

- 1 (a) Define the term *standard enthalpy of combustion*, ΔH_c^\ominus

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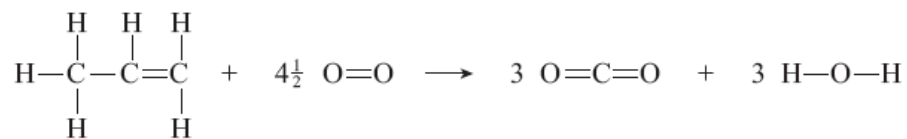
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(3 marks)

- (b) Use the mean bond enthalpy data from the table and the equation given below to calculate a value for the standard enthalpy of combustion of propene. All substances are in the gaseous state.

Bond	C=C	C—C	C—H	O=O	O=C	O—H
Mean bond enthalpy/kJ mol ⁻¹	612	348	412	496	743	463



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(3 marks)

- (c) State why the standard enthalpy of formation, ΔH_f^\ominus , of oxygen is zero.

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(1 mark)

- (d) Use the data from the table below to calculate a more accurate value for the standard enthalpy of combustion of propene.

Compound	C ₃ H ₆ (g)	CO ₂ (g)	H ₂ O(g)
Standard enthalpy of formation, $\Delta H_f^\ominus / \text{kJ mol}^{-1}$	+20	-394	-242

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(3 marks)

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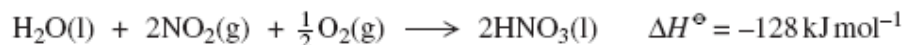
State Hess's Law.

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(1 mark)

Nitric acid can be made by reacting water, nitrogen dioxide and oxygen according to the following equation.



Some standard enthalpies of formation, ΔH_f^\ominus , are given in the table below.

Substance	H ₂ O(l)	NO ₂ (g)	O ₂ (g)
$\Delta H_f^\ominus / \text{kJ mol}^{-1}$	-286	+34	0

Use the data above to calculate a value for the standard enthalpy of formation of nitric acid.

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(4 marks)