1. Which of the following is/are aromatic?
   a) [Diagram]
   b) [Diagram]
   c) [Diagram]
   d) [Diagram]
   e) [Diagram]

2. Draw the potential energy diagram for the cation (c) in problem 1, and show the ground state π electron configuration.

3. Predict the product(s):
   a) o-xylene \( \xrightarrow{\text{KMnO}_4, \text{H}_2\text{O}, \text{heat}} \) \( \text{CO}_2\text{H} \)
   b) [Diagram] \( \xrightarrow{\text{Cl}_2, \text{hv}} \) [Diagram]

4. Which of these reactions requires more energy?
   a) [Diagram] \( \xrightarrow{\text{H}_2, \text{Ni}} \) [Diagram]
   b) [Diagram] \( \xrightarrow{\text{H}_2, \text{Ni}} \) [Diagram]

5. Calixene (below) is polar. Structure (a) is the most important resonance form. Two less important resonance contributors of calixene are shown also. Why is the actual molecule polarized as in structure (a) and not (b) or (c)?
   a) [Diagram]
   b) [Diagram]
   c) [Diagram]
6. Name each of the following compounds.

a) \( p\)-Xylene

b) 1,4-dibromo-2-chlorobenzene

c) 2-bromo-1,3-difluoro benzene

d) Phenol

e) 2-nitrophenol

f) Benzoic acid

g) Acetophenone

7. Draw structures for each of the following compounds:

a) \( p\)-bromobenzyl alcohol

b) 3,4-dinitrobenzoic acid

8. On the lines below, write the letter of the molecule that matches the statement.

a) aromatic

b) not aromatic, \( n \) polyene

b  reacts with \( \text{Br}_2 \) in \( \text{CCl}_4 \), cold, dark

a  does not react with cold, dilute \( \text{KMnO}_4 \)

b  is not a planar molecule

a  does not undergo hydration in aqueous acid