

Question	Answer	Marks	Guidance
1(a)	carbon dioxide escapes /leaves /lost /released <b>OR</b> not a closed system;	1	gas escapes /leaves /lost /released
(b)	CaO + H <sub>2</sub> O → Ca(OH) <sub>2</sub> reactants; product;	2	One mark for each side correct <b>A</b> multiples <b>I</b> state symbols
(c)	M1 number of moles of CaCO <sub>3</sub> = (12.5 / 100 =) 0.125 <b>or</b> 125000 <b>OR</b> 56 / 100 = 0.56;  M2 mass calcium oxide = (0.125 × 56) = 7 (tonnes) <b>OR</b> 0.56 × 12.5 = 7;	2	Correct answer scores both marks  <b>A</b> answers in g or kg
(d)(i)	<i>Any two from:</i> does not wash away / insoluble / lasts a long time; does not increase pH above 7 / neutral / has pH 7; naturally occurring / does not need to be processed;	2	<b>A</b> does not leach out
(d)(ii)	<i>Any three from:</i> (flue gas contains) sulfur dioxide; flue gas / sulfur dioxide is acidic; calcium carbonate reacts with sulfur dioxide; to make a salt / calcium sulfite <b>OR</b> neutralisation;	3	<b>A</b> CaCO <sub>3</sub> is a base
(d)(iii)	making steel or iron / in a <u>blast</u> furnace / toothpaste / (making) glass / building / (making) cement / treating acidic river or lakes / chalk;	1	

- 2 (a) (i) pieces have (same) surface area [1]  
 same amount / mass / quantity / volume / number of moles of carbonate [1]
- (ii) no more bubbles / carbon dioxide **or** piece disappears / dissolves [1]
- (b) experiment 1  $\text{Ca}^{2+} + \text{CO}_2 + \text{H}_2\text{O}$  [1]
- (c) more concentrated **or** higher concentration (of acid) (in experiment 1) [1]  
 accept: arguments based on collision theory
- (ii) ethanoic acid is a weak acid **or** hydrochloric acid is a strong acid [1]  
 accept: stronger or weaker
- ethanoic acid less ionised / dissociated / lower / smaller concentration of hydrogen ions [1]  
 accept: less hydrogen ions and vice versa argument but not dissociation of ions
- (iii) lower temperature (particles) have less energy [1]  
 moving more slowly [1]  
 fewer collisions / lower collision rate [1]  
**or**  
 lower temperature (particles) have less energy [1]  
 fewer particles collide [1]  
 with the necessary energy to react [1]  
 note: less energy fewer successful collisions gains all 3 marks

**[Total: 10]**

- 3 (a) (i) (mass at  $t=0$ ) – (mass at  $t = 5$ ) [1]  
**NOTE:** must have mass at  $t = 5$  not final mass
- (ii) fastest at origin  
slowing down between origin and flat section gradient = 0  
where gradient = 0  
**three** of above in approximately the correct positions [2]
- (iii) 3 correct comments about gradient = [2]  
2 correct comments about gradient = [1]  
1 correct comment about gradient = [0] [2]
- (b) start at origin and smaller gradient [1]  
same final mass just approximate rather than exact [1]
- (c) smaller surface area [1]  
lower collision rate [1]
- (ii) molecules have more energy [1]  
collide more frequently / more molecules have enough energy to react [1]
- (d) number of moles of HCl in  $40 \text{ cm}^3$  of hydrochloric acid,  
concentration  $2.0 \text{ mol / dm}^3 = 0.04 \times 2.0 = 0.08$  [1]  
maximum number of moles of  $\text{CO}_2$  formed = 0.04 [1]  
mass of one mole of  $\text{CO}_2 = 44 \text{ g}$  [1]  
maximum mass of  $\text{CO}_2$  lost =  $0.04 \times 44 = 1.76 \text{ g}$  [1]

**[Total: 15]**

- 4 (a) (i) (attractive force between) positive ions and (negative) electrons [1]  
 opposite charges attract ONLY [1]  
 electrostatic attraction ONLY [1]
- (ii) lattice / rows / layers of lead ions / cations / positive ions [1]  
**NOT:** atoms / protons / nuclei  
 can slide past each other / the bonds are non-directional [1]
- (b) (i) anhydrous cobalt chloride becomes hydrated [1]  
**ACCEPT:** hydrous
- (ii) carbon dioxide is acidic [1]  
 sodium hydroxide and calcium oxide are bases / alkalis [1]
- (iii) Any two of:  
 water, calcium carbonate and sodium carbonate [2]  
**ACCEPT:** sodium bicarbonate
- (c) number of moles of  $\text{CO}_2$  formed =  $2.112 / 44 = 0.048$  [1]  
 number of moles of  $\text{H}_2\text{O}$  formed =  $0.432 / 18 = 0.024$  [1]
- $x = 2$  and  $y = 1$  **NOT:** ecf from this line
- formula is  $2\text{PbCO}_3 \cdot \text{Pb}(\text{OH})_2$  /  $\text{Pb}(\text{OH})_2 \cdot 2\text{PbCO}_3$  [1]

**[Total:12]**