Material science Question Papers (AD-302)

MATERIAL SCIENCE (AMIE)

Q. No.	Year	Questions
1a	S-2000	Calculate the volume of FCC unit cell in terms of the atomic radius **R.** Also calculate It's packing factor.
1b	S-2000	Why are the most metals and alloys used in common applications polycrystalline in nature ? Is it possib crystals of metals and alloys ? Describe a common method for measuring grain size in metals and alloy
2a	S-2000	What is Burger's Vector ? How does dislocation density influence mechanical properties ? Is dislocatior materials influenced by annealing ?
2b	S-2000	Explain phenomenon of yielding in mild steel. Why is the yield point in copper not distinct ?
3a	S-2000	Briefly explain the mechanism of fatigue crack initiation in metals ?
3b	S-2000	How does creep differ from high temperature fatigue ? Explain different stages of creep ?
3c	S-2000	What is Tharmal Fatigue, explain with an example ?
4a	S-2000	What is diamagnetism and paramagnetism? Explain in brief. Name one material of each type ?
4b	S-2000	Calculate (i) The saturation magnetisation and (ii) the saturation flux density for Nickel, which has a de g/cm3. Atomic weight of Nickel -58.71. Magnetic moment per Nickel atom =0.6 Bhor magneton μB = 9 and μ0 = 4 π* 10-7 h/m
4c	S-2000	Cite the similarities and differences between ferromagnetic and ferrimagnetic materials.
5a	S-2000	What is the nature of bonding in semiconductivity materials ? What is meant by semiconductor device typical components of a semiconductor device ? What are dielectric materials and explain their applica dielectric material.
5b	S-2000	What is the disctinction between electronic and ionic conduction ? Explain with suitable examples ?
5c	S-2000	Is it possible for compound semiconductors to exibit intrinsic behaviour ?
6a	S-2000	A bimetallic strip is constructed from strips of two different metals that are bonded along their lengths such device may be used in a thermostat to regulate temperature.
6b	S-2000	The thermal conductivity of plain carbon steel is greater than that of stainless steel . Explain why it is s

7a	S-2000	What is meant by critical resolved shear stress. Derive it's expression.
7b-i	S-2000	Explain phenomenon of Recovery
7b-ii	S-2000	Explain phenomenon of Recrystallisation
7b-iii	S-2000	Explain phenomenon of Grain growth
8a-i	S-2000	Full Annealing, assuming a medium carbon steel, explain final mocro structure.
8a-ii	S-2000	Normalising, assuming a medium carbon steel, explain final mocro structure.
8a-iii	S-2000	Quenching and Tempering, assuming a medium carbon steel, explain final mocro structure.
8b	S-2000	Cite three sources of internal resudual stress in metal components. What are the possible adverse conseq these stresses ?
8c	S-2000	Briefly explain the difference between Hardness and Hardenability.
1a	W-2000	Describe n-type and p-type semiconductors with structural reasoning. Give an example for each.
1b	W-2000	Explain ferromagnetism with B-H loop
1c	W-2000	What is slip ? How it is measured ? Distinguish slip with twinning. Why stress required for slip in actual me considerably less than the theoretically calculated stress.
1d	W-2000	What is precipitation hardening ? How does it differ with dispersion hardening ?
2a	W-2000	Calculate he atoms per unit cell of metallic zinc. Draw (121) plane and <121> direction in a cubic lattice.
2b	W-2000	Calculate the planner density of atoms in (111) plane of aluminium. [Atomic radius of aluminium -0.143 nr
2c	W-2000	Define [i] Screw dislocation [ii] Jog [iii] Stacking Fault Energy [iv] Shokely Partial [v] Low angle grain boundr resolved shear stress
2d	W-2000	Discuss the mechanism of dislocation multiplication by Frank-Read Source.
3a	W-2000	Copper is a conductor but silicon is a semiconductor- explain and illustrate with their electronic configurat
3b	W-2000	State the basic differences between metallic Bond and Ionic Bond
3c	W-2000	Why does continuous cold working make a material harder ? How can it's softness be recovered ?
3d	W-2000	Rolling of pure lead at room temperature can be called hot rolling - explain
4a	W-2000	Name a thermoplastic and a thermosetting polymer. State two characteristics in each case.
4b	W-2000	Discuss the electrochemical phenomenon of corrosion.

