

Bond energy calculations (Higher only)

Q1. (2019)

03.4	<p>(bonds broken) $((4 \times 463) + (2 \times 138) =)$ 2128</p> <p>(bonds made) $((4 \times 463) + (496) =)$ 2348</p> <p>(energy change = bonds broken – bonds made) $(2128 - 2348 =)$ (–) 220 (kJ)</p> <p>alternative approach:</p> <p>(bonds broken) $(2 \times (\text{O}=\text{O}) = (2 \times 138) =)$ 276 (1)</p> <p>(bonds made) $(1 \times (\text{O}=\text{O}) =)$ 496 (1)</p> <p>(energy change = bonds broken – bonds made) $(276 - 496 =)$ (–) 220 (kJ) (1)</p>	<p>an answer of (–) 220 (kJ) scores 3 marks</p> <p>an incorrect answer for one step does not prevent allocation of marks for subsequent steps</p> <p>ignore energy change sign</p> <p>allow correct calculation using incorrect values from step 1 and/or step 2</p>	<p>1</p> <p>1</p> <p>1</p>	<p>AO2 5.1.1.1 5.5.1.1 5.5.1.3</p>
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Q2. (2022)

06.5	<p>(bonds broken = $(4 \times 413) + \text{C}=\text{C} + 431 =)$ 2083 + C=C</p> <p>(bonds made = $(346 + 339 + (5 \times 413) =)$ 2750</p> <p>(energy released = bonds made – bonds broken =) $56 = 2750 - [2083 + \text{C}=\text{C}]$</p> <p>(C=C) = 611 (kJ/mol)</p>	<p>allow correct use of incorrect value(s) from step 1 and / or step 2</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>	<p>AO2 5.5.1.3</p>
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Q3. (2024)

05.3	(bonds broken =) $945 + 3X$		1	AO2 5.5.1.1 5.5.1.3
	(bonds made = $6 \times 391 =$) 2346		1	
	(energy released = bonds made – bonds broken =) $93 = 2346 - [945 + 3X]$	allow correct use of incorrectly determined value(s) of bonds broken and/or bonds formed	1	
	$(3X =) 1308 \text{ (kJ/mol)}$		1	
	$(X =) 436 \text{ (kJ/mol)}$	allow correct use of an incorrectly determined value for $3X$	1	