

# Chemical tests

## Mark Scheme 3

<b>Level</b>	IGCSE(9-1)
<b>Subject</b>	Chemistry
<b>Exam Board</b>	Edexcel IGCSE
<b>Module</b>	Single Award (Paper 2C)
<b>Topic</b>	Inorganic Chemistry
<b>Sub-Topic</b>	Chemical tests
<b>Booklet</b>	Mark Scheme 3

**Time Allowed:** 78 minutes

**Score:** /65

**Percentage:** /100

**Grade Boundaries:**

9	8	7	6	5	4	3	2	1
>90%	80%	70%	60%	50%	40%	30%	20%	10%

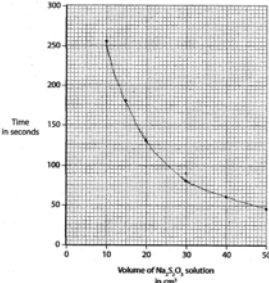
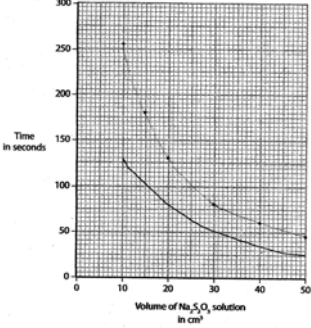
Question number	Answer	Notes	Marks
1 a	Any two of: <ul style="list-style-type: none"> <li>• (same) volume of acid</li> <li>• (same) concentration of acid</li> <li>• (same) concentration of alkali</li> <li>• (same) rate of stirring / stir for the same time</li> <li>• (same) starting temperature / temperature of acid/alkali/solutions/room</li> </ul>	Reject volume(s) of solutions Accept amount of acid as alternative to either of first two bullet points	2
b	M1 correct reference to accuracy / temperature rise  M2 correct reference to insulation / heat loss	eg accuracy improved or increased / temperature rise greater or more accurate or closer to correct value(s) / final temperatures higher Accept temperatures more accurate Ignore just higher temperatures Ignore results more reliable / valid  eg polystyrene is a (better) insulator / poorer conductor (than glass) / reduces heat loss / more heat trapped Ignore <u>no</u> heat loss Accept reverse argument for glass	2

Question number	Answer	Notes	Marks
1 c i	M1 (final) 39(.0) M2 (initial) 17(.0) M3(change) (+)22(.0)	Both values correct but in wrong order scores 1 mark (of M1 and M2)  M3 CQ on final and initial values	3
ii	<u>exothermic</u> AND temperature has increased / temperature change is positive / final temperature higher than initial temperature	Accept heat / thermal energy given out or transferred to the surroundings  Reject just energy has been given out	1

Question number	Answer	Notes	Marks
1 d	<p>Any two of:</p> <ul style="list-style-type: none"> <li>• correct statement about first part of graph, identified as positive gradient / positive correlation / temperature increase / temperatures up to 30 or 32.5 °C / volumes up to 20 or 22 cm<sup>3</sup> / experiments 1-4</li> <li>• correct statement about top of graph, identified as where lines cross / intersection / peak / maximum</li> <li>• correct statement about second part of graph, identified as negative gradient / negative correlation / temperature decrease / temperatures after 30 or 32.5 °C / volumes after 20 or 22 cm<sup>3</sup> or up to 40 cm<sup>3</sup> / experiments 5-8</li> </ul>	<p>eg reaction continuing or acid being neutralised or some acid still unreacted or heat being produced</p> <p>eg reaction complete or all acid neutralised or neutralisation point reached or shows volume of alkali needed to neutralise acid</p> <p>eg further alkali causes cooling or sodium hydroxide absorbs heat or no reaction occurs or no acid left or alkali in excess Reject reaction becomes endothermic</p> <p>Ignore references to direct proportion / particle collisions / limiting reagents / rate of reaction</p>	2
		<b>Total 10 marks</b>	

Question number		Answer	Notes	Marks
2	a	sulfur/precipitate forms	Accept usual precipitate alternatives Ignore precipitate colour Accept cloudy / opaque Reject wrongly identified <u>precipitate</u> (eg sodium chloride)	1
	b	to keep the depth/height/shalowness of liquid (in the conical flask) the same / OWTTE OR the same mass of sulfur (needed to obscure the cross)	Accept reverse argument Reject to keep the concentration the same	1
	c	reaction would start before the correct depth /concentration of liquid was obtained OR the reaction starts when the acid is added / straight away/ before the water is added	Ignore references to keeping the total volume constant Ignore references to fair test / accuracy / safety	1

