1. Draw the most stable resonance structures of each of the following isomeric polycyclic aromatic hydrocarbons, using Clar’s sextets to denote aromatic rings. Then, compare the four structures in terms of their stability. 

4 × 10 = 40 points
2. Provide a full orbital symmetry correlation diagram (this will require you to draw many orbitals) for a hypothetical [6+2] cycloaddition. Label all orbitals as symmetric or antisymmetric with respect to the \( \sigma \) symmetry plane. Correlate the orbitals of the starting materials with their counterparts in the product. Is this cycloaddition allowed? If so, with what geometry? \( 60 \text{ points} \)
3. Define, in your own words, the following terms. Be succinct but precise.  
   \[4 \times 5 = 20 \text{ points}\]
   Electrocyclization

   Kinetic isotope effect

   Pericyclic reaction

   Antarafacial

4. Predict the preferred position(s) for the electrophilic aromatic substitution of the molecule shown below. Explain your choice by drawing resonance structures.  
   \[40 \text{ points}\]
5. Suggest a mechanism by which each of the following two transformations could occur. More than one step is involved in each case. 

\[ \text{heat} \]