Cambridge Assessment International Education

Cambridge IGCSE™

CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/61**

Paper 6 (Extended) **May/June 2022**

MARK SCHEME

Maximum Mark: 60

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2022 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **10** printed pages.

© UCLES 2022

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

© UCLES 2022

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

MARK SCHEME NOTES

The following notes are intended to aid interpretation of mark schemes in general, but individual mark schemes may include marks awarded for specific reasons outside the scope of these notes.

Types of mark

M Method marks, awarded for a valid method applied to the problem.

A Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. For accuracy marks to be given, the associated Method mark must be earned or implied.

B Mark for a correct result or statement independent of Method marks.

When a part of a question has two or more 'method' steps, the M marks are in principle independent unless the scheme specifically says otherwise; and similarly where there are several B marks allocated. The notation '**dep**' is used to indicate that a particular M or B mark is dependent on an earlier mark in the scheme.

Abbreviations

awrt answers which round to
cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
nfww not from wrong working
oe or equivalent
rot rounded or truncated
SC Special Case
soi seen or implied

© UCLES 2022

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Partial Marks</th></tr>
<tr><td>1(a)</td><td>
<table>
<tr><th>Bin</th><th>Mass of items in bin</th><th colspan="5">Unused mass in bin</th></tr>
<tr><td>1</td><td>38, 6, 7, 9</td><td>22</td><td>16</td><td>9</td><td>[0]</td><td></td></tr>
<tr><td>2</td><td>21, 32</td><td>39</td><td>7</td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>50</td><td>10</td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>15, 27</td><td>45</td><td>18</td><td></td><td></td><td></td></tr>
<tr><td>5</td><td>25</td><td>35</td><td></td><td></td><td></td><td></td></tr>
</table>
</td><td>4</td><td>B1 for 15 as first entry in bin 4
B1 for 60 – their 15 unused in bin 4
B1 for 9 as the only extra entry in bin 1</td></tr>
<tr><td>1(b)</td><td>
<table>
<tr><th>Bin</th><th>Mass of items in bin</th><th colspan="5">Unused mass in bin</th></tr>
<tr><td>1</td><td>8, 10</td><td>12</td><td>2</td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>16, 3</td><td>[4]</td><td>1</td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>13, 5</td><td>[7]</td><td>2</td><td></td><td></td><td></td></tr>
<tr><td>4</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td><td>2</td><td>B1 for one correct row or
for all 5 items correctly placed or
for finding the correct unused masses for their positions of all 5 items or
for rows 2 and 3 reversed</td></tr>
<tr><td>2(a)</td><td>50, 38, 32, 27, 25, 21, 15, 9, 7, 6</td><td>1</td><td></td></tr>
<tr><td>2(b)</td><td>
<table>
<tr><th>Bin</th><th>Mass of items in bin</th><th colspan="5">Unused mass in bin</th></tr>
<tr><td>1</td><td>50, 9</td><td>[10]</td><td>1</td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>38, 21</td><td>[22]</td><td>1</td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>32, 27</td><td>[28]</td><td>1</td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>25, 15, 7, 6</td><td>[35]</td><td>[20]</td><td>[13]</td><td>7</td><td></td></tr>
<tr><td>5</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td><td>2</td><td>B1 for 2 correct rows or for their first 5 items correctly placed</td></tr>
</table>

© UCLES 2022

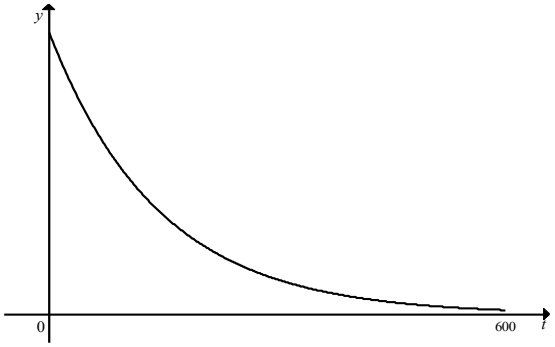
Question	Answer	Marks	Partial Marks
2(c)	Correct calculation to find either percentage e.g. **Method 1** $\frac{70}{300}[\times 100]$ or $\frac{5\times 60-230}{5\times 60}[\times 100]$ **Method 2** $\frac{10}{240}[\times 100]$ or $\frac{4\times 60-230}{4\times 60}[\times 100]$	**C1**	
	Method 1 23.3[3...%] **Method 2** 4.17 or 4.166 to 4.167[%] Valid comparison e.g. Method 2 gives approximately 19% less waste	**3**	**B1** for each percentage or **SC1** for **Method 1** $\left[\frac{70}{230}\times 100=\right]30.4[3...\%]$ or **Method 2** $\left[\frac{10}{230}\times 100=\right]4.35$ or 4.347 to 4.348[%] or **SC1** for the correct percentages incorrectly labelled **B1 FT** for a valid comparison, dependent on *their* two percentages
2(d)	270 ÷ 80 = 3.375 oe or 3 × 80 + 30 [=] 270 oe or 4 × 80 = 320 and 3 × 80 = 240 oe or 270 ÷ 3 = 90 and 270 ÷ 4 = 67.5 oe	**2**	**M1** for 270 ÷ 80 or 3.375 or 4 × 80 = 320 or 3 × 80 = 240 oe or 270 ÷ 3 = 90 or 270 ÷ 4 = 67.5 oe