4c	W-2000	Describe [i] Cathodic Protection [ii] Anodic Protection in this connection.
4d	W-2000	Explain the phenomenon of sensitization in stainless steel.
5a	W-2000	Draw a nominal stress-strain diagram of a ductile material and indicate [i] Proportional Limit [ii] Yield Point of necking. Show how yield strength and the percentage of elongation can be measred from the diagram.
5b	W-2000	Explain temper brittleness and it's problem.
5c	W-2000	What is Martensite ? What are Ms and M90 in T-T-T diagram ? In dualphase steels, why the martensite is
5d	W-2000	Difference between Pearlitic reaction and Bainitic reaction.
6a	W-2000	Distinguish between Fire Clay and Sillimanite refractories. Discuss the importance of Pure Oxide refractori modern furnaces.
6b	W-2000	Explain Slip Casting.
6c	W-2000	Draw a conventional creep curve (high temperature) indicating different stages of creep behaviour and sh vreep rate is determined. Explain with reason whether a coarse grained material or a fine grained materia preffered for creep resistance.
6d	W-2000	How can one justify that creep is a diffusion controlled process.
7a	W-2000	Annealing produces softer material while normalising produces stronger-justify. During heat treatement, v eutectoid carbon steels are heated over AC3, but hypo-eutectoid steels aer heated over AC1 only ?
7b	W-2000	Calculate the percentage of pro-eutectoid ferrite and total ferrite in 0.2 % carbon steel.
7c	W-2000	What is brittle to ductile transition temperature ? State it's importance in materials in sub-zero applicatio atleast three materials that can be used in sub-zero environment.
7d	W-2000	Why (70/30) brass is more ductile than (60/40) brass ?
8a	W-2000	Discuss the effects of following allowing elements in steel (i) Nickel (ii) Tungsten (iii) Manganese.
8b	W-2000	Explain (i) Strain Hardening Exponent (ii) Super Plasticity.
8c	W-2000	What is high speed steel ? What is red hardness ? State the reason of it's occurance.
8d	W-2000	Enumerate different methods of improving fatigue resistance of materials.
1a	S-2001	Discuss the structure of an atom with reference to Bhor's Theory. Riefly explain the model proposed by Ru
1b	S-2001	How is a simple molecule of hydrogen is formed ? What are the typical intermolecular bonding mechanism the intermolecular bonding in hydrogen.
1c	S-2001	With the elp of neat sketches differentiate Grain and Crystal. How does grain formation occur as molten m

		to room temperature ?
2a	S-2001	Defne the term Crystal and explain the following terms (i) Space Lattice (ii) Unit cell (iii) Effective number o Packing factor.
2b	S-2001	What is Polymorphism ? Give atleast two examples of polymorphism in materials.
2c	S-2001	Describe the method used for identifying planes and directions in a crystal lattice. How are the families of directions represented ?
3a	S-2001	What is a magnetic dipole ? Explain why only some elements show magnetic behaviour.
3b	S-2001	Describe following, with the help of neat sketches (i) Ferromagnetism (ii) Paramagnetism (iii) Diamagnetis
3c	S-2001	Define intrinsic and extrinsic seemiconductors. Explain how holes and electrons are created in an intrinsic semiconductor.
4a	S-2001	Distinguish between ductils and brittle fractre. Draw typical stress-strain curves for a hypo-eutectoid plane and white cast iron and label them.
4b	S-2001	What are dielectric materials ? Discuss their properties and factors affecting it's properties.
4c	S-2001	Define fatigue and creep. Describe a creep testing experiment and draw a typical creep curve.
5a	S-2001	Draw a representative TTT curve for eutectoid steel. What would be the effect of carbon and boran aditio curve ?
5b	S-2001	Differentiate between annealing and normalising. Discuss the purposes for which these treatements are d
5c	S-2001	What is the difference between hardness and hardenability ? Name different hardness testing machines., used and general testing procedure.
6a	S-2001	Differentiate between work hardening and precipitation hardening and discuss the mechanism of work ha
6b	S-2001	ritically compare the following (i) Cold Working and Hot Working (ii) Defromation by slip and twinning.
6c	S-2001	What are the austempering and martempering ? Why are these treatements given only to certain alloys ?
7a	S-2001	Write short notes on the following (i) Acid and basic refractories and their applications. (ii) Critically resolv stress (iii) Corrosion and it's control (iv) Bearing alloys
8a	S-2001	Write molecular structures of natural and vulcanized rubber.
8b	S-2001	Explain why thermoplastics are reshaped at elevated temperatures and not the thermosetting polymers.
8c	S-2001	What are heat resisting alloys ? Give chemical compositions of rail steel, hadfield steel and coinage bronze
1a	W-2001	Show that the atomic packing fraction for BCC crystal is 0.68

1b	W-2001	Briefly describe the electronic structure of an atom.
1c	W-2001	Name the crystal structures (BCC, FCC or HCP) for the following meals : Magnesium, Alpha Iron, Copper an
1d	W-2001	Distinguish between Unit Cell and Space Lattice.
2a	W-2001	What were the major differenciences in Rutherford's nuclear model ? How ware these overcome by Bhor
2b	W-2001	Explain the terms, True Stress, True Strain, Engineering Stress and Engneering Strain.
2c	W-2001	Distinguish between upper and lower yield points.
3a	W-2001	Sketch neatly a typical creep curve and explain it's various stages. Show how the curve would alter on vary tempeature.
3b	W-2001	An aluminium bar of 24 mm*30 mm cross section is under a load of 7000 kg and a steel bar of diameter 10 a load of 5000 kg. Which part has the greater stress ?
3c	W-2001	What is meant by ductile-britle transition temperature ? How can this temperature be controlled ?
3d	W-2001	Draw neatly the engineering stress-strain curve for mild steel.
4a	W-2001	By applying the principel of Zone theory explain the difference between conductors, insulators and semicc
4b	W-2001	Explain why repeatedly dropping a permanent magnet on the floor causes it's demagnetisation.
4c	W-2001	Explain the fllowing (i) Magnetisation (ii) Diamagnetisation (iii) Relative permeability and (iv) Domain.
5a	W-2001	What are the general properties of polymaric materias ?
5b	W-2001	Explain briefly a polymarisation mechanism.
5c	W-2001	Explain two methods of prevnting corrosion.
5d	W-2001	What are the main characteristics of ceramic materials ?
5e	W-2001	Differentiate between insulators and refractories.
6a	W-2001	Difference between Cold working and Hot Working.
6b	W-2001	What is meant by the term "Recovery" in metals ?
6c	W-2001	How are the bearing alloys classified ? Explain briefly the applications of bearing bronzes.
6d	W-2001	Explain the phenomenon of work hardening in metals.
6e	W-2001	Explainthe mechanism of slip by dislocation.
7a	W-2001	What are the purposes of normalising ? How does normalising differ from full annealing ?

