Honors 203/Chemistry 110
Homework 8-9 (20 pts)

Due Thursday, April 21st. *Spring 2011*

1. CIC 4.25. A premium gasoline available at most stations has an octane rating of 92. What does that tell you about:
   (a) the knocking characteristics of this gasoline?
   (b) whether the fuel contains oxygenates?

2. CIC 4.26. Figure 4.16 gives the energy content of several fuels in kilojoules per gram (kJ/g). Calculate the energy content in kilojoules per mole (kJ/mol) for each. How does the chemical composition of a fuel relate to its energy content? Visit Figures Alive! at the textbook's website for related activities.

3. CIC 4.29. A friend tells you that hydrocarbon fuels containing larger molecules liberate more heat than those with smaller ones.
   (a) Use these data, together with appropriate calculations, to discuss the merits of this statement.

Hydrocarbon	Heat of Combustion
octane, C_8H_{18}	5450 kJ/mol
butane, C_4H_{10}	2859 kJ/mol

   (b) Based on your answer to part a, do you expect the heat of combustion per gram of candle wax, $C_{25}H_{52}$, to be more or less than that of octane? Do you expect the molar heat of combustion of candle wax to be more or less than that of octane? Justify your predictions.

4. CIC 4.32. During the distillation of petroleum, kerosene and hydrocarbons with 12-18 carbons used for diesel fuel will condense at position C marked on this diagram. (see text)

   (a) Separating hydrocarbons by distillation depends on di erences in a speci c physical property. Which one?

   (b) How does the number of carbon atoms in the hydrocarbon molecules separated at A, B, and D compare with those separated at position C? Explain your prediction.

   (c) How do the uses of the hydrocarbons separated at A, B, and D di er from those separated at position C? Explain your reasoning.

5. CIC 4.33. Explain why cracking is necessary in the re nement of crude oil.

6. CIC 4.36. Octane ratings of several substances are listed in Table 4.5.

   (a) What evidence can you give that the octane rating is or is not a measure of the energy content of a gasoline?

   (b) Octane ratings are measures of a fuel's ability to minimize or prevent engine knocking. Why is the prevention of knocking important?

   (c) Why are higher octane gasolines more expensive than lower octane gasoline?