Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/62**

Paper 6 (Extended) **May/June 2015**

1 hour 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Graphics calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
Do not use staples, paper clips, glue or correction fluid.
You may use an HB pencil for any diagrams or graphs.
DO **NOT** WRITE IN ANY BARCODES.

Answer both parts **A** and **B**.
You must show all relevant working to gain full marks for correct methods, including sketches.
In this paper you will also be assessed on your ability to provide full reasons and communicate your mathematics clearly and precisely.
At the end of the examination, fasten all your work securely together.
The total number of marks for this paper is 40.

This document consists of **12** printed pages.

CAMBRIDGE International Examinations

Answer **both** parts **A** and **B.**

A INVESTIGATION MOLECULES (20 marks)

You are advised to spend no more than 45 minutes on this part.

This investigation looks at the number of spheres and rods that you need to make models of molecules.

1 Chemists use small spheres and rods to make models of molecules.

These diagrams show a sequence of molecules of height 1.

Molecule 1 Molecule 2 Molecule 3

(a) Draw the next two molecules in this sequence.

(b) Complete this table for molecules of height 1.

Molecule *m*	Number of spheres *s*	Number of rods *r*
1	1	0
2	2	1
3	3	2
4		
5		
6		

(c) Write down a formula for s in terms of m.

$s =$ .....

2 These diagrams show a sequence of molecules of height 2.

Molecule 1 Molecule 2 Molecule 3 Molecule 4

(a) Complete this table for molecules of height 2.

Molecule *m*	Number of spheres *s*	Number of rods *r*
1	2	1
2	4	4
3	6	7
4		
5		
6		

(b) Find, in terms of m, a formula for

(i) s,

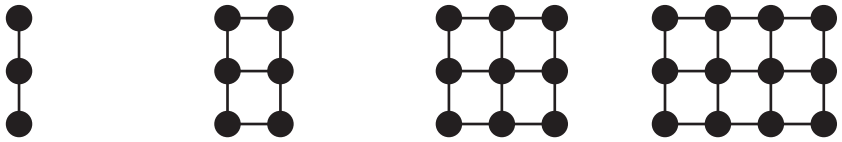
$s =$ .....

(ii) r.

$r =$ .....

3 These diagrams show a sequence of molecules of height 3.

Molecule 1 Molecule 2 Molecule 3 Molecule 4



(a) Complete this table for molecules of height 3.

Molecule *m*	Number of spheres *s*	Number of rods *r*
1	3	2
2	6	7
3	9	12
4		
5		
6		

(b) Find, in terms of m, a formula for

(i) s,

$s =$ .....

(ii) r.

$r =$ .....

4 **(a)** Use your answers to **questions 1(c)**, **2(b)** and **3(b)** to help you complete the table for molecules of height h.

Height (h)	Number of spheres (s) in terms of m	Number of rods (r) in terms of m
1		$m - 1$
2		
3		
4		
5	$5m$	$9m - 5$
6		

(b) Find, in terms of m and h, a formula for

(i) s,

$s =$ .....

(ii) r.

$r =$ .....

[Turn over

(c) Use your answer to **part (b)(i)** to find a formula for m in terms of s and h.

$m =$ .....

(d) Find a formula for r in terms of s and h.

$r =$ .....

5 **(a)** A molecule has height h and width w.
For example, Molecule 4 in **question 3** has $h = 3$ and $w = 4$.

Use your answer to **question 4(d)** to show that $r = 2hw - h - w$.

