



# Interactive Example Candidate Responses

Paper 5 (May / June 2016), Question 3

**Cambridge IGCSE™**  
**Physics 0625**



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3 In this experiment, you will investigate refraction using a transparent block.

Carry out the following instructions, using the separate ray-trace sheet provided. You may refer to Fig. 3.1 for guidance.

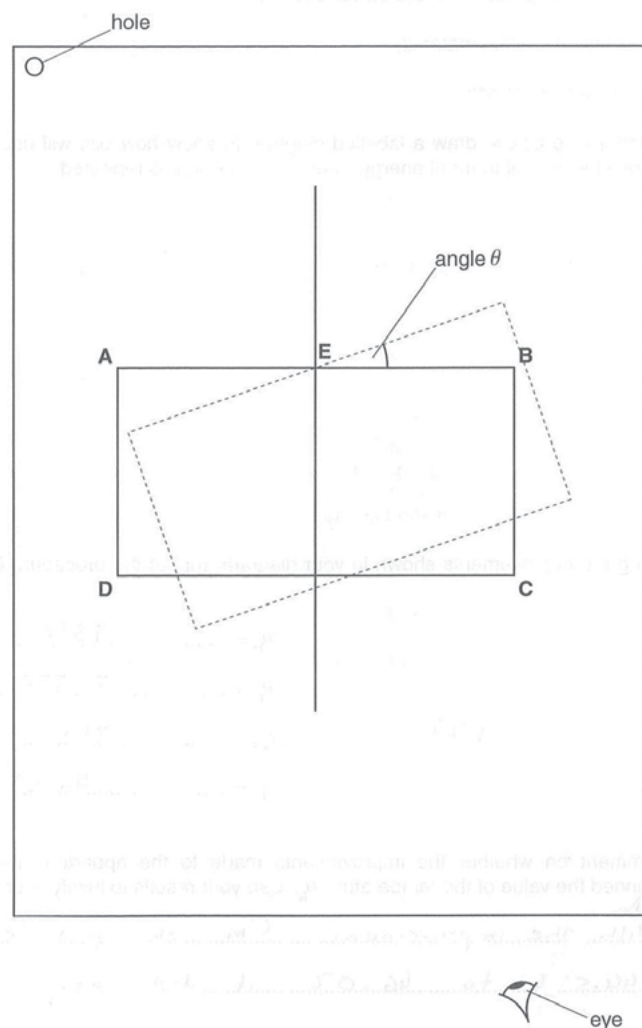


Fig. 3.1

Select  
page

Your  
Mark

3(a)

3(b)

3(c)

3(d)

| Q3  | Mark scheme  |
|-----|--|
| (a) | Ray trace:<br>Correct normal and all lines in approximately the right places<br>P at least 5 cm from <b>AB</b><br>Table:<br>$\theta$ values within $\pm 2^\circ$ of ray trace values<br>$\theta$ values within $\pm 1^\circ$ of 20, 30, 40, 50, 60 |
| (b) | Graph:<br>Axes correctly labelled and right way round<br>Suitable scales<br>All plots correct to $\frac{1}{2}$ small square<br>Good line judgement, thin, continuous line  |
| (c) | Triangle method shown on graph and triangle using at least half of candidate's line<br>G 0.9 – 1.1   |
| (d) | Points close to/scattered from line (to match graph)/all on line.  |

Your  
Mark

3(a)

3(b)

3(c)

3(d)

