Problem Set 6

Problem 4.5

How much heat is required when 10,000 kg of $CaCO_3$ is heated at atmospheric pressure from 50 to 880 °C? Use (a) direct integration of the C_P polynomial, (b) ICPH, and (c) MCPH. Report your answers in MJ.

Problem 4.9

A process stream is heated as a gas from 25 to 250 °C at constant P. A quick estimate of the energy requirement is obtained from Eq. 4.3, with C_P taken as constant and equal to its value at 25 °C. Is the estimate of Q likely to be low or high? Why?

Problem 4.10

(a) Evaluate the latent heat of vaporization ΔH_n of n-pentane by Eq. 4.13. How does this result compare with the value listed in Table B.2?

(b) Handbook values for latent heats of vaporization at 25 deg C of four compounds are given in the table below. Calculate ΔH_n by Eq. 4.14, and compare the result with the value given in Table B.2.

Latent heats of vaporization at 25 °C in J/g			
n-Pentane	366.3	Benzene	433.3
n-Hexane	366.1	Cyclohexane	392.5

Problem 4.12

Handbook values for the latent heat of vaporization in J/g are given in the table for several pure liquids at 0 °C.

	ΔH at 0 °C
Chloroform	270.9
Methanol	1,189.5
Tetrachloromethane	217.8

Calculate:

(a) The value of the latent heat at T_n by Eq. 4.14, given the value listed at 0 °C.

(b) The value of the latent heat at T_n by Eq. 4.13.

By what percentage do these results differ from the value listed in Table B.2 of App. B?

Problem 4.20

Hydrocarbon fuels can be produced from methanol by reactions such as the following, which yields 1-hexene:

$$6\ CH_3OH\ (g) \rightarrow C_6H_{12}\ (g) + 6\ H_2O\ (g)$$

Compare the standard heat of combustion at 25 °C of 6 CH_3OH (g) with the standard heat of combustion at 25 °C of C_6H_{12} (g) for reaction products CO_2 (g) and H_2O (g).