

Ans1)

Mechanical - Toughness, Creep, fatigue, Hardness.

Thermal - melting pt., Boiling Pt, Thermal conductivity

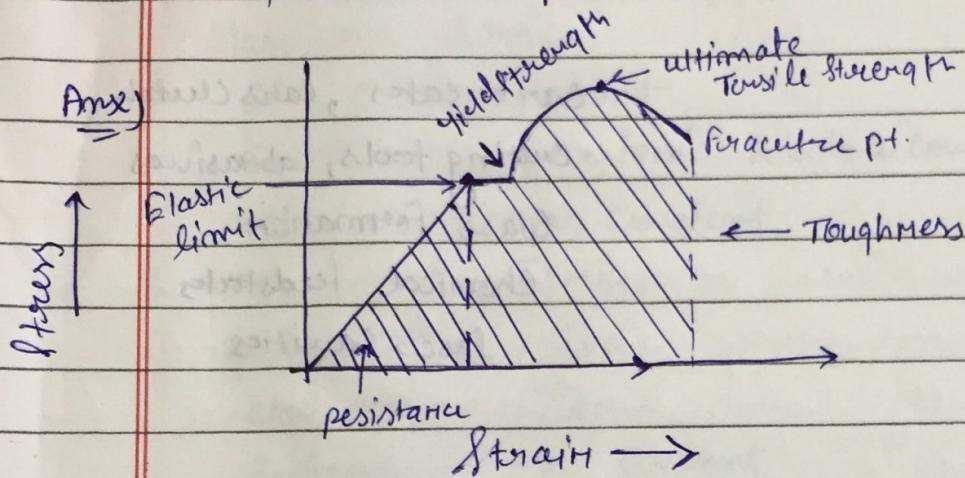
Electrical - Resistivity, Conductivity, Dielectric constant

Magnetic - Hysteresis, ferromagnetism, Permeability

Chemical - corrosion resistance, oxidation, Absorption

Optical - Opaque, Transparency, Ref index, Scatter

Physical - Shape size, grain structure color, statu

Ans2)

Technical properties of metal & Alloys :-

Technological properties can also be said to be mechanical properties of metal based on angle of consideration.

- Malleability
- Weldability
- Castability
- Ductility

Ans3)

<u>Metal</u>	<u>Application</u>
Iron	Vehicle chassis
Aluminium	Utensils
Copper	Wires
Zinc	Galvanizing process
Lead	Electrical Batteries

Alloy

Stainless steel (Fe + C)	Jewelleries, medical tools
Alnico (Fe + Al + Ni + Co)	Magnets in loudspeakers
Amalgam (Hg + Au + Sn + Cu + Zn)	Friction reducing
Babbit metal (Hg + Au + Sn + Sb (Sn + Sb))	Dental fillings

Ceramic

Silicon carbide	Car brakes, cars clutch
Tungsten Carbide	Cutting tools, abrasives
Glass Ceramic	Glass formation
Limestone	Chemical feedstocks
Alumina	Laser cavities

Polymer

PVC	Pipes, Cards
Rubber	Tyres
Bakelite	Buckets
Poly styrene	Poly bags
Neoprene	Laptop sleeves, Braces.

Composite -

Glass fiber	Thermal insulating material
Concrete	Civil construction
Plywood	Furniture
Clay	Pottery, bridges, walls
Bamboo	Construction work

Ans 5)

Quain
crystalline
aligned
less activation energy

Quain Boundary
Poly-crystalline
not aligned
more Activation Energy

Ans 6

graphite → covalent
Bakelite → covalent
Glass → Ionic
SiC → covalent
CdS → 15% ionic & balance covalent
AgCl → Polar Covalent
MgO → Ionic
Al₂O₃ → Ionic
clay → Ionic
Germanium → covalent
Brass → covalent (glycosidic)
ZnO → Ionic

Ans 7)

is Strength: In materials science, the strength of a material is its ability to withstand an applied load without failure.

ii) Ductility:

Ductility is a solid material's ability to deform under tensile stress. This is often characterized by the material's ability to be stretched into a wire.

Toughness: Toughness is the ability of a material to absorb energy and plastically deform without fracturing.

ii) Resistance → Resistance is the electric property that impedes or resist the current. Resistance depends on the material of which the object is made.

