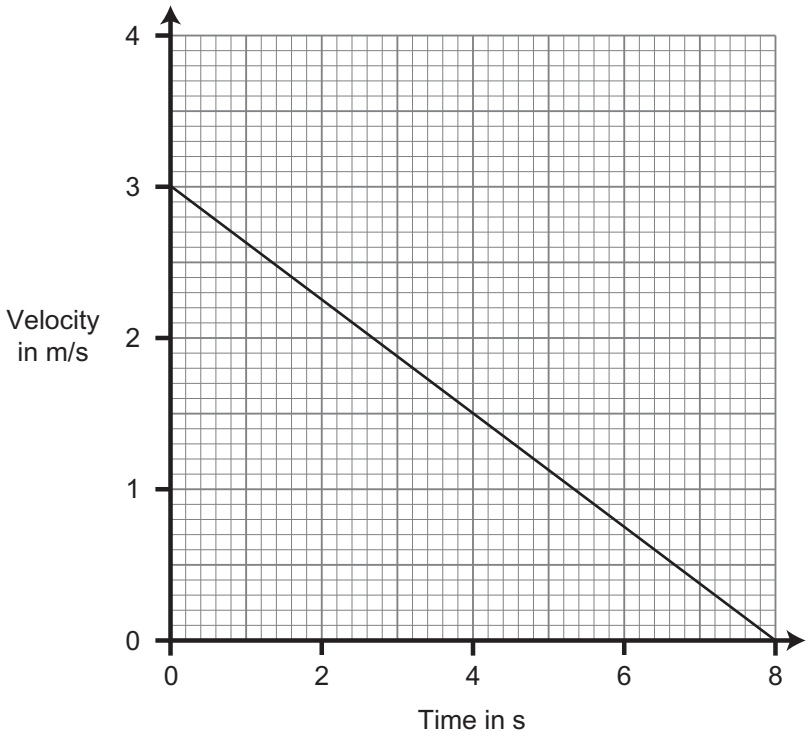
A velocity–time graph for a moving ball is shown below.



(b) Use the graph to find the distance travelled by the ball.

You are advised to show your working out.

Distance = _____ m [3]

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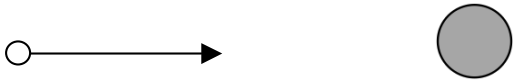
Marks	Remark

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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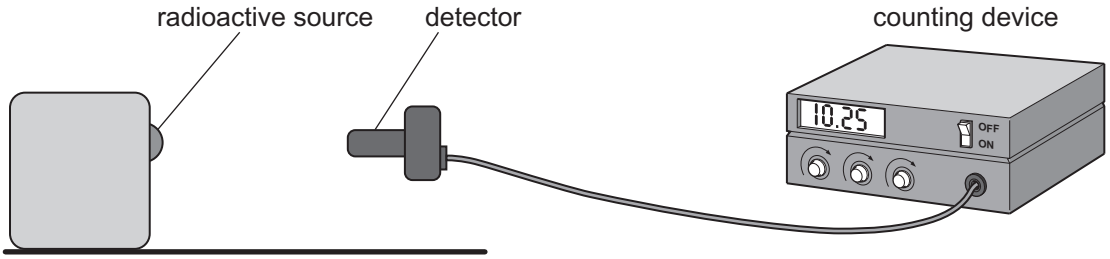
7 **(a)** Radium has a half-life of 3.6 days.