7b	W-2001	What are the benefits of alloying in general ? Whar are the effects of chromium as alloying element on the of steel ?
7c	W-2001	What are heat resisting steels ? Give a typical composition of a heat resisting steel used for gas turbine bla
7d	W-2001	Explaing briefly the factors responsible for plastic deformation in polycrystalline materials.
8a	W-2001	Explain Critical cooling rate.
8b	W-2001	Explain Jominy's Quench Test.
8c	W-2001	Explain Bauschinger's Effect.
8d	W-2001	Explain Galvanic corrosion.
8e	W-2001	Explain Martensitic transformation.
1a	S-2002	Draw the planes (110) and (111) in a simple cubic crystal.
1b	S-2002	Describe primary and secondary bonds with examples.
1c	S-2002	Copper has an FCC crystal structure and a unit cell with a lattice constant of 0.316 nm. What is it's interpla d220 ?
1d	S-2002	A hydrogen atom exists with it's electron in the n=3 state. The electron undergoes a transition to the n=2 s Calculate (i) The energy of the photon emitted (ii) It's frequency (iii) It's wavelength (iv) It's energy emitted in the transition.
2a	S-2002	Claculate the volume of the zinc crystal unit cell by using the following data. Zinc has HCP crystal structure a=0.2665 nm and c= 0.4947 nm.
2b	S-2002	Explain the mechanism of crack initiation and growth when a metal is subjected to cyclic stresses.
2c	S-2002	The flow curve equation of annealed 7075 aluminium alloy at room temperature is given by $\sigma = k \epsilon^n$, wher and n= 0.21. Calculate the tensile strength of the alloy.
3a	S-2002	Sketch schematically a generalised creep curve for metallic materials. How does the creep tare vary along Explain the effect of stress and temperature on the steady state creep rate.
3b	S-2002	Wha is the probability of an electron being thermally promoted to the conduction band in (i) Diamond [Eg Silicon [Eg=1.07 eV] at roo temperature 25 degree centigrade. K=86.2*10-6 eV.K-1.
3c	S-2002	Explain the various types of magnetism. What is the difference between soft and hard magnets ?
4a	S-2002	Explain (i) Seebeck Effect (ii) Meissner Effect.
4b	S-2002	Distinguish between intrinsic and extrinsic semiconductor.

4c	S-2002	Compute the thermal conductivity k of sodium at 0 degree centigrade or 273 degree kelvin using below giv 4.29 A, k=1.38*10-3, tc=3.1-10-4 sec, number of atoms (BCC)=2, m=9.11*10-31.
4d	S-2002	A wire sample 1 mm in diameter by 1m in length of an aluminium alloy is placed in an electrical circuit. A v of 432 mV is measured across the length of the wire as it carries a 10 A current. Calculate the conductivity
5a	S-2002	Explain briefly : Lead can creep under it's own weight at room temperature.
5b	S-2002	Explain briefly : Yield point phenomenon is observed in low carbon steel.
5c	S-2002	Sketch Edge and Screw dislocations.
5d	S-2002	Explain briefly :Difference in mechanical properties of fine and coarse grained materials.
6a	S-2002	Explain the meanings and significances of the following properties of refractoris : (i) Pyrometric cone equiv Refractories under load (iii) Spalling.
6b	S-2002	Distinguish between thermoplastics and thermosetting plastics.
6c	S-2002	What is meant by the term compounding of plastics ? What are the functions of ingradients used in compo plastics ?
6d	S-2002	Zinc is corroding with a current density of 3.427*10-7 A/cm2. What is the corrosion rate in (i) milligrams p centimetre per second (mcs) and (ii) milligrams per square decimetre per day (mdd) ?
7a	S-2002	Give the compositions, properties and applicaions of following : (i) Gun Metal (ii) Duralumin.
7b	S-2002	Sketch the Fe-Fe3 C diagram that represents the temperature ranges used for (i) Full Annealing (ii) Normal Speroidizing (iv) Stress Relief Annealing and (v) Recrystallization Annealing.
7c	S-2002	Define hardenability. Explain the effect of grain size and chemical composition on hardenbility.
7d	S-2002	Explain the characteristics of martensite.
8a	S-2002	A tensile stress of 15 mPa applied on [1 TO 0] axis of a single crystal of silver is just sufficient to cause slip [0 T 1] system. Calculate the critical resolved shear stress of silver. [Hint cos tita = 2/root of 6, cos lambda =
8b	S-2002	Distinguish between martempering and austempering in terms of (i) Process (ii) Advantages (iii) Applicatio Limitation with neat skecthes.
8c	S-2002	Explain the characteristics of tin based Babbit metal that make it suitable as a bearing material.
8d	S-2002	Distinguish between (i) Hot shortness and Cold shortness (ii) Hot working an dCold working.
1a	W-2002	What do you understand by metallic bonding ? Why it is non-directional in nature ? Distinguish it from cov bonding. What is meant by secondary bonding ?
1b	W-2002	Explaing (i) Why covelent bonded solids are poor electrical conductors ? (ii) Why Ionically bonded solids us

