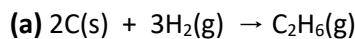
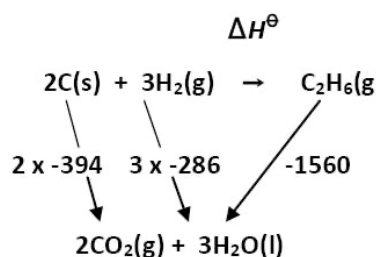


SL & HL Answers to Hess's Law questions

1.

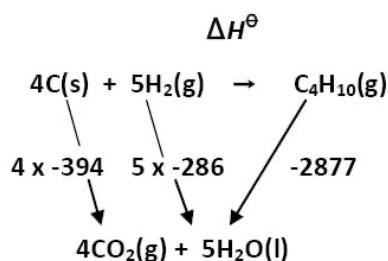


(b) By Hess's Law

$$(2 \times -394) + (3 \times -286) = \Delta H_f^\ominus + (-1560)$$

$$\Delta H_f^\ominus(\text{C}_2\text{H}_6) = -86 \text{ kJ mol}^{-1}$$

2. i.

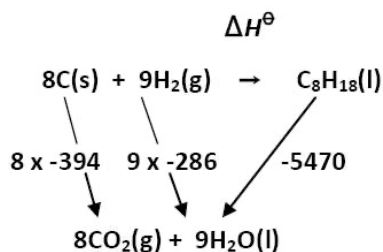


By Hess's Law

$$(4 \times -394) + (5 \times -286) = \Delta H_f^\ominus + (-2877)$$

$$\Delta H_f^\ominus(\text{C}_4\text{H}_{10}) = -129 \text{ kJ mol}^{-1}$$

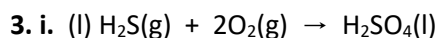
ii.



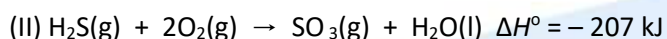
By Hess's Law

$$(8 \times -394) + (9 \times -286) = \Delta H_f^\ominus + (-5470)$$

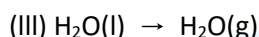
$$\Delta H_f^\ominus(\text{C}_8\text{H}_{18}) = -256 \text{ kJ mol}^{-1}$$



$$\Delta H^\ominus = -236 \text{ kJ}$$

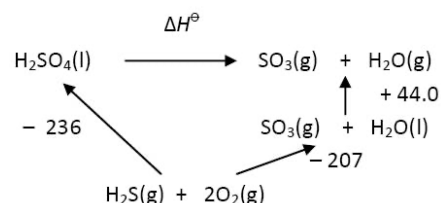


$$\Delta H^\ominus = -207 \text{ kJ}$$



$$\Delta H^\ominus = +44.0 \text{ kJ}$$

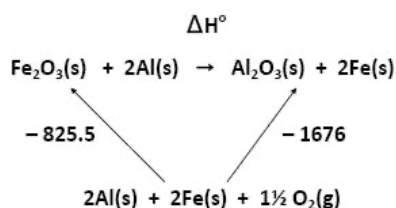
ii.



Subtract (I) from (II) to give $0 = \text{SO}_3\text{(g)} + \text{H}_2\text{O(l)} - \text{H}_2\text{SO}_4\text{(l)}$ $\Delta H_f^\ominus = -207 - (-236) = +29.0 \text{ kJ}$

Then add (III) and rearrange $\text{H}_2\text{SO}_4\text{(l)} \rightarrow \text{SO}_3\text{(g)} + \text{H}_2\text{O(g)}$ $\Delta H_f^\ominus = +29.0 + 44.0 = +73.0 \text{ kJ}$

4.



By Hess's Law

$$\Delta H^\ominus = -1676 - (-825.5) = -851 \text{ kJ}$$

$$\text{Amount of aluminium} = 20.0 / 26.92 = 0.743 \text{ mol}$$

$$2 \text{ mol of Al produce 1 mol of Al}_2\text{O}_3$$

$$20 \text{ g of Al produce } 0.743/2 \text{ mol of Al}_2\text{O}_3$$

$$\text{Heat evolved by 20 g of Al} = 0.743/2 \times 851 = 316 \text{ kJ}$$