

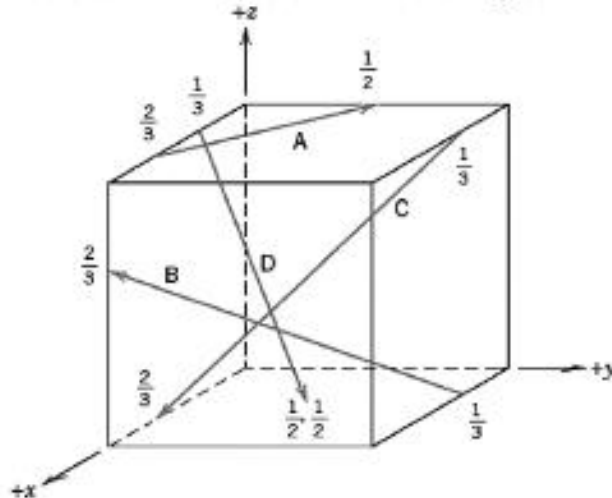
MSE 225-INTRODUCTION TO MATERIAL SCIENCE
RECITATION 2-THE STRUCTURE OF CRYSTALLINE SOLIDS

Q1. Calculate the radius of a vanadium atom, given that V has a **BCC** crystal structure, a density of 5.96 g/cm³, and an atomic weight of 50.9 g/mol.

Q2. Within a cubic unit cell, sketch the following directions;

- | | |
|-------------------|-------------------------|
| (a) $[\bar{1}10]$ | (e) $[\bar{1}\bar{1}0]$ |
| (b) $[\bar{1}21]$ | (f) $[\bar{1}22]$ |
| (c) $[0\bar{1}2]$ | (g) $[1\bar{2}\bar{3}]$ |
| (d) $[1\bar{3}3]$ | (h) $[\bar{1}03]$ |

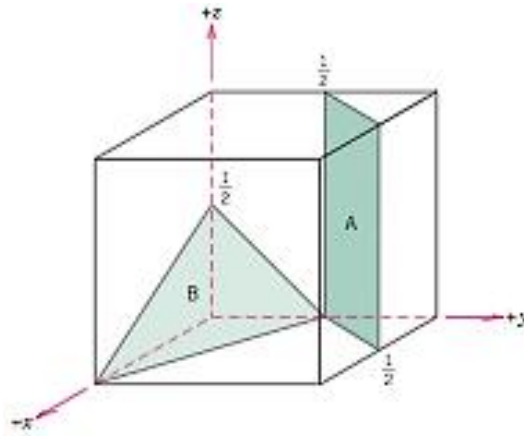
Q3. Determine the indices for the directions shown in the following cubic unit c



Q4. Sketch within a cubic unit cell the following planes:

- | | |
|-------------------------|-------------------------|
| (a) $(0\bar{1}\bar{1})$ | (e) $(\bar{1}1\bar{1})$ |
| (b) $(11\bar{2})$ | (f) $(12\bar{2})$ |
| (c) $(10\bar{2})$ | (g) $(\bar{1}2\bar{3})$ |
| (d) $(1\bar{3}1)$ | (h) $(1\bar{3}1)$ |

Q5. Determine the Miller indices for the planes shown in the following unit cell:



Q6.

- Derive linear density expressions for BCC $[110]$ and $[111]$ directions in terms of the atomic radius R .
- Compute and compare linear density values for these same two directions for tungsten ($R_{\text{tungsten}}=0.137 \text{ nm}$).

Q7.

- Derive planar density expressions for FCC (100) and (111) planes in terms of the atomic radius R .
- Compute and compare planar density values for these same two planes for nickel.