



Mechanical Engineering

Material Science

Hand Notes For GATE, IES, PSUs & Competitive Exam

Hand Notes

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Note : We also providing GATE, IES, PSUs & Competitive Exam Materials [Handnotes, Shortnotes & Books], All Reports [Seminar Reports & PPT]

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* Material Science *

Topics we are going to cover in this course

- ① Atomic structure and chemical bonding. → 11th & 12th
- ② *** crystallography → Tech (ME)
- ③ *** phase diagrams (compounds and alloys)
- ④ Mechanical properties of materials
- ⑤ Ferrous and Non Ferrous Metals.
- ⑥ *** Electrical and Electronic Materials
- ⑦ ** Magnetic properties of materials
- ⑧ Non Metals and Advance materials.
 - ↳ polymers ***
 - ↳ ceramics *
 - ↳ composites *
 - ↳ Nano and Metal materials.

→ Mechanical

→ Superconductivity
(electrical & electronic)

→ Civil & Nano Science

previous year Analysis

ESE - 2017

↓
9 Questions

↓
18 Marks

↳ Curies Temp.

ESE - 2018

↓
20 - Questions

↓
Curies Temp.

ESE - 2019.

(Tech) ↓

14 - Questions

↓
28 Marks.

Material Science

5 - 15%.

10 marks — 30 marks.

- ① Energy & environment → 20+ marks.
- ② Maths + Apti → 15-20 Marks.
- ③ Material Science
- ④ ICT + C.A → 20 marks.

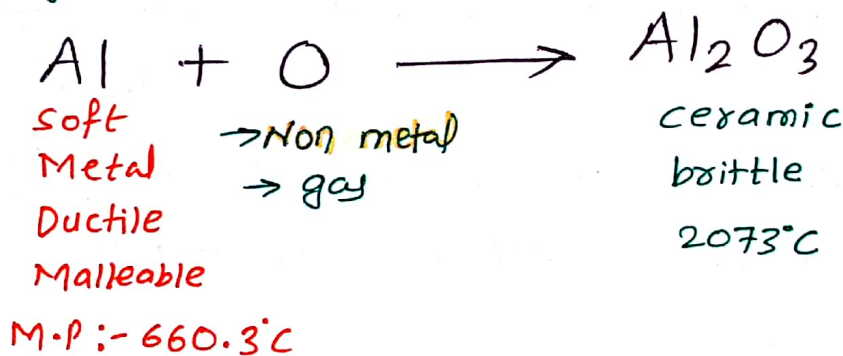
* Alloys and compounds *

compound :-

A compound is a mixture of two (or) more than two elements which are formed by chemical combination in a fixed proportion such that the properties of individual elements are not present in the mixture.

NOTE :-

A compound is always formed by chemical combination (or) by chemical reaction.



Ductility :-

→ Ductility is a property of material which takes that feasibility of a material to be drawn into wire.

→ Ductility is measured by Tensile forces.

Malleability :-

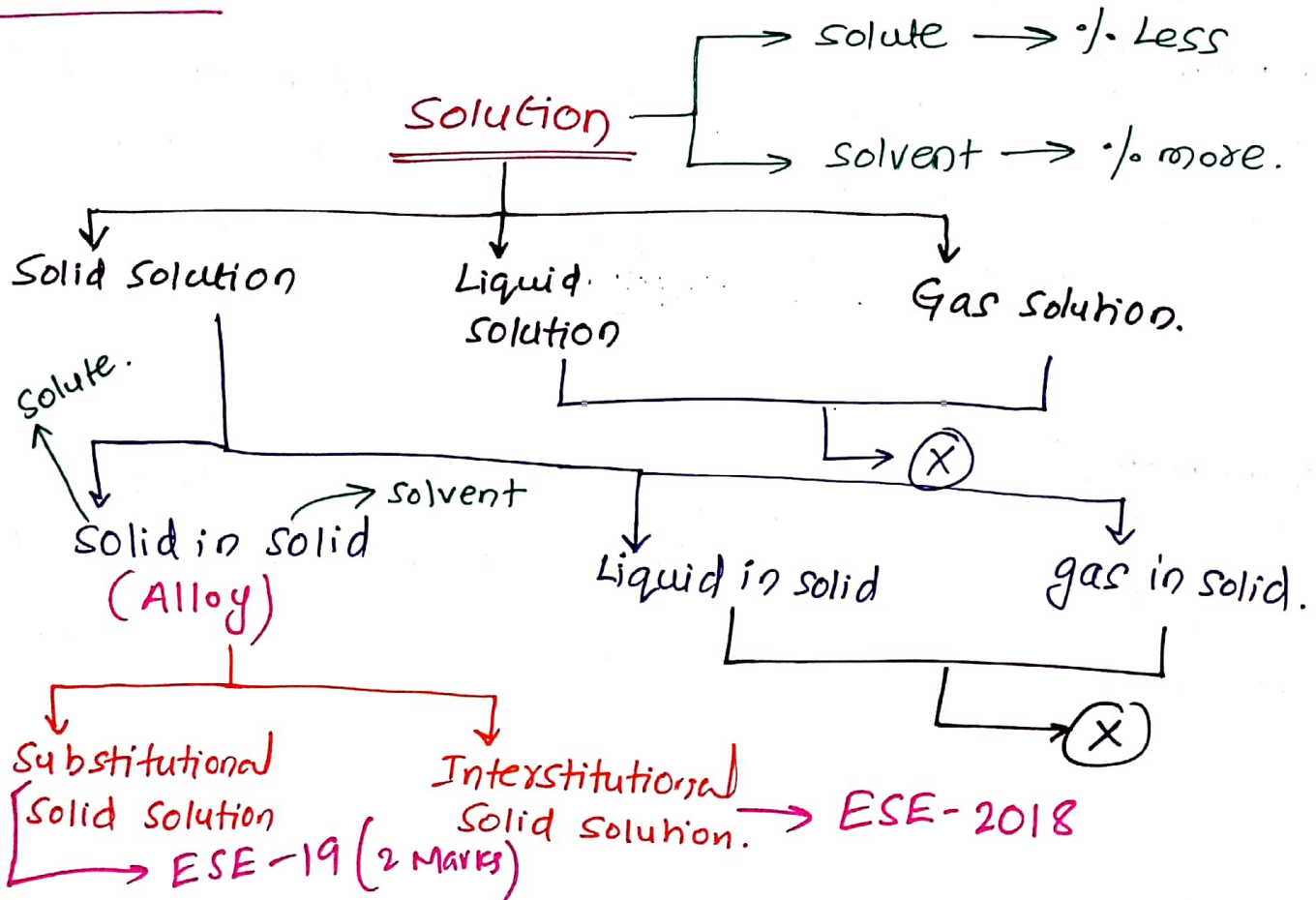
Malleability is the property of a material which states the feasibility of a material to be converted into thin sheets. It is related to the compressive forces.

