1. An organic compound has a molecular weight \( M = 260.4 \text{ g} \cdot \text{mol}^{-1} \). At a wavelength \( \lambda_{\text{max}} \) corresponding to a maximum of its absorption spectrum, the compound in solution is characterized by a decadic molar extinction coefficient \( \varepsilon = 10^5 \text{ mol}^{-1} \cdot \text{l} \cdot \text{cm}^{-1} \).

(a) What is the value of the effective cross section of its molecules for the absorption of light at the wavelength \( \lambda_{\text{max}} \)?

(b) What would be the maximum value of the extinction coefficient that would be expected for this compound?

2. A compact monomolecular layer of the compound described in exercise 1 above is adsorbed at a liquid|liquid interface. The refractive index of the monolayer and that of both liquids is \( n = 1.3 \).

(a) What is the value of the absorbance \( A \) of the monolayer at the wavelength \( \lambda_{\text{max}} \)?

(b) What would be the value of the Fresnel reflectance \( R_S \) at normal incidence of a similar dense monolayer deposited on a glass substrate in air?

3. A UV-curable lacquer contains an initiator diluted in an opaque polymer base. The absolute diffuse reflectance \( R_\infty \) of optically thick lacquer films \( (d \sim 1 \text{ mm}) \), containing various concentrations \( c \) of the initiator, is measured at a single wavelength. Results are provided by the table below.

Knowing the molecular weight of the initiator \( M = 339 \text{ g} \cdot \text{mol}^{-1} \), the phenomenological scattering coefficient of the polymer base \( S = 6.2 \cdot 10^2 \text{ cm}^{-1} \), and the density of the lacquer film \( \rho = 1.42 \cdot 10^3 \text{ kg} \cdot \text{m}^{-3} \), determine the decadic molar extinction coefficients \( \varepsilon \) of the polymer and the initiator at the probe wavelength.

<table>
<thead>
<tr>
<th>( c ) [weight %]</th>
<th>0</th>
<th>0.05</th>
<th>0.10</th>
<th>0.15</th>
<th>0.20</th>
</tr>
</thead>
<tbody>
<tr>
<td>( R_\infty ) [ - ]</td>
<td>0.81</td>
<td>0.66</td>
<td>0.55</td>
<td>0.49</td>
<td>0.44</td>
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