| Q3  | Mark scheme  |
|-----|--|
| (a) | <p>Ray trace:<br/>Correct normal and all lines in approximately the right places<br/>P at least 5 cm from <b>AB</b><br/>Table:<br/><math>\theta</math> values within <math>\pm 2^\circ</math> of ray trace values<br/><math>\theta</math> values within <math>\pm 1^\circ</math> of 20, 30, 40, 50, 60</p> |
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- (a) • Place the transparent block, largest face down, on the ray-trace sheet supplied. The block should be approximately in the middle of the paper. Draw the outline of the block **ABCD**.
- Remove the block and draw a normal at the centre of side **AB**. Label the point **E** where the normal crosses **AB**.
- Draw a line **FE** to the left of the normal and at an angle  $i = 20^\circ$  to the normal.
- Place a pin **P** on the line **FE**, at a suitable distance from the block for producing an accurate ray trace.
- There are vertical lines **L<sub>1</sub>** and **L<sub>2</sub>** drawn on the block. Replace the block so that line **L<sub>1</sub>** is at point **E**.
- Observe the images of **L<sub>1</sub>** and **P** through side **CD** of the block. Carefully move the block, keeping line **L<sub>1</sub>** at point **E**, until the vertical line **L<sub>2</sub>** and the images of **L<sub>1</sub>** and **P** appear one behind the other. This is indicated by the dashed position of the block shown in Fig. 3.1.
- Draw a line along side **AB** of the block to mark its new position.
- Remove the block.
- Measure the angle  $\theta$  between the original position of **AB** and the new position of **AB**, as indicated in Fig. 3.1.
- Record  $i = 20^\circ$  and  $\theta$  in Table 3.1.
- Repeat the procedure using values of  $i = 30^\circ, 40^\circ, 50^\circ$  and  $60^\circ$ .

Table 3.1

| $i/^\circ$ | $\theta/^\circ$ |
|------------|-----------------|
| 20         | 15              |
| 30         | 17              |
| 40         | 23              |
| 50         | 25              |
| 60         | 37              |

[4]

Your  
Mark

3(a)

3(b)

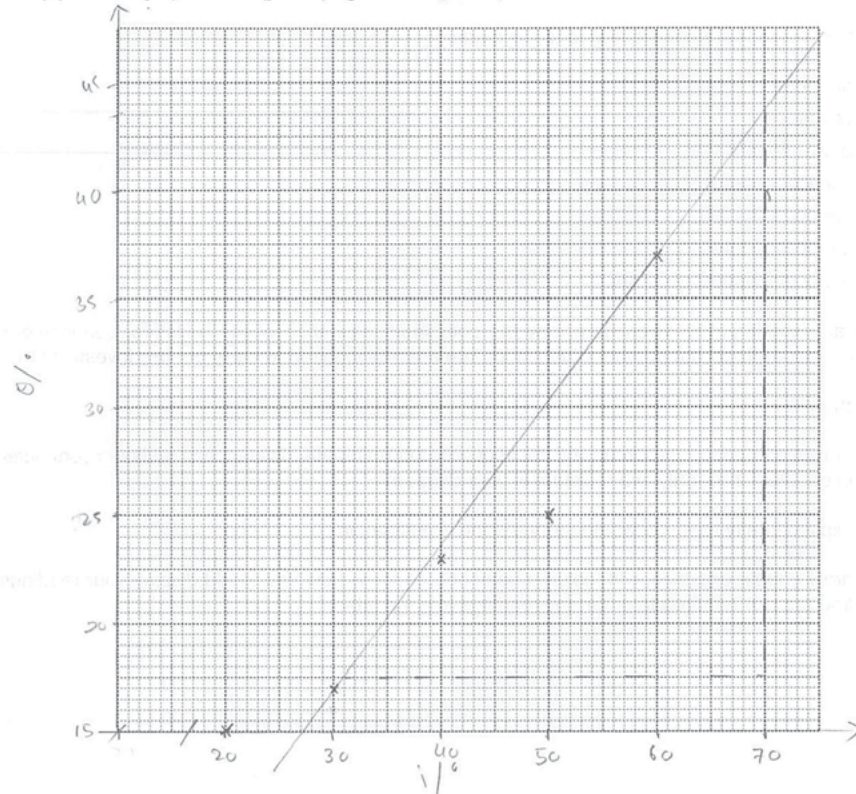
3(c)

3(d)

## Q3 Mark scheme

|     |  |
|-----|--|
| (a) | Ray trace:<br>Correct normal and all lines in approximately the right places<br>P at least 5 cm from <b>AB</b><br>Table:<br>$\theta$ values within $\pm 2^\circ$ of ray trace values<br>$\theta$ values within $\pm 1^\circ$ of 20, 30, 40, 50, 60 |
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(b) Plot a graph of  $\theta/^\circ$  (y-axis) against  $i/^\circ$  (x-axis).