Alloy :-

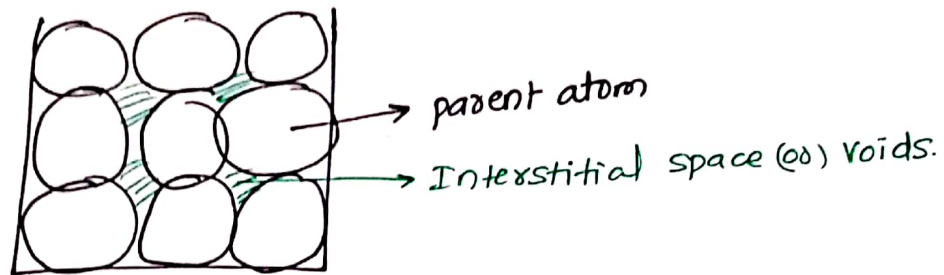
| | | | | |
|-----------|---|----------------|---|-----------------|
| Fe | + | C | → | Steel. |
| Metal | | Non-Metal | | Metallic Alloy. |
| M.P | | hard | | 1310 - 1497°C |
| 1537°C | | (eg) (diamond) | | hard |
| Ductile | | | | Ductile |
| Malleable | | | | Malleable. |

An Alloy is a homogenous mixture of two (or) more than two elements which are mixed with variable composition such that the resulting structure contains the properties of individual elements.

In An alloy The most imp thing is That
An alloy is a mixture and not a chemical comp-
-ound.



Substitutional Solid Solution:-



A Substitutional solid solution is a solid solution in which the mixture of metal with metal is created.

In Substitutional solid solution a parent atom is replaced by another foreign metal with relatively same size and same crystal structure.

NOTE:-

In case of substitutional solid solution, we can achieve 100% solubility, this can be achieved by substituting the parent atom with foreign atom.

The concept of solubility in case of substitutional solid solution was given by two scientists, i.e. Hume and Rothery.

According to Hume Rothery Rule an element is completely soluble into another element only and only if below conditions are satisfied.

- ① Relative radius factor ≤ 0.15
- ② crystal structure
- ③ The valency of both the elements should be same.
- ④ The electronegativity & electron affinity of metals should be same.

1) Relative Radius Factor :-

The Relative Radius of The two atoms which are going to mixed should be Less than 15%.

2) same crystal structure :-

The crystal structure of both The elements should be same.

3) Valency should be same.

The valency of both The elements should be same.

NOTE:-

According The 3rd point, we can only choose Metals and That to of **D-Block** Because only D-Block elements shows variable valency.

④ electronegativity & electronic affinity.

The electronegativity and electronic affinity of The metal should be same.

∴

→ Kisi say Roti kinchlena

→ Khud ki Roti be

Khana.
(bachalena)
(Strength)

Ese-19

⑥ which of The following features of atoms determine The degree to which The solute atoms dissolves into solvent atoms.

(A) Atomic size factor (B) crystal structure

(C) electron negativity.

(A) a, b (B) a, c (C) b, c (D) a, b, c