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திருப்பனந்தாள் - 612504

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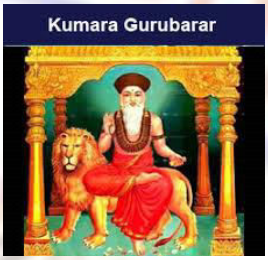

QUESTION BANK

Title of the Paper

Material Science

Course: III B.Sc. Physics

Prepared by

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MAJOR BASED ELECTIVE I
MATERIAL SCIENCE

Objectives:

To develop knowledge in material science and to understand the relationship between properties and material characteristics.

UNIT I Crystal Structure

Types of crystals-space lattice-basis- unit cell and lattice parameters – Bravais lattices-Lattice planes and Miller indices-inter planar spacing in a cubic latticecubic lattice-SC – BCC – FCC-Sodium chloride and Diamond crystal structure – Bonding of solids (Ionic , Covalent , Metallic , Hydrogen and Van der Waal).

UNIT II Super Conducting Materials

Superconductivity – Properties-Meissner's effect- London equations - types of superconductors Type I and Type II –High temperature superconductors - Josephson effects and its applications – SQUIDS - Applications of superconductor.

UNIT III Nano Materials

Nanoscience and nanotechnology – Nanomaterials- Properties of nanomaterials (size dependent) -synthesis of nanomaterials- Fullurenes-Application of nanomaterials – Carbon nanotubes- Fabrication and structure of carbon nano tubes - Properties of carbon nanotubes (Mechanical and Electrical) - Applications of CNT's.

UNIT IV Smart Materials

Metallic glass and its applications — Fiber reinforced metals – SAW Materials and its applications – Biomaterials – Ceramic-Nuclear engineering materials-Nanophase materials - SMART materials- Conducting polymers- Optical materials - Fiber optic materials and their applications.

UNIT V Mechanical Behavior Of Materials

Different mechanical properties of engineering materials – creep – Fracture technological properties – factors affecting mechanical properties of material-Heat treatment-cold and hot working-types of mechanical tests- metal forming process deformation of metals-Deformation of crystals and polycrystalline materials.

Books for study:

1. Dr. M.N. Avadhanulu, *Material science*, S.Chand & Company, New Delhi, 2014.

Books for Reference:

1. M.Arumugam, *Material science*, Anuradha puplishers, 1990.
2. V. Raghavan, *Material Science and Engineering* , Printice Hall India.,2004.
3. V. Rajendran, *Material Science*, Tata McGraw Hill Ltd, New Delhi,2001.

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UNIT- I
(CRYSTAL STRUCTURE)

CHOOSE THE CORRECT ANSWER

1. Lead is a metallic crystal having a _____ structure.
   a) FCC
   b) BCC
   c) HCP
   d) TCP

2. Which of the following has a HCP crystal structure?
   a) W
   b) Mo
   c) Cr
   d) Zr

3. Amorphous solids have _____ structure.
   a) Regular
   b) Linear
   c) Irregular
   d) Dendritic

4. At ___ iron changes its BCC structure to FCC.
   a) 308°c
   b) 568°c
   c) 771°c
   d) 906°c

5. Which of the following is a property of non-metallic crystals?
   a) Highly ductile
   b) Less brittle
   c) Low electrical conductivity
   d) FCC structure

6. Which of the following is not an amorphous material?
   a) Glass
   b) Plastics
   c) Lead
   d) Rubbers

7. The crystal lattice has a ___ arrangement.
   a) One-dimensional
   b) Two-dimensional
   c) Three-dimensional
   d) Four-dimensional

8. The smallest portion of the lattice is known as ____.
   a) Lattice structure
   b) Lattice point
   c) Bravais crystal
   d) Unit cell

9. Bravais lattice consists of ____ space lattices.
   a) Eleven
   b) Twelve
   c) Thirteen
   d) Fourteen

10. The axial relationship of a monoclinic crystal system is given as ____ .
    a) a=b=c
    b) a=b≠c
    c) a≠b=c
    d) a≠b≠c

ANSWERS:

1) a 2) d 3) c 4) d 5) c 6) c 7) c 8) d 9) d 10) d

TWO MARKS

11. What are the types of crystals?
12. Define Space lattice.
13. Define Unit cell.
14. What is Lattice parameter?
15. Define Cubic lattice.
16. What is BCC?
17. What is FCC?
18. What is Ionic bond?
19. What is Covalent bond?
20. Define Crystal structure.

