

## Mark Scheme - 2.2 Acids, Bases and Salts

1.

Mark	Answer
6 QWC	<p><b>Indicative content</b></p> <ul style="list-style-type: none"><li>• observations made when both acids react with metals, carbonates and bases e.g. temperature rise, liberation of gas, time to dissolve</li><li>• difference in rate of reaction and explanation in terms of strong/weak acid</li><li>• salts formed</li><li>• word / chemical equations</li></ul> <p><b>5-6 marks:</b> The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</p> <p><b>3-4 marks:</b> The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</p> <p><b>1-2 marks:</b> The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</p> <p><b>0 marks:</b> The candidate does not make any attempt or give a relevant answer worthy of credit.</p>

2.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)		1	battery acid			
	(ii)		1	blood			
	(iii)		1	<b>pure</b> water			
(b)			3	<b>A</b> copper carbonate (1) <b>B</b> copper oxide (1) <b>C</b> sodium hydroxide (1)	CuCO <sub>3</sub> CuO NaOH		

3.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)			5	A carbon dioxide / CO <sub>2</sub> B magnesium chloride / MgCl <sub>2</sub> C hydrogen / H <sub>2</sub> D sodium chloride / NaCl E copper(II) oxide / CuO copper(II) hydroxide / Cu(OH) <sub>2</sub>	copper oxide copper hydroxide		CuCO <sub>3</sub>
(b)			1	ZnCl <sub>2</sub>	Zn <sup>2+</sup> Cl <sub>2</sub> <sup>-</sup> Zn(Cl) <sub>2</sub>		

4.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)	1	sodium carbonate / $\text{Na}_2\text{CO}_3$	sodium hydrogencarbonate / $\text{NaHCO}_3$		
	(ii)	1	magnesium ethanoate / $(\text{CH}_3\text{COO})_2\text{Mg}$			
(b)		1	(ethanoic acid/it) is a weaker acid / has a higher pH (than that of sulfuric acid) ethanoic acid pH is 3/4 and sulfuric acid pH is 1/2 ethanoic acid has a lower $\text{H}^+$ ion concentration than sulfuric acid	less acidic	ethanoic acid pH is 3/4	
(c)		1	ethanol / $\text{C}_2\text{H}_5\text{OH}$			

5.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)	1	$25\text{cm}^3 \pm 1\text{cm}^3$			
	(ii)	1	$1.5\text{ }^\circ\text{C}$			
(b)		1	acid A (no mark)  temperature rise is greater / produces more heat – mark can <b>only</b> be awarded if A given			
(c)		3	add acid slowly from burette (1)  add indicator to sodium hydroxide solution / solution in cup (1)  indicator changes colour (1)	indication of precision    record volume required to change colour of indicator (2)		add indicator to acid/burette

6.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)		1	pH value of 1			
(b)		1	nitric, hydrochloric etc	HNO <sub>3</sub> , HCl etc		
(c)		1	carbon dioxide	CO <sub>2</sub>		
(d)		2	the gas is denser / heavier than air (1) does not support combustion or burning / extinguishes or puts out a flame (1)	gas doesn't burn / is not flammable	flame goes out – unless qualified	

7.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)	1	lemon juice			
	(ii)	1	saliva			
(b)	(i)	2	magnesium chloride (1)  water (1)	formulae		
	(ii)	2	carbon dioxide (1) gas must be correct to award test mark  turns limewater milky (1)			

8.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)		2	moles = conc $\times$ vol/1000 $= \frac{0.1 \times 17.5}{1000}$ (1) $= 0.00175$ (1) award (2) for cao			
(b)		1	176			
(c)		2	ecf possible from parts (a) and (b) mass = moles $\times$ $M_r$ = 0.00175 $\times$ 176 (1) 0.308 g /308 mg (correct unit required) therefore statement incorrect (1)	alternative method using given 300 mg mass		

9.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)		4	<p><b>A</b> sodium iodide  <b>B</b> ammonium carbonate  <b>C</b> calcium chloride  <b>D</b> iron(II) carbonate</p> <p>mark positive and negative ions independently</p> <p>8 ions correct = 4 marks            6/7 ions correct = 3 marks            4/5 ions correct = 2 marks            2/3 ions correct = 1 mark</p>	<p>NaI  <math>(\text{NH}_4)_2\text{CO}_3</math>  <math>\text{CaCl}_2</math>  <math>\text{FeCO}_3</math></p> <p>no credit for either ion if incorrect formula given  <b>instead</b> of name –            ignore formulae if names also given</p>		
(b)		1	<p>barium chloride (solution forms a) white precipitate</p> <p>test <b>and</b> result needed</p>	barium nitrate / $\text{Ba}^{2+}(\text{aq})$		

10.

