1. (8) Draw the **resonance contributing structures** indicated by the **curved arrows**. Assign formal charges and show unshared electron pairs as appropriate (2 pts each contributor).

![Resonance structures](image1)

2. (3) Which of the following structures contains an sp\(^2\)-hybridized nitrogen atom?

- \(\text{H}_2\text{C}+=\text{CH}-\text{N(CH}_3)_2\)
- \((\text{CH}_3)_3\text{N}\)
- \(\text{H}_2\text{NNH}_2\)
- \((\text{CH}_3)_2\text{NH}\)
- \(\text{H}_2\text{C}=\text{NCH}_3\)

3. (3) Which atomic orbitals of carbon atoms overlap to form C–C \(\sigma\)-bonds in the molecule of \(\text{CH}_3\text{COCH}_3\)?

- (s and sp\(^3\))
- (sp\(^2\) and sp\(^2\))
- (s and s)
- (sp\(^2\) and sp\(^3\))
- (sp\(^3\) and sp\(^3\))
- (sp and sp\(^3\))
- (sp and sp\(^2\))

4. (6) Give either the **IUPAC name** or the **correct structure** for each of the following compounds:

![IUPAC name or correct structure](image2)

2,2,3,3-tetramethylbutane (line-angle formula):

5. (3) Circle the correct molecular formula for the following line-angle structure:

- \(\text{C}_5\text{H}_{12}\)
- \(\text{C}_6\text{H}_{14}\)
- \(\text{C}_6\text{H}_{12}\)
- \(\text{C}_7\text{H}_{12}\)
- \(\text{C}_7\text{H}_{14}\)
- \(\text{C}_8\text{H}_{16}\)
- \(\text{C}_8\text{H}_{18}\)
- \(\text{C}_9\text{H}_{20}\)

6. (2) Circle the structure of the compound that has the **tertiary carbon** atom:

- \(\text{C}_2\text{H}_6\)
- \(\text{CH}_3\text{CH}_2\text{C(CH}_3)_3\)
- \(\text{C(CH}_3)_4\)
- \(\text{CH}_3\text{CH(CH}_3)_2\)
- \(\text{C}_3\text{H}_8\)
- \(\text{CH}_4\)