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# **GCE A LEVEL MARKING SCHEME**

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**SUMMER 2024**

**A LEVEL  
CHEMISTRY – UNIT 5  
1410U50-1**

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## About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

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## **GCE A LEVEL CHEMISTRY UNIT 5**

### **PRACTICAL EXAMINATION**

### **SUMMER 2024 MARK SCHEME**

#### **GENERAL INSTRUCTIONS**

##### Recording of marks

Examiners must mark in red ink.

The mark total should be entered onto the grid on the front cover.

##### Marking rules

All work should be seen to have been marked.

Crossed out responses not replaced should be marked.

##### Marking abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

cao = correct answer only

ecf = error carried forward

bod = benefit of doubt

## EXPERIMENTAL TASK

| Skill                                  | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Marks available |     |     |       |       |      |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | AO1             | AO2 | AO3 | Total | Maths | Prac |
| Teacher-awarded marks                  | working safely (1)<br>efficient use of time (1)                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2               |     |     | 2     |       | 2    |
| Results Part A<br>– recording          | appropriate table drawn (1)<br><br>titles and units included (1)<br><br>appropriate significant figures (1)<br>temperature to 3 sig figs (1 dp)<br>accept volume to 2 or 3 sig figs                                                                                                                                                                                                                                                                                                        | 2               | 1   |     | 3     |       | 3    |
| Results Part A<br>– accuracy and trend | <b>Test 1</b><br><br>final temperature increases from first to second reading (1)<br><br>final temperature decreases from third to fourth to fifth reading (1)<br><br>two highest values at 20 cm <sup>3</sup> and 30 cm <sup>3</sup> (1)<br><br><b>Test 2</b><br><br>final temperature increases from first to second to third reading (1)<br><br>final temperature decreases from fourth to fifth reading (1)<br><br>two highest values at 30 cm <sup>3</sup> and 40 cm <sup>3</sup> (1) |                 | 3   |     | 3     |       | 3    |

| Skill                                | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Marks available |     |     |       |       |      |
|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | AO1             | AO2 | AO3 | Total | Maths | Prac |
| Results Part B<br>– observations     | <b>Test 1</b><br><br><b>X</b> no observable change with either acid (1)<br><br><b>Y</b> no observable change with HCl and (white) precipitate forms with H <sub>2</sub> SO <sub>4</sub> (1)<br><br><b>Z</b> (white) precipitate with both acids (1)<br><br><b>Test 2</b><br><br><b>X</b> (white) precipitate with both acids (1)<br><br><b>Y</b> no observable change with either acid (1)<br><br><b>Z</b> no observable change with HCl and (white) precipitate forms with H <sub>2</sub> SO <sub>4</sub> (1) |                 | 3   |     | 3     |       | 3    |
| Analysis Part A<br>(i) Graph         | appropriate label for y-axis (1)<br><br>appropriate scale for y-axis (1)<br><br>all five points plotted accurately (2)<br>award (1) for any three/four points plotted accurately                                                                                                                                                                                                                                                                                                                               |                 | 4   |     | 4     |       | 4    |
| Analysis Part A<br>(ii) Intersection | two appropriate straight lines (1)<br><br>point of intersection read correctly (1)<br>ecf possible from poorly drawn lines                                                                                                                                                                                                                                                                                                                                                                                     |                 |     | 2   | 2     | 2     | 2    |

| Skill                                   | Marking details                                                                                                                                                                                                 | Marks available |     |     |       |       |      |
|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|                                         |                                                                                                                                                                                                                 | AO1             | AO2 | AO3 | Total | Maths | Prac |
| Analysis Part A<br>(iii) Concentration  | moles of NaOH = 0.050 mol (1)<br>moles of NaOH = moles of HCl (1)<br>$[\text{HCl}] = \frac{\text{moles of HCl}}{\text{volume of HCl at point of intersection}} \quad (1)$                                       |                 | 2   | 1   | 3     | 2     | 2    |
| Analysis Part A<br>(iv) Enthalpy change | total volume of solution<br>= 50.0 + volume of HCl at point of intersection (1)<br>$\Delta T$ from graph (1)<br>n(NaOH) = 0.050 mol (1)<br>correct value for $\Delta H$ (1)<br>negative sign for $\Delta H$ (1) |                 | 3   | 2   | 5     | 3     | 3    |