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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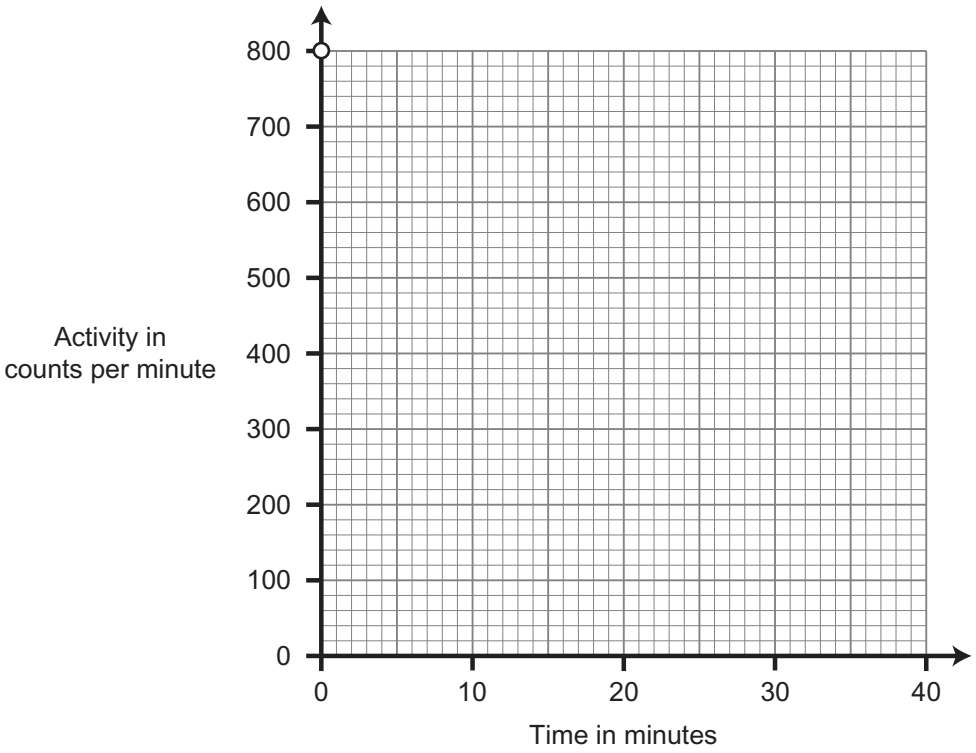
(b) (i) On the graph below the initial activity of 800 counts per minute is marked for you. Plot four more points, at ten minute intervals, if the half-life is exactly 10 minutes.



[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]

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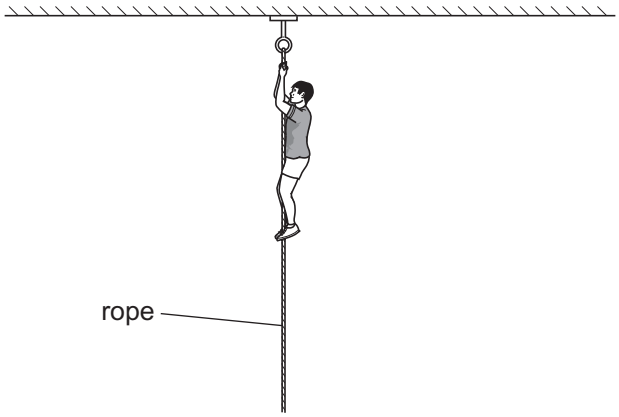
8 A gymnast pulls himself up a rope and at the instant shown he is stationary.



(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.

