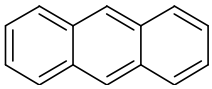
Molecular Photonics
Exercise **2**

Give answers to six out of the seven questions below:

1. What is the general trend that connects the size of a molecule, its polarizability and its ability to absorb light?

   a. Dodecane (**A**) is much longer then anthracene (**B**). Which one has a higher extinction coefficient (ε_{max})? Explain.

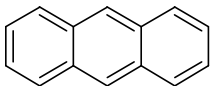
A



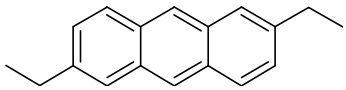
B

2. What is Kasha's Rule and what is its cause? Please explain, and give a sketch.

   a. Which one of the following molecules has a lower fluorescence quantum yield ? Explain.

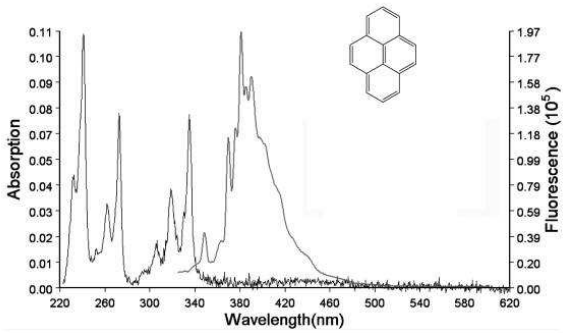


C

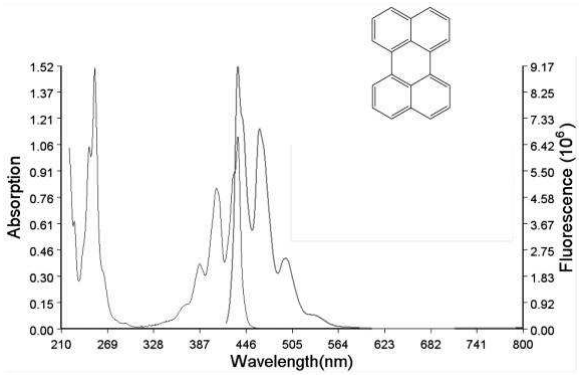


D

3. The spectra below describe the UV-vis absorbance and the fluorescence of pyrene (**E**) and perylene (**F**).



E



F

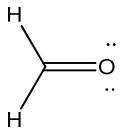
   a. Name the main transitions observed in the spectra.

   b. What is Stokes shift and what can we learn from the Stokes shifts in the spectra of **E** and **F**.

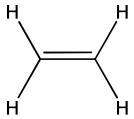
   c. What additional characteristic in the fluorescence spectra may help us strengthen the conclusion we come to after answering question b?

4. Draw a scheme that describes the transitions of the valance electrons in formaldehyde (**G**) and ethylene (**H**). Why in the case of **G** intersystem crossing is efficient and in the case of **H** it is not?

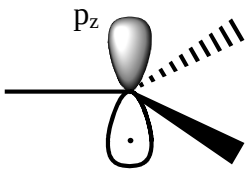
G



H



5. Momentum changes in an isolated system are not allowed. Explain how a change may become possible for the orbital momentum of the electron in the p_z orbital of $CH_3^{\bullet}$ without any external interference.



6. Explain shortly using simplified diagrams the principle of spin-orbit coupling. How this coupling is connected to “heavy atom” effect?
7. Triplets are lower in energy than singlets in the excited state. Why? (see uploaded file - HundsRule.PDF) What did Mulliken say regarding calculations and concepts?

For questions please contact Dr. Haim Weissman:
E-mail: haim.weissman at weizmann.ac.il; Tel.: 2628