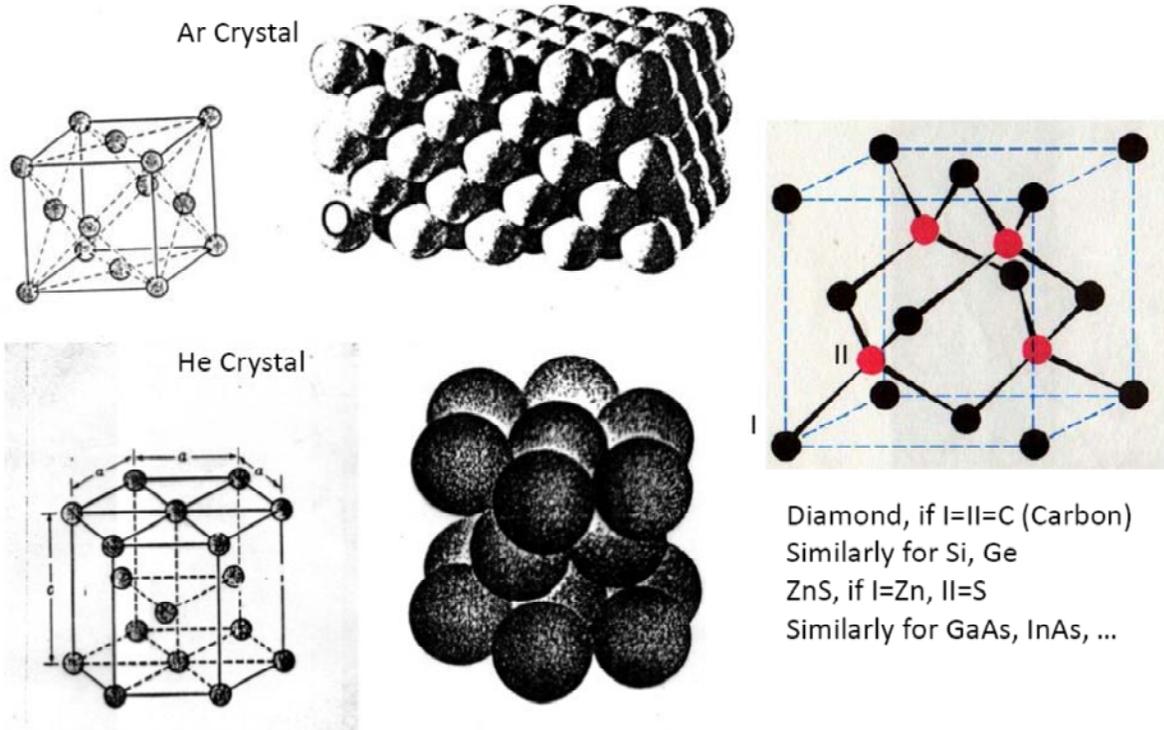


Phys 155, Winter 2009, Homework 1, due Jan 14

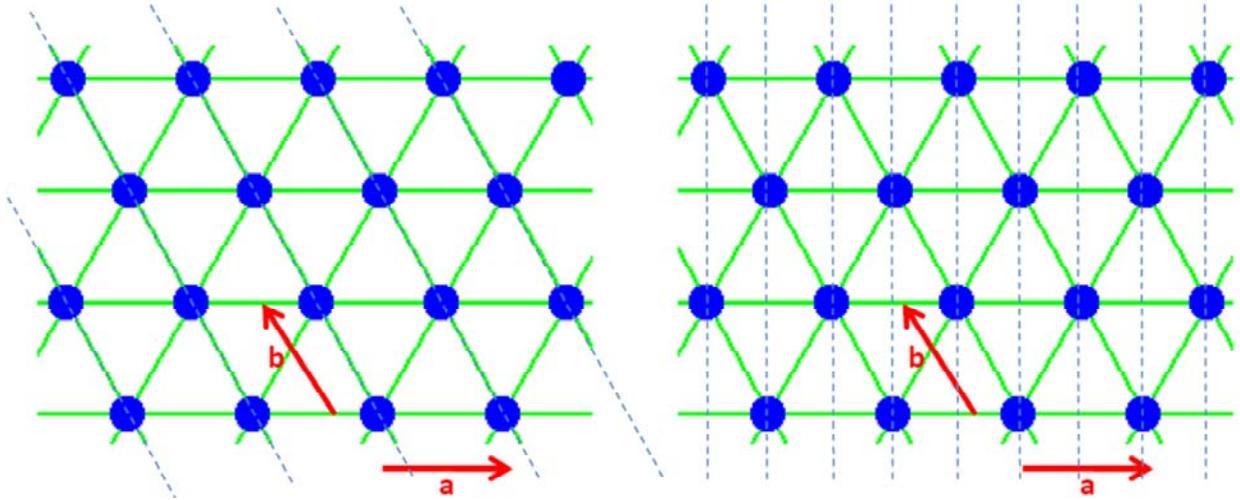
Each problem is worth 5 points.

- For each of the following three crystals, indicate a primitive [unit] cell, and indicate how many atoms there are per [unit] cell. Give brief explanations why.



- Use the semi-classical Bohr-Sommerfeld quantization condition  $\oint p dq = nh$  (the integral is over an orbit corresponding to one period) to derive the energy level of a one dimensional simple harmonic oscillator,  $E_n = n\hbar\omega$ , where  $\omega$  is the natural frequency of the oscillator. Remember to treat everything with classical mechanics, except for the quantization condition itself. Use the solution  $x = A \cos(\omega t + \phi)$  to evaluate the integral.
  - One would generally say that the solution of (a),  $E_n = n\hbar\omega$ , although incorrect for small  $n$  values, is an excellent solution since we are dealing with semi-classical physics (thus high  $n$ ). Nevertheless, the Bohr-Sommerfeld quantization condition can be, and is often, modified to include a problem-dependent constant  $\gamma$ ,  $\oint p dq = (n + \gamma)h$ , to give the correct result even for small  $n$  values. Assuming  $n = 0, 1, 2, \dots$  what is the value of  $\gamma$  necessary for this problem?
- Kittel 1.2

4. Find Miller indices for the following two sets of lattice lines (dashed lines) for the lattice given. Explain your answer.



5. Kittel 1.3