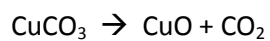
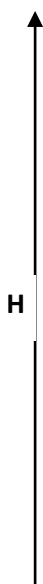


Energetics [D]

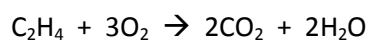
1. Copper carbonate can be thermally decomposed according to the following equation:



- State and explain whether this reaction is exothermic or endothermic: **[2]**
- Explain the meaning of the symbols ΔH : **[2]**
- State the sign and units of ΔH for this reaction: **[2]**
- Draw this reaction on an enthalpy profile: **[3]**



2. Calculate ΔH for the combustion of ethene: **[3]**



Bond energies:

C-H	C=C	O=O	C=O	O-H
413	612	498	805	464

3. The neutralisation of potassium hydroxide by hydrochloric acid in a polystyrene cup is exothermic.

- a. Sketch a graph showing the temperature of the reaction mixture as hydrochloric acid is added: **[3]**

- b. Mark the point where the acid has perfectly neutralised the alkali: **[1]**

- c. Explain why, using this apparatus, the measured temperature rise not as large as expected? **[2]**

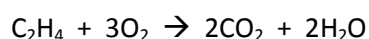
Energetics [D]

1. Copper carbonate can be thermally decomposed according to the following equation:



- a. State and explain whether this reaction is exothermic or endothermic: [2]
endothermic [1]
heat energy must be supplied to the copper carbonate [1]
- b. Explain the meaning of the symbols ΔH : [2]
enthalpy/energy change for the reaction [1]
per mole [1]
- c. State the sign and units of ΔH for this reaction: [2]
+ [1]
kJ/mol [1]
- d. Draw this reaction on an enthalpy profile: [3]
Reactants higher than products [1]
 ΔH and activation energy labelled [1]
formulae balanced [1]

2. Calculate ΔH for the combustion of ethene: **[3]**



Bond energies:

C-H	C=C	O=O	C=O	O-H
413	612	498	805	464

Bonds broken [1]

Bonds made [1]

ΔH calculated (-1318) and stated with units (kJ/mol)

3. The neutralisation of potassium hydroxide by hydrochloric acid in a polystyrene cup is exothermic.
- a. Sketch a graph showing the temperature of the reaction mixture as hydrochloric acid is added: **[3]**

starts going up [1]

then goes down [1]

straight lines drawn, meeting in the middle [1]

- b. Mark the point where the acid has perfectly neutralised the alkali: **[1]**

- c. Explain why, using this apparatus, the measured temperature rise not as large as expected? **[2]**

Heat energy is lost to the surroundings [1]

So less than expected is used to heat the reaction mixture [1]