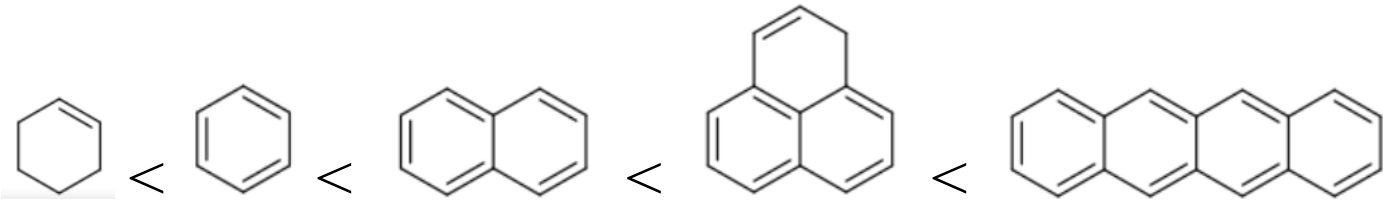
A.



Usually, the UV spectra of an aromatic compound (with no heteroatoms) are closely related to how large its conjugate systems are, i.e., the number of electron in its conjugate π bond. So, according to this principle, the conjugate π bond system of the given compounds are $\pi_6^6, \pi_{10}^{10}, \pi_{12}^{12}, \pi_{18}^{18}$ for benzene, naphthalene, phenalene and naphthacene, respectively. Cyclohexene has only one single double bond. Therefore, the sequence of the $\lambda_{\max}$ from the lowest to highest is as above.

B.

According to the Lambert-Beer law, the correlation between absorbance (A), molar absorptivity (ε), path length (b) and compound concentration (c) is as follows:

$$A = \varepsilon bc$$

We can recognize the absorbance of $Fe(phen)_3^{2+}$ is 1.70. Combined with the given data, the compound concentration is caculated as:

$$c = \frac{A}{\varepsilon b} = \frac{1.70}{1.89 \times 10^4 \times 1} = 9.00 \times 10^{-5}\ \text{mol} \cdot \text{L}^{-1}$$

C.

From the absorbance difference of the two entries, the molar absorptivity of Co(II) chelate can be obtained according to the Beer's law, as it can be calculated as:

$$\varepsilon = \frac{(A - A_0)}{bc} = \frac{0.491 - 0.276}{1 \times 4.25} = 0.0506\ \text{L} \cdot \text{mg}^{-1} \cdot \text{cm}^{-1}$$

Then the Co concentration of the 25+5 mL aliquot (the 5 mL refers to the added water, as shown in the chart) can be obtained as:

$$c = \frac{A}{\varepsilon b} = \frac{0.276}{0.0506 \times 1} = 5.45\ \text{ppm}$$

Transfer the result to the origin 500 mL solution:

$$c_0 = c \times \frac{500}{30} = 90.9\ \text{ppm}$$

Then the percentage of Co in the origin petroleum sample is:

$$\omega_{\text{Co}} = \frac{c_0 V}{m} = \frac{90.9 \times 10^{-3} \times 0.5}{3.65} \times 100\% = 1.25\%$$