

1. Which of these molecules are aromatic / antiaromatic / non-aromatic? Use the Hückel-rules and draw Frost-Musulin cycles to justify you answer.



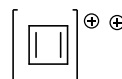
a)



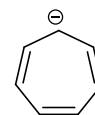
b)



c)



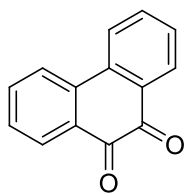
d)



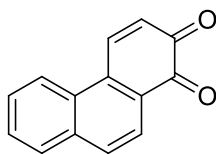
e)

2. Tropone (sum formula:  $C_7H_6O$ ) is a **cyclic ketone**. It is protonated by tetrafluoroboric acid ( $H^+BF_4^-$ ) and then forms a stable salt. Draw the structure of tropone and its salt. Why is it much easier to protonate it compared to cycloheptanone?

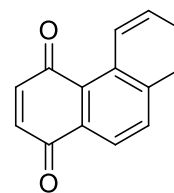
3. Phenanthrene can be oxidized with  $KMnO_4$  into a single diketone compound. Which product isomer (**1**, **2** or **3**) is formed? Provide a brief explanation justifying your choice.



1



2



3