Cambridge Assessment International Education

Cambridge International AS & A Level

THINKING SKILLS **9694/32**

Paper 3 Problem Analysis and Solution **May/June 2021**

MARK SCHEME

Maximum Mark: 50

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 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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.

Abbreviations

The following abbreviations may be used in a mark scheme:

AG	answer given (on question paper)
awrt	answer which rounds to
cao	correct answer only
ft	follow through (from earlier error)
oe	or equivalent
SC	special case
soi	seen or implied

Question	Answer	Marks
1(a)(i)	$6 \times (5 + 1) + 2 \times (5–1) = \underline{44}$ km. *1 mark for sight of 6 hours and 2 hours OR 6 km / h and 4 km / h*	**2**
1(a)(ii)	From two hours before to low tide.	**1**
1(b)	Using all 3 hours of incoming tide and the rest slack water: $3 \times (5 + 2) + 5 \times 5 = \underline{46}$ km.	**1**
1(c)	Avoiding going against the current would give maximum, taking 4 hours before high tide going up: $(1.5 \times 5 + 2.5 \times 7) = \underline{25}$ km. *1 mark for seeing that 3 of the 8 hours will be at 5 mph.* *SC: 1 mark for 50*	**2**
1(d)(i)	Needs the full three hours of stream to get $3 \times 7 + 5$ km, so earliest is 1.5 – 1 = 0.5 hours / 30 minutes **[1]** and latest 1.5 hours / 90 minutes **[1]**	**2**
1(d)(ii)	Shortest break is $3 \times 3 – 8 =$ <u>1 hour</u>	**1**
1(e)	Not more than 2 km / h for $(12 – 4 \times 1.5)/2$ hours = $\underline{6}$ km	**1**

Question	Answer	Marks
2(a)	7.5 hrs a day for 6 days = 45 hours **[1]** so 15 batches: <u>90</u> candles	**2**
2(b)(i)	45 hours at 50% of time, so 22.5 hours, 11 batches: 66 **AG**	**1**
2(b)(ii)	45 hours at 75% of time, so 33.75 hours **soi [1]** This is $16\frac{7}{8}$ batches, so some weeks he will be able to finish the leftovers and complete 17 batches = 102 candles. **[1]**	**2**
2(b)(iii)	50% of 7.5 = 3.75 hours selling and takes 1.5 hours break **[1]** starts at 14.15, **[1]** completes at 16.15 **AG**	**2**
2(c)(i)	<u>64</u> candles *Maximum 2 marks from:* Meghan: 7.5 + 4.5 = 12 hours, so 4 batches = 24 candles **[1]** Andy: Monday 75% of 7.5 hours = 5.625 hours Tuesday: No breaks or customers before 13:30 = 4.5 hours Total 10.125 hours, so 5 batches = 30 candles **[1]** Violet: 8 hours, so 10 candles **[1]**	**3**
2(c)(ii)	Meghan: 7.5 + 3 = 10.5 hours, 3 batches so 18 candles Andy: Monday 50% of 7.5 hours = 3.75 hours Tuesday: 3.75 hours selling, 1.5 hrs break, so 0 hours Total 3.75 hours, so 1 batch = 6 candles *1 mark for either total for Meghan or Andy correct* Violet: 8 hours, so 10 candles Total 18 + 6 + 10 = <u>34</u> candles	**2**
2(d)	Meghan completes batches of 6 at 12:00, 16:30, then 10:30, 15:00 Andy completes batches at 11:00, 14:30, 16:30, then 9:30, 11:30 Violet completes candles at 09:45 10:30, 11:15 12:00, 12:45 then 9:30, 10:15 11:00 <u>11:00 Tuesday: Violet</u> *1 mark for correct sequence for completion times for the first four batches or candles for any one person* *1 mark for correct times for second person.* *OR* *1 mark for 35 candles completed on Monday* *1 mark for first batch on Tuesday for any one person **soi***	**3**

