

Subject: Environmental Chemistry
Code: 2815/03

Session: January
Year: 2002

Final Mark Scheme

MAXIMUM MARK	45
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Environmental Chemistry 2815/03

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Final markscheme

1 (a)	Can be broken down by biological organisms ✓. AW	1
(b)	Two of making compost	
(c)	Making methane fuel producing heat (to kill weed seeds) reducing demand on peat less land needed for landfill ✓✓	2
(c)(i)	to make electricity ✓; generated via steam turbines / to provide heat for community/ to dry waste ✓	2
(ii)	A high temperature ✓ is needed to prevent formation of toxic ✓ dioxins ✓ Any two marks	2
	Question total	7

2 (a)	<p>volume = $2.58 \times 10^{-4} \times 24.0$ ✓ $= 0.00619 \text{ dm}^3$ ✓ Accept 0.0062 or 0.006192 dm^3 Or 6.19 cm^3 etc. The correct units must be given to earn the second mark, but there is no mark for units accompanying an otherwise erroneous attempt.</p>	2
(b)	It increases solubility ✓	1
(c)	Increased temperature causes increased plant/algal growth ✓. Excess algae use up oxygen by decay/nocturnal respiration ✓ The solubility of oxygen decreases in warm water ✓. The removal of oxygen kills (aerobic) animals ✓ AW	4
(d)(i)	<p>acid $\text{HCO}_3^- + \text{H}_2\text{O} \rightarrow \text{CO}_3^{2-} + \text{H}_3\text{O}^+$ or $\text{HCO}_3^- \rightarrow \text{H}^+ + \text{CO}_3^{2-}$ ✓ H^+/proton/hydrogen ion transfer from/produced by HCO_3^- AW ✓</p> <p>Base $\text{HCO}_3^- + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3 + \text{OH}^-$ ✓ H^+ transfer to HCO_3^- AW ✓</p>	4
(ii)	$\text{Ca}(\text{HCO}_3)_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O} + \text{CO}_2$	1
	Question total	12

3 (a)(i)	The average time a species exists (in the atmosphere)/ concentration/rate of removal. ✓	1
(ii)	Unreactive AW ✓	1
(b)	A general term for NO and/or NO ₂ AW ✓	1
(d)	Find any six of the following marking points: High temperature will speed up the formation of NO ✓ because molecules will possess more energy when they collide ✓ A greater proportion will have the activation energy ✓ . By Le Chatelier's principle ✓ high temperature will favour the endothermic reaction ✓ which produced NO. The high pressure will affect rate by increasing the concentration of molecules ✓ It will not affect yield because there are the same number of molecules on each side of the equation ✓ AW throughout Award 1 mark for clear well organised writing using specialist terms. Specifically, look for accurate use of the words molecule/mole and activation energy / equilibrium.	7
(d)	$\text{NO} + \text{O}_3 \rightarrow \text{NO}_2 + \text{O}_2$ ✓	1
(e)(i)	Solution in /reacts with water ✓ ; oxidation of sulphurous acid to sulphuric acid (by oxygen or ozone) ✓. Accept reverse sequence.	2
(ii)	Likely to have become sulphuric acid / acid rain before it gets up there. ✓	1
Question total		14
4 (a)	2 1 clay: hydrogen bonding ✓ to water molecules ✓ (which are sandwiched between layers) / cations ✓ attracted to negative charge or oxygen on each layer ✓. / Just weak attraction or van der Waals ✓ only 1 1 clay: hydrogen bonding ✓ between -O-H on surface of octahedral sheet / and O on surface of tetrahedral sheets ✓.	4
(b)	The clays lose large amounts of water from between the layers ✓ which causes them to shrink ✓ (and the soil to crack) AW	2
(c)(i)	Replacement of Si(IV) ✓ by Al(III) ✓ / Al(III) ✓ by Mg(II) ✓ (leaves the clay with a net negative charge) AW	2
(ii)	Find any four marking points from the following: The water sandwich structure of the clay ✓ provides a higher surface area ✓ with access for water and cations ✓. By comparison with a 1:1 clay there is a higher degree of replacement (see part (i)) providing more negative charge ✓ for ion exchange. AW	4
Question total		12
PAPER TOTAL		45