		melting points ? (iii) How is the equilibrium distance of seperation between two like atoms is fixed at degr What is meant by bond energy (iv) Calculate teh void fraction in BCC crystal.
2a	W-2002	Draw two FCC unit cells side by side. Construct from within the two, one body centered tetragonal unit cel it's c/a ratio.
2b	W-2002	What is Burger's Vector ? State, how you can determine the Burger's Vector of an edge dislocation.
2c	W-2002	What is critical resolved shear stress ? Derive an expression for the same.
2d	W-2002	Describe how the microstructural changes are effected when a single phase alloy is heavily cold worked ar annealed.
3a	W-2002	Distnguish between (i) Slip an dTwinning (ii) Elastic and Plastic Strain (iii) Tanscrystalline and intercrystallin Point defects an dline defects in crystals (v) Yield Strength and Ultimate Strength.
3b	W-2002	What is meant by Polygonisation ? Explain the echanism involved in Polygonisation.
4a	W-2002	What is creep ? Draw a typical creep curve showing different stages of creep. Explaing the mechanisms inv creep.
4b	W-2002	(i) Describe the mechanism of brittle fracture in materials. (ii) Explain why fatigue failure is initiated from t a body.
5a	W-2002	Explain-Metal are solids with partly filled zones.
5b	W-2002	Explain-Repulsive force between two like atoms is short range in nature.
5c	W-2002	Explain-Semiconductors have negative temperature co-efficient of resistance.
5d	W-2002	Explain-Pressure of small scale discontinuies in metals increases it's resistivity whereas larger scale microst features do not affect the resitivity.
5e	W-2002	Transition metals are eiher ferromagnetic or strongly paramagnetic in nature.
6	W-2002	Write short note on (i) Brillion Zones (ii) Impurity semiconductors (iii) Dielectric materials (iv) Free electron metals (v) factors affecting electrical resistance of materials.
7	W-2002	Differentiate between (i) Annealing and Normalising (ii) TTT and CCT diagrams (iii) Hardness and Hardenab Martensite and Pearlite (v) Cast Iron and Steel.
8a	W-2002	Enumerate the various types of corrosions normally encountered in materials. Explain the mechanism of s corrosion cracking. Describe some useful methods of corrosion control.
8b	W-2002	What do you understand by polymerisation ? State the characteristics of long chain polymers. Describe bri deformation behaviour of plastics.

1a	S-2003	For BCC iron, compute (i) the interplaner spacing (ii) the diffraction angle for [211] set of planes. The lattic for Fe is 0.2866 nm [2.866 A]. Also assume the monochromatic radiation having a wavelength of 0.1542 nr used, and order of reflection is 1.
1b	S-2003	Indicate millers indice for (i) Octahedral Plane (ii) Dodecahedral Plane. In BCC and FCC structures showing of their unit cell.
1c	S-2003	What will be the Miller indices for close packed directions in y iron ? Show with a neat sketch.
2a	S-2003	Differentiate between the mechanisms of Fatigue and Creep.
2b	S-2003	Explain the various types of magnetisms. What is the difference between Soft and Hard magnets.
2c	S-2003	Explain the effects of Stress and Temperature on the steady state creep rate.
2d	S-2003	How do you ehnance creep resistance of steel ? Which temperature is important for a creep resistant alloy
3a	S-2003	What do you mean by dislocation density ? How does it influence various mechanical properties ?
3b	S-2003	Explain the cause of brittle fracture of ductile material subjected to cyclic loading.
3c	S-2003	On a Stress-Strain diagram illustrate the following (i) Elastic Limit (ii) Yield Stress (iii) Ultimate Tensile Stran
3d	S-2003	How do you measure impact toughness ?
4a	S-2003	In terms of electron energy band structure, discuss reasons for the difference in electrical conductivity bet semiconductors and insulators.
4b	S-2003	Briefly explain why the magnitude of the saturation magnetisation decreases with increasing temperature ferromagnetic materials, and why ferromagnetic ebhaviour cases above Curie temperature ?
5a	S-2003	Explain the difference between Resolved Shear Stress and Critical Resolved Shear Stress.
5b	S-2003	Do all metals have the same Slip system ? Why or why not ?
5c	S-2003	Sketch Edge and Screw dislocations.
5d	S-2003	Why are most metals and alloys used in engineering applications polycrystalline in nature ?
6a	S-2003	Give compositions, properties and applications of (i) Gun metal (ii) Duralumin.
6b	S-2003	Draw steel portion of iron-carbon phase diagram and give classification of steel based on their structure.
6c	S-2003	Explain difference between (i) Hot working and Cold working (ii) Hot shortness and Cold shortness.
6d	S-2003	Distinguish between martempering and austempering giving suitable examples for their applications.
7a	S-2003	Explain TTT curves for a steel. How are they drawn ?

