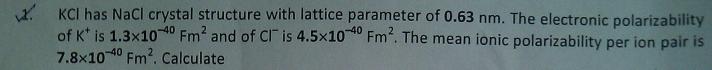
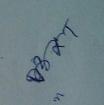
Maximum Marks: 20



- (4) the optical frequency dielectric constant,
- b) the low frequency dielectric constant and
- of the refractive index of the KCl crystal.



Using the concept of electron being scattered by phonons (having momentum $\hbar K$) in a solid (having Debye temperature T_D), qualitatively obtain the temperature dependence of electronic conductivity of the solids in the following regimes (i) $T < T_D$ and (ii) $T > T_D$.

- 3. State the experimental observation about the solids that Einstein's quantum theory of solid failed to explain. Why the Einstein's model failed to account for these observations?

 3
- 4. The Debye temperature (T_D) for silicon is **625** K. Make a plot of molar specific heat for silicon crystal as a function of temperature in the temperature range of 0 1000 K. Mark the scale appropriately on both the axes. Also determine the highest frequency for oscillators in the Debye model.

Answer the following (in not more than 3 sentences):

- The BaTiO₃ crystal exhibits ferroelectricity at room temperature. But above 130°C, it does not exhibit ferroelectric behavior. Why?
- (b) The NaCl is an ionic crystal. But it does not exhibit piezoelectricity. Why?
- (c) Briefly explain the working mechanism of the 'Intruder alarms'.

1x3=3