[4]

(c) Determine the gradient  $G$  of the graph. Show clearly on the graph how you obtained the necessary information.

$$g = \frac{v}{h} = 0.6666...7$$

$$= \frac{43.5 - 17.5}{70 - 31} \quad G = 0.667 \quad [2]$$

(d) Referring to your graph, comment on the quality of your measurements.

The measurements are not very accurate because they is no equal distribution of point on line of best fit. [1]

Tie your ray-trace sheet into this Booklet between pages 8 and 9.

[Total: 11]

Your  
Mark

3(a)

3(b)

3(c)

3(d)

### Q3 Mark scheme

|     |  |
|-----|--|
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3 In this experiment, you will investigate refraction using a transparent block.

Carry out the following instructions, using the separate ray-trace sheet provided. You may refer to Fig. 3.1 for guidance.

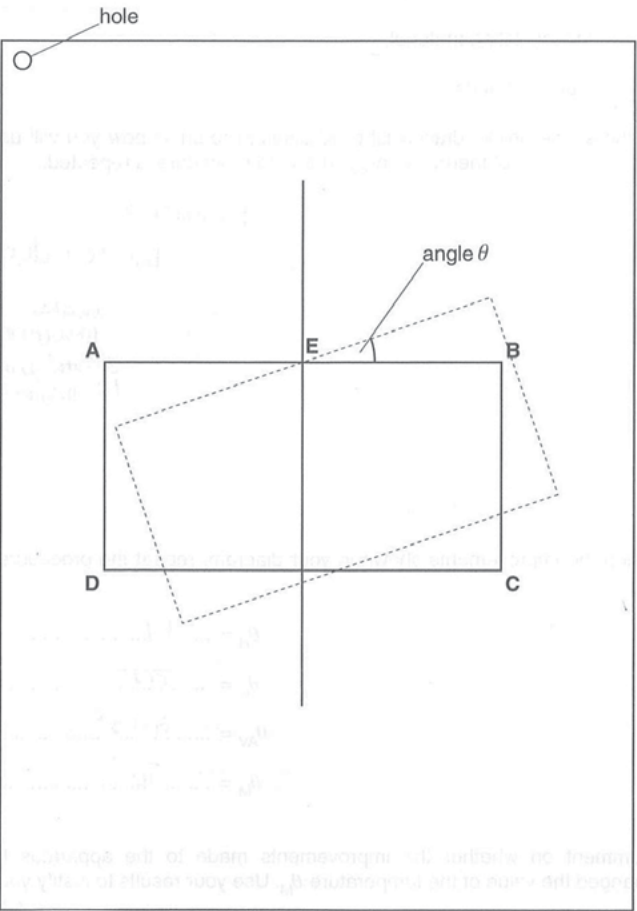


Fig. 3.1

Your  
Mark

3(a)

3(b)

3(c)

3(d)

| Q3  | Mark scheme  |
|-----|--|
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- Remove the block and draw a normal at the centre of side **AB**. Label the point **E** where the normal crosses **AB**.
  - Draw a line **FE** to the left of the normal and at an angle  $i = 20^\circ$  to the normal.
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Table 3.1

| $i/^\circ$ | $\theta/^\circ$ |
|------------|-----------------|
| 20         | 21              |
| 30         | 24              |
| 40         | 40              |
| 50         | 48              |
| 60         | 55              |

[4]

Your  
Mark

3(a)