7b	S-2003	How do the alloying elements affects tehse TTT curves ? Explain with skecthes.
7c	S-2003	Briefly describe the phenomenon of superheating and supercooling. Why do they occur ?
7d	S-2003	Provide two reasons why martensite is so hard and brittle ?
8a	S-2003	Briefly describe the microstructural difference between speroidite and tempered martensite.
8b	S-2003	Explain the tempered martensite is much harder and stronger than speroidite.
8c	S-2003	Difference between the steel used for cutting tools and forming dies, with reference to the heat treateme them.
8d	S-2003	Explain in brief the Bauchinger effect.
1a	W-2003	Draw the following lattcices BCC,FCC and HCP. Determini for each (i) Effective number of atoms (ii) Packing Co-ordination number
1b	W-2003	Explain Rutherford's model of an atom and mention it's disadvantages. How was Bhor's model better than model ?
2a	W-2003	Draw he stress strain curve for (i) Brittle material (ii) Ductile material. And give examples for each.
2b	W-2003	The engineering stress and strain at fracture were found to be 450 Mpa and 0.63 respectively. Determine stress and true strain.
2c	W-2003	Define Creep and Fatigue. How is creep and fatigue data is presented ? Give neat sketches.
2d	W-2003	Mention the mechanisms responsible for thermal conductvity in materials. What is the dominant mechani ?
3a	W-2003	With energy band gap diagrams differentiate between insulators, conductors and semiconductors.
3b	W-2003	Define (i) Curie Temperature (ii) Anti Ferromagnetism (iii) Diamagnetism (iv) Permeability.
3c	W-2003	Mention atleast one application of the following (i) Hard magnets (ii) Soft magnets (iii) Dielectrics (iv) Semi (v) Ferroelectrics (vi) Superconductors.
4a	W-2003	Discuss the martensites transformation. What are Ms and Mf temperatures ? What factors determine the temperature ?
4b	W-2003	Define Hardness and Hardenability.
4c	W-2003	Describe Jominy end quench test.
4d	W-2003	Mention the factors that affect Hardenability.
5a	W-2003	Define (i) Polymerisation (ii) degree of polymerisation (iii) Vulcanisation.

5b	W-2003	Define corrosion. Mention various forms. Discuss the corrosion control measures.
6a	W-2003	Differentiate between (i) Slip and twinning (ii) Hot and Cold working (iii) Elastic and Plastic deformation.
6b	W-2003	Briefly explain (i) Bauschinger's effect (ii) Season Cracking (iii) Work hardening (iv) Polygonisation.
6c	W-2003	Calculate the critical resolved shear stress in the following diagram
7a	W-2003	Draw a T-T-T diagram of an eutectoid steel and label all areas and phases.
7b	W-2003	What is Annealing ?
7c	W-2003	Explain Recovery, Recrystallization and Grain Growth.
8a	W-2003	Write a note the effect of alloying element additions to a plain carbon steel.
8b	W-2003	Give some applications for following (i) Medium Carbon Steel (ii) High Carbon Steel (iii) Cast Iron
8c	W-2003	Write notes on (i) Babbit materials (ii) Nuclear Metals (iii) Die Steels (iv) Magnetic Alloys.
1a	S-2004	An element with an atomic number 50 has all it's iner energy levels filled up expect 4f level, which is empt it's expected valence.
1b	S-2004	State and briefly explain the Pauli's exclusion principle.
1c	S-2004	Topaz, an orthorhombic semi-precious stone has a ratio of a:b:c of 0.529:1:0.477. Find the Miller indices o whose intercept is as below : 0.264:1:0.238.
1d	S-2004	A 3.5 mm titanium wire is drawn througha 3 mm diameter die, producing a wire having a yield strength of a tensile strength of 550 MPa. Determine the final diameter of the wire. [Given the modulas of elasticity o titanim=112GPa] .
2a	S-2004	Draw a neat skecth of iron-carbon phase diagram and label the various phase fields. Write down the vario reactions occuring in this system.
2b	S-2004	Outline the differences between the following pairs: (i) Slip and Twinning (ii) Fatigue and Creep (iii) Extrins Intrinsic semiconductor (iv) homogeneous and Heterogeneous nucleation (v) Hot and Cold working.
3a	S-2004	With the help of suitable diagram , explain the grain growth pattern in a sand cast steel containing 0.35 % Describe the process to refine the grain structure in such a steel.
3b	S-2004	Describe a practical method of assessing the depth of hardening of a steel.
3c	S-2004	Compare the methods available for increasing the creep strength of acrystalline solid.
4a	S-2004	What are the self-lubricating bearings ? Give three suitable examples of the materials used and state their application also.

4b	S-2004	Show how the True-Stress true-Strain diagram helps to explain the extent of plastic deformation and strai of materials.
4c	S-2004	State the objectives of pre-sintering and sintering.
5a	S-2004	Give a brief account of galvanic corrosion of metals.
5b	S-2004	Outline the factors which control the increasing sensivity of aoolys to intragranual corrosion.
5c	S-2004	The microstructure of an iron-carbon alloy at 800 degree centregrade contains 25 % Fe3C, and 75 % y (hav Calculate the total carbon content of the alloy with the help of lever rule.
5d	S-2004	With he help of four-parameter model explain the c behaviour of polymer.
6a	S-2004	What are High Speed Steels ? Give the composition, properties and applications of die steel.
6b	S-2004	menton the important requirements of electrical insulaors.
6c	S-2004	Explain the anistropy and magnetorestriction of magnetic materials. How do they affect the permeability materials ?
7a	S-2004	What are Cermets ? State their basic properties and uses.
7b	S-2004	What is meant by Brittle Transition Temperature of the material ? How it can be estimated ? Name a polyr retains it's ductility even upto 100 degree centigrade and explain with suitable reasonings.
7c	S-2004	Define Monomer and Polymer. Write the typical polymeric repeat structures for both addition and conden polymerisation. Which of the method is expected to result in branched structure ? Explain.
8a	S-2004	Explain what is meant by the terms piezoelectric and pyroelectric when applied to materials. How would y whether or not a material was (i) Piezoelectric (ii) Pyroelectric (iii) ferroelectric.
8b	S-2004	Explain how Annealing, Normalising and Hardening of steel is carried out. Discuss the various objectives fo these heat treatement processes.
1a	W-2004	(i) Write down the electronic configurations of atoms having atomic numbers Z=10,Z=18 and Z=26. (ii) Exp reason for poor conductivity of insulators (iii) Draw the nature of Bhor model of a hydrogen atom (iv) How are there in 1 gm of copper? Given atomic weight of copper is 63.5 gm/mol. And Avagadro's number = 6.0
1b	W-2004	(i) Name the types of primary bonds in following solids Silica [SiO2], Aluminium [Al], Cesium Chloride [csCl conventional unit cells for the following solids Gamma iron, BCT-iron, Graphite (iii) On the basis of the crys calculate the packing factor of Goldlattice. Also calculate the atomic radius of iron at 20 degree centigrade constant is 0.287 nm.
2a	W-2004	(i) Regroup the materials in order of conductors, semiconductors and insulators : Diamond, Silicon, Graphi Polyethylene and Aluminium (ii) Why metals are good conductors ? (iii) On increasing the temperature, wh electrical conductivity of metals in eneral decrease but those of insulators increases ? (iv) Describe briefly

