Answer EITHER Question 2 below OR Question 3 printed on page 8. 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 20 percent.

2. Answer the following questions related to hydrocarbons.

   (a) Determine the empirical formula of a hydrocarbon that contains 85.7 percent carbon by mass.

   (b) The density of the hydrocarbon in part (a) is 2.0 g L^{-1} at 50°C and 0.948 atm.
      (i) Calculate the molar mass of the hydrocarbon.
      (ii) Determine the molecular formula of the hydrocarbon.

   (c) Two flasks are connected by a stopcock as shown below. The 5.0 L flask contains CH_4 at a pressure of 3.0 atm, and the 1.0 L flask contains C_2H_6 at a pressure of 0.55 atm. Calculate the total pressure of the system after the stopcock is opened. Assume that the temperature remains constant.

   CH_4 C_2H_6

   5.0 L   1.0 L
   3.0 atm   0.55 atm
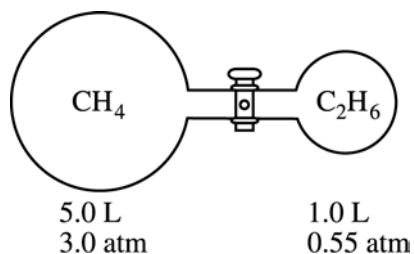
   (d) Octane, $C_8H_{18}(l)$, has a density of 0.703 g mL^{-1} at 20°C. A 255 mL sample of $C_8H_{18}(l)$ measured at 20°C reacts completely with excess oxygen as represented by the equation below.

   $$2\,C_8H_{18}(l) \;+\; 25\,O_2(g) \;\rightarrow\; 16\,CO_2(g) \;+\; 18\,H_2O(g)$$
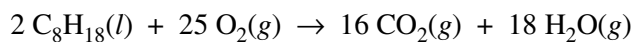
   Calculate the total number of moles of gaseous products formed.

GO ON TO THE NEXT PAGE.