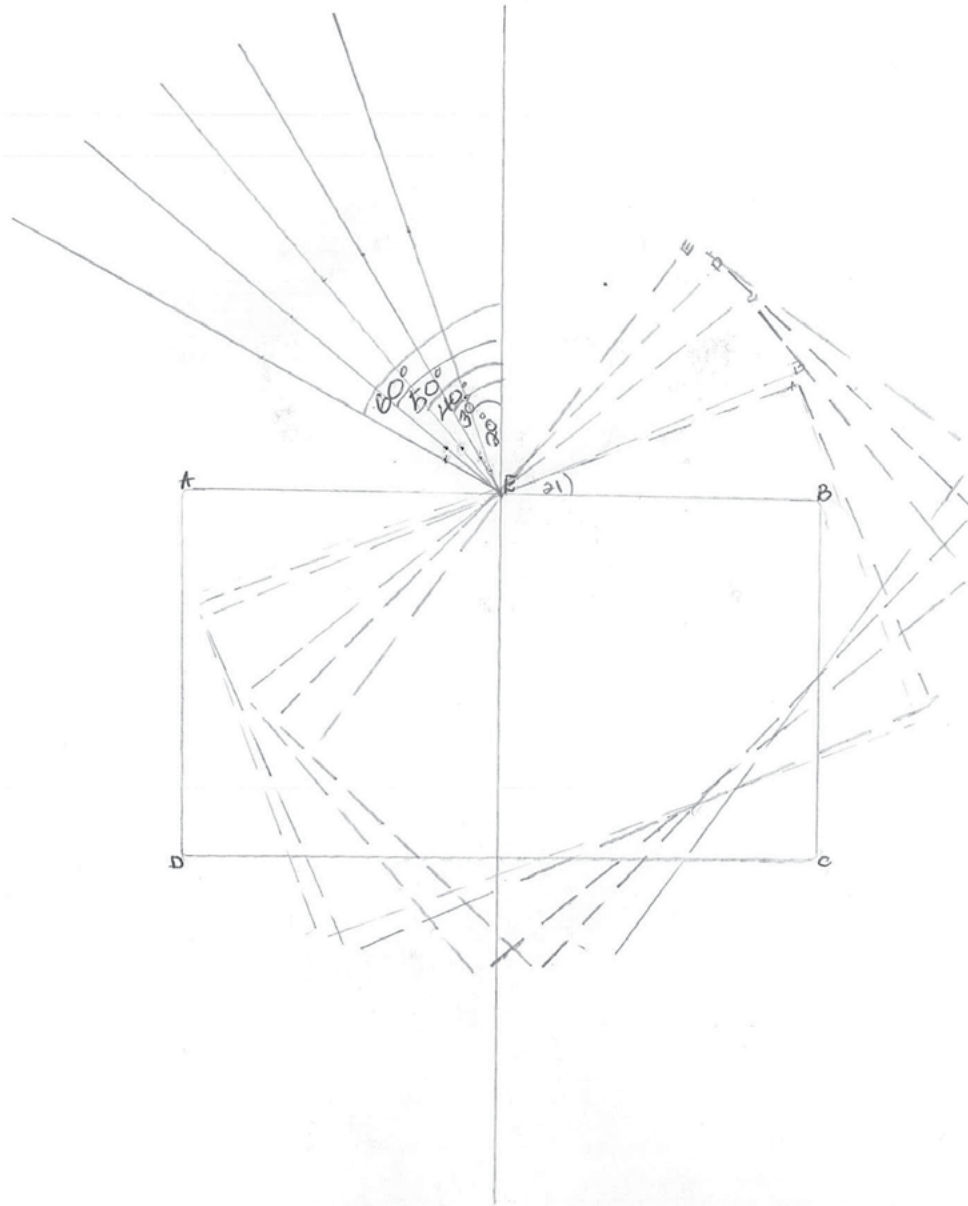
3(b)

3(c)

3(d)

| Q3  | Mark scheme  |
|-----|--|
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Your  
Mark

3(a)

