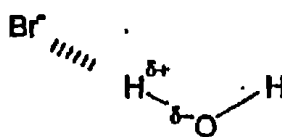
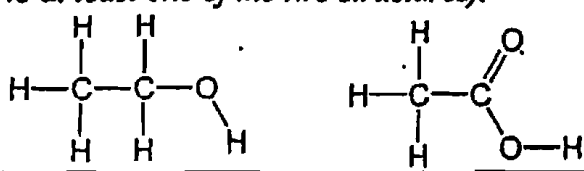


CHEMISTRY OF NATURAL RESOURCES

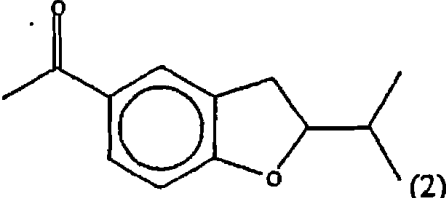
Mark Scheme Page 1 of 7	Unit Code 2851 2848	Session Jan	Yea 2002	FINAL
Question	Expected answers			Marks
1 (a)	$2\text{Br}^-(\text{aq}) + \text{Cl}_2(\text{aq}) \rightarrow 2\text{Cl}^-(\text{aq}) + \text{Br}_2(\text{aq})$ formulae correct (1); balanced (1); state symbols (1) <i>accept</i> $\text{Cl}_2(\text{g})$ and $\text{Br}_2(\text{g})/(\text{l})/(\text{l})$.			3
1 (b)	To vaporise/remove the bromine (1).			1
1 (c) (i)	Br 0 S +4 Br -1 S +6, 1 mark each, sign needed; For S, no positive signs scores 1 mark out of the possible 2; accept charges after numbers.			4
1 (c) (ii)	S (or SO_2) (1); Then explanation: loses (gives) electrons (1); or Br_2 gains electrons/is reduced (1); or in terms of oxidation state change i.e. S oxidation state/number increases or Br oxidation state/number decreases (1).			2
1 (c) (iii)	 <p>Interaction between Br and H of water (1) Br and H atoms may be just drawn next to each other; correct charges on Br and H, allow if no δs given (1).</p>			2
1 (d)	Toxicity, or corrosive nature/harmful <u>to humans</u> (1) NOT irritant / volatility			1
Total mark				13

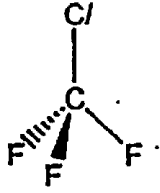
Mark Scheme Page 2 of 7	Unit Code 2851 2848	Session Jan	Year 2002	FINAL
Question	Expected answers			Marks
2 (a) (i)	$\text{CaO} + 3\text{C} \rightarrow \text{CO} + \text{CaC}_2$ <i>formulae correct (1) balanced (1)</i>			2
2 (a) (ii)	Use of equation (as written) to write correct mole ratios/ 3:1 (1) <i>i.e. 3 mole C gives 1 mole calcium carbide (ecf. from (i))</i> $M_r(\text{CaC}_2) = 64$ (1); 1 t gives 64/36 t (1) or equivalent; Answer = 1.78 t (1) <i>Give the full 4 marks if answer correct. Allow full marks ecf from (i)</i>			4
2 (b)	Large amount of energy needed for heating or high temperature needed (1).			1
2 (c) (i)	<i>There are four marking points all 1 mark:</i> Addition of water in tap funnel or similar; to calcium carbide in flask (1 mark only if both water & calcium carbide are in flask); delivery tube, + no leaks + not sealed; collection over water.			4
2 (c) (ii)1.	Water molecule is a proton/ H^+ /hydrogen ion (1) donor (1)			2
2 (c) (ii)2.	OH^- (1) <i>accept</i> $\text{Ca}(\text{OH})_2$.			1
2 (c) (iii)1.	$ \begin{array}{c} \text{Br} \quad \text{Br} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{H} \\ \quad \\ \text{Br} \quad \text{Br} \end{array} $ (1)			1
2 (c) (iii)2.	1,1,2,2-tetrabromoethane 1 mark for name and 1 mark for correct numbers. Allow ecf on name.			2
2 (c) (iv)	Electrophilic (1) <i>accept</i> electrophile; addition (1)			2
2 (c) (v)	Triple bond has a greater electron density (<i>allow</i> negative charge) than double (1), <i>this mark is for a comparison;</i> bromine molecule more polarised by triple bond or electron deficient/electrophilic bromine attracted more strongly (1).			2
2 (d) (i)	This is a Greenhouse gas or gas absorbs infrared/heat (1); leads to global warming/example of effect (1).			2
2 (d) (ii)	Calcium hydroxide is an alkali (1); enters water or leaches into the water system or enters soil (1);			2
2 (e) (i)	120 degrees (± 2.5) (1)			1
2 (e) (ii)	Correct <i>cis</i> (1); and correct <i>trans</i> (1); <i>no need for labels.</i> structures have restricted rotation about carbon-carbon double bond (1).			3
Total mark				29

