Question 1

(i) Explain the difference between crystal structure and atomic structure. Why is studying crystal structure important?

(ii) Identify the closed-packed **directions** in FCC and BCC structures.

(iii) Make a sketch for a cubic unit cell and show the $[\bar{1}\ 1\ 0]$, $[0\ \bar{1}\ 2]$, *and* $[\ \bar{1}\ \bar{2}\ 1]$ **directions.**

(iv) Make a sketch for a cubic unit cell and show the $(0\ \bar{1}\ \bar{1})$ and $(1\ 0\ \bar{2}\ )$ **planes**.

Question 2

(i) Determine the relationship between the atomic radius, *r*, and lattice parameter, *a*, for the SC, BCC and FCC structures. If the lattice parameter of Molybdenum (Mo) is a = 3.22×10^{-10} m, calculate its atomic radius.

(ii) Rhodium has an atomic radius of 0.1345 nm and a density of 12.41 g/cm^3. Using this information, determine whether it has an FCC or BCC crystal structure.

Question 3

(i) Calculate the **highest** linear density (atoms/m) encountered in Vanadium (V).

(ii) For Vanadium, calculate the planar density value for the (100) plane.

Question 4

(i) Calculate the interplanar spacing (d_{hkl}) of {1 1 0} planes in Copper (Cu), where the lattice parameter is $a = 3.61\times10^{-10}$ m.

(ii) Determine the expected diffraction angle (2θ) for the first-order reflection from the (1 1 3) set of planes for FCC platinum when monochromatic radiation of wavelength 0.1542 nm is used. The atomic radius of platinum is 0.1387 nm.