



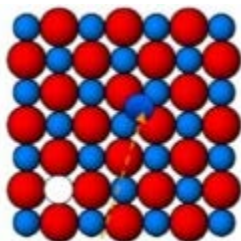
## INDIAN SCHOOL AL WADI AL KABIR

CLASS: XII	DEPARTMENT: SCIENCE 2020 - 2021 SUBJECT : CHEMISTRY	Date of completion: 27.08.2020
WORKSHEET No. 6 with answers	TOPIC: SOLID STATE	NOTE: A4 FILE FORMAT
NAME OF THE STUDENT:	CLASS & SEC:	ROLL NO:

### Worksheet Questions with Answers

1. What are fluids?  
Liquids and gases which have ability to flow
2. What is the cause of rigidity in solids?  
The constituents particles in solids have fixed positions and can only oscillate about their mean position
3. What kind of attractive forces are present in the molecular solids?  
Dipole-Dipole interactions, London / dispersion forces, hydrogen bonding.
4. What kind of attractive forces are present in the ionic solids?  
Coulombic or electrostatic force of attraction / ionic bonding.
5. What kind of attractive forces are present in the network solids?  
Covalent bonding
6. What kind of attractive forces are present in the metallic solids?  
Metallic bonding
7. What are pseudo solids?  
Amorphous solids
8. What is isotropy?  
The phenomenon due to which in amorphous solids, a physical property has same value in all direction
9. What is anisotropy?  
The phenomenon due to which in crystalline solids, same physical property have different values in different directions.
10. Which type of solids has sharp melting points?  
Crystalline solids
11. Which type of intermolecular force is present in ice?  
Hydrogen bonding
12. Which property of glass enables it to be moulded and blown into various shapes?  
Amorphous solids soften over a range of temperature.
13. What is a unit cell?  
The smallest repeating pattern of constituent particles which represents structure of a solid
14. What is space lattice?  
The arrangement of lattice points in three dimensional space of a solid.

15. How many lattice points and atoms present in fcc unit cell?  
Lattice points = 14;  $z = 4$
16. What is the coordination number of both hcp and ccp?  
Coordination number = 12
17. Which type of voids are present in a solid crystal?  
There are two types of voids – tetrahedral voids and octahedral voids
18. What is the coordination number of the :  
a. Octahedral void = 6      b. Tetrahedral void = 4
19. What are imperfections in solids?  
Any type of deviation in regular arrangement of crystalline solids
20. Which type of solids will give X-ray diffraction experiment?  
Crystalline solids – due to regular arrangement of particles and long range order.
21. Refer to the picture carefully : (For practice)



- a. Identify the type of defect
- b. Is this solid electrically neutral
- c. Give two examples of solids of this defect.
- d. Is this an ionic or a non-ionic solid? Give a reason.
- e. What happens to the density of the solid in this defect
22. (For practice)

The compound Cuprous oxide can be prepared in the laboratory. In this oxide , copper to oxygen ratio was found to be slightly less than 2: 1 .What type of defect is mentioned ? Give a reason.

23. Identify the types of crystalline solids: (For practice)

Examples	Types of Crystalline solids
Ammonium phosphate	
Silicon carbide	
Molecular phosphorus	
Phosphorus pentoxide	
Caesium	
C( graphite)	
PVC	
Bronze	
Lithium bromide	

## 24. Derivation:

If the radius of the octahedral void is  $r$  and radius of the atoms in close-packing is  $R$ , derive relation between  $r$  and  $R$ .

Sol. A sphere is fitted into the octahedral void as shown in the diagram.

$\triangle ABC$  is a right angled triangle.



$$\begin{aligned} \therefore BC^2 &= AB^2 + AC^2 \\ (2R)^2 &= (R+r)^2 + (R+r)^2 \\ (2R)^2 &= 2(R+r)^2 \\ \Rightarrow \frac{(2R)^2}{2} &= (R+r)^2 \\ \frac{2R \times 2R}{2} &= (R+r)^2 \\ 2R^2 &= (R+r)^2 \end{aligned}$$

which can be written as :

$$\begin{aligned} (\sqrt{2}R)^2 &= (R+r)^2 \\ \Rightarrow \sqrt{2}R &= R+r \\ r &= \sqrt{2}R - R \\ r &= R(\sqrt{2} - 1) \\ r &= R(1.414 - 1) \\ r &= 0.414R \end{aligned}$$

## 25. Numerical Based :

Analysis shows that nickel oxide has the formula  $Ni_{0.98}O_{1.00}$ . What fractions of nickel exist as  $Ni^{2+}$  and  $Ni^{3+}$  ions?

