1. For silicon, electron mobility is \( \mu_n = 1360 \left( \frac{T}{300} \right)^{-2.42} \text{cm}^2/\text{V.s} \), where \( T \) is absolute temperature in Kelvin (K). Calculate the value of diffusion constant for electron at 400°C. Boltzmann constant \( k = 1.38 \times 10^{-23} \text{ m}^2 \text{kg.s}^{-2} \text{K}^{-1} \), electron charge \( q = 1.602 \times 10^{-19} \text{ C} \).

2. There are two semiconductors – A and B. A has 3 times effective mass of electron than that of B. Two identical (geometrically) sample of A and B are taken. Both the doped with donors (i.e. N-type doping). Sample of ‘A’ is doped 2 times than that of sample of ‘B’. Next, resistance of sample ‘B’ is measured to be 20 Ohm. What is the resistance of sample ‘A’?

3. Three intrinsic (undoped) samples of silicon are taken. They are doped with the following-
   (a) \( 10^{15} \text{ cm}^{-3} \) phosphorus,
   (b) \( 10^{16} \text{ cm}^{-3} \) boron, and
   (c) \( 10^{18} \text{ cm}^{-3} \) arsenic.

   Draw the following side-by-side showing (qualititatively) conduction band, valence band, and Fermi energy level
   A. Intrinsic band diagram of the undoped sample
   B. Band diagram in case ‘a’
   C. Band diagram in case ‘b’
   D. Band diagram in case ‘c’

   HINT 1: Arsenic and phosphorus are group-V elements; boron is group-III element.

   HINT 2: Remember that the relative position of Fermi energy level matters when you are drawing side-by-side

Best of luck ☺