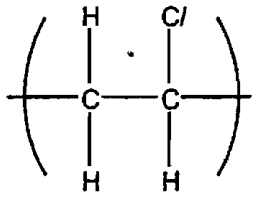
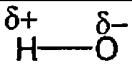
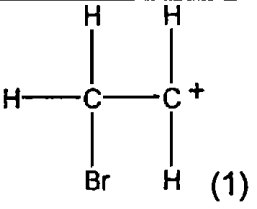
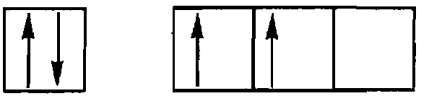
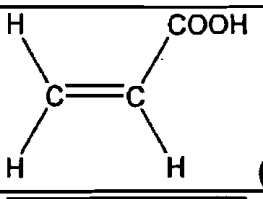
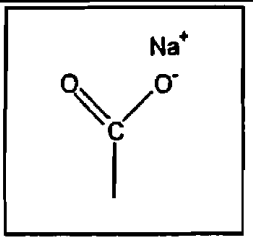
Question	Expected answers	Marks
1 (a) (i)	chloroethene (1). *Ignore numbers if 1 or 2.*	1
1 (a) (ii)	Softens / changes shape / remoulded (1); when heated/*allow* when it is melted / no cross-links (1).	2
1 (a) (iii)	 *allow* $-CH_2-CHCl-$ (1).	1
1 (b)	 *(uses numbers to identify) correct bond (1); partial charges correct (1).*	2
1 (c) (i)	Acidified/sulphuric acid (1) *allow any mineral acid/*H^+ ; (potassium) dichromate/$Cr_2O_7^{2-}$ (1).	2
1 (c) (ii)	condensing vapours (1); returning liquid to flask /vapours not allowed to escape (1).	2
1 (c) (iii)	1700-1725 cm^{-1} (1); C=O (1).	2
1 (d)	Elimination (1).	1
1 (e) (i)	Bromine molecule is polarised (1); by the C=C bond/electrophilic attraction/electrons/negative charge *ignore electronegativity* (1).	2
1 (e) (ii)	 (1)	1
	Total mark	**16**

Question	Expected answers	Marks
2 (a)	*Any 5 points from:* CO_2 ***absorbs*** (1); infrared ***radiation/light*** (1); ***emitted***/radiated from/given *off* from the Earth (1); ***molecules***/bonds ***vibrate*** (1); molecules have greater (kinetic) energy/faster vibrations (1); links energy to temperature/hotter/warmer (1); *QWC* 1 mark for two sentences / 2 bullet points including correct use of **two** of the words above in ***italics*** used correctly.	6
2 (b) (i)	*There are two alternative ways to tackle this question:* Increase in $[CO_2]$ /decrease in $[HCO_3^-]$ *(1 mark for using concentrations)*; *then any 3 points from 4:* gas moves equilibrium position in **2.1** to right/equilibrium in **2.2** to right (1); this increase in CO_2(aq) causes/ decrease in CO_2(aq) causes (1); equilib. pos. in **2.2** to move to right/ equilib. pos. in **2.1** to move to right (1); and more ions will form/more CO_2 dissolves ***or*** thus CO_2 gas is continually removed (1). *QWC* *At least two readable and clear sentences with no more than one spelling, punctuation or grammatical error* (1).	5
2 (b) (ii)	Hydrogen ions are formed (1).	1
2 (c)	*Any two sensible* ***linked*** *points: e.g.* extract CO_2 gas (1) and bury as liquid (1); encourage photosynthesis (1) by plants, *or* by imitating plants (1); use the right fuel for the job (1) *example* (1); use fewer 'vehicles'/less power generation (1) to reduce emissions/use less fossil fuel (1).	2
2 (d) (i)	Can with gas flow in and out on opposite sides (1); Granular/mesh absorbent/thin tube coated (1); correct labels (1).	3
2 (d) (ii)	$Ca(OH)_2(s) + CO_2(g) \rightarrow CaCO_3(s) + H_2O(l)$ *1 mark for correct equation;* *1 mark for state symbols correct.*	2
2 (e)	H^+/ H_3O^+ and CO_3^{2-} (*allow* carbonate *or* CO_3^-) *1 mark for each ion correct.*	2
2 (f) (i)	*1 mark for each one correct including sign:* -1, -2, -2, 0 *allow sign after number.*	4
2 (f) (ii)	O in sodium peroxide *alone* (1) has its oxidation state increased and decreased (1) *these two are linked*; *The second mark can be gained for linking oxidation state change correctly to oxidation/reduction.*	2
2 (f) (iii)	Oxygen is formed (1).	1
	Total mark	**28**

Question	Expected answers	Marks
3 (a)	d block (1)	1
3 (b) (i)	**4**NaOH + $ZrSiO_4 \rightarrow$ Na_2SiO_3 + Na_2ZrO_3 + **2**H_2O *1 mark for each side correct.*	2
3 (b) (ii)	Filtration (1) *allow* vacuum filtration/centrifuge.	1
3 (b) (iii)	M_r ($ZrSiO_4$) = 183 & M_r (ZrO_2) = 123 (1); Mass of ZrO_2 = 1000 x 123 / 183 = 672 kg (1).	2
3 (c) (i)	3s 3p  *1 mark for 4 electrons;* *1 mark for detail correct.*	2
3 (c) (ii)	SiO_2 is a solid (1) CO_2 is a gas (1) (*or expressed in terms of* relative melting / boiling points) ***or*** *describes* relative compressability/relative densities (2); ***or*** SiO_2 is insoluble in water (1) CO_2 is soluble (1).	2
3 (c) (iii)	SiO_2 has giant (covalent) structure (of atoms)/network/lattice structure (1); CO_2 has a molecular structure (1).	2
3 (c) (iv)	Intermolecular bonds/ forces between molecules are easier to break (1); than (chemical) bonds in a giant structure (1).	2
3 (d) (i)	Correct shape curve (2 humps shown, 2nd not greater than 1st) (1); drawn underneath profile given (1); *1 mark for each of the 2 correct labels & 1 mark for identifying the first hump (arrows can be single or double headed)* (3).	5
3 (d) (ii)	Catalysed reaction has lower activation enthalpy/requires less energy(1); more collisions/particles will have the necessary activation enthalpy (1); more collisions will lead to products (1).	3
	Total mark	**22**

Question	Expected answers	Marks
5 (a)	 (1).	1
5 (b)	 and H_2O *H_2O correct (1); structure of salt (1); correct charges (1).* *Do not allow* C-NaO.	3
5 (c)	Moles of hydroxide = (35.0/1000) x) 0.10 = (3.5×10^{-3}) *mark is for Concentration X Volume so may have* 3.5 (1); Moles of carboxylic acid groups = 3.5×10^{-3} (1);	2
5 (d) (i)	Covalent bond (1); Between 2 polymer chains *or* linking polymer chains (1).	2
5 (d) (ii)	Make them stronger (1)	1
	Total mark	**9**