CEM 924 (Spring 2001) - Problem Set #2

(1) (a) (5 points) Sketch the (tungsten) W(200) surface (as viewed from along the surface normal).

(b) (5 points) On your sketch of the surface, label the [100], [010], [001], [011] and [021] directions.

(c) (5 points) Calculate the absolute surface coverage (in atoms·cm^{-2}) for the W(200) surface if the dimension of the tungsten *bulk* unit cell, a_0 = 3.16 Å.

(d) (5 points) What is the distance between the centers of two adjacent W atoms in the [001] and [011] directions?

(e) (5 points) What is the nearest neighbor distance for (*surface* or *bulk*) W?

(2) Sketch the following surface adsorbate structures:

(a) (5 points) FCC(100) p(2x1) - O with O atoms adsorbed in 4-fold hollow sites.

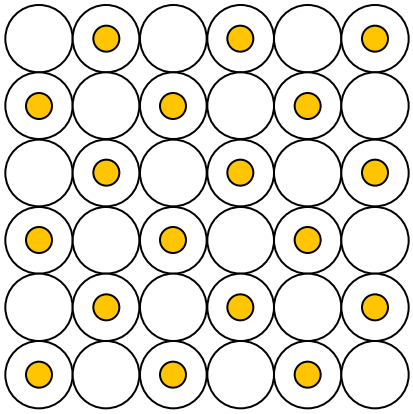
(b) (5 points) FCC(111) p(2x2) - S with S atoms adsorbed in on-top sites.

(c) (5 points) FCC(100) c$\left(\sqrt{10}\text{x}\sqrt{10}\right)$R18.4-N with N atoms adsorbed in 2-fold bridge sites.

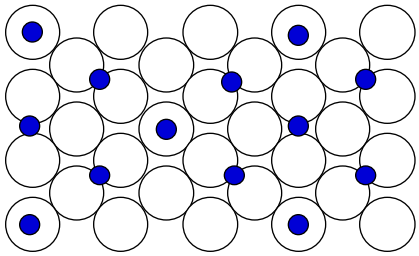
(d) (5 points) Calculate the fractional coverage (adsorbate atoms per surface primitive unit cell) for the structure given in part (c)

(3) Give the matrix notation for the following adsorbate structures: (Hint: There are several acceptable answers for (c)!)

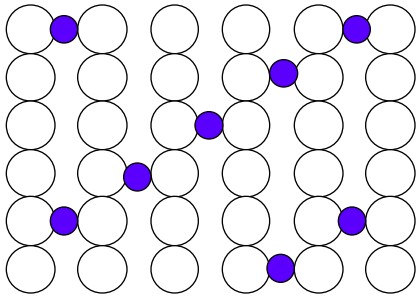
(a) (5 points)



(b) (5 points)



(c) (5 points)



(4) (a) (15 points) In a LEED experiment, a 50 eV beam of electrons directed along the surface normal strikes a Cu(001) surface. Copper is a FCC metal with nearest-neighbor distance of 2.56 Å. By drawing an Ewald sphere diagram for surface diffraction, calculate the diffraction angle for the [10] back-scattered (diffracted) beam along the [100] direction.

(b) (10 points) At what incident beam energy is the back-scattered (02) beam (just) diffracted?

Total 85 points