CHEM1902/4 Worksheet 1 – Answers to Critical Thinking Questions

The worksheets are available in the tutorials and form an integral part of the learning outcomes and experience for this unit.

**Model 1: Bonding in Organic Molecules**

1. Four.
   
   ![Diagonal model](image)

2. Two.

3. It occupies the position of a bond, causing the shape to be pyramidal rather than planar.

   ![Model](image)

4. Negative charge: one less bond than typical. Positive charge: one more bond than typical. Number of bonds = typical number + charge.

5. See below.

   ![Images](image)

**Model 2: Hybridization**

1. Each is made up by mixing 2s with three 2p orbitals. Each is 25% 2s and 75% 2p.

2. Three hybrid orbitals would result. They are arranged in a trigonal plane with 120° between them.

3. \( sp^2 \)

4. The \( p \)-orbital that is left over has 1 electron in it. It can combine with the \( p \)-orbital on the other carbon to make a \( \pi \) bond with 2 electrons in.

5. Weaker due to poorer overlap.

6. 2 bonds: a double bond.
Extension.

Each C atom is bonded to 2 other atoms, requiring two hybrid orbitals pointing 180° from each other. These are \( sp \) hybrids formed by mixing 2s with one 2p orbital.

One is used to \( \sigma \)-bond to H and one is used to \( \sigma \)-bond to the other C atom, as shown on the left below. This leaves two unused \( p \)-orbitals which can overlap with the matching \( p \) orbitals on the other C atom to form two \( \pi \) bonds, as shown on the right below.

\[
\text{H} - \text{C} = \text{C} - \text{H}
\]

Overall, there are 3 bonds between the C atoms: \( 1 \times \sigma + 2 \times \pi \).

**Model 3: Naming Organic Molecules**

1. See below.
2. See above.

3. Yes.

4. See above.

Key to success: practice further by completing this week's tutorial homework
Key to even greater success: practice even further by completing this week's suggested exam questions.