FIVE MARKS

21. Discuss the Space lattice unit cell and lattice parameters.
22. Explain the Bravais lattices.
23. Explain the lattice planes and Miller indices.
24. Write a short note Inter planar spacing in a Cubic lattice.
25. Explain the Cubic lattice SC.
26. Explain the Cubic lattice BCC.
27. Explain the Cubic lattice FCC.
28. Brief explanation of the Sodium chloride.
29. Explain the Diamond crystal structure.
30. Explain the Metallic bond.

TEN MARKS

31. Explain the types of Crystals.
32. Explain the Bravais lattices, lattice planes and miller indices.
33. Describe the Inter planar spacing in a Cubic lattice.
34. Describe the Cubic lattice SC, BCC and FCC.
35. Explain the Sodium chloride and Ionic bond.
36. Explain the Diamond crystal structure.
37. Explain the bonding of solids covalent bond.
38. Explain the Metallic bond and Ionic bond.
39. Explain the Covalent bond and Hydrogen bond.
40. Explain the Hydrogen and Vander waal.

UNIT- II
(SUPER CONDUCTING MATERIALS)

CHOOSE THE CORRECT ANSWER

1. In super conductivity the conductivity of a material becomes
   a) Zero
   b) Finite
   c) Infinite
   d) None of the above

2. The super conducting state is perfectly _____ in above.
   a) Diamagnetic
   b) Paramagnetic
   c) Ferromagnetic
   d) All of the above

3. The energy required to break a cooper pair is ____ of the energy gap of super conductor.
   a) One half
   b) Equal to
   c) Twice
   d) Thrice

4. Super conductivity was first observed by
   a) Ohm
   b) Ampere
   c) H.K.Onnes
   d) Schrieffer

5. The first successful theory on super conductivity was due to
   a) Schrieffer
   b) Onnes
   c) Ampere and Schrieffer
   d) Bardeen cooper and Schrieffer

6. The current in a super conductor produces
   a) Zero, voltage drop across it
   b) A small voltage drop across it
   c) A large voltage drop across it
   d) A strong electric, field around it

7. The critical temperature the resistance of a super conductor
   a) Increase rapidly
   b) Decrease rapidly
   c) Remain constant
   d) Increase slowly

8. Super conductivity is exhibited by
   a) Hydrogen at 4.2 k
   b) Mercury at 4.0 k
   c) Mercury at 4.2 k
   d) Potassium at 4.2 k

9. The magnetic lines of force cannot penetrate the body of a super conductor a phenomenon is known as
   a) Isotopic effect
   b) Bcs theory
   c) Meissner effect
   d) London theory

10. Which of the following conductor has highest critical temperature
   a) Aluminium
   b) Zinc
   c) Molybdenium
   d) Tin

ANSWERS:

1) c 2) a 3) b 4) c 5) d 6) d 7) b 8) a 9) c 10) d

TWO MARKS

11. Define Super conductivity.
12. Define properties of Meissner's effect.
13. What are the types of super conductors?
14. What are the type of I super conductors?
15. What are the type of II super conductors?
16. What are high temperature super conductors?
17. What are Josephson effects?
18. Define Squids.
19. What are Josephson effects and its application?
20. What are applications of super conductors?

FIVE MARKS

21. Explain the super conductivity.
22. Explain the propertiesMeissner's effect.
23. Describe the London equations.
24. Explain the types of super conductors.
25. Explain the high temperature super conductors.
26. Explain the type I and type II.
27. Briefly explain the Josephson effects and its applications.
28. Explain the Squids.
29. Explain the applications of super conductors.
30. Describe the Josephson's effects and its applications.