Question number		Answer	Notes	Marks
2	d	<p>fume cupboard / well-ventilated room /open windows / extractor fan</p> <p>OR</p> <p>wear eye protection / safety goggles / OWTTE</p> <p>OR</p> <p>(gas) mask / respirator</p>		1
		<p>(SO<sub>2</sub>/it is) poisonous/toxic</p> <p>OR</p> <p>reference to specific harmful effect on humans (eg affects breathing/respiratory irritant /eye irritant/triggers asthma attack/makes bronchitis or emphysema worse)</p> <p>OR</p> <p>to prevent gas reaching eyes/lungs/OWTTE</p>	<p>Ignore references to pollution / acid rain / greenhouse effect</p> <p>Ignore just harmful</p> <p>Mark independently</p> <p>To score M1 and M2, explanation must match precaution:</p> <ul style="list-style-type: none"> <li>• fume cupboard etc can link with all explanations</li> <li>• eye protection etc. can link with all explanations except those involving breathing etc.</li> <li>• mask etc. can link with all explanations except those involving eyes etc.</li> </ul>	1

Question number	Answer	Notes	Marks		
2	e	i	<p>all points correctly plotted to nearest gridline</p>  <p>suitable curve of best fit based on plotted points</p>	<p>Deduct 1 mark for each incorrect plot</p>	2
		ii	<p>curve completely below original curve</p> <p>starts at vol = 10 cm<sup>3</sup>, finishes at vol = 50 cm<sup>3</sup></p> 	<p>Do not penalise continuation of line above 255 s unless incorrect (eg straight line to 300 s)</p> <p>Do not award mark if curve starts from (10,255) DEP on point plotted for experiment 1</p>	1 1

(Total for Question 2 = 10 marks)

Question number		Answer	Notes	Marks
3	a	brown precipitate	Accept usual alternatives for precipitate Ignore qualifiers such as dark / light Ignore red(dish) / orange / rust(y) Reject other colours Ignore all names and formulae	1
	b	i	ammonium / $\text{NH}_4^+$  gas given off is ammonia / $\text{NH}_3$	1  1
		ii	sulfate / $\text{SO}_4^{2-}$	1
	c	Zn / zinc (atom) (it) loses (2) electrons / gives electron(s) to $\text{Fe}^{3+}$ /zinc is oxidised / zinc increases its oxidation number	Accept $\text{Fe}^{3+}$ gains electron(s)/is reduced/oxidation number decreases Ignore $\text{Fe}^{3+}$ converted to $\text{Fe}^{2+}$ / Zn converted to $\text{Zn}^{2+}$ Reject iron/Fe gains electrons M2 DEP on M1	1 1

(Total for Question 3 = 6 marks)



Question number	Answer	Notes	Marks
4 (a)	hydrogen / H <sub>2</sub> burns with a pop/squeak OR use burning/lit splint/flame to see if pop/squeak	Ignore H Must be reference to test and result Reference to splint/match with no indication of flame is not enough Reject reference to glowing splint Ignore flame extinguished 'Squeaky pop test' on its own is not sufficient	1 1
(b) i	AgCl  (dilute) nitric acid / HNO <sub>3</sub>	Ignore names even if wrong Accept sulfuric acid / H <sub>2</sub> SO <sub>4</sub> Reject hydrochloric acid / HCl Ignore conc(entrated) acid Ignore acid(ified) without a named acid Reject other named acids	1 1
ii	iron nitrate	Accept ferrous nitrate and ferric nitrate Ignore oxidation states (II) and (III) Reject other oxidation states	1

Question number	Answer	Notes	Marks
4 (c)	(add) sodium hydroxide (solution) / NaOH	<p>Any group I hydroxide / ammonium hydroxide / barium or calcium hydroxide / ammonia solution (names or formulae)</p> <p>If reagent incorrect, then 0/3</p> <p>If reagent missing, then M2 and M3 can be awarded</p> <p>If near miss (eg ammonia hydroxide) then M2 and M3 can be awarded</p>	1
	green precipitate	<p>Ignore qualifiers such as light / pale / dark</p> <p>Accept solid / suspension / ppt(e) in place of precipitate</p> <p>Reject all other colours</p> <p>Ignore names and formulae even if incorrect</p>	1
	brown precipitate	<p>Ignore qualifiers such as light / pale / dark / rusty / foxy / orange</p> <p>Accept red-brown</p> <p>Accept solid / suspension / ppt(e) in place of precipitate</p> <p>Reject all other colours</p> <p>Ignore names and formulae even if incorrect</p> <p>If both colours correct, penalise missing precipitate once only</p> <p>Do not award M2 or M3 for two correct observations in the wrong order</p> <p>Ignore references to bubbles etc</p>	1
<b>Total</b>			<b>8</b>

