Assignment 1

Q(4). Density = $\frac{mass}{Volume}$

In unit cell =

$ZnS \equiv 4\,Zn$ atom $+ 4\,S^{2-}$ atom

mass = $(4 \times 63.5 + 4 \times 32) \times 1.66 \times 10^{-27}$

$\therefore$ density $= \frac{(254 + 128) \times 1.66 \times 10^{-27}}{a^3} = 5.67$

a =

Q.(9) AgI

1 unit cell = 4 Ag atom + 4 I atom

$\Rightarrow$ mass $= (4 \times 107 + 4 \times 127) \times 1.66 \times 10^{-24}$ g

$\therefore$ density $= \frac{(254 + 508) \times 1.66 \times 10^{-24}}{a^3} = 5.64$

$\Rightarrow a = 6.5 \times 10^{-8}$ cm.

$\Rightarrow$ (c) option

Q.(5) $\frac{r_-}{r_+} = 0.225 \Rightarrow r_- \equiv 0.225\, r_+$.

$\Rightarrow$ (a).

Q.(6) cell contain $4\,Cl^{\ominus} + 4\,Na^+$

$\Rightarrow \frac{(4 \times 23 + 4 \times 35.5) \times 1.66 \times 10^{-24}\,g}{(600 \times 10^{-10})^3\ cm^3} = d$

135 + 213

$92 + 142 = 234$

$\frac{234 \times 10^{-24}}{216 \times 10^{-24}} = 1.79$ gm/ml

Q.(7) In CCP.

effective octahedral void = 4

" tetrahedral " = 8

In CCP packing O is lattice

∴ contribution of 'O' = 4

∵ 1/5 tetrahedral voids are filled with X

thus contribution of X $= 8 \times \frac{1}{5} = \frac{8}{5}$

∵ 1/2 octahedral voids are filled with Y

thus contribution of Y $= 4 \times \frac{1}{2} = 2$

∴ formula is $X_{\frac{8}{5}} Y_2 O_4$

$\Rightarrow X_{\frac{4}{5}} Y O_2$

$= \boxed{X_4 Y_5 O_{10}}$ (C)

(16) ~~Contributi~~ contribution in lattice

Cu	4
Ag.	$12 \times \frac{1}{4} = 3$
Au	Au

then formula is ~~cc~~ $Cu_4 Ag_3 Au$

(C)

Q.(17) ⇒ density = 2 Kg/dm³

$a = 700$ pm.

∵ fcc lattice ∴

contribution of atoms = $8 \times \frac{1}{8} + 6 \times \frac{1}{2} = 4$.

∴ density = $\frac{4 \times M \times 1.66 \times 10^{-27} \cdot Kg}{(700 \times 10^{-11}\ dm)^3}$

$\Rightarrow 2 = \frac{4 \times M \times 1.66 \times \cancel{10^{-27}}}{73 \times \cancel{10^{-27}}}$

$\Rightarrow M = \underline{103.3\ gm/mol}$.

Q.(18) (a) since $r_A + r_B$ for bcc = $\frac{\sqrt{3}}{2} a$.

Q.(8)

Contribution in lattice of $X = \frac{X}{8} \times 8 = X$

" " " $Y = Y$.

" " " $Z = 12 \times \frac{Z}{4} = 3Z$.

∴ formula: XYZ_3 : (C)

Q.(9) ⇒ $\sqrt{3}a = (2r_+ + 2r_-)$

$\frac{\sqrt{3} \times 450}{2} = (r_+ + 225)$

190.7 pm (A)

Q.(10) $2r_+ + 2r_- = 600$

⇒ $190 + r_+ = 300$

$r_+ = 110$ pm (B)

Q.(11) (D)

Q.(12) (C)

Q.13 coordination no is (6) (D)

Q.(14) (A)

Q.(15) (B)

Q.(19) (C) Fe_3O_4

Q.(20) (B)

Q.(21) (B) $4r = \sqrt{2}a$

Q.(22) B

Q.(23) A (CsCl) has 8:8 coordination no.

