Published

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### Question 1(a)

**Titration**

**Measurements (1)**
Both readings i.e. initial and final are present for each titration and readings are recorded to 1dp.

**Titres (1)**
All the titres are calculated correctly i.e. no subtraction errors.

**Accuracy (6)**
For the two best titres give:
- 3 marks for a titre within 0.2 cm³ of the Supervisor’s value.
- 2 marks for a titre within 0.3 cm³ of the Supervisor’s value.
- 1 mark for a titre within 0.4 cm³ of the Supervisor’s value.

**Concordance (3)**
Give 3 marks if all the ticked values are within 0.2 cm³.
Give 2 marks if all the ticked values are within 0.3 cm³.
Give 1 mark if all the ticked values are within 0.4 cm³.

**Average (1)**
Give 1 mark for calculating the correct average of selected titres.

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**Marks:** 12

**Guidance:**
- **Reject** final readings in excess of 50.0
- **Reject** initial readings of 50

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### Question 1(b)

Assuming a pipette volume of 25 cm³ and the average volume of Q used = 24.8 cm³:

Mole of potassium manganate(VII) in the average volume

\[ \text{Mole} = \frac{(24.8 \times 0.0200)}{1000} = 0.000496 \]

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**Marks:** 1

**Guidance:** Accuracy marks are awarded using the candidate’s correct values.

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### Question 1(c)

Answer from (b) × 5

\[ 0.000496 \times 5 = 0.00248 \]

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**Marks:** 1

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<table>
<thead>
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<th>Question</th>
<th>Answer</th>
<th>Marks</th>
<th>Guidance</th>
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</table>
| 1(d)     | Answer from (c) × 500 / 25 (or 20)  
          = 0.00248 × 500 / 25 
          = 0.0496  | 1     |          |
| 1(e)     | Answer from (d) × 56  
          = 0.0496 × 56  
          = 2.78 g  | 1     |          |
| 1(f)     | Answer from (e) × 100 / 3.12  
          = 2.78 × 100 / 3.12  
          = 89.1%  | 1     |          |
Question 2 General points

R is nitric acid  
S is zinc carbonate

For ppt: **accept** solid/suspension/powder but **ignore** substance/particles/deposit/residue/sediment/gelatinous/insoluble  
**Ignore** cloudy/milky/white/gelatinous solution for ppt forms but **accept** cloudy/milky/white/gelatinous solution for ppt remains  
**Ignore** solution/ppt turns colourless for ppt dissolves but **accept** clears for ppt dissolves  
For gases: to gain credit for the name of the gas produced, the test must be at least partially correct.  
For the evolution of a gas in a liquid **accept** the observation effervescence/bubbles/fizz/gas vigorously evolved but **ignore** gas evolved.  
Solutions: colourless is **not** equivalent to clear and clear is **not** equivalent to colourless

Marks awarded for conclusions are dependent on correct evidence.

<table>
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<th>Question</th>
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| 2(test 1) | (a) solution turns red (1)  
(b) solution turns yellow (1) | 19 | To score ammonia mark there must be an indication of a test i.e. smell of ammonia, alkaline gas, tested with litmus |
| 2(test 2) | gas turns damp red litmus blue (1)  
ammonia (1) | | |
| 2(test 3) | (a) solution turns yellow (1)  
(b) solution turns blue or black (1) | | |
| 2(test 4) | solid disappears or dissolves (1)  
solution turns blue (1) | | |
| 2(test 5) | bubbles (1)  
gas turns limewater milky (1)  
carbon dioxide (1)  
**Allow** solid disappears or dissolves to score 1 if mark not awarded in test 4. | | To score carbon dioxide mark there must be an indication of a test i.e. tested with limewater.
<table>
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<tr>
<th>Test</th>
<th>Description and Evidence</th>
<th>Marks</th>
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<tbody>
<tr>
<td>2(test 6)</td>
<td>white ppt (1) soluble in excess (1) colourless solution (1)</td>
<td></td>
</tr>
<tr>
<td>2(test 7)</td>
<td>white ppt (1) soluble in excess (1) colourless solution (1)</td>
<td></td>
</tr>
<tr>
<td>2(test 8)</td>
<td>gas turns damp red litmus blue (1) ammonia (1) <strong>Allow</strong> the marks for the test and identification of carbon dioxide if not awarded in test 5.</td>
<td></td>
</tr>
</tbody>
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**Evidence:**
- Test 1(a) red with methyl orange
- Test 2 alkaline gas/ammonia
- In both tests 6 & 7 white ppt which dissolves Carbon dioxide identified in test 5 or test 8

**Conclusions**
- Cation in **R** is H$^+$ (1)
- Anion in **R** is NO$_3^-$ (1)
- Cation in **S** is Zn$^{2+}$ (1)
- Anion in **S** is CO$_3^{2-}$ (1)

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