Question number	Answer	Accept	Reject	Marks
5 (a)	<b>M1</b> - bubbles (of gas) / fizzing / effervescence	gas/carbon dioxide given off		1
	<b>M2</b> - <u>lump/calcium carbonate/solid</u> disappears/gets smaller	dissolves forms a colourless solution		1
(b)	<b>M1</b> - (bubble through) limewater/calcium hydroxide <b>solution</b>	<b>white</b> precipitate/ suspension/solid (formed)		1
	<b>M2</b> - (goes) milky/cloudy/chalky  M2 dependent on M1 or near miss, e.g. $\text{Ca}(\text{OH})_2(\text{s})$ IGNORE references to lighted spill goes out			1
(c)	time <b>increases</b> , mass <b>decreases</b>  IGNORE references to mass eventually stops decreasing	reverse statement mass decreases with time (they have a) negative correlation 3 min 18s to 3 min 30s	mass goes down with no reference to time	1
(d) (i)	3.3 to 3.5			1
	(ii) lump/calcium carbonate/solid <u>completely</u> reacted	used up/has gone	has dissolved (both) reactants used up	1

Question Number	Answer	A	Reject	Marks
5 (e) (i)	calcium chloride <b>AND</b> hydrochloric acid  IGNORE carbon dioxide / carbonic acid / calcium carbonate	hydrogen chloride for hydrochloric acid correct formulae		1
(ii)	calcium chloride <b>AND</b> hydrochloric acid  IGNORE carbon dioxide / carbonic acid	hydrogen chloride for hydrochloric acid correct formula	calcium carbonate	1
(f)	<b>M1</b> - steeper curve to left of original starting at, or close to (100,0) <b>M2</b> - levels at 98.4 g		curves that 'dip' below 98.4 by more than ½ small square	1 1
			<b>Total</b>	<b>11</b>

Question number	Answer	Accept	Reject	Marks
6 (a)	Cu( <sub>2</sub> penalise incorrect use of cases and subscript ignore names	Formula showing correct charges on the ions		1
(b)	to remove carbonate (ions) / to avoid precipitating any other (named) insoluble (barium) compounds / to remove ions that would form (white) precipitates	to remove compounds that would form (white) precipitates		1
(c)	CuSO <sub>4</sub> .5H <sub>2</sub> O / CuSO <sub>4</sub> 5H <sub>2</sub> O (i.e. no dot)	formula showing correct charges on the ions		1
(d)	(use a clean) wire / glass rod / silica rod  ignore references to hydrochloric acid  (to put) solid in <u>non-luminous / Bunsen</u> flame  No marks if solid is in container eg test tube / tray / crucible	any method of introducing the solid / solution into the flame. e.g. (wet) wooden spill / tip or sprinkle in  Bunsen/non-luminous anywhere in answer Burner in place of flame Blue for non-luminous	copper rod / any metal that will burn or melt in a flame (eg magnesium, aluminium)	1  1
			<b>Total</b>	<b>5</b>

Question number	Answer	Accept	Reject	Marks
7(a)(i)	fermentation			1
(ii)	(to provide the) catalyst/enzyme/zymase	to increase the rate of the reaction		1
(b)(i)	<b>M1</b> (test) – flame test	suitable description of flame test		2
(ii)	<b>M2</b> (observation) – brick red / orange-red copper(II) ions: <b>M1</b> (test) – (aqueous) sodium hydroxide / NaOH <b>M2</b> (observation) – blue precipitate ignore shades of blue <b>M2</b> dep on <b>M1</b> or near miss of formula, eg Na(OH) <sub>2</sub> sulfate ions: <b>M1</b> (test) – (dilute) hydrochloric acid / HCl <b>M2</b> (test) - (aqueous) barium chloride / BaCl <sub>2</sub> <b>M3</b> (observation) – white precipitate <b>M3</b> dep on <b>M2</b> or near miss	red accept other suitable alkalis suitable alternatives to precipitate  (dilute) nitric acid / HNO <sub>3</sub> (aqueous) barium nitrate / Ba(NO <sub>3</sub> ) <sub>2</sub>	all other colours  Reject sulfuric acid for <b>M1</b> only	5

Question number	Answer	Accept	Reject	Marks
7 (c)	<p><b>M1</b> (pressure) – 60-70 atm</p> <p><b>M2</b> (catalyst) – phosphoric acid / <math>\text{H}_3\text{PO}_4</math> ignore references to concentration</p>	<p>any pressure or range within this range</p> <p>phosphoric(V) acid</p>	any other oxidation state	2
(d)	<p><b>M1</b> (<math>\Sigma</math> bonds broken) 348 + 412 + 360 (= 1120)</p> <p><b>M2</b> (<math>\Sigma</math> bonds made) 612 + 463 (= 1075)</p> <p><b>M3</b> <b>M1</b> – <b>M2</b> / <math>\Sigma</math> bonds broken – <math>\Sigma</math> bonds made</p> <p><b>M4</b> (+)45 (kJ/mol)</p> <p>Correct answer with no working scores 4</p> <p>– <b>5 (kJ/mol) scores 3</b></p>	<p>3231</p> <p>3186</p>		4

Total 15 marks