Q.(24) A

Q.(25) (D)

(26) on increasing pressure coordination no. decreases

(B)

Q.(27) (C)

Q.(28) ~~Th Th~~

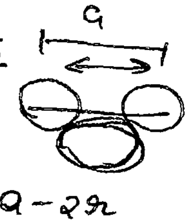
since carbon must be sp^3 hybrid it must has 4 coordination no.

thus ~~structure~~ must be like ZnS, where both Zn and S have coordination no of 4.

thus 50% tetrahedral voids must be ~~occup~~ occupied

Q.(29) All 1st group metal Halides except CsCl has Rocksalt structure

Q.(30) ∵ fcc lattice ∴ $4r = 4.070\,A^\circ \times \sqrt{2}$



∴ $r =$ ~~1.0175~~ 1.438

∴ closest distance will be $a - 2r$

⇒ $2.878\,A^\circ$

Q. (31) (C)

Q. (32) ∵ contribution of atoms = 1.

∴ Volume occupied = $\frac{4}{3}\pi r^3$.

and ∵ $2r = a$

⇒ Volume occupied = $\frac{\pi a^3}{6}$

Q (33) Coordination no in rocksalt structure is 6

Q. (34) (D)

Q (35) (B)

Body centre has 8:8 coordination no.

Q. (36) (A)

$2(r_+ + r_-) = a$.

⇒ $r_+ + r_- = \frac{a}{2}$

Q (37)

contribution by Li ions = 8.

" " Se " = $8\times\frac{1}{8} + 6\times\frac{1}{2} = 4$

⇒ Li_2Se

Q. 38 (C)

Q (39) (B) $0.41 < \frac{r_+}{r^-} < 0.73$

Q(40) A

Q.(41) Coordination no. increases with increase in pressure and decrease in Temp. (C)

Q(42) $\frac{r_+}{r_-} = \frac{r_+}{r_-} = \frac{126}{216} = 0.58$

since $0.41 < \frac{r_+}{r^-} < 0.73$

∴ coordination no = 6. (C)

Q.(43) (D)

Q.(44) Since in rocksalt structure

$2(r_+ + r_-) = a$.

$\Rightarrow (75 + r_-) = 200$.

$\Rightarrow r^- = 125\ pm$

⇒ (B)

Q(45) (D) ∵ Void fraction in fcc is 0.26.

Q.(46) Contribution of $F = 8 \times \frac{1}{8} = 1$

" " $M = 1 = 1$

∴ ⇒ formula = MF

Q(47) (D)

Q.(48) (C)

Q(50) B is incorrect

Q(49) (D)

Home Assignment-2

Q.① (A) contribution of $A = 8\times\frac{1}{8} = 1$

" " $B = 6\times\frac{1}{2} = 3$

∴ formula = AB_3

Q.② (B) → It will be ~~cubic close~~ HCP.
and then void % is 26%.

Q.③ (A)

Q.④ D.

Q.⑤ In BCC ⇒ $4r = \sqrt{3}a$.

⇒ $r = 1.86 A^{\circ}$

(B)

Q.⑥ contribution of atoms in BCC $= 8\times\frac{1}{8}+1 = 2$

" " " FCC $= 8\times\frac{1}{8}+6\times\frac{1}{2} = 4$.

∴ ~~set~~ (n_1, n_2) is (2, 4) -

(B)

Q.⑦ (C)

Q.⑧ (C)

Q.⑨ . 4 since Zn is present in tetrahedral void

(C)

Q.⑩ considering electrostatic force

$$F = \frac{k q_1 q_2}{r^2}$$

Force between NaCl $\Rightarrow \frac{K e \cdot e}{r^2}$

" ; CaO = $\frac{K 2e \cdot 2e}{r^2}$ = 4 (Force between NaCl).

∴ ~~c~~ Lattice energy $\approx 4u$ — u is Lattice energy of NaCl

Q(12) (D)

~~KCl will have Rock salt structure ∴ coordination no. 6~~

~~In CsCl~~

~~Q.~~

Q(13) ~~Ans~~

(A) on increasing Temp coordination no decreases

Q.(14) $\sqrt{2} a = 4r$.

$\Rightarrow a = \frac{4 \times 100}{\sqrt{2}}$

$= 2\sqrt{2} \times 100$

$= 2 \times 1.414 \times 100 = 2 \times 141.4 = \underline{282.8 \text{ pm}}$

thus (D)

Q.(15) Sr^{+2} will replace 2 Na^+ thus no of Sr^{2+} added will be equal to vacancy created.