| Skill                                 | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Marks available |     |     |       |       |      |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | AO1             | AO2 | AO3 | Total | Maths | Prac |
| Analysis Part B<br>(v) Identification | <b>Test 1</b><br><b>X</b> contains sodium ions / is sodium nitrate<br>⇒ no precipitates form because sodium chloride and sodium sulfate / all sodium salts are soluble (1)<br><br><b>Y</b> contains calcium ions / is calcium nitrate<br>⇒ one (white) precipitate because calcium sulfate is insoluble and calcium chloride is soluble (1)<br><br><b>Z</b> contains lead ions / is lead(II) nitrate<br>⇒ two (white) precipitates because lead chloride and lead(II) sulfate are both insoluble (1)<br><br>if no credit given award (1) for correctly identifying the ions in all three solutions |                 |     |     |       |       |      |
|                                       | <b>Test 2</b><br><b>X</b> contains lead ions / is lead(II) nitrate<br>⇒ two (white) precipitates because lead chloride and lead(II) sulfate are both insoluble (1)<br><br><b>Y</b> contains sodium ions / is sodium nitrate<br>⇒ no precipitates form because sodium chloride and sodium sulfate / all sodium salts are soluble (1)<br><br><b>Z</b> contains calcium ions / is calcium nitrate<br>⇒ one (white) precipitate because calcium sulfate is insoluble and calcium chloride is soluble (1)<br><br>If no credit given award (1) for correctly identifying the ions in all three solutions |                 |     | 3   | 3     |       | 3    |

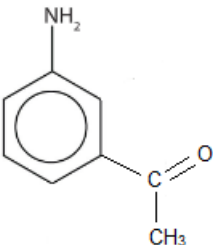
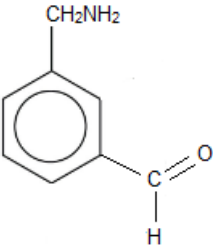
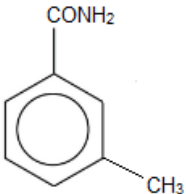
| Skill                                    | Marking details                                                                                                                                                                                                                                                                                                                                                                   | Marks available |           |           |           |          |           |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----------|-----------|-----------|----------|-----------|
|                                          |                                                                                                                                                                                                                                                                                                                                                                                   | AO1             | AO2       | AO3       | Total     | Maths    | Prac      |
| Analysis Part B<br>(vi) Largest enthalpy | <p>award (2) for either of following<br/>sodium hydroxide because sodium sulfate is the most soluble of the salts formed<br/>sodium hydroxide because calcium sulfate and lead sulfate are insoluble</p> <p>award (1) for sodium hydroxide and reason not linked to solubility e.g. sodium hydroxide because it is the strongest base / Group 1 hydroxides are strong alkalis</p> |                 |           | 2         | 2         |          |           |
| <b>Total</b>                             |                                                                                                                                                                                                                                                                                                                                                                                   | <b>4</b>        | <b>16</b> | <b>10</b> | <b>30</b> | <b>7</b> | <b>25</b> |

