Answer EITHER Question 7 below OR Question 8 printed on page 14. Only one of these two questions will be graded. If you start both questions, be sure to cross out the question you do not want graded. The Section II score weighting for the question you choose is 15 percent.

7. Answer the following questions about thermodynamics.

Substance	Combustion Reaction	Enthalpy of Combustion, ΔH°_{comb}, at 298 K (kJ mol^{-1})
$H_2(g)$	$H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l)$	-290
$C(s)$	$C(s) + O_2(g) \rightarrow CO_2(g)$	-390
$CH_3OH(l)$		-730

(a) In the empty box in the table above, write a balanced chemical equation for the complete combustion of <u>one</u> mole of $CH_3OH(l)$. Assume products are in their standard states at 298 K. Coefficients do not need to be whole numbers.

(b) On the basis of your answer to part (a) and the information in the table, determine the enthalpy change for the reaction $C(s) + H_2(g) + H_2O(l) \rightarrow CH_3OH(l)$.

(c) Write the balanced chemical equation that shows the reaction that is used to determine the enthalpy of formation for <u>one</u> mole of $CH_3OH(l)$.

(d) Predict the sign of ΔS° for the combustion of $H_2(g)$. Explain your reasoning.

(e) On the basis of bond energies, explain why the combustion of $H_2(g)$ is exothermic.

GO ON TO THE NEXT PAGE.