∴ ∵ 2×10^{-3} mol % is added $\Rightarrow 2 \times 10^{-5}$ mole added per 1 mole NaCl

⇒ conc of hole created ⇒ $2 \times 10^{-5} \times 6.02 \times 10^{23}$ hole ~~atom~~ % is created

$= \underline{12.04 \times 10^{18}}$ ⇒ ~~A~~ (B)

(16) same layer, twice will not be closed packing
~~for f.c.c. $\sqrt{2}a = 392$.~~

~~$a = 2\sqrt{2}r$.~~

Q(17) In fcc ~~$4r =$~~

$$2(r_+ + r_-) = \sqrt{2}a.$$

$$\Rightarrow (r_+ + r_-) = \frac{a}{\sqrt{2}}$$

(C)

Q.(18) (B) $4r = \sqrt{2}a$. (fcc)

$$\Rightarrow r = \frac{a}{2\sqrt{2}} = \frac{392}{2\sqrt{2}} = 139 \text{ pm}$$

$\Rightarrow$ (B)

Q.(19) (D)

Q.(20) There ~~are~~ is 4 void per unit cell in FCC

And no of atoms per FCC lattice = 4.

$\Rightarrow$ 1 void per atom

$\Rightarrow$ (C)

Q.(21) (B)

Q.(22) Density ~~this six~~ decreases since no of atom decreases.

(A)

Q. (23) (D)

Q. (24) (D)

Q. 25 (B)

Q. (26) contribution of atom = 4 (f.c.c).

$\therefore$ density = $\frac{4 \times 60.2 \times 1.66 \times 10^{-24}}{a^3} = 6.25$

$= 4 \times 10^{-8}$ cm

$= 4 \times 10^{-10}$ m

$= 400$ pm

(C)

Q. (27)

$d = \frac{m}{V} =$

since $z = 4$, thus 2 must be Pb and 2 must be S atom

$\Rightarrow d = \frac{2(239) \times 1.66 \times 10^{-24} g}{(5 \times 10^{-8} cm)^3} = \frac{2 \times 239 \times 1.66}{125}$

$= 6.35$ g/cm³

(B)

Q. (28) CsCl lattice has 1 Cs atom and 1 Br atom contribution

$\Rightarrow$ density = $\frac{(133 + 80) \times 1.66 \times 10^{-24} g}{a^3} = 4.49$ g/ml

$\Rightarrow$ 4.26 A° $= a$

Q.29

$\sqrt{3}a = 4 \times r$ (B.C.C)

$\Rightarrow r = \frac{3.011 \times \sqrt{3}}{4} A^\circ$

$r = 1.303 A^\circ$

$density = \frac{2 \times 50.94 \times 1.66 \times 10^{-24}}{~~1.30~~ (~~1.303~~ 3.011 \times 10^{-8} cm)^3}$

$= \frac{2 \times 50.94 \times 1.66}{~~(1.303)^3~~ (3.011)^3} = \frac{169.12}{~~2.212~~ 27.29}$

(D) $d \Rightarrow 6.19 \ g/cm^3$

Q.30

NaBr.

Contribution of Na atoms $= 8 \times \frac{1}{8} + 6 \times \frac{1}{2} = 4$

" " Cl atom = 4.

$3.203 = density = \frac{4 \times (23+80) \times 1.66 \times 10^{-24}}{a^3}$

(A) $a = 5.97 A^\circ$

Q.32

$d = \frac{m}{V}$

$\Rightarrow 10.53 = \frac{4 \times 107.88}{N_A \times (4.0774 \times 10^{-8})^3}$

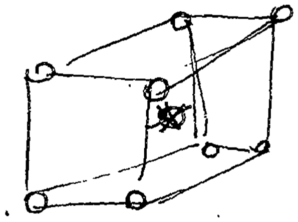
$N_A = \frac{4 \times 107.88 \times 10^{24}}{(4.0774)^3 \times 10.53} = \frac{}{713}$

$= 6.05 \times 10^{24}$

(B)

~~Q (32)~~

Q (31)



$$\Rightarrow \quad d = \frac{1 \times (132.9 + 126.9) \times 1.66 \times 10^{-24}\ g}{(4.562 \times 10^{-8})^3\ cm^3}$$

$$= \frac{431.268}{94.947}$$

$$= 4.54\ g/cm$$

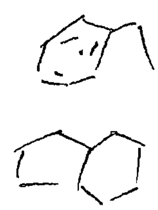
(c)

