1. (a) How to define the energy band gap (Eg) values of materials from their HOMO (highest occupied molecular orbital in valence band) and LUMO (lowest unoccupied molecular orbital in conduction band) energy levels?
(b) How to measure the previous Eg, HOMO level, and LUMO level values of materials?
(c) Describe the relationship among Eg, conductivity, and transmittance of materials.

2. (a) Regarding the driving type of the electrodes in LCDs, what are the differences between simple matrix LCDs and active matrix LCDs?
(b) Describe the requirements for the cathode (陰極) and anode (陽極) materials in organic light emitting diodes (OLEDs) in terms of work functions (功函數).
(c) What are the major differences for the cathode (陰極) and anode (陽極) materials between OLEDs and LCDs.

3. 若想要知道薄膜中是否有多晶矽的晶粒或非晶矽或是兩種共存，說明可使用的分析方法及其原理。

4. 鍺錫氧透明導電膜 (ITO)的膜厚為 100 nm，若要分析其中的化學組成，說明可使用的分析方法及其原理。

5. Find the equivalent resistance $R_{eq}$ of the ladder resistors with infinite stages shown in the figure.

6. (a) Find the average power dissipation of $R_2$ for the figure shown below.
(b) Find the root mean square values of (1) the voltage across $R_2$. (2) the current flowing through $R_2$ for the figure shown below.
7. Organic semiconductors are used as the active materials in organic light-emitting diode (OLED) devices, please sketch a simple diagram to indicate the typical structure of OLED and describe its physical mechanism briefly.

8. According to the following figures, please use the following equation and electromagnetic theory to explain the working principle of the motor.

\[ \vec{T} = m \times \vec{B} \]

10. According to the following figure, please explain the “Hall effect.”