MSE 235
2023-2024 FALL SEMESTER
RECITATION-01

1) **(a)** Give the electron configurations of Cl, Cl⁻, Al, Al³⁺ and determine number of valence electrons

(b) Calcium oxide(CaO) exhibits predominantly ionic bonding. The Ca^{2+} and O^{2-} ions have electron structures that are identical to which inert gases?

2) **(a)** Within a cubic unit cell, sketch the following planes and directions;

   i)   (202),

   ii)   [102],

(b) Determine the indices for the directions and planes shown in the following cubic unit cells:
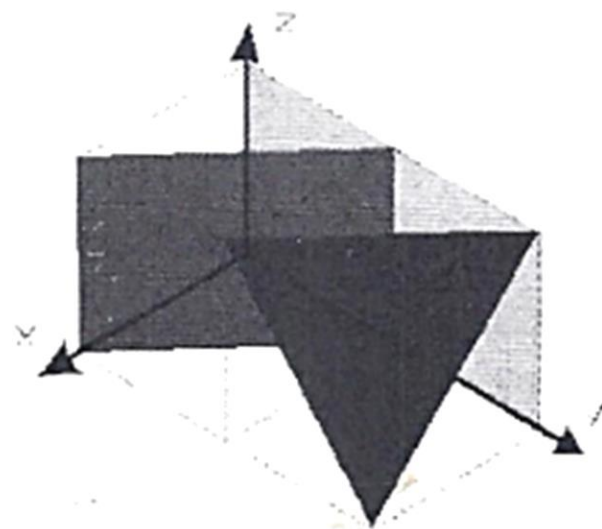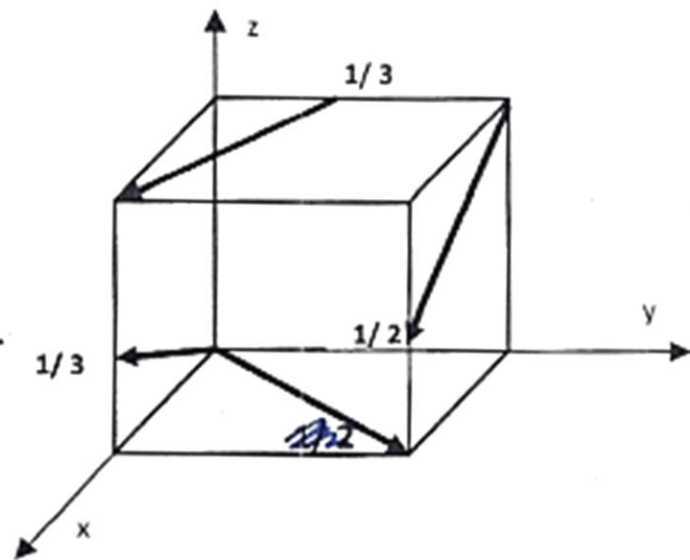
(c) Calculate the planar density of (111) plane in an FCC crystal.

3)

(a) Calculate the radius of potassium (K) atom, given that K has a BCC crystal structure, density of 0.862 g/cm^3, and an atomic weight of 39.1 g/mol

(b) Calculate the unit cell parameter (a) of K unit cell.

**(c)** What is the size of interstitial site?

4) Methylene chloride is a common ingredient of paint removers. Besides being an irritant, it also may be absorbed through skin. When using this paint remover, protective gloves should be worn.

If butyl rubber gloves (0.04 cm thick) are used, what is the diffusive flux of methylene chloride through the glove?

5) An FCC iron-carbon alloy initially containing 0.20 wt% C is carburized at an elevated temperature and in an atmosphere that gives a surface carbon concentration constant at 1.0 wt%. If after 49.5 h the concentration of carbon is 0.35 wt% at a position 4.0 mm below the surface, determine the temperature at which the treatment was carried out.
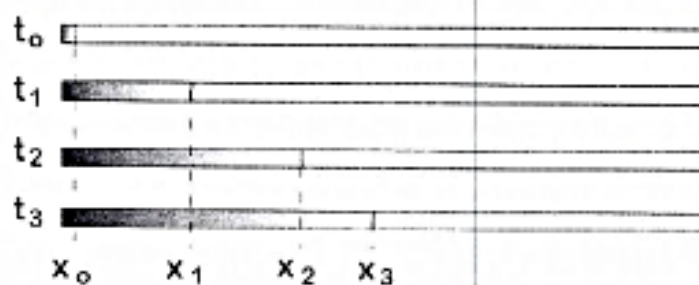
$$\frac{C(x_i,t_i)-C_o}{C_s-C_o}=1-\text{erf}\left(\frac{x_i}{2\sqrt{Dt_i}}\right)$$

Tabulation of Error Function Values

z	$\text{erf}(z)$	z	$\text{erf}(z)$	z	$\text{erf}(z)$
0	0	0.55	0.5633	1.3	0.9340
0.025	0.0282	0.60	0.6039	1.4	0.9523
0.05	0.0564	0.65	0.6420	1.5	0.9661
0.10	0.1125	0.70	0.6778	1.6	0.9763
0.15	0.1680	0.75	0.7112	1.7	0.9838
0.20	0.2227	0.80	0.7421	1.8	0.9891
0.25	0.2763	0.85	0.7707	1.9	0.9928
0.30	0.3286	0.90	0.7970	2.0	0.9953
0.35	0.3794	0.95	0.8209	2.2	0.9981
0.40	0.4284	1.0	0.8427	2.4	0.9993
0.45	0.4755	1.1	0.8802	2.6	0.9998
0.50	0.5205	1.2	0.9103	2.8	0.9999