## Answers to Aspects of Agriculture End of Unit Test

<table>
<thead>
<tr>
<th>Q</th>
<th>Answer with marks</th>
<th>Marking suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(a)</td>
<td>–3 (1); +5 (1); +3 (1); 0 (1)</td>
<td>All signs after numbers can score max. 3</td>
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<tr>
<td>1(b) (i)</td>
<td>Reduction (1)</td>
<td></td>
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<tr>
<td>1(b) (ii)</td>
<td>Neither (1)</td>
<td></td>
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<tr>
<td>1(b) (iii)</td>
<td>Oxidation (1)</td>
<td></td>
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<tr>
<td>1(c) (i)</td>
<td>Nitrogen: small molecule with covalent bonding (1); non-polar/cannot hydrogen-bond with water (1)</td>
<td></td>
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<tr>
<td>1(c) (ii)</td>
<td>Ammonium nitrate(V) (1); an ionic substance (1)</td>
<td></td>
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<tr>
<td>1(d) (i)</td>
<td>Accept temperatures in range 400–500 °C (1); pressures in range 25–150 atmospheres (1); catalyst: iron (1)</td>
<td></td>
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<tr>
<td>1(d) (ii)</td>
<td>There are fewer molecules on the right-hand side of the equation (1); increasing the pressure favours the side with fewer molecules (or words to that effect) (1)</td>
<td></td>
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<tr>
<td>1(d) (iii)</td>
<td>It is not economical because the running costs/capital costs are too high/need thick-walled vessels/it is dangerous (1)</td>
<td></td>
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<tr>
<td>1(e)</td>
<td>Two from (2): controlling soil pH; controlling pests; controlling weeds</td>
<td></td>
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<tr>
<td>1(f) (i)</td>
<td>Rate = $k \cdot [\text{NH}_3]^x \cdot [\text{enzyme}]^y$ (1) for equation without x and y (1) for assignment of x and y</td>
<td></td>
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<tr>
<td>1(f) (ii)</td>
<td>It increases (1)</td>
<td></td>
</tr>
<tr>
<td>1(f) (iii)</td>
<td>$k$ increases with temperature (1); but enzyme becomes denatured/deactivated/destroyed above 35 °C (1)</td>
<td></td>
</tr>
<tr>
<td>2(a) (i)</td>
<td>So that they break down into harmless products (1); and do not become concentrated in food chains/affect other organisms/get leached into water supplies (1)</td>
<td></td>
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<tr>
<td>2(a) (ii)</td>
<td><img src="image" alt="Chemical structure" /> (not stable, but students will not know this) Carboxylic acid/alcohol group (1); rest of molecule correct (1)</td>
<td></td>
</tr>
<tr>
<td>2(b)</td>
<td>Two chlorines replaced by bromines and CN group replaced by Cl/overall $M_r$ increased (1); this increased the intermolecular forces (1)</td>
<td></td>
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<tr>
<td>2(c) (i)</td>
<td>$K_{ow} = \frac{[\text{CYM2(octan-1-ol)}]}{[\text{CYM2(aq)}]}$ (1)</td>
<td></td>
</tr>
<tr>
<td>2(c) (ii)</td>
<td>CYM2 is much more soluble in fats than in water (1); hence it will kill insects by moving from aqueous solution into their body fat (1)</td>
<td></td>
</tr>
</tbody>
</table>
### 3(a) Answer with marks
Turning nitrogen into its compounds (1)

### 3(b) Answer with marks
More NO (1); (forward) reaction is endothermic (1); favoured by raising temperature/correct use of Le Chatelier (1)

### 3(c) (i)
\[ K_p = \frac{P_{NO}}{P_{N_2} \cdot P_{O_2}} \]
- (1) use of ‘p’ notation;
- (1) correct arrangement of NO/\(N_2\)/O\(_2\) even if square brackets used

### 3(c) (ii)
\[ P_{NO} = 1.0 \times 10^{-5} \times 0.8 \times 0.2 (1); (= 1.6 \times 10^{-6}) \]
\[ P_{NO} = \sqrt{\text{previous answer}} (1); = 1.3 \times 10^{-3} \text{ atm} (1) \text{ includes 2/3 sig figs and units} \]

### 3(d) (i)
\[ 2NO + O_2 \rightarrow 2NO_2 (1); \]
\[ 3NO_2 + H_2O \rightarrow 2HNO_3 + NO (2) \text{ for complete equation}; (1) \text{ if species correct} \]

### 3(d) (ii)
Oxides of non-metals are (often) acidic (1)

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### 4(a) Answer with marks
It is acidic/corrosive (1)

### 4(b) (i)
\[ \begin{array}{c}
\text{Si}\\
\text{O}\\
\text{O}\\
\text{O}\\
\end{array} \]
- (1) correct round Si;
- (1) correct round O

### 4(b) (ii)
\[ \begin{array}{c}
\text{HO}^-\\
\text{HO}^-\\
\text{Al}^{3+}\\
\text{OH}^-\\
\end{array} \]
- (1) for octahedral shape
- (1) for ions labelled

### 4(b) (iii)
Clays are made of silicate and/or aluminate which have negatively charged surfaces (1); cations are held but anions are not (1)

### 4(c) (i)
Diagram showing:
- sodium ions being poured into soil and ammonium ions leaving (1);
- ammonium ions held on soil (1);
- type of process named as ion exchange (1)

### 4(c) (ii)
The smaller ion attracts more water molecules/is more highly hydrated (1); the water molecules contribute to the size of the aqueous ion (1)

### 4(c) (iii)
\[ NH_4^+ (1); \text{ since the aqueous ions are smaller} (1) \]