Suppose Ni present as  $Ni^{2+} = x$

Then Ni present as  $Ni^{3+} = 0.98 - x$

by multiplying the charge of the ion with the fractions available, we get

$$[(+2x) + (+3(0.98 - x)) + (-2 \times 1)] = 0$$

$$x = 0.94$$

$$\therefore \text{Fraction of Ni present as } Ni^{2+} = \frac{0.94}{0.98} \times 100 = 96\%$$

$$\text{Fraction of Ni present as } Ni^{3+} = 100 - 96 = 4\%$$

26. Aluminium crystallises in a cubic packed structure. Its metallic radius is 125 p.m.

- What is the length of the side of the unit cell?
- How many unit cells are there in  $1.00\text{cm}^3$  of aluminium?

Given  $r = 125 \text{ pm}$ ,  $a = ?$ , structure = *ccp* (*fcc*)

(i) For *ccp* (*fcc*),

$$\begin{aligned} 4r &= \sqrt{2}a \\ a &= 2\sqrt{2}r \\ &= 2 \times 1.414 \times 125 \text{ pm} \\ &= 354 \text{ pm} \end{aligned}$$

(ii) Volume of one unit cell =  $a^3$

$$= (354 \times 10^{-10} \text{ cm})^3 = 4.44 \times 10^{-23} \text{ cm}^3$$

$$\begin{aligned} \text{Number of unit cells in } 1 \text{ cm}^3 &= \frac{1 \text{ cm}^3}{4.44 \times 10^{-23} \text{ cm}^3} \\ &= 2.25 \times 10^{22} \text{ unit cells} \end{aligned}$$

27.

If NaCl is doped with  $10^{-3}$  mol %  $\text{SrCl}_2$ , what is the concentration of cation vacancies ?

we know that  $10^{-3}$  mol %  $\text{SrCl}_2 = \frac{10^{-3}}{100} = 10^{-5}$  moles of  $\text{SrCl}_2$

Each  $\text{Sr}^{2+}$  will replace two  $\text{Na}^+$  ions. To maintain electrical neutrality it occupies one position and thus creates one cation vacancy.

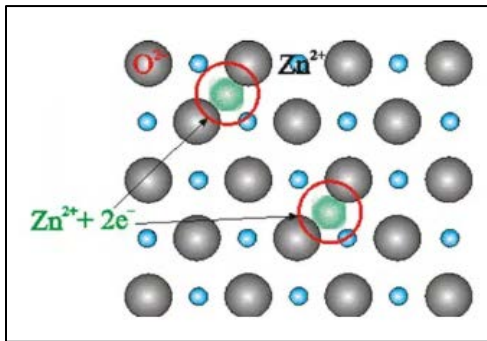
ratio = 2: 1: 1

Moles of cation vacancy =  $10^{-5}$

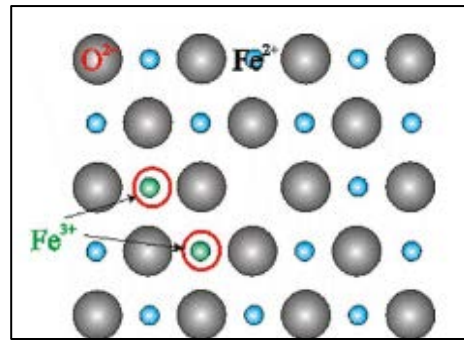
∴ Number of cation vacancies

=  $10^{-5} \times 6.022 \times 10^{23} = 6.022 \times 10^{18} \text{ mol}^{-1}$

28. Refer to the diagram carefully and answer to the following : (For practice)

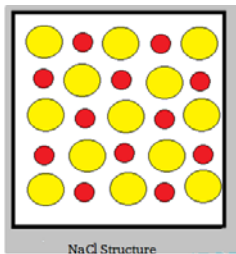


SOLID A



SOLID B

- Identify the type of defect in each case
- What is the chemical equation involved in SOLID A?
- What is the role of  $\text{Fe}^{3+}$  in the SOLID B?