Question	Answer	Marks
3(a)(i)	11 → 5 → 8 **[1]** 8 → 4 → 7 7 → 3 → 6 **[1]** *Accept → 4 and → 3 not stated*	**2**
3(a)(ii)	Start with 100 cards Remove 11 initially Remove three sets of 3 during the process 100 – 11 – 9 = <u>80</u>	**1**
3(b)	35 → 17 → 20 20 → 10 → 13 **[1]** 13 → 6 → 9 9 → 4 → 7 7 → 3 → 6 So <u>5</u> divisions	**2**
3(c)	<u>14</u> *1 mark for accurately testing any of 12, 13, 15 and 16 as a starting number. This may be done by reducing to previously considered case.*	**2**
3(d)	The smallest initial number of cards to require 5 divisions is 22 **[1]** For 6 divisions it is 38 and for 7 divisions it is 70. The largest possible starting number must therefore require 7 divisions **[1]** 7 divisions will involve the addition of 21 cards from the box, so the initial number taken must be 100 – 21 = <u>79</u> 1 division: 7 (3 additional cards needed from pack) 2 divisions: 8–9 (6 additional cards needed from pack) 3 divisions: 10–13 (9 additional cards needed from pack) 4 divisions: 14–21 (12 ...) 5 divisions: 22–37 (15 ...) 6 divisions: 38–69 (18 ...) 7 divisions: 70–133 (21 …) *SC: 3 marks for 78 if requiring at least one card to be left*	**3**

Question	Answer	Marks
4(a)(i)	1 of each prize	**1**
4(a)(ii)	1 first and 2 third, or 3 second	**1**
4(b)	Ellen's team	**1**
4(c)(i)	He has to win \$140 from 4 prizes **[1]** The only possible sum is \$40 + \$40 + \$30 + \$30. **[1]** OR It is not possible to reach \$140 in 4 quizzes without winning a first prize. If there were only 1 first prize then the other three prizes would have to total \$100, which is not possible as the highest amount is \$30. **[1]** 3 first prizes would give \$120 of prize money, but there is no way to obtain \$20 as the remaining prize. **[1]** Since there must be at least 2 first prizes and also at most 2 first prizes, the number of first prizes must be exactly 2. So Hari's team must have 2 first prizes and 2 second prizes.	**2**
4(c)(ii)	Duong's team won the October quiz and, as they have the highest best score of any team, they must have won another quiz earlier in the year. **[1]** Duong's team must have at least 1 (an odd number of) third place (from \$5) **[1]** Thus 2 prizes left totalling \$50 must both be thirds, so they must have received 2 firsts and 3 thirds. **[1]**	**3**
4(d)	Any team with total prize money not a multiple of 10 must have received a third prize. Bianca's, Duong's, Ellen's and Francesca's teams must have won at least 1 third prize. **[1]** The 6 remaining third prizes must be in three pairs, so at most 3 teams have received third prize on at least two occasions. **[1]** *SC: 1 mark for October is 10th month so max 5 $\times$ 2.*	

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>4(e)</td><td>
<table>
<tr><th>Team</th><th>First</th><th>Second</th><th>Third</th></tr>
<tr><td>A</td><td>1</td><td>2</td><td></td></tr>
<tr><td>B</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>C</td><td></td><td>3</td><td></td></tr>
<tr><td>D</td><td>2</td><td></td><td>3</td></tr>
<tr><td>E</td><td></td><td>1</td><td>1</td></tr>
<tr><td>F</td><td>3</td><td></td><td>1</td></tr>
<tr><td>G</td><td>1</td><td>1</td><td>4</td></tr>
<tr><td>H</td><td>2</td><td>2</td><td></td></tr>
</table>

If not fully correct, award 1 mark each (max 4) for:
• Bianca [1, 1, 1] AND Duong [2, 0, 3] AND Hari [2, 2, 0]
• Ali [1, 2, 0]
• Chen [0, 3, 0]
• Ellen [0, 1, 1]
• Francesca [3, 0, 1]
• Grigory [1, 1, 4]
</td><td>5</td></tr>
</table>