1. Each of the following structures is wrong according to the Clar's sextet notation. Redraw the structures so that they correctly represent some rings with formal delocalization (circles inscribed within hexagons) and some without it (actual double bonds shown). Then, using those structures, predict the relative ordering of bond lengths in the molecules shown.

4 × 10 = 40 points
2. For the reaction shown below, provide a full orbital symmetry correlation diagram (this will require you to draw many orbitals). Label all orbitals as symmetric or antisymmetric with respect to both the σ plane and the $C_2$ axis. Correlate the orbitals of the starting materials with their counterparts in the product. Is the ring closure proceeding with conrotatory or disrotatory geometry? How about the reverse reaction? 60 points
3. Define, in your own words, the following terms. Be succinct but precise.  
   Radical clock  
   \( 4 \times 5 = 20 \text{ points} \)

   *Ipso*-substitution

   Sigmatropic shift

   1,3-dipolar cycloaddition

4. Predict the preferred position(s) for the nitration of the molecule shown below. Explain your choice by drawing resonance structures.  
   \( 40 \text{ points} \)

   ![Image of a molecule with OMe and NO₂ groups]
5. Suggest a mechanism by which each of the following two transformations could occur. More than one step is involved in each case. In the second case, predict the most likely product and mechanistically explain its formation. 

2 × 20 = 40 points