		of a n-type silicon semiconductor.
2b	W-2004	(i) What is Ferromagnetism ? How does it differ from diamagnetism ? (ii) Draw the conventional B-H curve magnet and a soft magnet, indicating their significance.
3a	W-2004	(i) Draw the nature of engineering Stress-Strain diagrams fro gray cast iron and 70/30 brass [Cartridge bras does the engineering Stress-Strain diagram differ from load-elongation diagram ? (iii) What are the units o and True Strain in MKS ystem ?
3b	W-2004	Derive the relationship between True Stress and Engineering Stress and True Strain with Engineering Strai
3c	W-2004	Draw the nature of S-N [Stress vs. Nuber of cycles of failure] curve of fatigue failure for medium carbon ste aluminium, indicating their endurance limits. Why is fatigue strength is lower than tensile strangth ?
4a	W-2004	(i) Why is corrosion is called electrochemical phenomenon ? (ii) Write down the Nernst Equation (iii) The E standard Mg-Cu galvanic cell is -2.70 V. If the standard half-cell emf for the oxidation of Mg is -2.36 V, wha standard half-cell emf of copper ? (iv) Draw the electrode kinetic behaviour of a pure metal [say Zinc] in ac schematically indicating E corr and I corr.
4b	W-2004	(i) Give examples of a galvanic corrision and a pitting corrosion (ii) Why are pure metals more corrosion re impure metals ?
4c	W-2004	(i) Explain Homopolymer and Copolymer, with their schematic molecular chain arrangements. (ii) If a parti polyethylene has a molecular mass of 420,000 gm/mol, what is the avarage degree of polymerisation ?
5a	W-2004	(i) Define Slip, Twinning, Burger's Vector, Jog, Edge dislocation, with schematic diagrams [Burger's Vetctor shown in a Burger's Circuit] (ii) What are the principal slip planes and slip directions for pure Zinc ? (Draw r diagrams) (iii) Why do single crystals of pure FCC metals like Silver have low value of critical resolved shear compared to Ag-Cu alloy for same orientation (iv) A brass sheet is 9.5 mm thick and is cold rolled with a 30 in thickness. What will be the final thickness of the sheet ? Will there be any gain in mechanical properties rolled product? Explain (v) What is the ductile to brittle impact transition temperature ?
6a	W-2004	(i) What do you mean by Recrystallisation Temperature ? (ii) If it takes 5*10+3 min to recrystallize a piece at 250 degree centigrade and 360 min at 300 degree centigrade completely, what is the activation energy process, assuming teh process obeys Arrhenius type rate equation and the time to recrystallize = C.e+Q/RT Given R=8.314 J/[Mol.K], T is in Kelvins, Q is teh activation energy in J/Mol and C is a constant (iii) Dstinguis Hot working and Cold working (iv) Draw teh nature of high temperature creep curve and indicate it's differ
6b	W-2004	(i) Explain the stages of a cup and cone fracture (ii) Why are the surface hardening treatements often used the performance of a steel shafts ? (iii) On the basis of hall fetch equation say how can the polycrystalline strangthened ? (iv) List two ways of processing by which preffered orientation of grains can be obtained in
7a	W-2004	(i) Draw the cooling cuves for Martempering and Austempering operations for a eutectoid plain carbon ste superimposed on TTT diagrams [Use separate diagrams] (ii) How are the eutectoid temperature of steels a additions of austenite or ferrite stabilizing alloying elements (iii) Differentiate between any two Annealing

