WEEK TWO

CRYSTAL STRUCTURE OF MATTER

Solids can be classified into two. The classes are:

1. Crystalline solids
2. Non crystalline or Amorphous solids

CRYSTALLINE SOLIDS

Most solids have regular shapes which could be evident from their external appearances. In some, this regularity of form is not so evident and only with the aid of a microscope can their crystalline nature be revealed. Such solids which have definite geometric shapes are said to be crystalline. The shapes of crystals vary from substance to substance but crystals of a particular substance have the same shape irrespective of their size.

The regularity of form or shape observed in crystals is as a result of atoms, molecules or ions being closely packed together.

A crystal is a piece of solid matter in which the atoms, molecules or ions are arranged in a regularly repeating pattern or lattice. Examples of crystals are sodium chloride, copper ii) tetraoxosulphate(vi), ice, diamond, graphite, aluminium etc.

CRYSTAL LATTICE

The arrangement of particles in a crystal is called crystal lattice. Crystal lattices have regular structure with each structure being made up of a number of repeating parts known as unit cells.

GROWING CRYSTALS

Dissolve some blue crystals of copper(ii)tetraoxosulphate(vi) in a beaker of cold water. Stir until it dissolves. Prepare a saturated solution by adding more of the salt until no more salt is dissolved. Hang a piece of thread in the solution and leave the arrangement in a place where it will not be disturbed for a long time, probably one week. It will be observed that some small clear cube shaped crystals will be formed on the thread. Sodium chloride can also be used in the procedure in place of copper(ii)tetraoxosulphate(vi). Different substances give different shapes of crystals.

CHARACTERISTICS OF CRYSTALS

1. They have regular shape
2. They have the same shape irrespective of size
3. They seem to grow by adding successive layers
4. They may be cleared along a direction parallel to one edge
5. They have flat sides and straight edges

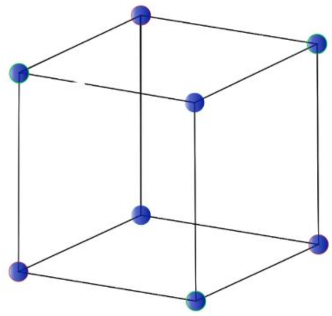
STRUCTURE OF SIMPLE CRYSTALS

Crystals may have any of the following structures:

1. Simple cubic structure
2. Face centred cubic structure

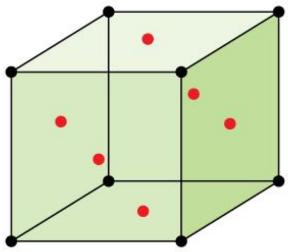
3. Body centred cubic structure
4. Hexagonal close packed structure

THE SIMPLE CUBIC STRUCTURE



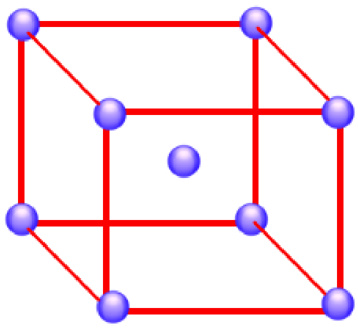
In this structure, the atoms, molecules or ions are located at the corners of an imaginary cube. Solids with this type of structure are: sodium chloride, calcium chloride, magnesium oxide, potassium bromide etc.

FACE CENTRED CUBIC STRUCTURE



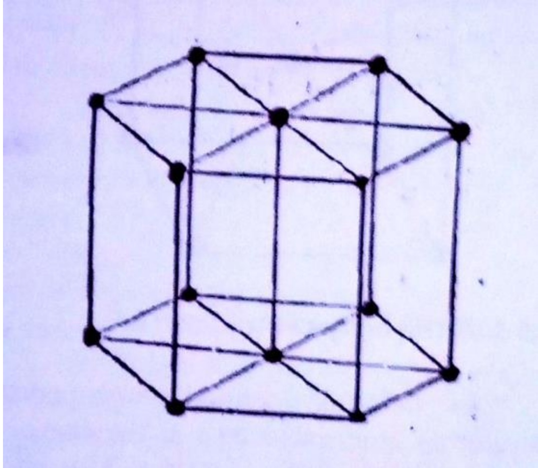
In this structure, particles are located at the edges and in the centre of each face. Examples are silver, aluminium, lead, copper and zinc sulphate.

BODY CENTRED CUBIC STRUCTURE



In the body centred cubic structure, an atom is located at the centre as well as the edges. The Alkali metals (lithium, sodium, potassium, rubidium, caesium) and some transition metals like iron, chromium, molybdenum and tungsten have body centred cubic structure.

HEXAGONAL CLOSE PACKED STRUCTURE



This is the structure of crystals such as magnesium, Zinc, graphite and Titanium.

NON CRYSTALLINE OR AMORPHOUS SOLIDS

The word ‘’amorphous’’ means without shape or form. The orderly arrangement of particles which is conspicuous in crystals is lacking in amorphous solids.

Amorphous solids have no definite geometric shape or form. Some examples of amorphous solids are glass, charcoal, some plastics and composite materials. A composite material is one which is produced by the combination of two or more materials and still combines the advantages of the chosen materials. An example is reinforced concrete.

DIFFERENCES BETWEEN CRYSTALLINE AND AMORPHOUS SOLIDS

Crystalline solids	**Amorphous solids**
They have definite shapes	They have no definite shapes
They have definite melting points	They have no definite melting points
They are usually soluble in water	They are usually insoluble in water

CLASSROOM EXERCISE

1. Give brief explanation of the two classification of Solid.
2. Highlight two differences between crystalline solids and amorphous solids.
3. State three structures of simple crystals.