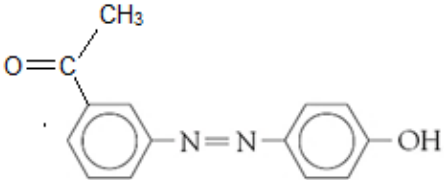
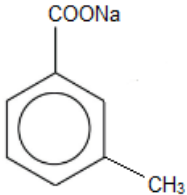
### PRACTICAL METHODS AND ANALYSIS TASK

| Question |     |      |    | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Marks available |          |          |          |          |          |
|----------|-----|------|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|----------|----------|----------|----------|
|          |     |      |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | AO1             | AO2      | AO3      | Total    | Maths    | Prac     |
| 1        | (a) |      |    | filter paper / U-tube of agar soaked in aqueous / saturated $\text{KNO}_3$<br>accept any suitable electrolyte e.g. KCl                                                                                                                                                                                                                                                                                                                                                                                                                          | 1               |          |          | 1        |          | 1        |
|          | (b) | (i)  |    | Cu electrode labelled positive                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |          | 1        | 1        |          |          |
|          |     | (ii) | I  | $\text{Fe} + \text{Cu}^{2+} \rightleftharpoons \text{Fe}^{2+} + \text{Cu}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |          | 1        | 1        |          |          |
|          |     |      | II | <u><math>\text{Fe}^{2+}</math> / Fe half-cell</u><br>award (1) for either of following<br>colour of (pale) green solution becomes deeper (due to increasing concentration of $\text{Fe}^{2+}$ ions)<br>size of Fe electrode decreases<br><br><u><math>\text{Cu}^{2+}</math> / Cu half-cell</u><br>award (1) for either of following<br>blue colour of solution becomes paler (due to conversion of $\text{Cu}^{2+}$ to Cu / decreasing concentration of $\text{Cu}^{2+}$ ions)<br>size of Cu electrode increases / Cu deposited on Cu electrode |                 |          | 2        | 2        |          | 2        |
|          |     |      |    | <b>Question 1 total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>1</b>        | <b>0</b> | <b>4</b> | <b>5</b> | <b>0</b> | <b>3</b> |

| Question                                |                |                |                | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Marks available |                |                |                |                |                                         |      |      |             |      |                                       |              |       |       |              |                              |       |              |       |       |  |   |  |   |   |   |
|-----------------------------------------|----------------|----------------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------------|----------------|----------------|----------------|-----------------------------------------|------|------|-------------|------|---------------------------------------|--------------|-------|-------|--------------|------------------------------|-------|--------------|-------|-------|--|---|--|---|---|---|
|                                         |                |                |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | AO1             | AO2            | AO3            | Total          | Maths          | Prac                                    |      |      |             |      |                                       |              |       |       |              |                              |       |              |       |       |  |   |  |   |   |   |
| 2                                       | (a)            |                |                | small drops of liquid may fall from the funnel (into the burette) during the titration (leading to a false burette reading)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1               |                |                | 1              |                | 1                                       |      |      |             |      |                                       |              |       |       |              |                              |       |              |       |       |  |   |  |   |   |   |
|                                         | (b)            |                |                | award (1) for either of following<br>water does not react with any of the reagents<br>adding water does not change the number of moles of reagents added                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1               |                |                | 1              |                | 1                                       |      |      |             |      |                                       |              |       |       |              |                              |       |              |       |       |  |   |  |   |   |   |
|                                         | (c)            |                |                | pink                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1               |                |                | 1              |                | 1                                       |      |      |             |      |                                       |              |       |       |              |                              |       |              |       |       |  |   |  |   |   |   |
|                                         | (d)            |                |                | <div>mass of <math>\text{FeC}_2\text{O}_4 \cdot x\text{H}_2\text{O}</math> = 3.481 g      (1)</div> <table><tr><td></td><td>Titration<br/>1</td><td>Titration<br/>2</td><td>Titration<br/>3</td><td>Titration<br/>4</td></tr><tr><td>Initial burette reading / <math>\text{cm}^3</math></td><td>1.60</td><td>0.30</td><td><b>0.80</b></td><td>1.20</td></tr><tr><td>Final burette reading / <math>\text{cm}^3</math></td><td><b>29.45</b></td><td>27.45</td><td>28.00</td><td><b>28.30</b></td></tr><tr><td>Titre volume / <math>\text{cm}^3</math></td><td>27.85</td><td><b>27.15</b></td><td>27.20</td><td>27.10</td></tr></table> <div>all readings must be given to 2dp<br/>award (2) for four correct values<br/>award (1) for any two correct values<br/><br/>mean titre = 27.15 <math>\text{cm}^3</math>      (1)</div> |                 | Titration<br>1 | Titration<br>2 | Titration<br>3 | Titration<br>4 | Initial burette reading / $\text{cm}^3$ | 1.60 | 0.30 | <b>0.80</b> | 1.20 | Final burette reading / $\text{cm}^3$ | <b>29.45</b> | 27.45 | 28.00 | <b>28.30</b> | Titre volume / $\text{cm}^3$ | 27.85 | <b>27.15</b> | 27.20 | 27.10 |  | 4 |  | 4 | 2 | 4 |
|                                         | Titration<br>1 | Titration<br>2 | Titration<br>3 | Titration<br>4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                |                |                |                |                                         |      |      |             |      |                                       |              |       |       |              |                              |       |              |       |       |  |   |  |   |   |   |
| Initial burette reading / $\text{cm}^3$ | 1.60           | 0.30           | <b>0.80</b>    | 1.20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |                |                |                |                |                                         |      |      |             |      |                                       |              |       |       |              |                              |       |              |       |       |  |   |  |   |   |   |
| Final burette reading / $\text{cm}^3$   | <b>29.45</b>   | 27.45          | 28.00          | <b>28.30</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |                |                |                |                |                                         |      |      |             |      |                                       |              |       |       |              |                              |       |              |       |       |  |   |  |   |   |   |
| Titre volume / $\text{cm}^3$            | 27.85          | <b>27.15</b>   | 27.20          | 27.10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |                |                |                |                |                                         |      |      |             |      |                                       |              |       |       |              |                              |       |              |       |       |  |   |  |   |   |   |