29. Perfect crystal structure of NaCl is shown alongside:  
Two types of defects occur in this crystal structure.  
Identify and explain the defects. (for practice)

30. Explain the following : ( for practice)

- When LiCl crystal is heated in Li vapours.
- When KCl crystal is heated in K vapours
- Zinc oxide is yellow when hot and white when cold.

**OBJECTIVE TYPE QUESTIONS:**

- Which of the following conditions favours the existence of a substance in the solid state?
  - High temperature
  - High thermal energy
  - Low temperature**
  - Weak cohesive forces
- Which of the following is an amorphous solid?
  - Graphite
  - Quartz glass**
  - Chrome alum
  - Silicon carbide
- Iodine molecules are held in the crystal lattice by .....
  - London forces**
  - Dipole-dipole interaction
  - Covalent bonds
  - Coulombic forces
- Graphite cannot be classified as .....
  - Conducting solid
  - Covalent solid
  - Network solid
  - Ionic solid**
- Which of the following point defects are shown by AgBr crystals?
  - Schottky defect
  - Both Schottky and Frenkel defects**
  - Frenkel defect
  - Metal excess defect
- In which pair most efficient packing is present?
  - hcp and bcc
  - bcc and ccp
  - hcp and ccp**
  - bcc and fcc
- In which of the following will be covering tetrahedral voids :
  - hcp**
  - simple cube
  - bcc
  - none of these

**8. Match the types of defects: ( for practice)**

Column I	Column II
(i) Impurity defect	a. sodium chloride with anionic sites called F-centres
(ii) Metal excess defect	b. FeO with ferric ions
(iii) Metal deficiency defect	c. NaCl with $\text{Sr}^{2+}$ and some cationic sites vacant

**9. Match the type of packing given: ( for practice)**

Column I	Column II
(i) square close packing in two dimensions	a. coordination number 6
(ii) hexagonal close packing in two dimensions	b. Pattern of spheres is repeated in every fourth layer
(iii) hexagonal close packing in three dimensions	c. coordination number 4
(iv) cubic close packing in three dimensions	d. Pattern of spheres is repeated in alternate layers

**10. Assertion and Reason Type :**

- (i) Assertion and reason both are correct statements and reason is correct explanation for assertion.  
 (ii) Assertion and reason both are correct statements but reason is not correct explanation for assertion.  
 (iii) Assertion is correct statement but reason is wrong statement.  
 (iv) Assertion is wrong statement but reason is correct statement.

- a. Assertion : Graphite is a good conductor of electricity  
 Reason : Graphite is an allotrope of carbon
- b. Assertion : F- centres are formed in sodium chloride crystals  
 Reason : Sodium chloride crystal with F-centres loses the property of colour.
- c. Assertion : Zinc oxide is yellow when hot and never changes the colour when cold.  
 Reason : Zinc oxide has a chemical formula ZnO

Answers: a. ( ii) b. (iii) c. (iv)

Year 2019: ( 2 marks)

Aluminium crystallises in a fcc structure. Atomic radius of the metal is 125 pm. What is the length of the side of unit cell of the metal ?

**OR**

The compound CuCl has fcc structure like ZnS. Its density is  $3.04 \text{ g cm}^{-3}$ .

What is the volume of unit cell ?

Given : Atomic mass of Cu = 63.5 u; Cl = 35.5 u

$$N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$$

For fcc, $r = \frac{a}{2\sqrt{2}}$ $a = 2r \times \sqrt{2}$ $= 2 \times 125\text{pm} \times 1.414$ $= 353.5 \text{ pm}$	½  ½  1
OR	
$d = \frac{zM}{a^3 N_A}$ $a^3 = \frac{4 \times 99 \text{ g mol}^{-1}}{3.04 \text{ g cm}^{-3} \times 6.022 \times 10^{23} \text{ mol}^{-1}}$  $a^3 = 21.6 \times 10^{-23} \text{ cm}^3$ (Deduct half marks if correct unit is not given)	½  ½  1

Prepared by Ms. Jenifer Robinson