

Sol'n for the Midterm Exam (AMIE312-01/02)

1. (1) compound 4: BODIPY $\Rightarrow$ corrole
 compound 5: corrole $\Rightarrow$ BODIPY

(2) Förster ET: $k_{ET} = \alpha \cdot \frac{\kappa^2 k_D^0 J}{R_{DA}^6}$

$$\Rightarrow R_{DA} = \left(\frac{\alpha \cdot \kappa^2 k_D^0 J}{k_{ET}} \right)^{\frac{1}{6}}$$

$$= \left(\frac{10^{-30} \text{ A}^2 \cdot 8.8 \times 10^{-25} \text{ mm}^2 \times \frac{2}{3} \times 1.28 \times 10^8 \text{ s}^{-1} \times 2.7 \times 10^{-14} \text{ mm}^2 \cdot \text{cm}^6}{1.2 \times 10^8 \text{ s}^{-1}} \right)^{\frac{1}{6}}$$

$$= \left(\frac{8.8 \times \frac{2}{3} \times 1.28 \times 2.7 \times 10^9}{1.2} \right)^{\frac{1}{6}} \text{ Å}$$

$$= \underline{51 \text{ Å}}$$

- (3) ① increase in J btw corrole Abs & BODIPY PL
 ② use of a short linker btw corrole & BODIPY
 ③ use of an energy donor w/ large k_D^0
 ④ use of an energy acceptor w/ large $\epsilon \sim$ ①
 ⑤ proper orientations btw corrole & BODIPY

2. (1) $\log P = -\frac{16200 \text{ K}}{400 \text{ K}} - 4993 + 5006 = -27.5$

$$\therefore P = 3.16 \times 10^{-28} \text{ torr} (\Rightarrow 3.16 \times 10^{-28} \times 6.89 \times 10^3 \text{ Pa} = 2.17 \times 10^{-25} \text{ Pa})$$

(2) $J = \alpha \cdot \frac{P}{\sqrt{2\pi m k T}} \cdot \frac{\partial S \cdot \omega \theta}{\pi}$

$$= 0.8 \times \frac{10^{-28} \text{ torr} \times \frac{6.89 \times 10^3 \text{ Pa}}{1 \text{ torr}} \cdot \frac{1 \text{ kg}}{1 \text{ Pa} \cdot \text{m} \cdot \text{s}^2} \times 1 \text{ mm}^2 \times \left(\frac{1 \text{ cm}}{10^3 \text{ mm}} \right)^2}{\sqrt{2\pi \times 26.98 \frac{\text{g}}{\text{mol}} \times 1.38 \times 10^{-23} \frac{\text{J}}{\text{mol} \cdot \text{K}} \times \frac{1 \text{ mol}}{6.02 \times 10^{23}} \cdot \frac{1 \text{ kg}}{10^3 \text{ g}} \times 400 \text{ K}}} \cdot \frac{1}{\pi}$$

$$= 4.45 \times 10^{-17} \text{ s}^{-1}$$

- (3) Refer to the lecture materials

3. Refer to the lecture materials