Mark Scheme Page 3 of 7	Unit Code 2851 2848	Session Jan	Year - 2002	FINAL
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Question	Expected answers	Marks
3		
3 (a) (i)1.	Acidified (1); dichromate (1) <i>or</i> , specific names/formulae given.	2
3 (a) (i)2.	Heat (under reflux) (1) <i>accept</i> reflux, NOT high temperature.	1
3 (a) (ii)	CH ₃ COCH ₃ /C ₃ H ₆ O	1
3 (b)	1 mark for each, if full structures (<i>accept</i> -OH, the O must be correctly attached to at least one of the two structures). 	2
3 (d)	<i>Any 2 points from 4:</i> (Reactants <i>or</i> products) wasted <i>or</i> lot of reactant needed(1); product separation (1); separation by fractional distillation needs high temperatures (1); storage <i>or</i> getting rid of unwanted products (1).	2
3 (e) (i)	Solid / solid <i>or</i> liquid (1).	1
3 (e) (ii)	Rate increases (1).	1
3 (e) (iii)	Yield decreases (1).	1
3 (f) (i)	d-block (1).	1
3 (f) (ii)	Catalyst is in <u>same</u> (1); <u>phase (state)</u> as reactants (1).	2

3 (f) (iii)	Correct shape for uncatalysed reaction (<i>1 peak</i>) and for catalysed (<i>2 peaks</i>) (1), <i>ignore starting & ending points of these curves;</i> correct labels for activation enthalpies (1); lower activation enthalpy for catalysed reaction (1); correct label for intermediate (1); correct label for enthalpy change of reaction (1); <u>single</u> product line lower than <u>single</u> reactant line (1).	6
3 (g) (i)	M_r (CaCO ₃) = 100.1(1), <i>accept</i> g.; moles = $0.1/100.1 = 9.99 \times 10^{-4}$ mol <i>accept</i> 1.0×10^{-3} etc. (1).	2
3 (g) (ii)	2.00×10^{-3} mol, <i>ecf</i> (1).	1
3 (g) (iii)	$(2.00 \times 10^{-3}) \times 1000/20$ <i>or</i> concentration = moles/volume (1); = $0.100 \text{ mol dm}^{-3}$ (1) <i>ecf</i> ; Correct sig. figs. for this part only: 2/3 (1).	3
Total mark		26

Question n 4	Expected answers	Marks
4 (c) (i)	Elimination (1).	1
4 (c) (ii)	Catalyst of Ni <i>or</i> catalyst (1); and heat/high temperature (1) <i>do not allow</i> heat under reflux; <i>or</i> , Pt/Pd (1); at rtp (1).	2
4 (c) (iii)	 <p>(2)</p> <p>other sensible hydrogenation (terminal C=C only, C=O or benzene) (1) and molecule correct (1). <i>No marks for drawing trametone.</i></p>	2
4 (d) (i)	<p>4 point from the following increased $[H^+]$ /more H^+ (1); H^+ reacts with HCO_3^- (1); (by Le Chatelier's Principle), position of equilibrium in Equation 4.1 moves to right /more H_2CO_3 formed (1); increased $[H_2CO_3]$ (1); (by Le Chatelier's Principle), position of equilibrium in Equation 4.2 moves to right/more CO_2 formed. (1).</p>	4
4 (d) (ii)	<p>Equilibrium in reaction 4.1 moves to the right (1); in order to counteract the increased concentration of hydrogencarbonate (1). <i>or</i> HCO_3^- will accept H^+ /neutralises acid (1); and equilibrium moves to right (1).</p>	2
4 (d) (iii)	(Rapid) <u>breathing</u> (1); expels <u>carbon dioxide out of the lungs</u> (1).	2
Total mark		13

Question	Expected answers	Marks
5 (a)	 <p>formulae correct (1); correct tetrahedral shape (1).</p>	2
5 (b)	instantaneous dipole – induced dipole (1) <i>accept van der Waals forces.</i>	1
5 (c)	Carbon $\delta+$ (1); rest <i>or</i> F <i>or</i> Cl $\delta-$ (1). (1) <u>only</u> if no δ .	2
5 (d)	non-toxic (1); non-flammable/unreactive (1).	2
5 (e) (i)	$O + O_2 \xrightarrow{h\nu} O_3 / 3O_2 \rightarrow 2O_3$	1
5 (e) (ii)	$O_3 \xrightarrow{h\nu} O + O_2 / O + O_3 \rightarrow 2O_2$ (1) <i>hν used correctly at least once for photolysis, accept uv (1); no mark for hν if used incorrectly at all.</i>	2
5 (f)	<p><i>Any 5 of the following 7 points:</i> CFCs broken down by sunlight (UV); to produce chlorine atoms; chlorine atoms react with ozone; producing ClO radicals; these react with O; to regenerate chlorine atoms ; this reaction is very fast (much quicker than in part d (ii)) / chlorine is a catalyst;</p> <p><i>QWC (ensure text is legible and spelling, grammar and punctuation are accurate, so the meaning is clear)</i></p> <p><i>At least two readable and clear sentences with no more than one spelling, punctuation or grammatical error; (1)</i></p>	6
Total mark		16