SEMICONDUCTOR PHYSICS **ECE 1336**

Problem Set #9: Quantum Theory of Electrons - 2

1.

(a) Typically, the conductivity of semiconductors is found to increase with increasing temperature. Describe the physical process(es) that contribute to this increase in conductivity.

(b) Explain why metals do not have the same relationship between conductivity and temperature as semiconductors. What physical process causes the conductivity of metals to decrease with increasing temperature?

2. The figure below shows the absorption coefficients for five different semiconductors labelled V, W, X, Y, and Z.

(a) Based on their respective curves, determine which semiconductors have direct band gaps and which have indirect band gaps. Explain your answer.

(b) Estimate the band gap energy for each of the semiconductors.

(c) The absorption coefficient curves shown in the figure represent those of five *real* semiconductors which are commonly used in microelectronics, photonics, and photovoltaic applications. Based on your answers in (a) and (b), determine the identity of at least three of these semiconductors.