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## Problem Set 6

### Problem 4.5

How much heat is required when 10,000 kg of  $\text{CaCO}_3$  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  $\Delta H_n$  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  $\Delta H_n$  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.

	$\Delta H$ at 0 °C
Chloroform	270.9
Methanol	1,189.5
Tetrachloromethane	217.8

Calculate:

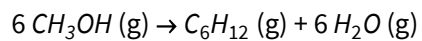
(a) The value of the latent heat at  $T_n$  by Eq. 4.14, given the value listed at 0 °C.

(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:



Compare the standard heat of combustion at 25 °C of 6  $\text{CH}_3\text{OH} (\text{g})$  with the standard heat of combustion at 25 °C of  $\text{C}_6\text{H}_{12} (\text{g})$  for reaction products  $\text{CO}_2 (\text{g})$  and  $\text{H}_2\text{O} (\text{g})$ .