

Enthalpy

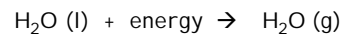


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Enthalpy (H) ~ heat content (q) @ constant pressure

$$\Delta H = \text{thermal (heat) energy change} = q$$

Physical process



$$\Delta H_{\text{vap}} = 44 \text{ kJ/mole}$$

heat of vaporization

What happens for the reverse process?

$$\Delta H = -44 \text{ kJ/mole and exothermic}$$

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What does the sign of the enthalpy tell you?

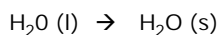
Endothermic process or reaction

$$\Delta H > 0 \text{ or positive}$$

Exothermic process or reaction

$$\Delta H < 0 \text{ or negative}$$

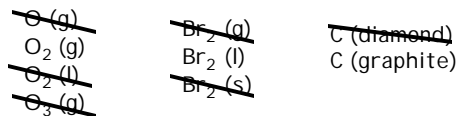
Endothermic or exothermic?



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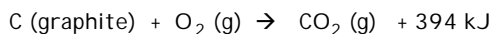
Standard State Conditions

- Temperature - 25°C or 298K
- Pressure - 1.00 atm
- Element in its stable state



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Chemical process



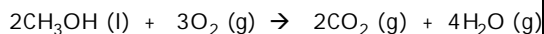
$$\Delta H_{\text{f}}^{\circ} = -394 \text{ kJ/mole}$$

This is the standard molar enthalpy of formation for the formation of one mole substance from its elements in their standard states.

$$\Delta H_{\text{f}}^{\circ} = 0 \text{ kJ/mole for free elements}$$

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Combustion of methanol

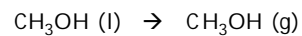


$$\Delta H_{\text{f}}^{\circ}: -239 \text{ kJ/mol} \quad 0 \quad -394 \quad -242$$

$$\Delta H_{\text{rxn}} = \sum n\Delta H_{\text{f,products}}^{\circ} - \sum n\Delta H_{\text{f,reactants}}^{\circ}$$

where n is the number of moles

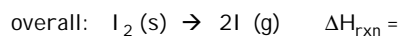
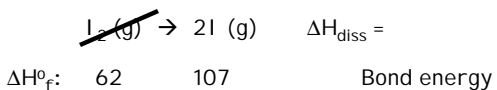
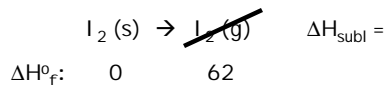
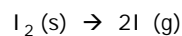
How about just vaporizing the methanol?



$$\Delta H_{\text{f}}^{\circ}: -239 \text{ kJ/mol} \quad -201 \text{ kJ/mole}$$

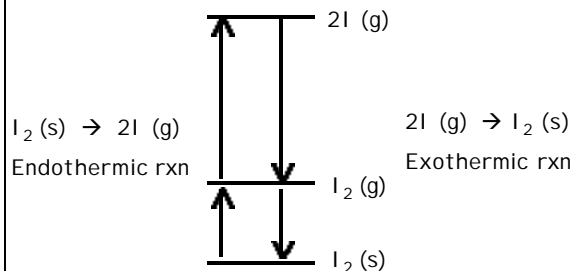
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Describe all processes for the following:



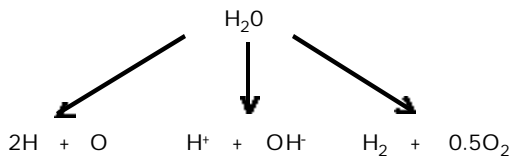
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Energy Diagram



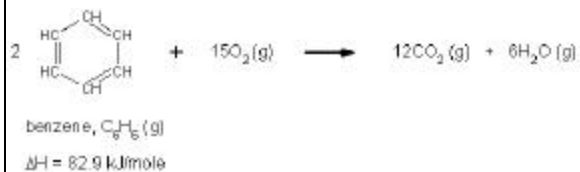
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From an energetics point of view, what is happening in each case for the water? Is the reaction endothermic or exothermic?



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Compare the ΔH for this reaction calculated by ΔH_f data with that calculated from bond energies.



Bond Energy Calculator - an interactive Excel spreadsheet - [Click here](#)

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Write the reaction used for the measurement of the standard molar enthalpy of formation of benzene.

Do you think this reaction is possible?

⋮

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