		Normalising or Hardness and Hardness and Hardenability or Brass and Bronze.
7b	W-2004	Define any three Pearlite, Bainite, Martensite, Austenite, Critical cooling rate, Proeutectoid cementite.
8a	W-2004	Justify (i) Multiple tempering is often used in heat treatement of alloy tool steels (ii) Die casting Silumin all cases contain 10-13 % silicon in aluminium (iii) Martensitic transformation is a diffusionless process (iv) Sea of brass is an example of galvanic corrosion (v) The strength of the Maraging steels is not due to martensit
8b	W-2004	Write short note on Percipitation hardening or Define Vacancy, Polymorphoism, Poisson's ratio, Insulator a series.
1a	S-2005	What is Burger's Vector ? Show it by drawing a Burger Circuit. What is Frank read source ? State it's import plastic deformation.
1b	S-2005	Distinguish between (i) Slip and Cross Slip (ii) Sessile dislocation and Glissile dislocation.
1c	S-2005	What is critical resolved shear stress ? Derive it's formulae.
1d	S-2005	Calculate the degree of freedom of ice and water kept in a beaker at 1 atmosphere pressure.
2a	S-2005	State Fick's law of diffusion. How can it help you in problems of Case Carburising ? Given an activation ene kJ/Mol, for the diffusion of carbon in FCC iron and an initial temperature of 1000 kelvin, find the temperat increase the diffusion coefficient by a factor 10 [R=8.314 J/Mol.K] Will you use a very igh temperature ?
2b	S-2005	What is a phase ? What is the difference between alpha iron and ferrite ? Define an invariant reaction with
2c	S-2005	Difference between (i) Phase Rule and Phase Diagram (ii) Solvus Line and Solidus Line.
3a	S-2005	Explain Lever Rule with a Tie Line. Find the weigh percentage of pro-eutectoid ferrite just above the eutect temperature of a 0.3 % C-steel.
3b	S-2005	Derive the relationship between True Strain and Engineering Strain. What is Resilience ? Why is it importan material ?
3c	S-2005	Describe the Yield Point Phenomenon. Draw the engineering Stress-Strain diagram of lass. Why does necki during tension test of ductile material ?
3d	S-2005	Justify (i) Zinc is not ductile as Copper (ii) Cold working increases hardness of materials (iii) Steel is a brittle sub-zero atmosphere.
4a	S-2005	Suggest one suitable material for each of the following (i) file Cabinet (ii) Water Tap (iii) Manhole Cover (iv Chair (v) Glass Cutter.
4b	S-2005	Explain with reasons (i) Ceramics are vey hard (ii) Solar cells are semiconductors with p-n junction (iii) high creep is a diffusion controlled process (iv) Brittle fracture commanly occurs in Grey Cast Iron (v) Brass is alw than Copper at room temperature.

5a	S-2005	(i) Why has ferrite very low solubility of carbon, while austenite has high solubility of carbon (ii) What is ha Why it is not so high in plain carbon steels ? (iii) Draw the Peritectic reaction of Fe-C system.
5b	S-2005	(i) State the advantages of Normalising over Annealing (ii) What is critical cooling rate ? Why is the shape o diagram in form of english letter C ? (iii) What is Tempering ? Is it essential for high carbon steel after quen Write the scientific names of following polymers with one of their typical use : Teflon, ABS.
6a	S-2005	Explain a chain polymerisation reaction.What is the degree of ploymerisation ? If a particular type of polye mass of 140,000 g/Mol, what is it's degree of polymerisation ?
6b	S-2005	Distinguish between Homopolymer and Copolymer. State the basic structural units of PMMA and nylon 6,6 their properties.
6c	S-2005	Define a semiconductor and a transistor.
7a	S-2005	Differentiate beween Ceramics and Glass, with examples. What is the Glass Transition Temperature ? Wha glass is used in spectacle lenses ?
7b	S-2005	Explain the reason for the rising popularity of Pure Oxide Ceramics over traditional refractories. What is m Where is it commonly being used ?
7c	S-2005	Draw the crystallographic unit of SiO4 4- iron. What is Mullite ? Explain Slip casting.
7d	S-2005	What is Alnico ? Explain Patenting.
8a	S-2005	(i) Why are monovelent metals like Silver or Copper so conductive ? (ii) Discuss dielectric constant and diel strength for ceramics (iii) Name two important ceramic insulators with their properties.
8b	S-2005	(i) What is Hysteresis Loop ? Explain it's importance (ii) Distinguish between Diamagnetism and Paramagne
8c	S-2005	What is E-glass ? Where it is commonly used ?
8d	S-2005	By energy Band Model explain the electrical cunduction of an intrinsic semiconductor.
1a	W-2005	Calculate the volume of FCC unit cell in terms of the atomic radius R. Show that the atomic packing factor cell is more than that of BCC.
1b	W-2005	Difference between Frenkel pairs and Shottkey defects.
1c	W-2005	Explain why interstitial atoms such as C in Fe, can diffuse more rapidly, compared to vacancies.
2a	W-2005	Atensile sample of polycrystalline copper has been loaded in tension to an arbitary stress, **O** exceeding the **O**o and then unloaded. (**i**) With a schematic true stress-true strain curve representing the loading and unlo behaviour, show how elastic and plastic strains can be determined. (**ii**) If the sample was a single crystalof subjected to compression right after unloading in tension, will the yield stress be equal to, more or less tha Explain.