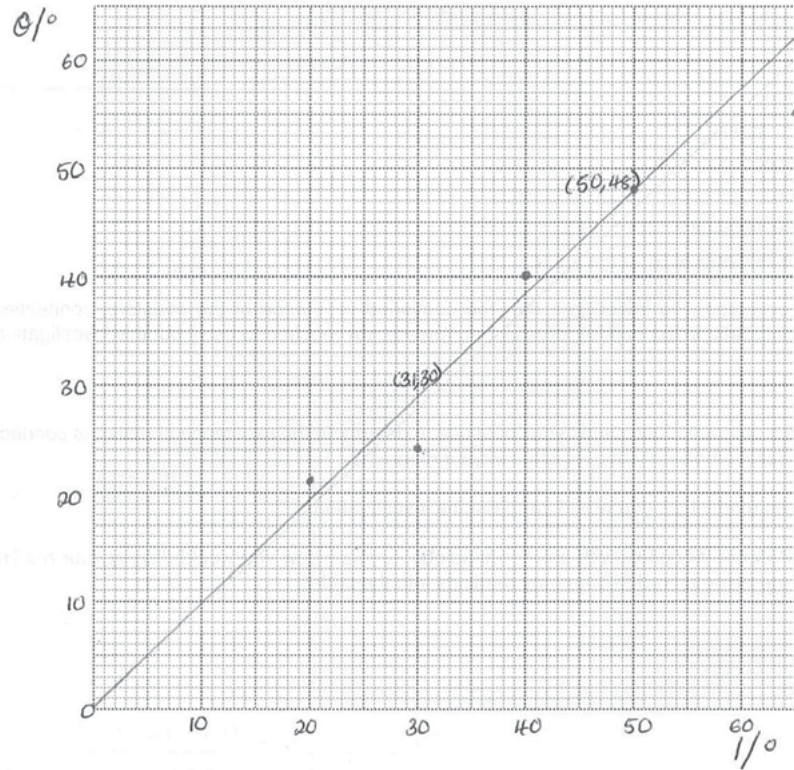
3(b)

3(c)

3(d)

| Q3 Mark scheme |  |
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(b) Plot a graph of  $\theta/^\circ$  (y-axis) against  $i/^\circ$  (x-axis).



[4]

(c) Determine the gradient  $G$  of the graph. Show clearly on the graph how you obtained the necessary information.

$$\begin{matrix} (31, 30) & (50, 48) \\ x_1 & y_1 & x_2 & y_2 \end{matrix}$$

$$G = \frac{x_2 - x_1}{y_2 - y_1} = \frac{50 - 31}{48 - 30} = 1.0555 \dots G = 1.06 \dots [2]$$

(d) Referring to your graph, comment on the quality of your measurements.

Accurate as they have a large difference  
in between ~~the~~ each other [1]

Tie your ray-trace sheet into this Booklet between pages 8 and 9.

[Total: 11]

Your  
Mark

3(a)

3(b)

3(c)

3(d)

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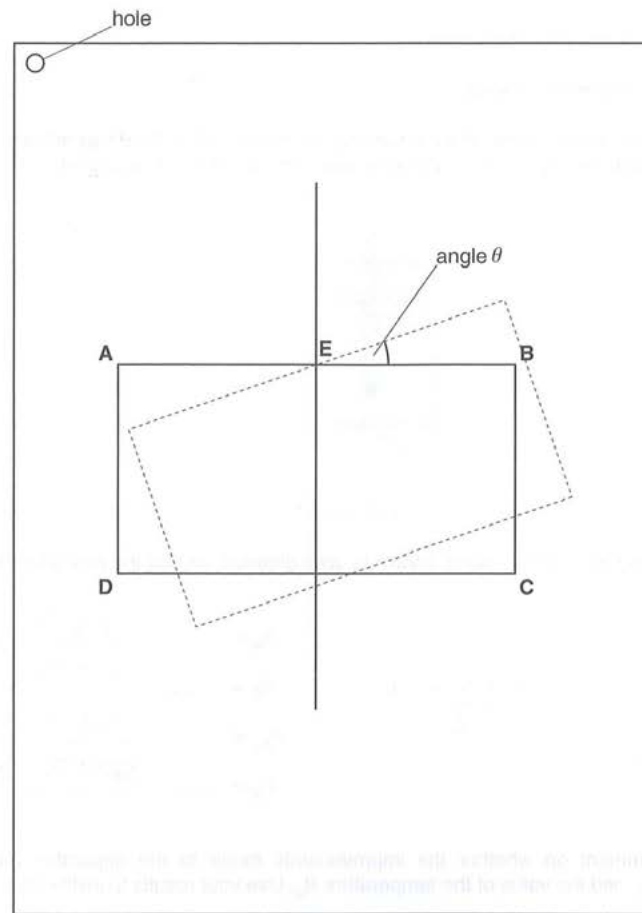