~~Q (32) MgO:~~

~~1 cell has → 4 'Mg', → 4 'O'~~

~~$\Rightarrow d = \frac{4 \times 40 \times 1.66 \times 10^{-24}}{(4.21 \times 10^{-8})^3}$~~

~~$= \frac{398.4}{74.61}$~~



Q-33 In CaF_2 · $\frac{n_+}{n_-} = \frac{8}{4}$

If $TiO_2 = \frac{n_+}{n_-} = \frac{6}{3}$.

⇒ (c)

Q(34) $d = \frac{mass}{Volume}$

$\Rightarrow d = \left(\frac{4 \times 200}{24 \times 10^{23}}\right) \frac{\times 1}{(2 \times 10^{-8})^3}$

$= \frac{4 \times \overset{100}{\cancel{200}} \times 10}{24 \times 8}$

$= 41.6\ g/ml$

$\Rightarrow$ (A)

Q(35) contribution of Zn atom = 4

" " S atom = 4

$3.4 = \frac{4 \times (63.5 + 32) \times 1.66 \times 10^{-24}}{a^3}$

$a = 5.7\ A^{\circ}$

$\Rightarrow$ (A)

Q(36) contribution of X = 4

for there are 8 tetrahedral void

∴ Y contribution = 8.

since there are 4 octahedral void

thus Z contribution = $4 \times \frac{1}{2}$ (since only half are occupied)

= 2

$\Rightarrow X_4 Y_8 Z_2 \Rightarrow X_2 Y_4 Z$

Q. Comprehension Type.

Passage 1.

(1) $d = \frac{4 \times 108 \times 1.66 \times 10^{-24}}{a^3} = 10.6$ $\left[\frac{1}{N_A} = 1.66 \times 10^{-24}\right]$

$a^3 = 67.65 \times 10^{-24}$

$\Rightarrow$ $\boxed{a = 0.407 \text{ nm}}$ — (A)

(2)

$d = \frac{4 \times 100}{12 \times 10^{23}} \times \frac{1}{(2 \times 10^{-8})^3}$

$d = \frac{400}{12 \times 8 \times 10^{23} \times 10^{-24}}$

$d = \frac{400 \times 10}{12 \times 8}$

$d = 41.66 \text{ g/cm}^3$ (A)

80
39

(3) $\Rightarrow$ $d = \frac{Z \times M}{N_A \cdot a^3}$

$2.75 = \frac{Z \times 119}{6.023 \times 10^{23} \times (6.54 \times 10^{-8} \text{ cm})^3}$

$\Rightarrow 2.75 = \frac{Z \times 119}{6.023 \times 10^{23} \times 6.54^3 \times 10^{-24}}$

$\frac{2.75 \times 6.023 \times 6.54}{1190} = Z = 3.9 \Rightarrow \approx 4$ (C)

[thus f.c.c]

Passage 2

2(1) CCP ⇒ ~~8~~ 4 contribution of 'O' atom

C.C.P has 8 tetrahedral voids

since $\frac{1}{8}$th are occupied by X metal

thus unit lattice contains 1 X' atom

C.C.P has 4 octahedral voids

since half are occupied by Y metal atom ⇒ unit cell contains '2' Y atom.

or since Al^{+3} Mg^{+2} and O^{2-} is used

thus to maintain electrical neutrality compound must be:

$MgAl_2O_4$ ✓ ~~$AlMg_2O_4$~~ ✗

⇒ (B)

since

~~(2)~~ ⇒ $Y = Al^{+3}$

$X = Mg^{2+}$

⇒ Q(2) : (B)

⇒ Q(3) (A)

~~(4) Charge due to cation = +8.~~

~~∴ If X has charge $\frac{8}{3}$ thus to remain neutral.~~

~~valency must be~~ (3) ⇒ (C)

Q(4) When O^{2-} is replac. by $X^{-8/3}$
3 atoms of X will be required to balance the charge
Thus. 1 vacancy will be left
⇒ (A)