2b	W-2005	Assuming that the true stress-true strain curve follows the relation : **O= O**o +**K** enp, where **O** is the true str
2c	W-2005	Draw schematic stress atrain curves for ideally elastic, ideally plastic and viscoelastic solid. Explain how is t of viscoelastic solid differ from those of from other two.
3a	W-2005	Explain why is twinning associated with homogeneous shear, though atoms are displaced by equal distanc
3b	W-2005	What are the three regimes of a typical creep curve, showing creep strain against time ? Distinguish betwe deformation mechanisms involved in the three stages of creep.
3c	W-2005	What is the fundamental difference between stress relaxation test and a creep test ?
4a	W-2005	Explain on the basis of dislocation theory, why ceramics and intermetallic compounds are brittle, while me ductile ?
4b	W-2005	
4c	W-2005	Mild steel samples A, B and C have been fractured by impact at liquid nitrogen temperature and in tension rate of 10-5 s-1 at 700 degree Centigrade in air. Explain with reasons the differences in fracture surface mo
4d	W-2005	What are the differences in grain structure and dislocation substructure do you expect after working differ same strip of copper through similar reduction at room temperature and 0.6 of iy's absolute melting point
5a	W-2005	What are the eutectoid and eutectoid reactions in the Fe-C binary phase diagram ?
5b	W-2005	If you carry out impact test on 0.4% C steel, subjected to heat treatements : (**i**) quenching in brine after so the A3, and (**ii**) tempering at 50 degree centigrade for 1 hour. Will the results vary ? Explain.
5c	W-2005	
5d	W-2005	Differentiate between age hardening and dispersion hardening, emphasizing on how dislocations interact second phase and suitability for application of materials strengthened by those methods at high temperat
6a	W-2005	What are the two mechanisms responsible for thermal conductivity in materials ? Why are amorphous cer polymers less thermally conductive, compared to those, which are crystalline ?
6b	W-2005	Explain two different sources of thermal stresses in materials, which could be of any dimensions and used structural components. How is the thermal shock resistance dependent on thermal conductivity, coefficien expansion, elastic modulus, and anisotropy along crystallographic directions ?
6c	W-2005	How will you select and design materials to be used in (**i**) turbine blades of jet engines, operating at 1300 c centigrade, (**ii**)propeller of a ship travelling in the Arctic ocean. Empasise on requirements of microstructu and mechanical properties.
7a	W-2005	What do you mean by glass transition temperature ? How do the plots showing variation of specific volum temperature for amorphous glass ceramic and a crystalline solid differ ?

7b	W-2005	Why are ionic ceramics used as dielectric in capacitors, what does dielectric constant depend on ? What is ferro-electric ceramics, is it necessary for iron to be present ?
7c	W-2005	Distinguish between structure and properties of thermosetting and thermoplastic resins.
7d	W-2005	Is substitutional solid solution of ceramics possible ? What is the additional condition, which is not a requi metals ?
8a	W-2005	Distinguish between paramagnetism and ferromagnetism, explaining the mechanism involving electron sp
8b	W-2005	Draw the hysterisis loop for hard and soft magnets, and explain the differences in behaviour in response to field with emphasis on the magnetization parameters.
8c	W-2005	Distinguish between addition and condensation polymerization, and state which of those are applied for p polyethylene and poly carbonates.
8d	W-2005	Using the character of electron distribution in different energy bands, explain the cause behind a material conductor, and other acting as insulator.
1a	S-2006	Explain semiconductors, intrinsic and extrinsic semiconductors.
1b	S-2006	mention four strengthning mechanisms of metals and alloys. Explain any one of them.
1c	S-2006	Why are metals mostly ductile and ceramics mostly brittle at room temperature ?
2a	S-2006	What are the invariant points [degrees of freedon=0] in a binary phase diagram with eutectic ?
2b	S-2006	Explain the terms isomorphous, eutectic, peritectic and eutectoid systems.
2c	S-2006	Explain how will you determine the elastic and plastic components of strain from a sketimatic stress-strain showing loading and unloading in plastic strain range.
2d	S-2006	Define the following ters (i) Yield Strength (ii) Tensile Strength (iii) Poisson's Ratio
3a	S-2006	Explain the mechanism of creep.
3b	S-2006	Distuinguish between ductile and brittle fracture.
3c	S-2006	What do you mean by Normalising and Tempering and indicate how those heat treatement affect the prop steel ?
3d	S-2006	A sodium silicate glass has no surface defects as etching has removed them, but has a crack inside from 2 u length. Calculate the surface energy of glass if fracture strength = 100 MNm-2 and Young's modulus=70 GN
4a	S-2006	Write a note on viscoelastic properties of materials, showing schematic plots of variation of stress with str with time.
4b	S-2006	Differentiate between Edge and Screw dislocation.

4c	S-2006	Explain cold working, warm working and hot working.
4d	S-2006	What is Buschinger's Effect ?
5a	S-2006	Discuss the mechanism of age hardening of Al alloys.
5b	S-2006	How is hardenability is carried out ?
5c	S-2006	Discuss the heat transfer characteristics during quenching and it's effects on mechanical properties.
5d	S-2006	Disciss the nitriding process.
6a	S-2006	What are hthe effects of high temperature on mechanical properties of metals ?
6b	S-2006	What will be your considerations for choice of an alloy for high temperature applications ?
6c	S-2006	A continuous and aligned glass fibre reinforced composite consists of 40 vol % of glass fibre having a modu 69 Gpa and 60 vol % of a polyester resin that, when hardened, displays a modulus of 3.4 Gpa. Calculate the elasticity of this composite in the longitudinal directions.
6d	S-2006	Discuss Zone Theory of solids and explain Zones in conductors and insulators.
7a	S-2006	A transformer core is wound with a coil carrying an alternating current at a frequency of 50 Hz. Assuming t magnetism to be uniform throughout the core volume of 0.02 m+3. calculate the hysteresis loss. The hyste has an area of 80,000 units, when teh axes are drawn in units of 10-4 Wbm-2 and 10-2 Am-1.
7b	S-2006	Distinguish between soft and hard magnets.
7c	S-2006	Write the peritectic, eutectic and eutectrial reaction of Fe-Fe3C phase diagram.
7d	S-2006	Discuss the cooling process of 0.6 % C steel from 1500 degree centigrade to room temperature.
8a	S-2006	Give some applications of Polyethylene, Nylon and Polyester.
8b	S-2006	What is Polymerization ? With the help of suitable examples, compare and contrast the process of additio polymerization and condensation polymerization.
8c	S-2006	Name two commonly used thermosetting polymers and their applications.
8d	S-2006	Why are fibre glass reinforced composites used extensively ?