Fig. 3.1

Your  
Mark

3(a)

3(b)

3(c)

3(d)

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Table 3.1

| $i/^\circ$ | $\theta/^\circ$  |
|------------|------------------|
| 20         | 50               |
| 30         | <del>50</del> 52 |
| 40         | <del>52</del> 54 |
| 50         | <del>54</del> 56 |
| 60         | <del>56</del> 60 |

[4]

Your  
Mark

3(a)

3(b)

3(c)

3(d)

## Q3 Mark scheme

|     |  |
|-----|--|
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Your  
Mark

3(a)

3(b)

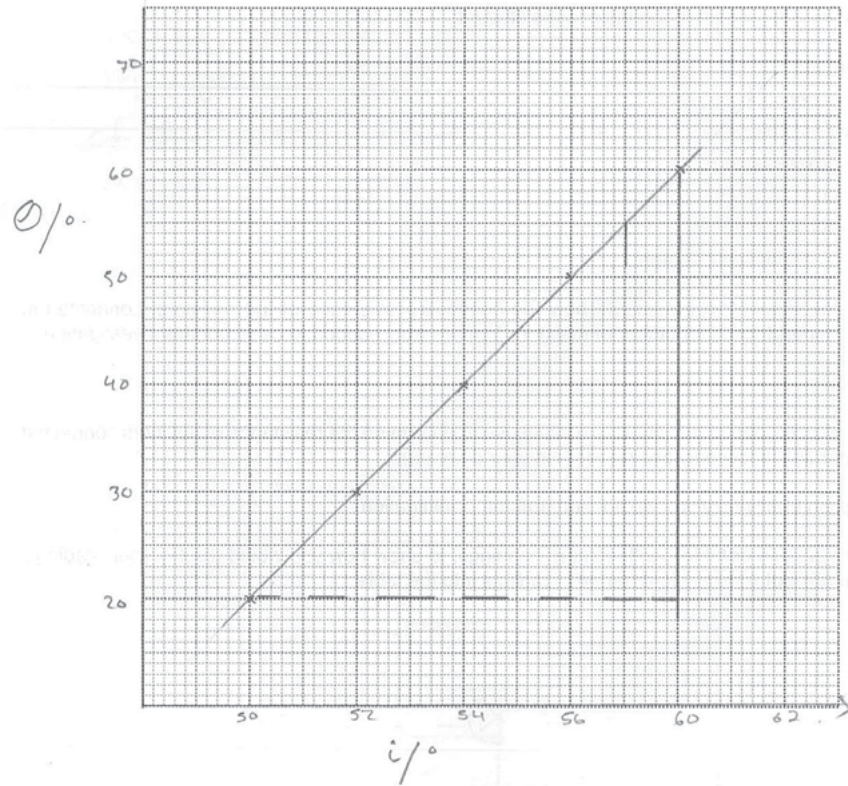
3(c)

3(d)

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(b) Plot a graph of  $\theta/^\circ$  (y-axis) against  $i/^\circ$  (x-axis).



[4]

(c) Determine the gradient  $G$  of the graph. Show clearly on the graph how you obtained the necessary information.

$$G = \frac{y_2 - y_1}{x_2 - x_1} = \frac{60 - 20}{60 - 50} = \frac{40}{10}$$

$$G = 4 \quad [2]$$

(d) Referring to your graph, comment on the quality of your measurements.

As the angle increases so does  
the angle of incidence. [1]

Tie your ray-trace sheet into this Booklet between pages 8 and 9.

[Total: 11]

Your  
Mark

3(a)

3(b)

3(c)

3(d)

### Q3 Mark scheme

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|-----|--|
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Cambridge Assessment International Education  
The Triangle Building, Shaftesbury Road, Cambridge, CB2 8EA, United Kingdom  
t: +44 1223 553554  
e: [info@cambridgeinternational.org](mailto:info@cambridgeinternational.org) [www.cambridgeinternational.org](http://www.cambridgeinternational.org)

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