WORKSHOP for Chapter 13
Spectroscopy / Structure Determination

1. Identify compounds of the given molecular formula that show only one ^{1}H NMR signal:

     C_2H_6O C_3H_4 $C_2H_4Br_2$
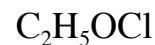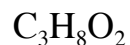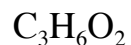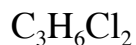
     C_4H_6 C_5H_{12} C_5H_{10}
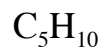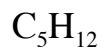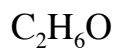
2. Identify compounds of the given molecular formula that show only two ^{1}H NMR signals:

     $C_3H_6Cl_2$ $C_3H_6O_2$ $C_3H_8O_2$ C_2H_5OCl

3. How many ^{1}H NMR signals will each of the following compounds show?

    a) $(CH_3)_3CCH_2CH_3$

    b) $CH_3COCOOCH_3$

    c) $CH_3COCH_2COCH_3$

    d) $CH_3COCH_2CH_2COCH_3$

    e) $CH_3COCH_2CH_2COOCH_3$

    f) $CH_3COCH_2CHClCOCH_3$
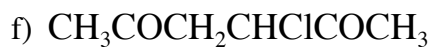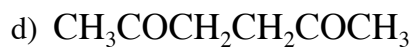
4. Deduce the unknown structures from the data presented.

   a) C_4H_8O

      triplet (1.0 ppm, 3H)
      singlet (2.1 ppm, 3H)
      quartet (2.4 ppm, 2H)

   b) $C_4H_8O_2$

      triplet (1.2 ppm, 3H)
      singlet (2.1 ppm, 3H)
      quartet (4.1 ppm, 2H)

   c) C_8H_8O

      singlet (2.4 ppm, 3H)
      multiplet (7.5 ppm, 5H)

   d) C_2H_5BrO

      singlet (3.3 ppm, 3H)
      singlet (4.9 ppm, 2H)

   e) C_4H_9Br

      doublet (1.1 ppm, 6H)
      multiplet (1.9 ppm, 1H)
      doublet (3.4 ppm, 2H)

   f) $C_4H_8O_3$

      triplet (1.3 ppm, 3H)
      quartet (3.7 ppm, 2H)
      singlet (4.2 ppm, 2H)
      singlet (11.0 ppm, 1H)

   g) C_3H_7ClO

      triplet (1.4 ppm, 3H)
      quartet (3.8 ppm, 2H)
      singlet (5.6 ppm, 2H)

   h) $C_6H_{12}O_2$

      singlet (1.2 ppm, 6H)
      singlet (2.1 ppm, 3H)
      singlet (2.8 ppm, 2H)
      singlet (3.7 ppm, 1H)