- Resistivity → Resistivity or the resistance (electrical) is an interval property that quantified how strong a given material appears the flow of electric current. It is intrinsic property.
- Conductivity: Opp. to conductivity is resistivity.

iii) Resilience: Resilience is the ability of a materials to absorb energy when it is deformed elastically and release that energy upon unloading.

Ans 8) Macro → 50x max. by lens
Micro → 100-2000x by Optical Microscope
Sub → upto 15000x by Scanning Electroscope or Transmission electroscope.

Ans 10) An Element is made of only one kind of atom, while a compound contains the atoms of 2 or more elements. Elements can not be compounds are made of diff. elements.

Boron, Silica, Germanium

Arsenic, Antimony, Tellurium

Ans 11) 1. Designing springs → Steel, Titanium, Bronze

2. Gear tooth → cast iron, steel, Bronze

3. Relay switch → copper, Nickel.

4. Heating Element → Nichrome

Ams12) Amorphous materials :

1. short range order in Amorphous solids.
2. don't have sharp melting point.
3. less rigid
4. undergo irregular or conchoidal breakage
5. independent of direction.

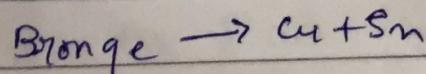
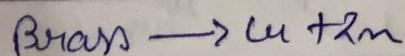
Crystalline Materials :

1. long range order in Crystalline.
2. melt at a sharp temperature.
3. more rigid
4. cleaved along definite planes.
5. dependent on direction.

Ams13) Composites :- A combination of two or more materials (reinforcing elements, fibers and composite materials matrix blinder), differing in form or compositions or a macroscale. The constituents retain their identities, that is, they do not dissolve or merge completely into one another although they act in concert.

Ceramic : A ceramic is an inorganic, non-metallic solid materials comprising metal, non metal or metalloid atoms primarily held in ionic & covalent bonds eg - glasses

Alloys : A metal made by combining 2 or more metallic elements, especially to give greater strength or resistance to the corrosion



• Mixture : A mixture is a material system made up of two or more different substances which are mixed but not combined chemically. A mixture refers to the physical combination of 2 or more substances on which the identities are retained.

Compound : A compound is a substance formed when 2 or more chemical elements are chemically bonded together.

Ans 14) Structure sensitive :

Yield stress, fracture toughness structure sensitive properties are those drastically affected by impurities, residual stress and grain size. Permeability (μ), coercive force (H_c), hysteresis loss (W_s) and magnetic stability are all considered to be structure sensitive.

Structure Insensitive :

Structure Insensitive refers to those properties that are not markedly affected by small changes in grain composition, small amounts of certain impurities, heat treatments or plastic deformation, saturation induction (β), resistivity (ρ) & Curie Temperature (T_C) are some of structure insensitive.

Ans 15 Substructure : Scanning Electron Microscope, Electron Transmission Microscope, upto 1,50,000 \times

Crystal Structure : \rightarrow X-Ray diffractions upto 10 $^{-3}$ m

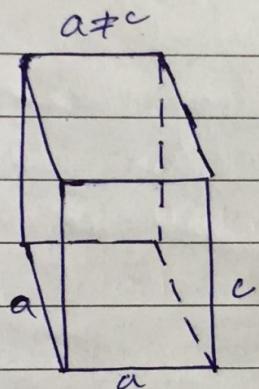
Ans 1D

~~E~~ Most symmetric: cubic crystal structures are most symmetric because in cubic unit cell, all the angles are equal i.e. $\alpha = \beta = \gamma = 90^\circ$.

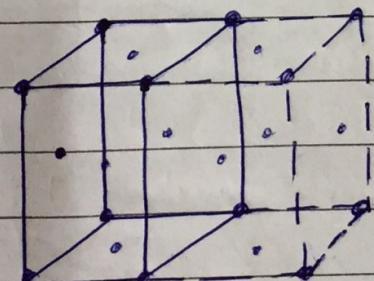
least symmetric -

Tetragonal crystal structure is least symmetric because it has no angle equal $\alpha \neq \beta \neq \gamma \neq 90^\circ$.

Ans 1E Let FCT exists - Face centred Tetragonal lattice is equivalent to Body-centred Tetragonal lattice



Simple



$$a = b \neq c$$

$$\alpha = \beta = \gamma = 90^\circ$$

FCT can be equally define by BCT space lattice

&

In FCT
lattice Pt. \rightarrow ④

& In B.C.T.

lattice Pt. \rightarrow ②

so ② is less & we prefer less or minimum points