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Partial Marks</th></tr>
<tr><td>2(e)</td><td>28, 13, 7, 4 or 30, 28, 21, 13</td><td>C1</td><td></td></tr>
<tr><td></td><td>
<table>
<tr><th>Bin</th><th>Mass of items in bin</th><th colspan="5">Unused mass in bin</th></tr>
<tr><td>1</td><td>30, 10</td><td>[10]</td><td>[0]</td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>21, 19</td><td>[19]</td><td>[0]</td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>28, 7, 4</td><td>[12]</td><td>[5]</td><td>[1]</td><td></td><td></td></tr>
<tr><td>4</td><td>13</td><td>[27]</td><td></td><td></td><td></td><td></td></tr>
<tr><td>5</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
oe
or
<table>
<tr><th>Bin</th><th>Mass of items in bin</th><th colspan="4">Unused mass in bin</th></tr>
<tr><td>1</td><td>10, 19, 7, 4</td><td>[30]</td><td>[11]</td><td>[4]</td><td>[0]</td><td></td></tr>
<tr><td>2</td><td>30</td><td>[10]</td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>28</td><td>[12]</td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>21, 13</td><td>[19]</td><td>[6]</td><td></td><td></td><td></td></tr>
<tr><td>5</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
oe</td><td>2</td><td>B1 for the first 2 rows correct
or B1 for the last 2 rows correct

or
B1 for the first 2 rows correct
or B1 for the last 2 rows correct</td></tr>
<tr><td></td><td>3.3
or [3 × 40 =] 120 and 132 seen
or 132 ÷ 3 = 44 seen
or an argument such as
Bin 1 30 10 full Bin 2 21 19 full
Bin 3 has to have 28 and 13 to improve on 4 bins,
but 28 + 13 = 41 > 40 So Bin 4 is required.
so [4 bins] is a best solution</td><td>1</td><td>FT their number of bins used</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Partial Marks</th></tr>
<tr><td rowspan="4">3</td><td>
<table>
<tr><td>Bin</td><td>Mass of items in bin</td></tr>
<tr><td>1</td><td>9, 4, 7</td></tr>
<tr><td>2</td><td>15,</td></tr>
</table>
</td><td>C1</td><td></td></tr>
<tr><td>
<table>
<tr><td>Bin</td><td>Mass of items in bin</td></tr>
<tr><td>1</td><td>15, 4</td></tr>
<tr><td>2</td><td>9, 7</td></tr>
</table>
</td><td>C1</td><td></td></tr>
<tr><td>$x + y \leqslant 5$ oe
or
<table>
<tr><td>Bin</td><td>Mass of items in bin</td></tr>
<tr><td>1</td><td>9, 4, 7</td></tr>
<tr><td>2</td><td>15, 3, 2</td></tr>
</table>
<table>
<tr><td>Bin</td><td>Mass of items in bin</td></tr>
<tr><td>1</td><td>15, 4</td></tr>
<tr><td>2</td><td>9, 7, 3</td></tr>
<tr><td>3</td><td>2</td></tr>
</table>
</td><td>C1</td><td></td></tr>
<tr><td>$x = 2$ and $y = 3$ or $x = 3$ and $y = 2$</td><td>1</td><td></td></tr>
<tr><td rowspan="2">4(a)</td><td>Diagram showing 3 or 4 items correctly
or
reasoning using dimensions e.g.
‘3 items uses 90 by 60 and that leaves 90 by 30, so one more will fit’</td><td>C1</td><td></td></tr>
<tr><td>4</td><td>1</td><td></td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Partial Marks</th></tr>
<tr><td>4(b)</td><td>
<table>
<tr><th>Bin</th><th>Mass of items</th><th colspan="4">Unused mass in bin</th><th>Items</th></tr>
<tr><td>1</td><td>41, 33, 16</td><td>[49]</td><td>[16]</td><td>[0]</td><td></td><td>[3]</td></tr>
<tr><td>2</td><td>22, 18, 14, 8</td><td>[68]</td><td>[50]</td><td>[36]</td><td>[28]</td><td>[4]</td></tr>
<tr><td>3</td><td>7, 6, 5, 4</td><td>[83]</td><td>[77]</td><td>[72]</td><td>[68]</td><td>[4]</td></tr>
</table>
</td><td>2</td><td>B1 for any two correct rows</td></tr>
<tr><td></td><td>Evidence of 3 bins as best solution for items:

