From page 10

Sodium carbonate reacts with hydrochloric acid in an exothermic reaction. The equation for the reaction is:

$$Na_2CO_3(s) + 2HCl(aq) \rightarrow 2NaCl(aq) + CO_2(g) + H_2O(l)$$

A student investigated the effect of changing the mass of sodium carbonate powder on the highest temperature reached by the reaction mixture.

Q6. Plan a method to investigate the effect of changing the mass of sodium carbonate powder on the highest temperature reached.

02.1	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO1 4.5.1.1 RPA 4
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.	3–4	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	

Indicative content

- **measure volume of (hydrochloric) acid**
- with a measuring cylinder

- pour (hydrochloric) **acid into a suitable container** eg polystyrene cup
- measure the initial temperature (of hydrochloric acid)
- with a thermometer

- **add a known mass of sodium carbonate**
- measured with a balance
- stir

- **measure the highest temperature reached**

- **repeat with different masses of sodium carbonate**
  or
  add successive masses of sodium carbonate to the same mixture

- repeat the whole investigation

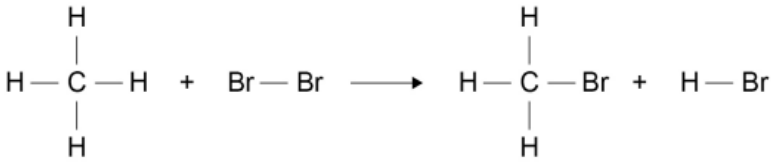
- use the same starting temperature
- use the same volume of (hydrochloric) acid each time
- use the same concentration of (hydrochloric) acid each time

[6 marks]

AQA June 22 H Q2.1

From page 11

Q6. Bromine reacts with methane in sunlight. Below is the displayed formulae for the reaction of bromine with methane. HT



The table shows the bond energies and the overall energy change in the reaction.

	C—H	Br—Br	C—Br	H—Br	Overall energy change
Energy in kJ/mol	412	193	X	366	– 51

Calculate the bond energy X for the C-Br bond.

Broken

4 x C-H 4×418

1 x Br-Br 193

1841 ✓

Made

3 x C-H 3×412

1 x C-Br X

1 x H-Br 366

1602+X ✓

✓

So 1841 − (1602+X) = − 51

So 1841 = −51 + (1602+X)

X = 1840 + 51 − 1602 ✓

= 290 kJ/mol

Q9. The table shows data about different ways to power electric cars.

03.5	**Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	5–6
	Level 2: Some logically linked reasons are given. There may also be a simple judgement.	3–4
	Level 1: Relevant points are made. This is not logically linked.	1–2
	No relevant content	0

reasons why fuel cells could be judged as better

from the table	from other knowledge
• time for refuelling a fuel cell is faster than recharging **or** a fuel cell does not need to be recharged • a fuel cell has a greater range	• hydrogen can be renewable if made by electrolysis using renewable energy • lithium-ion batteries can catch fire • produces only water **or** no pollutants produced • lithium-ion batteries may release toxic chemicals on disposal • lithium-ion batteries (eventually cannot be recharged so) have a finite life

reasons why the lithium-ion battery could be judged as better

from the table	from other knowledge
• lithium-ion uses energy more efficiently • cost of lithium-ion car much less • cost of recharging much less than refuelling with hydrogen	• hydrogen is often made from fossil fuels so is not renewable • charging points are more widely available than hydrogen filling stations • hydrogen takes up a lot of space **or** is difficult to store • hydrogen can be highly flammable / explosive • no emissions produced • (catalyst in the hydrogen fuel-cell eventually becomes poisoned so) have a finite life