

Question	Answer	Marks	Guidance
1(a)	carbon dioxide escapes / leaves / lost / released OR not a closed system;	1	gas escapes / leaves / lost / released
(b)	CaO + H ₂ O → Ca(OH) ₂ reactants; product;	2	One mark for each side correct A multiples I state symbols
(c)	M1 number of moles of CaCO ₃ = (12.5 / 100 =) 0.125 or 125000 OR 56 / 100 = 0.56; M2 mass calcium oxide = (0.125 × 56) = 7 (tonnes) OR 0.56 × 12.5 = 7;	2	Correct answer scores both marks A 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	A 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 OR neutralisation;	3	A CaCO ₃ 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 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 CO_2 formed = 0.04 [1]
mass of one mole of $\text{CO}_2 = 44 \text{ g}$ [1]
maximum mass of 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 [1]
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: [2]
water, calcium carbonate and sodium carbonate
ACCEPT: sodium bicarbonate
- (c) number of moles of CO_2 formed = $2.112 / 44 = 0.048$ [1]
number of moles of H_2O 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]