Passage 3

Number of particles is = ~~$6 \times 12 \times \frac{1}{6}$~~ $12 \times \frac{1}{6} + 2 \times \frac{1}{2} + 3.$

$= 2 + 1 + 3 = 6.$

∴ no of T. voids = 12
no of O void = 6

~~A~~ contribution of A = 6.
contribution of C = $0.1666 \times$ ~~12~~ $6 + \frac{1}{4} \times 12$
$= 1 + 3 = \underline{4}$

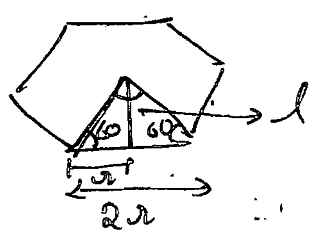
~~contribution of~~ 1
∴ formula is $A_6C_4 = A_3C_2$

Q. (2)

coordination no is . 12

Q (3) $d = \frac{m}{V}$

$\Rightarrow d = \frac{108 \times 6 \times 1.66 \times 10^{-19}}{\text{Volume of unit cell}}$



$d_{sg} = \frac{m}{V}$

$d_{cell} = \frac{m}{V_{cell}} \cdot \frac{0.74}{x}$

$\frac{d_{sg}}{d_{c}} = \frac{0.741}{0.74}$

$\Rightarrow \tan 60 = \frac{l}{r}$

$\Rightarrow l = \sqrt{3} r$

$\Rightarrow$ Area of $\Delta = \frac{1}{2} \times 2r \times \sqrt{3} r$

$= \sqrt{3} r^2$

6 atm

$d = \frac{\text{mass}}{\text{Volume}}$

$d = \frac{\text{mass}}{V}$ $\qquad V_{cell} \times 0.74 = V.$

since 26% of volume is empty

Q.3

$$\frac{d_{Ag}}{d_{cell}} = \frac{\frac{mass}{V_{Ag}}}{\frac{mass}{V_{cell}}}$$

∵ packing fraction is 0.74 for H.C.P.

$\Rightarrow V_{Ag} = 0.74\, V_{cell}$

$$\Rightarrow \frac{d_{Ag}}{d_{cell}} = \frac{V_{cell}}{0.74\, V_{cell}}$$

$\Rightarrow d_{cell} = d_{Ag} \times 0.74$

$= 1.44 \times 10^{3} \times 0.74$

$= 1.07 \times 10^{3}$ g/cc

Ans (A)

Q.4 Carbon form C.C.P. thus contribution of carbon $= 8 \times \frac{1}{8} + 6 \times \frac{1}{2} = 4$

Iron occupies edge centre ∴ contribution of Iron is $12 \times \frac{1}{4} = 3$.

∴ formula is Fe_3C_4

$$\Rightarrow C\% = \frac{4 \times 12}{4 \times 12 + 3 \times 56} \times 100$$

$$= \frac{48}{48 + 168} \times 100 = 22.22\%$$

$\Rightarrow$ (A)

Q5 Contribution of I atoms $= 12 \times \frac{1}{6} + 2 \times \frac{1}{2} + 3$

$= 6$

∴ Octahedral voids = 6

∴ ... are occupied by Cd.

∴ contribution $= 6 \times \frac{1}{2} = 3$

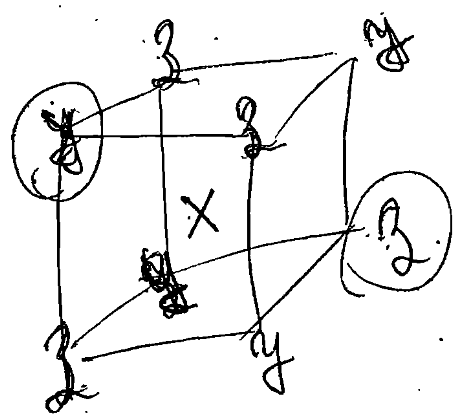
⇒ formula Cd_3I_6

⇒ CdI_2 (B)

Q6 contribution of $X = \ldots + 1 = 1$ (BC)

contribution of $Y = 3 \times \frac{1}{8} = \frac{3}{8}$

" " $Z = 3 \times \frac{1}{8} = \frac{3}{8}$



∴ $X_1 Y_{3/8} Z_{3/8}$

⇒ $X_8Y_3Z_3$ (C)