Mark	Answer
6	<p><b>Indicative content</b> appropriate apparatus required, measured amount of alkali (or acid) in conical flask, add indicator <i>e.g. phenolphthalein</i>, add acid (alkali), drop-wise near end point/colour change, record volume of acid (alkali) added, repeat without indicator adding recorded volume of acid (alkali), boil off some of the water, leave solution to evaporate, dry crystals obtained</p> <p><i>Credit awarded for sequenced labelled diagrams as part of the response.</i></p> <p><b>5-6 marks</b> The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</p> <p><b>3-4 marks</b> The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</p> <p><b>1-2 marks</b> The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</p> <p><b>0 marks</b> The candidate does not make any attempt or give a relevant answer worthy of credit.</p>



11.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)		1	burette			
(b)		1	indicator(s)			pH indicator universal indicator
(c)		2	<p>adding smaller volume of acid (at a time) /            adding 0.1 cm<sup>3</sup> acid (at a time) / <i>accept any volume below 0.5 cm<sup>3</sup></i> (1)</p> <p>to obtain the exact end point value /            to get the exact volume indicator turns red /            changes colour            to get the exact volume when complete            neutralisation occurs (1)</p> <p><i>answer must imply a 'better'/more accurate            volume reading obtained</i></p>	adding drops (at a time)	repeat readings	
(d)		1	<p>B</p> <p>need the <i>most</i> acid</p> <p>– both needed</p>		needs lot of acid / more acid	

12.

Mark	
6	<p data-bbox="354 342 1806 516">Indicative content: a description of the reaction between the carbonate and the acid – apparatus named, effervescence, exothermic, the formation of blue coloured copper sulfate solution and the addition of excess of the copper carbonate. The removal of the excess copper carbonate by filtration. Obtaining the crystals by evaporation. Either allowing the solution to evaporate at room temperature or by heating the solution and allowing the remaining solution to evaporate naturally to dryness. Credit to be given for word/symbol equation.</p> <p data-bbox="354 557 1793 695">5 – 6 marks: The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</p> <p data-bbox="354 703 1755 805">3 – 4 marks: The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</p> <p data-bbox="354 813 1759 915">1 – 2 marks: The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</p> <p data-bbox="354 924 1528 950">0 marks: The candidate does not make any attempt or give a relevant answer worthy of credit.</p>

13.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)		1	copper oxide / (black) solid remains copper oxide / (black) solid stops reacting		an excess blue solution	
(b)	(i)	1	filter / filtration / filtering			
	(ii)	1	water / H <sub>2</sub> O (ignore incorrect formula if given with correct name)			
(c)	(i)	1	copper oxide / CuO (ignore incorrect formula if given with correct name)			
	(ii)	1	copper sulfate / CuSO <sub>4</sub> (ignore incorrect formula if given with correct name)		water	

14.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)		1	to use up / to neutralise / remove (all) the acid	to react with <b>all</b> the acid		to use <b>it</b> all up
(b)		2	(filter) funnel (1) magnesium oxide (1)	MgO	filter solid	
(c)		1	mark credited for process <b>or</b> how it is carried out i.e. evaporate <b>or</b> leave on window sill / in a warm place / leave for a length of time	heat / boil	leave it	
(d)		1	magnesium sulfate + water	MgSO <sub>4</sub> + H <sub>2</sub> O		
(e)		1	MgCl <sub>2</sub>			

15.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)		1	sulfuric	H <sub>2</sub> SO <sub>4</sub>		
(b)		2	any 2 of 3 points for (1) each  bubbles / fizzing / effervescence (1) blue solution / colour change (1) temperature increases (1)			
(c)		2	filter (1)  evaporate water / evaporate <b>some</b> of solution / evaporate overnight / evaporate in warm place (1)	leave for <b>length of time</b> in <b>warm place</b>		
(d)		1	copper(II) chloride + water	CuCl <sub>2</sub> + H <sub>2</sub> O		

16.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)		3	pH = 5 (1) weak acid / not very acidic (1) since grapes are eaten (1)	pH = 1 <b>and</b> acidic – 1 mark only  safe to eat		
(b)	(i)	3	all five points plotted correctly - 2 marks four points plotted correctly - 1 mark  smooth curve - 1 mark	straight lines joining points (since biological data is used)		
	(ii)	1	4.4			
	(iii)	1	55 minutes - from graph $\pm 1$	if line not extrapolated accept value in the range 52-60		

17.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)		1	25.0	25		
(b)		3	number of moles NaOH = concentration $\times$ volume $= 0.1 \times 25/1000$ $= 0.0025$ (1)  (stoichiometry / equation shows 1:1) 0.0025 mol CH <sub>3</sub> COOH : 0.0025 mol NaOH (1)  concentration CH <sub>3</sub> COOH $= \text{number of moles} \div \text{volume}$ $= 0.0025 \div 25/1000$ $= 0.1$ (1)  – correct answer only (cao) (3) – follow through error (ft)	$cV = cV$ $c \times 25 = 0.1 \times 25$ (2)  $c = \frac{0.1 \times 25}{25} = 0.1$		
(c)	(i)	1	60			
	(ii)	2	number of moles = concentration $\times$ volume $= 0.1 \times 100/1000$ $= 0.01$ (1)  number of moles = mass / M <sub>r</sub> mass = number of moles $\times$ M <sub>r</sub> $= 0.01 \times 60 = 0.6$ g ( $\therefore$ label information incorrect) (1)	number of moles in $100\text{cm}^3 = 0.083$ (1)  concentration calculated above as $0.1 \text{ mol/dm}^3$ – not $0.83 \text{ mol/dm}^3$ (1)		