| Question |     |  |  | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Marks available |          |          |           |          |          |
|----------|-----|--|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|----------|-----------|----------|----------|
|          |     |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | AO1             | AO2      | AO3      | Total     | Maths    | Prac     |
|          | (e) |  |  | $3\text{MnO}_4^- + 5\text{FeC}_2\text{O}_4 + 24\text{H}^+ \rightarrow 3\text{Mn}^{2+} + 5\text{Fe}^{3+} + 10\text{CO}_2 + 12\text{H}_2\text{O}$<br>award (1) for three correct species added<br>award (1) for correct balancing <b>only when all formulae are correct</b>                                                                                                                                                                                                             |                 |          | 2        | 2         |          |          |
|          | (f) |  |  | $n(\text{MnO}_4^-) = 0.0215 \times \frac{27.15}{1000} = 0.000584 \text{ mol} \quad (1)$<br>$n(\text{FeC}_2\text{O}_4 \cdot x\text{H}_2\text{O}) \text{ in } 25 \text{ cm}^3 = 0.000973 \text{ mol} \quad (1)$<br>$n(\text{FeC}_2\text{O}_4 \cdot x\text{H}_2\text{O}) \text{ in } 500 \text{ cm}^3 = 0.01946 \text{ mol}$<br><br>$M_r(\text{FeC}_2\text{O}_4 \cdot x\text{H}_2\text{O}) = \frac{3.481}{0.01946} = 178.9 \quad (1)$<br>$x = \frac{178.9 - 143.8}{18.02} = 2 \quad (1)$ |                 | 4        |          | 4         | 4        |          |
|          |     |  |  | <b>Question 2 total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>3</b>        | <b>8</b> | <b>2</b> | <b>13</b> | <b>6</b> | <b>7</b> |

