Why study materials science :- Classification of Materials. Property of Material

The following types of material are discussed here.

(i) **Metals** — Many properties of metals are directly attributed to these electrons. Metals are good conductor of electricity and heat and not transparent to visible light; further-more, metals are quite strong, yet deformable, which account for their extensive use in structural applications.

(ii) **Ceramics** — These are compounds between metallic and nonmetallic elements; they are most frequently oxides, nitrides and carbides. That are composed of clay minerals, cement and glass. These materials are typically ~~insolative~~ insulative to the passage of electricity and heat, and are more resistant to high temp. and harsh environments than metals and polymers. With regard to mechanical behavior, ceramics are hard but very brittle.

(3) **Polymers** :- Polymers include the familiar plastics, rubbers, nylons, wood, silk, polycarbonate, polyester etc. Many of them are organic compounds that are chemically based on carbon, hydrogen and other non-metallic elements: furthermore, they are very large molecular structures. These materials typically have low densities and may be extremely flexible.

4) **Composites** — A number of composite materials have been engineered that consists of more than one material type. Fiberglass is a familiar eg, in which glass fibers are embedded within a polymeric material. Fiber glass acquires strength from the glass and flexibility from the polymer.

(5) **Semiconductors** :- Semiconductors have electrical properties that are intermediate between the electrical conductors and insulators. Furthermore, the electrical characteristics of these materials are extremely sensitive to the ~~presence~~ presence of minute concentrations may be controlled ~~over~~ over very small spatial regions. The semiconductor have made possible the advent of integrated circuitry that has totally revolutionized the electronics and computer industries over the past two decades.

(6) Biomaterials - Biomaterials are employed in components into the human body for replacement of a diseased or damaged body parts. these materials must not produce toxic substances and must be compatible with body tissue.

(7) Magnetic Materials:- Many of our modern technological devices rely on magnetism and magnetic materials; these includes electrical power generators and transformers, electric motors, radio, television, telephones, computers, and computer of sound and video reproduction systems.

(8) Liquid crystalline Materials →

Q- Name crystalline mat. →

Advance Materials:- Means used in high technology applications: so that materials used in electronic equipment (VCRs, CD players, computers, fiber optic systems, spacecraft, aircraft and military rocketry. And also materials that are used for lasers, integrated circuits, magnetic storage, liquid crystal displays (LCDs), and thermal protection system for the space shuttle orbiter.

Smart Materials:- Components of a smart material include some type of sensor (that detects an input signal), and an actuator (that performs a responsive and adaptive function). Actuators may be called upon to change shape, position, natural frequency or mechanical characteristics in response to change in temp., electric field, and/or magnetic field.

(i) Shape memory alloys are metals that, after having been deformed revert back to their original shapes when temp. is changed.
(ii) Piezoelectric ceramics expand and contract in response to an applied electric field.
(iii) Magnetostrictive materials - Same as piezoelectric. (magnetic effect)
(iv) Electrorheological fluid - are liquid that experiences dramatic changes in viscosity upon the application of electric or mgtic field.

for eg. Smart material is used in new corporate aerodynamic cockpit noise that is created by rotating ro. blades. Piezoelectric sensors inserted into the blades, monitor blade stresses and deformations. feedback signals from these sensors are feed into a computer - controlled adaptive device, which generate noise - canceling antinoise.

Liquid Crystals: The type materials are used in gas liquid chromatography because their mechanical & electrical properties lie between crystalline solids and isotropic liquid. LCs are employed in digital displays like digital watches, pocket calculators, LCD. and it is also used as solvent during the spectroscopic study of structure of anisotropic molecules.

Nano Materials:- To understand the chemical and physical of materials has been to begin by studying larger and complex structures, and then to investigate the fundamental building blocks of these structures, ~~and then to investigate the~~ that are smaller and simpler. However, with the advent of scanning probe microscope, which permit observation of individual atoms and molecules, it has been possible to manipulate and move atoms and molecules to form new structures and, thus, design new materials that are built from simple atomic level constituents. this ability to carefully arrange atoms provides opportunities to develop mechanical, electrical, magnetic and other properties that are not otherwise possible. eg. carbon nanotube. The dimensions of these structural entities are on the order of a nanometer (1 or as a rule, less than 100 nanometers (equivalent to a few atom d

in DNA corresponding to a specific acid? It must be more than two, since four bases can produce only 4^2 or 16 distinct types of pairs. This is not enough words to specify the 20 amino acids separately. The words of the code ~~not~~ could consist of base triplets, since there are 4^3, or 64 distinct combinations possible, more than enough to specify 20 amino acids.

The combination of three bases to specify a given amino acid is called a <u>codon</u>. It is a nonoverlapping code with successive three-base codons to specify successive amino acids in a protein. eg. The codon formed by three uracils, UUU, specifies phenylalanine, while UCU specifies serine. It is apparent, however, that there are 64 codons than needed amino acids. As a ~~result of~~ result, the code is degenerate, with more than one codon corresponding to the same amino acid. Each possible codon corresponds to either the stop code or a specific amino acid.

The reason for the degeneracy in the code for most of the amino acid can be supported by several arguments. Without degeneracy there might be 64-20, or 44 stop codes. As a result, mutations or errors in transcription would lead to short, ineffective proteins. Secondly, because the degeneracy occurs among codons that are very similar, errors will most likely still lead to a protein that can carry on, in some way, the intended function. A third advantage of degeneracy is that it allows the base composition of DNA to vary over a wide range without restricting the ability of the DNA to specify a range of amino acids. If biological systems evolve to give the greatest effectiveness to organisms it has clearly been found best to see that almost all codons correspond to one of the 20 amino acids.