



# Combined Science Chemistry Paper 1

## Foundation Tier: Extended Open Response

6c (2024)



\*(c) A student has three solids, A, B and C.

The solids are sodium carbonate, powdered zinc and copper oxide, but the student does not know which solid is which.

The student reacted each solid with dilute sulfuric acid.

Figure 9 shows the student's observations and the results of tests on any gases produced.

observations and results				
	reaction with dilute sulfuric acid	gas bubbled through limewater	gas tested with a lit splint	
powdered zinc → solid A	bubbles seen colourless solution formed	no change	squeaky pop	Hydrogen
Copper Oxide → solid B	blue solution formed some black solid remains at bottom of test tube	no gas produced	no gas produced	Sulfur
Sodium carbonate → solid C	bubbles seen colourless solution formed	limewater turned cloudy	puts out lit splint	

CO<sub>2</sub> Figure 9

Use the observations and results in Figure 9 to identify which solid is which.

Your answer should include

- how each test result helps you to identify the solid
- word equations to support your answer.

(6)

Solid A

• Colourless

• Has Hydrogen

• No change through lime water

These leads it to be Powdered Zinc

Solid C

- High CO<sub>2</sub> amount since it puts out lit splint
- Also cloudy

limewater means CO<sub>2</sub> is present

Must be Sodium carbonate since

Carbonate has CO<sub>2</sub> contents

Solid B

Must be copper sulphate

• Blue Solution Formed → Cu Copper sulphate

• Black Soluble → copper oxide sludge

• No gas Produced → Must be Copper sulphate



Question number	Indicative content	Mark
6(c)	<p>Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <p><b>AO1 (3 marks) AO3 (3 marks)</b></p> <ul style="list-style-type: none"> <li>solid <b>A</b> is powdered zinc</li> <li>metal + acid → metal salt + hydrogen</li> <li>zinc + sulfuric acid → zinc sulfate + hydrogen</li> <li>bubbles seen so gas is produced</li> <li>does not turn limewater cloudy so gas is not carbon dioxide</li> <li>test for hydrogen is lit splint</li> <li>lit splint makes squeaky pop</li> <li>so gas produced is hydrogen</li> </ul> <ul style="list-style-type: none"> <li>solid <b>B</b> is copper oxide</li> <li>metal oxide + acid → metal salt + water</li> <li>copper oxide + sulfuric acid → copper sulfate + water</li> <li>no gas is produced</li> <li>copper oxide is black</li> <li>some left in excess at bottom of test tube</li> <li>copper sulfate solution is blue</li> </ul> <ul style="list-style-type: none"> <li>solid <b>C</b> is sodium carbonate</li> <li>metal carbonate + sulfuric acid → metal sulfate + carbon dioxide + water</li> <li>sodium carbonate + sulfuric acid → metal sulfate + carbon dioxide + water</li> <li>bubbles seen so gas is produced</li> <li>test for carbon dioxide is limewater</li> <li>limewater turned cloudy so gas produced is carbon dioxide</li> <li>no reaction with lit splint</li> <li>so no hydrogen gas produced</li> </ul>	(6) AO1; AO3

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	<ul style="list-style-type: none"> <li>The plan attempts to link knowledge and understanding of scientific enquiry, techniques and procedures, flawed or simplistic connections made between elements in the context of the question. (AO1)</li> <li>Analyses the scientific information but understanding and connections are flawed. An incomplete plan that provides limited synthesis of understanding. (AO3)</li> </ul>
Level 2	3–4	<ul style="list-style-type: none"> <li>The plan is mostly supported through linkage knowledge and understanding of scientific enquiry, techniques and procedures, some logical connections made between elements in the context of the question. (AO1)</li> <li>Analyses the scientific information and provides some logical connections between scientific enquiry, techniques and procedures. A partially completed plan that synthesises (AO3)</li> </ul>
Level 3	5–6	<ul style="list-style-type: none"> <li>The plan is supported throughout by linkage knowledge and understanding of scientific enquiry, techniques and procedures, logical connections made between elements in the context of the question. (AO1)</li> <li>Analyses the scientific information and provide logical connections between scientific concepts throughout. A well-developed plan that synthesises relevant understanding coherently. (AO3)</li> </ul>



Level	Mark	Descriptor	Additional Guidance
	0	No rewardable material.	Read whole answer and ignore all incorrect material and any references to other metals / discard any contradictory material then:
Level 1	1–2	<u>Additional Guidance</u> Correctly identifies at least 1 solid or product  Identifies product with correct test  Gives at least 1 general observation  Gives at least 1 general word equation  Identifies all 3 substances	<u>Possible candidate response</u> (all examples, not a definitive list) solid A – zinc (1) reaction with solid A gives off hydrogen (1) limewater cloudy so is carbon dioxide (1)  gas is released so must be bubbles (1)  metal + acid → salt + hydrogen (2) solid A is zinc and the gas given off is hydrogen (2) A – zinc, B – copper oxide, C – sodium carbonate (2)
Level 2	3–4	<u>Additional Guidance</u> Correctly identifies at least 2 solids with at least one linked explanation Correctly identifies at least 1 solid and 1 product with at least one linked explanation  Gives at least one correct word equation Identifies one solid with correct word equation Correctly identifies all 3 solids with linked explanations for just 1 solid	<u>Possible candidate response</u> solid A is zinc and solid B is copper oxide. Copper oxide is black (3)  solid C is sodium carbonate as carbon dioxide turned limewater cloudy (3)  solid B is copper oxide, which is black. It produces copper sulfate, which is blue (4) zinc + sulfuric acid → zinc sulfate and hydrogen (3) Solid B: copper oxide + sulfuric acid → copper sulfate + water (4) A – zinc, B – copper oxide, C – sodium carbonate; and hydrogen is produced when zinc reacts with an acid as zinc is a metal (4)
Level 3	5–6	<u>Additional Guidance</u> Correctly identifies 2/3 solids with linked explanations for at least two Fully identifies one solid with all products and a linked explanation  Identifies all 3 solids backed by relevant information	<u>Possible candidate response</u> solid A is zinc as hydrogen is produced. Solid B is copper oxide as it is black. (5)  Solid B: copper oxide + sulfuric acid → copper sulfate (blue solution) + water (5)  solid A is zinc because hydrogen is produced. Solid B is copper oxide, which forms blue copper sulfate solution. Solid C is sodium carbonate as it is the only solid that could produce carbon dioxide (6)