

## Multiple Choice Answers

Q7: A

|                     |                                                                                                                                                                                      |                     |                     |  |                     |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------|--|---------------------|
| 4(a)(i)             | <ul style="list-style-type: none"> <li>rates are equal</li> <li>concentrations are no longer changing</li> </ul>                                                                     |                     |                     |  |                     |
| 4(a)(ii)            | <table border="1"> <tr> <td><b>M1</b> decreases</td><td><b>M2</b> decreases</td></tr> <tr> <td></td><td><b>M3</b> no change</td></tr> </table>                                       | <b>M1</b> decreases | <b>M2</b> decreases |  | <b>M3</b> no change |
| <b>M1</b> decreases | <b>M2</b> decreases                                                                                                                                                                  |                     |                     |  |                     |
|                     | <b>M3</b> no change                                                                                                                                                                  |                     |                     |  |                     |
| 4(a)(iii)           | forward reaction is exothermic                                                                                                                                                       |                     |                     |  |                     |
| 4(b)                | <b>USUAL METHOD</b><br><b>M1</b> 2490<br><b>M2</b> 2670<br><b>M3</b> -180<br><b>ALTERNATIVE METHOD</b><br><b>M1</b> 850<br><b>M2</b> 1030<br><b>M3</b> -180                          |                     |                     |  |                     |
| 4(c)                | <b>M1</b> 3 dot and cross bonding pairs<br><b>M2</b> one lone pair on the N atom (to complete the N octet)<br><b>M3</b> three lone pairs on each Cl atom (to complete each Cl octet) |                     |                     |  |                     |
| 4(d)(i)             | <b>M1</b> solid disappears<br><b>M2</b> effervescence/bubbling/fizzing                                                                                                               |                     |                     |  |                     |
| 4(d)(ii)            | <b>M1</b> $0.005 \div 5 \times 10^{-3}$ (mol)<br><b>M2</b> $0.0025 \div 2.5 \times 10^{-3}$ (mol)<br><b>M3</b> 60 (cm <sup>3</sup> )                                                 |                     |                     |  |                     |

|      |                                                                                                                                                                 |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4(a) | <b>M1</b> 3 dots and 3 crosses shared<br><b>M2</b> one non-bonding pair of 2 dots on one N atom and 2 crosses on the other N atom to complete the octet on both |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|

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| 4(b)(i)   | <b>Conditions can be in any order</b><br><b>M1</b> (temperature) 450 <b>and</b> °C<br><b>M2</b> (pressure)<br>200 <b>and</b> atmospheres / 20 000 <b>and</b> kPa<br><b>M3</b> iron <b>and</b> catalyst |
| 4(b)(ii)  | $N_2 + 3H_2 \rightleftharpoons 2NH_3$                                                                                                                                                                  |
| 4(c)(i)   | $5O_2 \rightarrow 4NO + 6H_2O$                                                                                                                                                                         |
| 4(c)(ii)  | <b>M1</b> -3<br><b>M2</b> +2                                                                                                                                                                           |
| 4(c)(iii) | increase in oxidation number                                                                                                                                                                           |
| 4(c)(iv)  | $4NO + 3O_2 + 2H_2O \rightarrow 4HNO_3$<br><b>M1</b> HNO <sub>3</sub> (1)<br><b>M2</b> equation completely correct                                                                                     |
| 4(d)      | <b>M1</b> 15<br><b>M2</b> 7.5<br><b>M3</b> 990                                                                                                                                                         |

|           |                                                                                                                                                                                                                                                                                                  |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2(a)      | <b>M1</b> <b>pair</b> of electrons<br>M2 electron(s) shared between <b>two</b> atoms                                                                                                                                                                                                             |
| 2(b)(i)   | <b>M1</b> the oxidation number of chlorine / Cl<br>M2 (oxidation number) is +1                                                                                                                                                                                                                   |
| 2(b)(ii)  | <b>M1</b> O with 1 dot-cross bonding pair with each Cl<br><b>M2</b> 4 non-bonding dots for O<br><b>M3</b> 6 non-bonding crosses for each Cl                                                                                                                                                      |
| 2(b)(iii) | <b>M1</b> (forces of) attraction between molecules are broken (during boiling)<br><b>M2</b> covalent bonds (between Cl and O atoms) are broken (during thermal decomposition)<br><b>M3</b> weak attraction between molecules and strong covalent bonds / bonding between atoms correctly applied |
| 2(b)(iv)  | <b>M1</b> no ions<br><b>M2</b> no mobile electrons                                                                                                                                                                                                                                               |
| 2(c)(i)   | graphite                                                                                                                                                                                                                                                                                         |
| 2(c)(ii)  | electrons                                                                                                                                                                                                                                                                                        |
| 2(c)(iii) | <b>M1</b> 5 correct Si atoms<br><b>M2</b> 4 correct O atoms                                                                                                                                                                                                                                      |

## Multiple Choice Answers

Q7: C