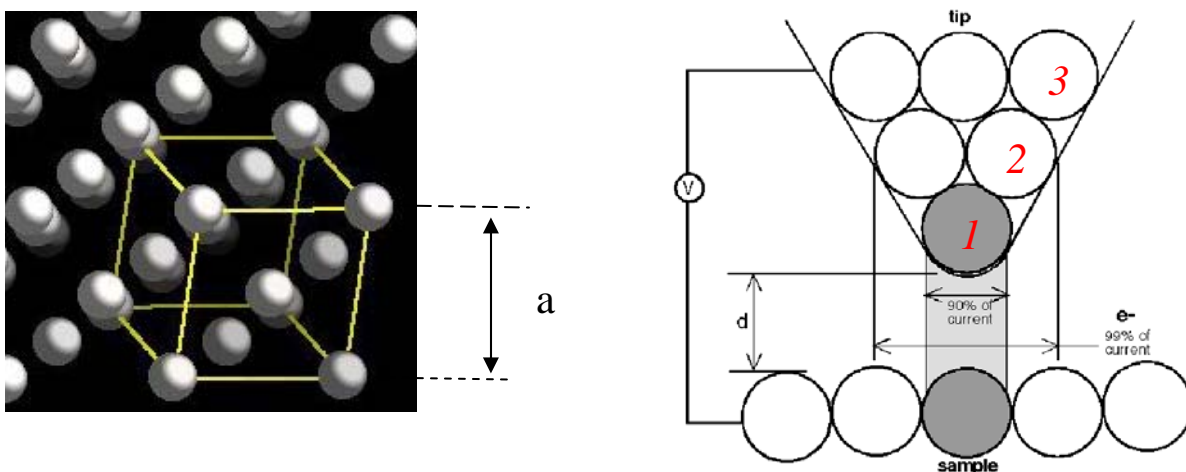


Molecules on Surface—Homework
(Due Friday February 29, 2008 by 5pm)

1. Assume tip-sample configuration below and a tunneling current given by

$$I_T \propto AV_T \exp(-\kappa d)$$

Typical values of bias voltage (V_T) and κ are 1V and 2.2\AA^{-1} , respectively. The tip material is Pt (crystal structure FCC with lattice parameter $a = 0.39\text{ nm}$ and radius $r = 0.135\text{ nm}$).



Estimate the increase in the tunneling current I_T going from

- a) Atom 1 (90% of current) to atom 2 (~ 99%)
- b) Atoms 1 (90% of current) to atom 3

(25 points)

2. Supramolecular chemistry uses molecules rather than atoms as building blocks. The molecules are held together by weak *noncovalent* interactions, such as *hydrogen bonding*, *polar attractions*, *π - π stacking*, *van der Waals forces*, etc...

- a) Explain why covalent bonding is wrong for this kind of chemistry.
- b) For the design of 2D bimolecular structures which type of adsorption would you use and why.

(25 points)

3. Explain why scanning tunneling microscopy (STM) images do not represent the real topography of the surface of a sample. Be explicit and support your answer. Give an example.

(25 points)

4. What kind of information is obtained by OMTS (orbital mediated tunneling spectroscopy)? Why is it important to know this information? To which other techniques STM spectroscopy results can be compared to?

(25 points)