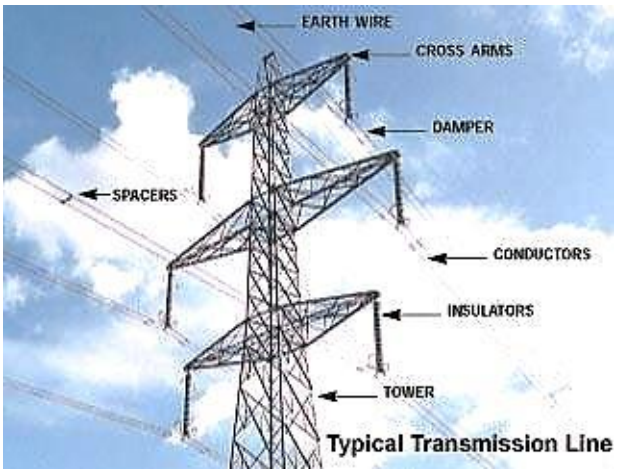
Note: These questions will be discussed in the tutorial sessions on September 12.



Question 1:

Electrical utility companies must transport electricity from the power generation plant to consumers. As shown below, one of the common transmission methods is to use aboveground wires suspended between structural support towers. The towers and transmission wire are often fabricated from metals, but the "spacers" between the transmission lines and the towers are usually made from ionic solids. Explain the choice of materials for these three applications.

Question 2:

Calculate the force of attraction between a K^+ and an O^{2-} ion the centers of which are separated by a distance of 1.5 nm.

Question 3:

For each of the following compounds, state whether the bonding is essentially metallic, covalent, ionic, van der Waals, or hydrogen:

(a) Ni, (b) ZrO_2, (c) graphite, (d) solid Kr, (e) Si, (f) BN, (g) SiC, (h) Fe_2O_3, (i) MgO, (j) W, (k) H_2O within the molecules, (l) H_2O between the molecules.

If ionic and covalent bonds are involved in the bonding of any of the compounds listed, calculate the percentage ionic character in the compound.

Question 4:

Calculate the number of atoms in one ton of iron.

Question 5:

The interaction energy between Na^+ and Cl^- ions in the NaCl crystal can be written as:

$$E(r) = -\frac{4.03 \times 10^{-28}}{r} + \frac{6.97 \times 10^{-96}}{r^8}$$

Where the energy is given in joules per ion pair, and the interionic separation *r* is in meters. Calculate the binding energy and the equilibrium separation between the Na^+ and Cl^- ions. Also estimate the elastic modulus Y of NaCl given that:

$$Y = \frac{1}{6r_0}\left[\frac{d^2E}{dr^2}\right]_{r=r_0}$$