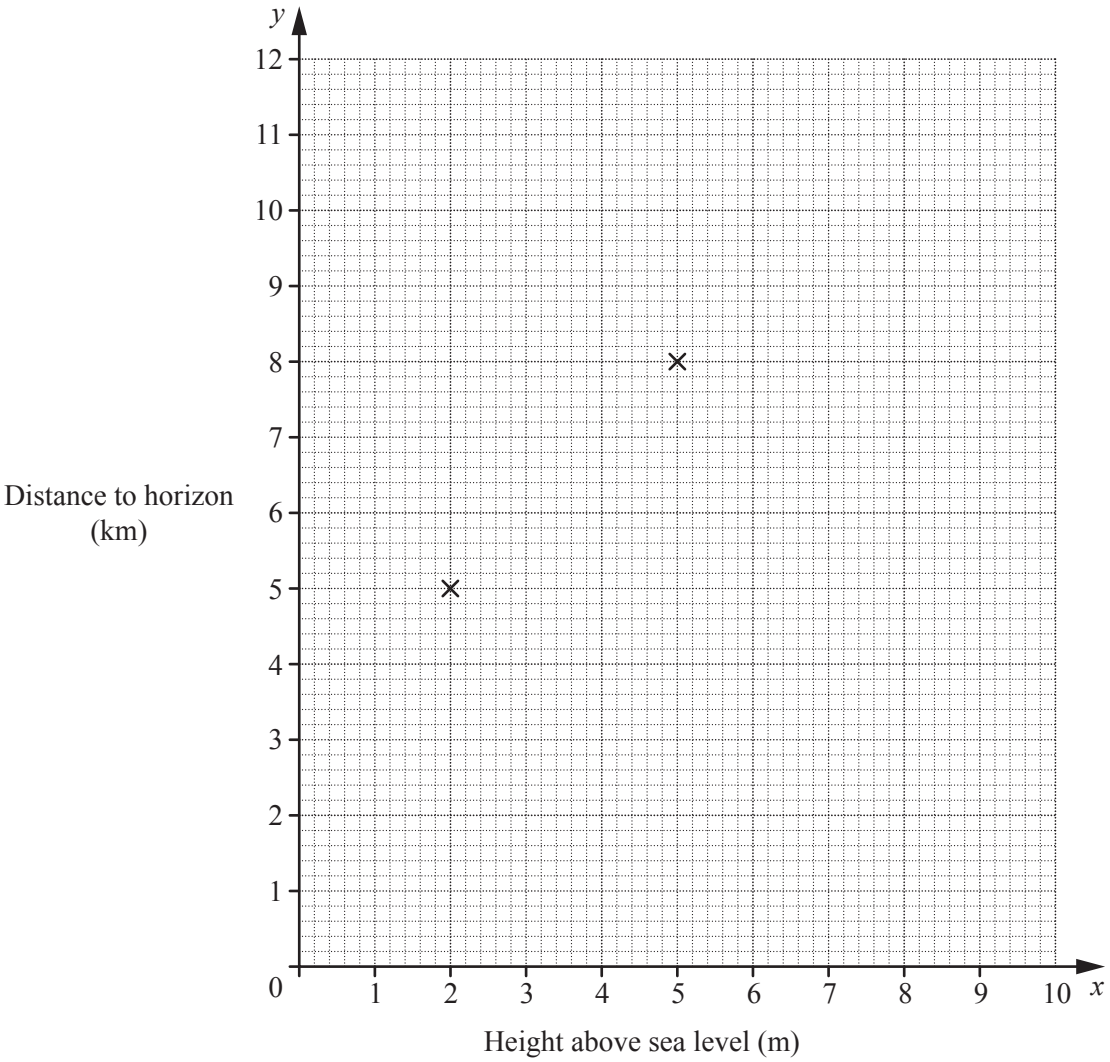
(b) Can a square molecule have 544 rods?

B MODELLING WHERE IS THE HORIZON? (20 marks)

You are advised to spend no more than 45 minutes on this part.

This table shows the distance to the horizon (y kilometres) at different heights above sea level (x metres).

x	1	2	3	4	5	6	7	8	9	10
y	3.6	5.0	6.2	7.1	8.0	8.7	9.4	10.1	10.7	11.3



1 **(a)** On the grid, plot the points given in the table.
The points (2, 5) and (5, 8) have been plotted for you.

(b) The simplest way to model the data is with a straight line.

(i) On the grid, draw the straight line passing through (2, 5) and (5, 8).

Find the equation of this line.

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(ii) Using this model what is the distance to the horizon when at sea level?

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2 Another model for the data is $y = ax^2 + bx + c$.
Assume that, when the height is 0, the distance to the horizon is 0.

(a) Show that $c = 0$.

(b) When $c = 0$, the model is $y = ax^2 + bx$.

(i) Use the point (2, 5) to form an equation in a and b.

.....

(ii) Use the point (5, 8) to form another equation in a and b.

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(c) Solve the equations in **part (b)** and write down your model.

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(d) Sketch the graph of y against x for $0 \leqslant x \leqslant 10$.

(e) Comment on the validity of this model.

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Question 3 is printed on the next page.

3 Another model for this data is $y = ax^b$.

(a) Use (2, 5) and (5, 8) to write down two equations in a and b.

....

(b) Show that $1.6 = 2.5^b$.

(c) Show that $b = 0.5$, correct to 1 decimal place.

(d) Find the value of a and write down your model.

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(e) Compare the model in this question with the data on page 8.

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