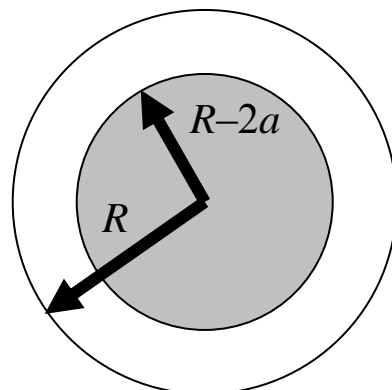# NanoLab (Phys4970) Homework (40pts)   Name _____

A sphere of radius R is composed of atoms of radius a. Make the assumption that the surface atoms occupy a spherical shell $2a$ thick. Use the packing fraction f to correct for the interstitial volume. You do not need to consider the granular nature of the particle any further (ignore packing, stacking, surface corrugations, etc.).

Solve problems 1 & 2 so you get a general equation that can be used to generate the numbers to fill in the table in part 3.

1. 10 pts) Find the number of atoms in a nanoparticle give the R, a, and f.

2. 10 pts) What fraction of atoms lie on the surface?

Packing fractions:
FCC & HCP $f = 0.740$
  BCC $f = 0.680$
  SC $f = 0.524$

$$f = \frac{nV_a}{V}$$

V_a is the volume of a spherical atom
n is the number of atoms in volume V

3. 20 pts) Fill out the following table for gold nanoparticles ($a = 1.44$ Å). Gold is an FCC crystal.

Total Number of Atoms and the Percent of Atoms on the Surface in a Gold Nanoparticle as a Function of Radius						
R (μm)	1	0.3	0.1	0.03	0.01	0.003
n						
$n_{surface}/n$ (%)						