$11 \div 4 = 2.75$
or
$2 \times 4 = 8$ and $3 \times 4 = 12$ oe</td><td>2</td><td>B1 for evidence of best solution for mass e.g.
Mass $174 \div 90 = 1.9[33...]$
or
1 bin = 90 and $2 \times 90 = 180$ oe and 174 seen
OR
partial evidence of best solution for items e.g. $11 \div 4$ or 2.75 or $12 \div 4$ or $2 \times 4 = 8$ or $3 \times 4 = 12$</td></tr>
<tr><td></td><td>40.5[0]</td><td>1</td><td>dep on correctly packing the 3 bins, ignoring unused masses/number of items or evidence of the 3 bins as best solution</td></tr>
<tr><td>5(a)(i)</td><td>$100 \div 2 = 50$, $50 \div 2 = 25$ oe or
$400\left(\frac{1}{2}\right)^{\frac{400}{100}}$ or $400\left(\frac{1}{2}\right)^{4}$</td><td>C1</td><td></td></tr>
<tr><td></td><td>25</td><td>1</td><td></td></tr>
<tr><td>5(a)(ii)</td><td>Correct sketch

</td><td>1</td><td></td></tr>
<tr><td></td><td>y-intercept at 400</td><td>C1</td><td></td></tr>
<tr><td>5(a)(iii)</td><td>$400\left(\frac{1}{2}\right)^{\frac{50}{100}} - 400\left(\frac{1}{2}\right)^{\left[\frac{100}{100}\right]}$
or $282.8... - 200$ oe seen</td><td>C1</td><td></td></tr>
<tr><td></td><td>82.8</td><td>1</td><td></td></tr>
</table>

© UCLES 2022

Question	Answer	Marks	Partial Marks
5(a)(iv)	A sketch of $y = 10$ on the diagram in **(ii)** or on a new sketch in this part or $10 = 400\left(\frac{1}{2}\right)^{\frac{t}{100}}$	**C1**	
	$532[.19...\div 100]$ or $\frac{\log(0.025)}{\log(0.5)}$ $[\times 100]$	**C1**	
	5.32	**1**	
	Alternative method		
	$10 = 400\left(\frac{1}{2}\right)^{T}$	**(C1)**	
	Sketch of relevant functions or $\frac{\log(0.025)}{\log(0.5)}$	**(C1)**	
	5.32	**(1)**	
5(b)(i)	$B(t) = 200\left(\frac{1}{2}\right)^{\frac{t}{30}}$	**1**	
5(b)(ii)	$200\left(\frac{1}{2}\right)^{\frac{300}{30}}$ or $200\left(\frac{1}{2}\right)^{10}$ or $\left(\frac{1}{2}\right)^{\frac{300}{30}}$ or $\left(\frac{1}{2}\right)^{10}$ oe	**C1**	
	$\frac{1}{1024}$	**1**	
5(c)	$[C(t) =]240\left(\frac{1}{4}\right)^{\frac{t}{48}}$	**2**	**B1** for two of 240, $\frac{1}{4}$ or $\frac{t}{48}$ oe correctly used in the model
	for $0 \leqslant t \leqslant 288$	**1**	
6(a)(i)	Valid explanation e.g. $N(0) = N_0 \times 3^0$ or $N(0) = N_0 \times 1$ or When $t = 0$, $3^{kt} = 1$	**1**	
6(a)(ii)	$\frac{N_0}{2}$ oe	**1**	
6(a)(iii)	$\frac{N_0}{2} = N_0 \times 3^{kH}$ leading to $3^{kH} = \frac{1}{2}$	**1**	

Question	Answer	Marks	Partial Marks
6(b)(i)	$3^{10k} = 0.5$ soi	**M1**	
	$10k = \frac{\log\frac{1}{2}}{\log 3}$ or $[k =]\frac{\log\frac{1}{2}}{10\log 3}$ oe leading to $k = -0.0630[9...]$ or -0.0631	**A1**	
6(b)(ii)	relevant sketch of intersecting graphs or $4 = 40 \times 3^{-0.063t}$ or $\frac{1}{10} = 3^{-0.063t}$ oe	**C1**	
	$y = 4$ or $y = 0.1$ indicated on relevant sketch of intersecting graphs or $\frac{\log\frac{1}{10}}{\log 3} = -0.063t$	**C1**	
	33.2 to 33.3	**1**	
	Correct units stated e.g. Minutes	**C1**	
7(a)	relevant sketch of intersecting graphs or $49 = 60 \times 3^{1.6k}$ or $\frac{49}{60} = 3^{1.6k}$	**C1**	
	$y = 49$ or $y = \frac{49}{60}$ indicated on relevant sketch of intersecting graphs or evidence of a calculation for the value of k e.g. $\frac{\log\frac{49}{60}}{\log 3} = 1.6k$	**C1**	
	$k = -0.115[2...]$	**1**	
	relevant sketch of intersecting graphs to solve $30 = 60 \times 3^{-0.1152...H}$ or Evidence of a calculation for the value of the half-life H e.g. $\frac{\log\frac{1}{2}}{\log 3} = -0.115H$	**C1**	**FT** *their* value of k
	awrt 5.48 or 5.49	**1**	
7(b)	Valid verification e.g. $60\left(\frac{1}{2}\right)^{\frac{1.6}{5.476...}} = 49$ or $60\left(\frac{1}{2}\right)^{0.292....} = 49$	**1**	