**Problem Set 12.1**

1. Percent composition of a hydrocarbon is 85.6% C and 14.5% H. Calculate the empirical formula.
2. A 1.00 g sample of the hydrocarbon at a temperature of 273 K and a pressure of 1.0x105 Pa (1.00 atm) has a volume of 0.399 dm3. Calculate the molar mass
3. Using 1 and 2, deduce the molecular formula.
4. Explain why incomplete combustion is harmful to humans
5. Give the structural formulas for the isomers of C4H10 and state the name of each one.
6. Name the compound C2H4 and draw its structural formula
7. What is the IUPAC name for CH3CH2CH(CH3)2 ?
8. Which statement about neighboring members of all homologous series is correct?
   1. They have the same empirical formula.
   2. They differ by a CH2group.
   3. They possess different functional groups.
   4. They differ in their degree of unsaturation.
9. When one mole of ethene reacts with two moles of oxygen gas
   1. Δ*H* is positive.
   2. the oxidation number of carbon is unchanged.
   3. an alcohol is formed.
   4. carbon monoxide is produced.
10. Which formula is a correct representation of pentane?
    1. CH3CH2CH2CH2CH3
    2. CH3(CH2)2CH3
    3. CH3(CH2)3CH3
    4. CH3(CH3)3CH3
11. Which is a correct definition of the term *empirical formula*?
    1. formula showing the numbers of atoms present in a compound
    2. formula showing the numbers of elements present in a compound
    3. formula showing the actual numbers of atoms of each element in a compound
    4. formula showing the simplest ratio of numbers of atoms of each element in a compound
12. The reaction of ethanal and oxygen can be represented by the unbalanced equation below.

\_\_ CH3CHO \_\_ O2 + → \_\_ CO2 + \_\_ H2O

When the equation is balanced using the smallest possible integers, what is the coefficient for O2 ?

1. The equation for the complete combustion of butane is

2C4H10 +13O2→8CO2 +10H2O

What is the amount (in mol) of carbon dioxide formed by the complete combustion of three moles of butane?

1. How many hydrogen atoms are contained in one mole of ethanol,C2H5OH?
2. The percentage by mass of the elements in a compound is 72% Carbon, 12%H and 16% Oxygen. What is the mole ratio of C:H in the empirical formula of this compound.
3. Write a balanced combustion reaction for propane
4. Calculate the heat of combustion for propane using bond enthalpies and compare to the heat of combustion listed in your data booklet.
5. Is the combustion of propane exothermic or endothermic?
6. A compound that contains only carbon, hydrogen, and oxygen has the following percentage by mass: carbon 60%, hydrogen 8%, oxygen 32%. What is the empirical formula?
7. State and explain the trend in boiling point for the alkanes homologous series.