1. Which are the three elements with the highest Debye temperatures and which have the lowest values?

2. (a) Consider a dielectric crystal made up of layers of atoms, with rigid coupling between the layers so that the motion of the atoms is restricted to the plane of the layer. Show that the phonon heat capacity in the Debye approximation in the low temperature limit is proportional to $T^2$.

   (b) Suppose instead, as in many layer structures, that adjacent layers are very weakly bound to each other. What form would you expect the phonon heat capacity to approach at extremely low temperatures?

3. Estimate for 300 K the root mean square thermal dilation $\Delta V/V$ for a primitive cell of sodium. Take the bulk modulus (giving the change in volume as the pressure is changing) as $7 \times 10^{10}$ erg cm$^{-3}$. Note that the Debye temperature 158 K is less than 300 K, so that the thermal energy is of the order of $k_B T$. Use this result to estimate the root mean square thermal fluctuation of the lattice parameter.