

Chem 102 practice problem key:

Problem #1

This problem is based on a hypothetical 2-dimensional crystal. It tests if you understand the process we used for analyzing real 3-dimensional crystals. It is simpler but you have to redefine things. We use area density, $d_{\text{area}} = \text{mass}/\text{area}$, and $A_{\text{uc}} = \text{area of unit cell}$.

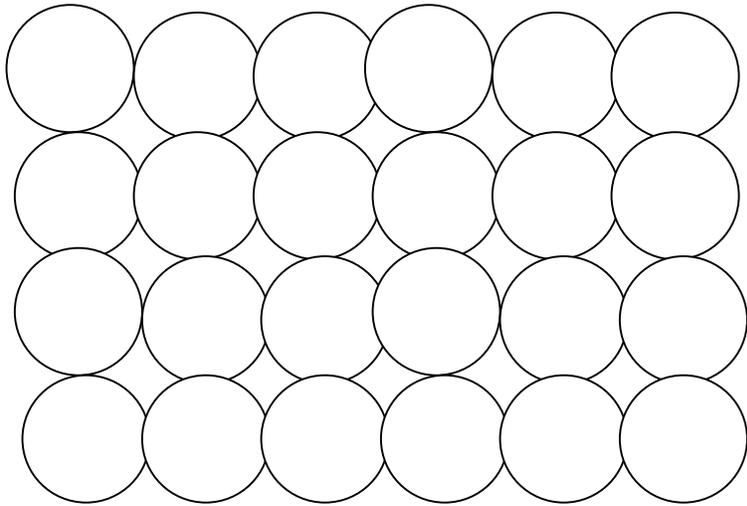
Assuming that the sketch below represents a very small part of a hypothetical **2-dimensional** crystalline solid. The circles are the atoms, and the unit cell is a square. What would be the answers to the following questions? (of course this is just hypothetical; assume the crystal was perfectly illustrated and each circle and there are no “overlapping regions between atoms”)

a) #circles /unit cell=

b) % area occupied

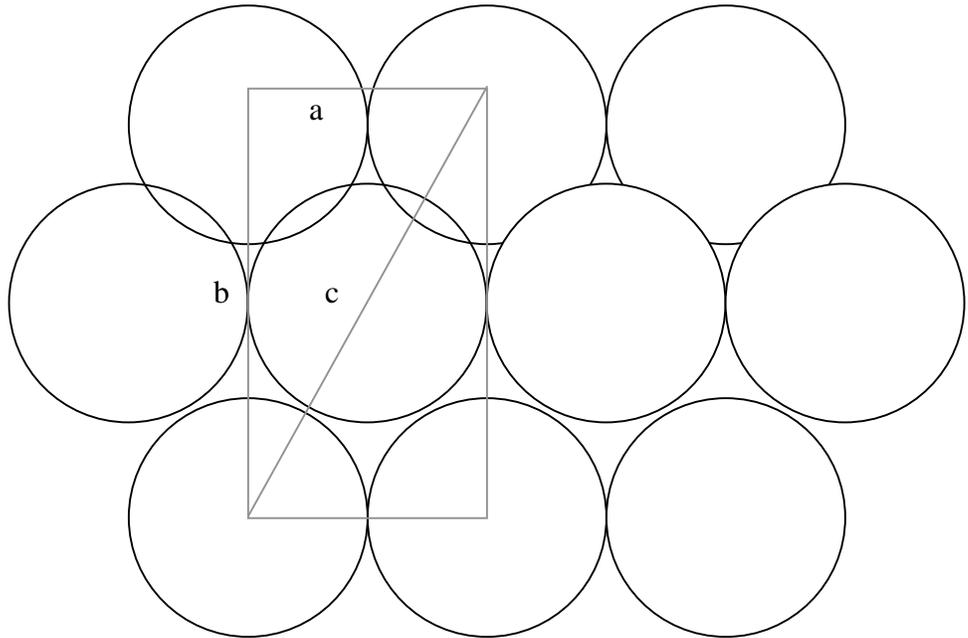
c) if the density of the crystal is 0.0010 g/cm^2 , and the atomic weight of the hypothetical 2-dimensional atom is 2500 g/mol , what is the radius of the atom in angströms(\AA)?

(n.b. $1 \text{ \AA} = 10^{-8} \text{ cm}$).

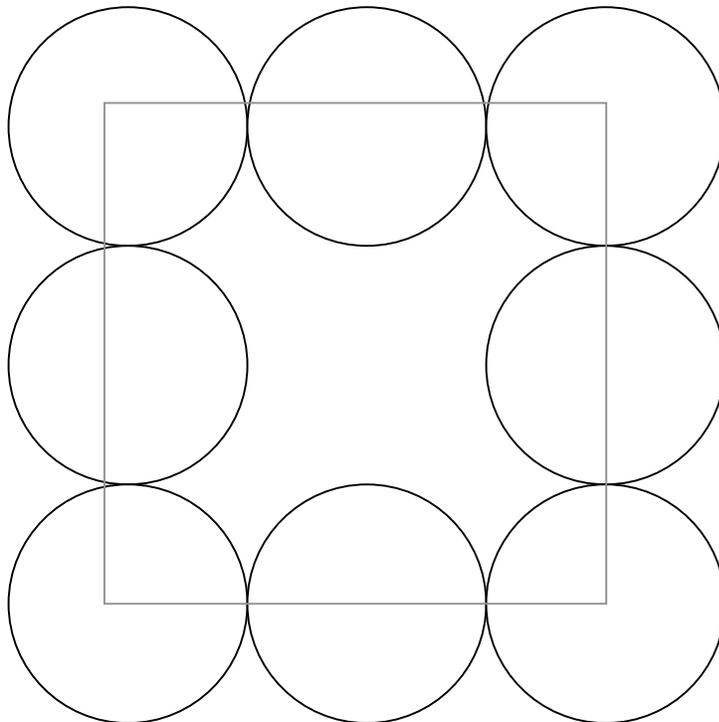


Problem #2: Also based on a 2-dimensional crystal:

- a) What is the area of the unit cell of the hypothetical 2-d crystal below. The unit cell has been drawn for you. It is not a square but a rectangle.
- b) what is the % area occupied?



Problem #3: consider the hypothetical 2 dimensional unit cell below. What is the % area occupied by the circles?



Problem #4: **This problem is for a regular 3-dimensional crystal (not 2-d as in the previous ones!)**

Consider a hypothetical metal whose **face-centered cubic** unit cell has a density 10.0g/cm^3 and whose radius is known to be 1.30\AA . (one face of the cube is shown for your benefit).

a) how many atoms/unit cell? b) what is V_{uc} in terms of r ? c) what is 1.30\AA in terms of cm ?

d) What is the atomic weight of this hypothetical atom (in amu/atom or g/mole but NOT g/atom)?

