

Question	Answers	Notes	Total	Crit	
1	a	Transition metals	1	A	
	b	Period 4	1	A	
	c	An isotope is an atom with same number of protons and electrons (but) different number of neutrons.	<i>Award 1 mark for same atomic number but different mass number</i>	2	A
	d	Neutrons = 36 Electrons = 29		2	A
	e	Alloy		1	A
	f	Greater resistance to corrosion (so) it won't deteriorate or High enough melting point so (so)that it can be made into moulds or Makes a hard substance (so) it can be made into objects that won't be easily destroyed or Is malleable (so) it can be made into statues	<i>Accept due to weather affects</i>	2	A

2	a	Oxidation		1	A																
	b	A ▾		1	A																
	c	4Fe 3O ₂ 2Fe ₂ O ₃		3	A																
	d	n(Fe) = m / MM = 0.60 / 56 n(Fe) = 0.011 mol 0.011/4 (0.00275) x 3= 0.00825 mol	ECF from part c Award mp 3 for 0.023/4 (if 26 is used) Award mp 4 for 0.1725 (if 26 is used) Award 1 mark if ratio 4/3 stated	4	A																
	e	<table border="1"> <thead> <tr> <th>Substance</th> <th>State at room temperature</th> <th>Soluble in water</th> <th>Conductivity at room temperature</th> </tr> </thead> <tbody> <tr> <td>Chlorine ▾</td> <td>Gas</td> <td>Slightly</td> <td>No</td> </tr> <tr> <td>Iron ▾</td> <td>Solid</td> <td>No</td> <td>Yes</td> </tr> <tr> <td>Iron (III) chloride ▾</td> <td>Solid</td> <td>Yes</td> <td>No</td> </tr> </tbody> </table> <p>One substance correctly identified All substances correctly identified</p>	Substance	State at room temperature	Soluble in water	Conductivity at room temperature	Chlorine ▾	Gas	Slightly	No	Iron ▾	Solid	No	Yes	Iron (III) chloride ▾	Solid	Yes	No		2	A
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f	2, 8, 7 or 1s ² 2s ² 2p ⁶ 3s ² 3p ⁵		1	A																	

g	<p>Iron loses electrons or forms positive ions/cations</p> <p>Chlorine gains electrons or forms negative ions/anions</p> <p>Forming an ionic bond</p> <p>(because of the) electrostatic attraction or attraction between the <u>opposite</u> charged ions</p>		4	A
h	<p><input type="text" value="Corrosive"/></p>		1	D

3	a	evidence of an average calculation Correctly rounded to 2.93	<i>Do not award this mark for an incorrect value even if correctly stated to 3 sig figs</i>	2	C D
	b	pH probe gives numerical/quantitative data or data to 3 sig figs Indicator paper gives a range of colours or a range of pH or qualitative data or Measured pH is dependent on interpretation of a scale (so) pH probe gives more valid data	<i>Only award the third mark if the first two marks are awarded</i>	3	C
	c	Lemon juice The largest increase in pH		2	C

d		1	2	3	4	17	B
	Variables	some variables implied	size as IV or final mass or pH or volume of gas as DV or one CV identified	size as IV and final mass or pH or volume of gas as DV and one CV identified	size as IV and final mass or pH or volume of gas as DV and at least two CV identified		
	Equipment	correct equipment to measure IV or DV or CV	two pieces of correct equipment to measure IV or DV or CV	correct equipment to measure IV and DV and CV			
	Sufficient data	reference to different sizes	at least five sizes or three trials	at least five sizes and three trials	at least five sizes and three trials and calculates mean		
	Method	attempt at method but may be not relevant	attempt at method, insufficient detail about IV, DV or CVs so method is not likely to give relevant data	method is described, could be followed for IV, DV and CVs and will produce relevant data	complete method for IV, DV and CVs is fully explained and could be replicated		
	Safety	a safety concern is mentioned	a safety concern is mentioned and linked to acidity				
e	Research question to include IV: Thickness of coating DV: accept any relevant DV for example [max 1] <ul style="list-style-type: none"> • change in mass of marble (chips) • volume of gas produced • detail or colour of sculpture • pH change 					2	B

4	a	<p>IV: Number of teaspoons <i>or</i> amount of baking soda</p> <p>DV: Number of candles extinguished</p> <p>Accept any reasonable CV, for example [max 1]</p> <ul style="list-style-type: none"> • volume of vinegar • type or size of teapot • distance between the spout and the top of the flame 	<i>Accept quantity for volume</i>	3	B
	b	<p>If the mass of baking soda increases</p> <p>Then more candles will be extinguished</p> <p>Because more carbon dioxide is produced</p>		3	B
	c	<p>Accept any two reasonable limitations, for example [max 2]</p> <ul style="list-style-type: none"> • Mass of baking soda was not measured • Need to replace the lid of the teapot quickly • Distance between spout and candle is not specified • Only one trial for each mass or no calculation of average 		2	C
	d	<p>Accept any reasonable suggestion, for example [max 1]</p> <ul style="list-style-type: none"> • Concentration of acid • Type of acid • Volume of acid • Surface area of carbonate • Temperature of solution 	<i>Accept quantity of acid</i>	1	C

<p>e</p>	<p>Table Object</p> <table border="1"> <thead> <tr> <th>Mass of baking soda / g</th> <th>Number of candles extinguished</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>2</td> </tr> <tr> <td>2</td> <td>4</td> </tr> <tr> <td>3</td> <td>6</td> </tr> <tr> <td>4</td> <td>8</td> </tr> <tr> <td>5</td> <td>9</td> </tr> </tbody> </table> <p>Table with two columns</p> <p>Headers: Mass (of baking soda) and g and number of candles</p> <p>Data in order and units in the header only</p>	Mass of baking soda / g	Number of candles extinguished	1	2	2	4	3	6	4	8	5	9	<p>Accept % candles extinguished</p>	<p>3</p>	<p>C</p>
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<p>f</p>	<p>y axis scale with even increments and y axis scale starting at zero</p> <p>All data correctly plotted</p> <p>A line of best fit with approximately the same number of points above and below the line</p> <p>x axis: Mass (of baking soda) and y axis: number of candles (extinguished)</p> <p>Unit included with baking soda label</p>	<p><i>Mp3 can be awarded for incorrectly plotted data</i></p> <p><i>ECF for Y axis from 4e</i></p>	<p>5</p>	<p>C</p>												

5	a	<p>The hanging extinguisher is the heaviest and can extinguish an area of 3 m²</p> <p>The largest area that can be extinguished is 35m² by the ball (which is not the heaviest)</p> <p>(so) the research statement is not valid</p>	<p><i>ORA. Must include data in the response</i></p> <p><i>do not award the third mark unless the first two marks are awarded</i></p>	3	C
	b	<p>Fire extinguisher ball</p> <p>Accept any two reasonable justifications, for example [max 2]</p> <ul style="list-style-type: none"> • Dropped from a high • Does not need to be in a fixed space or manually operated • Extinguishes over a large area • Lightweight to store and transport • Less maintenance than the other dry powders, types or low maintenance 		3	C
	c	Exothermic		1	A

6	a	Adenosine: <input type="text" value="Alcohol"/>	Caffeine: <input type="text" value="Alkene"/>		2	A																									
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	1	2	3	4
Social impact	A social impact for one extract is identified	A social impact is identified for both extracts	A social impact is identified for both extracts with supporting evidence	
Environmental impact	An environmental impact is implied	An environmental impact for one extract is stated	An environmental impact for both extracts is stated	An environmental impact for both extracts is stated with supporting evidence
Final choice	final choice is stated	final choice is stated with justification		

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D