Answers to Aspects of Agriculture End of Unit Test

Q	Answer with marks	Marking suggestions
1(a)	–3 (1); +5 (1); +3 (1); 0 (1)	All signs after numbers can score max. 3
1(b) (i)	Reduction (1)	
1(b) (ii)	Neither (1)	
1(b) (iii)	Oxidation (1)	
1(c) (i)	Nitrogen: small molecule with covalent bonding (1); non-polar/cannot hydrogen-bond with water (1)	
1(c) (ii)	Ammonium nitrate(V) (1); an ionic substance (1)	
1(d) (i)	Accept temperatures in range 400–500 °C (1); pressures in range 25–150 atmospheres (1); catalyst: iron (1)	
1(d) (ii)	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)	
1(d) (iii)	It is not economical because the running costs/capital costs are too high/need thick-walled vessels/it is dangerous (1)	
1(e)	*Two from* (2): controlling soil pH; controlling pests; controlling weeds	Allow alternatives
1(f) (i)	Rate = $k[NH_3]^x[\text{enzyme}]^y$ (1) for equation without x and y (1) for assignment of x and y	
1(f) (ii)	It increases (1)	
1(f) (iii)	*k* increases with temperature (1); but enzyme becomes denatured/deactivated/destroyed above 35 °C (1)	

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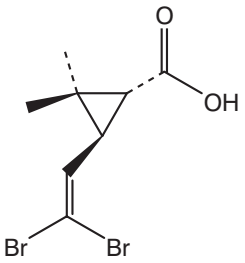
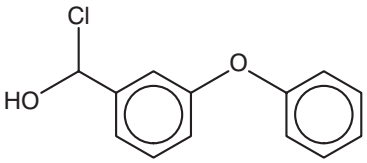
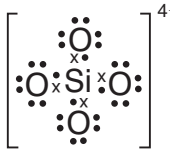
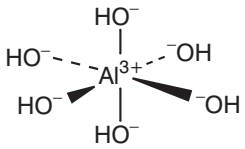
2(a) (i)	So that they break down into harmless products (1); and do not become concentrated in food chains/affect other organisms/get leached into water supplies (1)	
2(a) (ii)	 *or*  (not stable, but students will not know this) Carboxylic acid/alcohol group (1); rest of molecule correct (1)	
2(b)	Two chlorines replaced by bromines and CN group replaced by Cl/overall M_r increased (1); this increased the intermolecular forces (1)	
2(c) (i)	K_{ow} = [CYM2(octan-1-ol)]/[CYM2(aq)] (1)	
2(c) (ii)	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)	

Q	Answer with marks	Marking suggestions
3(a)	Turning nitrogen into its compounds (1)	
3(b)	More NO (1); (forward) reaction is endothermic (1); favoured by raising temperature/correct use of Le Chatelier (1)	
3(c) (i)	$K_p = p_{NO}{}^2/p_{N_2}\,p_{O_2}$ (1) use of 'p' notation; (1) correct arrangement of $NO^2/N_2/O_2$ even if square brackets used	
3(c) (ii)	$p_{NO}{}^2 = 1.0 \times 10^{-5} \times 0.8 \times 0.2$ (1); $(= 1.6 \times 10^{-6})$ $p_{NO} = \sqrt{}$(previous answer) (1); $= 1.3 \times 10^{-3}$ atm (1) 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) for complete equation; (1) if species correct	
3(d) (ii)	Oxides of non-metals are (often) acidic (1)	

Q	Answer with marks	Marking suggestions
4(a)	It is acidic/corrosive (1)	
4(b) (i)	 (1) correct round Si; (1) correct round O	Brackets and charge not essential
4(b) (ii)	 (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); since the aqueous ions are smaller (1)	