| Question |     |  | Marking details                                                                                                                                                                                                                                                         | Marks available |     |     |       |       |      |
|----------|-----|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |     |  |                                                                                                                                                                                                                                                                         | AO1             | AO2 | AO3 | Total | Maths | Prac |
| 3        | (a) |  | <p>compound A</p>  <p>tests 1 and 2 show that a carbonyl group is present and that it is a ketone / not an aldehyde</p> <p>tests 4 and 5 shows that it has an aromatic amine group</p> |                 |     |     |       |       |      |
|          |     |  | <p>compound B</p>  <p>tests 1 and 2 show that a carbonyl group is present and that it is an aldehyde</p> <p>test 4 shows that it has an aliphatic amine group</p>                      |                 |     | 6   | 6     |       | 6    |
|          |     |  | <p>compound C</p>  <p>test 1 shows that it has no carbonyl group</p> <p>test 3 shows that it has an amide group (which is hydrolysed giving ammonia gas)</p>                          |                 |     |     |       |       |      |
|          |     |  | <p>for each compound</p> <p>award (2) for correct structure and clear reasoning for one of the groups</p> <p>award (1) for one correct group with clear reasoning</p> <p>award (1) for correct structure with no clear reasoning</p>                                    |                 |     |     |       |       |      |

| Question |     |      | Marking details                                                                                                                                                                                                                                                                                                                                            | Marks available |     |     |       |       |      |
|----------|-----|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |     |      |                                                                                                                                                                                                                                                                                                                                                            | AO1             | AO2 | AO3 | Total | Maths | Prac |
|          | (b) | (i)  |                                                                                                                                                                                                                                                                           |                 | 1   |     | 1     |       |      |
|          |     | (ii) |                                                                                                                                                                                                                                                                           |                 | 1   |     | 1     |       |      |
|          | (c) | (i)  | award (1) for correct conversion of units<br><br>$28^{\circ}\text{C} \Rightarrow 301\text{ K}$<br>$1\text{ atm} \Rightarrow 1.01 \times 10^5\text{ Pa}$<br>$75.2\text{ cm}^3 \Rightarrow 75.2 \times 10^{-6}\text{ m}^3$<br><br>$\text{moles of gas} = \frac{1.01 \times 10^5 \times 75.2 \times 10^{-6}}{8.31 \times 301} = 0.00304\text{ mol} \quad (1)$ | 1               | 1   |     | 2     | 2     |      |
|          |     | (ii) | moles of compound <b>B</b> = 0.00304 mol<br><br>mass of compound <b>B</b> = $0.00304 \times 135.09 = 0.411 \quad (1)$<br><br>concentration = $\frac{0.411}{0.2} = 2.06\text{ g dm}^{-3} \quad (1)$<br><br>ecf possible from part (i)                                                                                                                       |                 |     | 2   | 2     | 2     | 2    |
|          |     |      | Question 3 total                                                                                                                                                                                                                                                                                                                                           | 1               | 3   | 8   | 12    | 4     | 8    |

**A2 UNIT 5: PRACTICAL EXAMINATION**  
**SUMMARY OF ASSESSMENT OBJECTIVES**

|                                            | Question     | AO1      | AO2       | AO3       | TOTAL MARK | MATHS     | PRAC      |
|--------------------------------------------|--------------|----------|-----------|-----------|------------|-----------|-----------|
| <b>Experimental Task</b>                   | <b>Total</b> | <b>4</b> | <b>16</b> | <b>10</b> | <b>30</b>  | <b>7</b>  | <b>25</b> |
| <b>Practical Methods and Analysis Task</b> | <b>1</b>     | <b>1</b> | <b>0</b>  | <b>4</b>  | <b>5</b>   | <b>0</b>  | <b>3</b>  |
|                                            | <b>2</b>     | <b>3</b> | <b>8</b>  | <b>2</b>  | <b>13</b>  | <b>6</b>  | <b>7</b>  |
|                                            | <b>3</b>     | <b>1</b> | <b>3</b>  | <b>8</b>  | <b>12</b>  | <b>4</b>  | <b>8</b>  |
| <b>TOTAL</b>                               |              | <b>9</b> | <b>27</b> | <b>24</b> | <b>60</b>  | <b>17</b> | <b>43</b> |