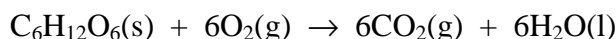


- Glucose is a common food source. The net reaction for its metabolism in humans is:



Calculate ΔH° for this reaction given the following heats of formation.

$$\Delta H^\circ_f(\text{C}_6\text{H}_{12}\text{O}_6(\text{s})) = -1274 \text{ kJ mol}^{-1}, \quad \Delta H^\circ_f(\text{CO}_2(\text{g})) = -393 \text{ kJ mol}^{-1} \quad \text{and} \\ \Delta H^\circ_f(\text{H}_2\text{O}(\text{l})) = -285 \text{ kJ mol}^{-1}$$

Using $\Delta_{\text{rxn}}H^\circ = \sum m\Delta_fH^\circ(\text{products}) - \sum n\Delta_fH^\circ(\text{reactants})$:

$$\Delta_{\text{rxn}}H^\circ = [6 \times \Delta_fH^\circ(\text{CO}_2(\text{g})) + 6 \times \Delta_fH^\circ(\text{H}_2\text{O}(\text{l}))] - [\Delta_fH^\circ(\text{C}_6\text{H}_{12}\text{O}_6(\text{s}))] \\ = [(6 \times -393) + (6 \times -285)] - [-1274] = -2794 \text{ kJ mol}^{-1}$$

(Note that $\Delta_fH^\circ(\text{O}_2(\text{g})) = 0$ as it is an element in its standard state).

Answer: **-2794 kJ mol⁻¹**

If the combustion of glucose is carried out in air, water is produced as a vapour. Calculate the ΔH° for the combustion of glucose in air given that



As vaporising liquid water requires energy (+44 kJ mol⁻¹), the combustion enthalpy is reduced. Six moles of H₂O are produced in the combustion so the enthalpy of combustion is reduced to:

$$-2794 + (6 \times +44) = -2530 \text{ kJ mol}^{-1}$$

Answer: **-2530 kJ mol⁻¹**

Will ΔS be different for the two oxidation reactions? If so, how will it differ and why?

As gaseous molecules have higher entropy than liquid phase molecules, oxidation to produce H₂O(g) will lead to a higher value for ΔS than oxidation to produce H₂O(l).

Marks
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