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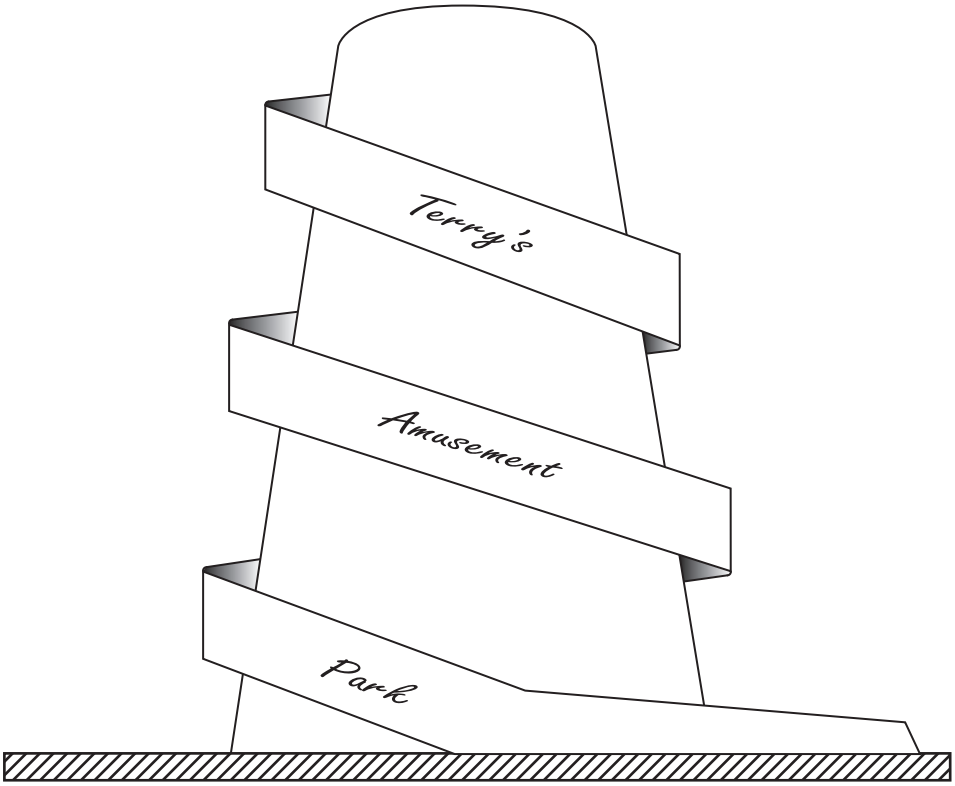

(a) How much potential energy does Frank have at the top of the helter-skelter?

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]

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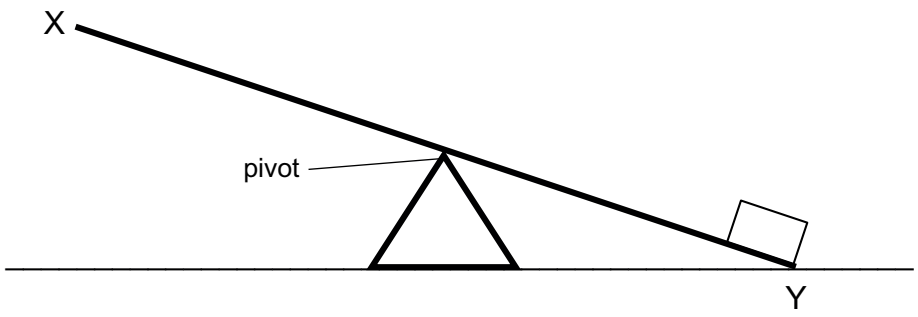
Marks	Remark

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]

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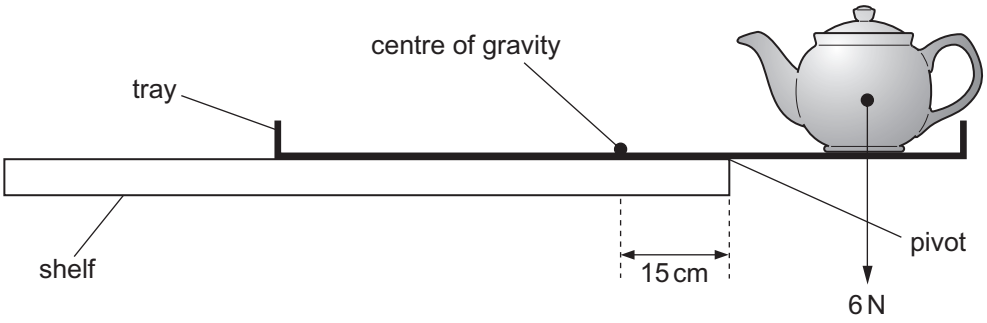
(b) A teapot is placed on a tray and the tray is set on a shelf as shown. The tray has a weight of 10 N.



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]

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