TEN MARKS

31. Describe the super conductivity.
32. Explain the propertiesMeissner's effect.
33. Explain the London equations.
34. Explain the type I and type II.
35. Briefly explain the Josephson effects and its applications.
36. Explain the Squids and super conductivity.
37. Explain the London equations and applications of super conductor.
38. Explain the Squids and Josephson effects and its applications.
39. Explain the Meissner's effect and type I and type II.
40. Explain the super conductivity and high temperature super conductors.

UNIT-III
(NANO MATERIALS)

CHOOSE THE CORRECT ANSWER

1. For high sensitivity or selectivity environmental sensors to sense the gaseous chemical like
   a) Co_2
   b) No_3
   c) O_2
   d) No

2. Fabrics are extensively made out of nano materials like.
   a) Carbon nano tubes
   b) Fullerenes
   c) Mega tubes
   d)Polymers

3. The synthesized magnetic Nano particles from ____ have been found to Self arrange automatically.
   a) Zinc
   b) Copper
   c) Iron
   d) Zirconium

4. The Nano particles from Iron and Palladium are used to produce____.
   a) Magnets
   b) Magnetic lens
   c) Magnetic meters
   d) Magnetic storage devices

5. Nano particles target the rare ___ causing cells and remove them from blood.
   a) Tumour
   b) Fever
   c) Infection
   d) Cold

6. ____ is the field in which the Nano particles are used with Silica coated Iron oxide.
   a) Magnetic applications
   b) Electronics
   c) Medical diagnosis
   d) Structural and Mechanical materials

7. Coating the Nano crystals with the ceramics is carried that leads to ___.
   a) Corrosion
   b) Corrosion resistant
   c) Wear and tear
   d) Soft

8. The ____ to the ceramics are superior coatings.
   a) Nano particles
   b) Nano powder
   c) Nano crystals coating
   d) Nano gel

9. ____ of ceramic components are easier through Nano structuring.
   a) Lubrication
   b) Coating
   c) Fabrication
   d) Wear

10. Industrial catalysts should have ____ surface area.
    a) High
    b) Low
    c) Moderate
    d) No

ANSWERS:

1) d 2) b 3) c 4) d 5) a 6) c 7) b 8) c 9) c 10) a

TWO MARKS

11. Define Nano Science.
12. Define Nano Technology.
13. Define Nano materials.
14. What is synthesis of Nano materials?
15. Define properties of Nano materials?
16. What is Fullurenes?
17. What are Carbon Nano tubes?
18. Define Fabrication.
19. What is CNT's?
20. Define Electrical properties of Carbon Nano tubes.

FIVE MARKS

21. Explain the Nano Technology.
22. Explain the properties of Nano materials size dependent.
23. Describe the synthesis of Nano materials.
24. Explain the applications of Nano materials.
25. Explain the Carbon Nano tubes.
26. Explain the Fabrication and structure of Carbon Nano tubes.
27. Explain the mechanical properties of Carbon Nano tubes.
28. Explain the Electrical properties of Carbon Nano tubes.
29. Explain the applications of CNT's.
30. Explain the Fullurenes.

TEN MARKS

31. Explain the Nano Science and Nano Technology.
32. Explain the Nano materials.
33. Briefly explain the properties of Nano materials size dependent.
34. Explain the synthesis of Nano materials.
35. Explain the Fullurenes and Nano materials.
36. Explain the applications of Nano materials.

37. Explain the Carbon Nano tubes.
38. Explain the Fabrication and structure of Carbon Nano tubes.
39. Explain the Mechanical Electrical Carbon Nano tubes.
40. Briefly explain the applications of CNT's.

UNIT- IV
(SMART MATERIALS)

CHOOSE THE CORRECT ANSWER

1. Which of the following impurity in cast Iron makes it hard and brittle?
   a) Silicon
   b) Sulphur
   c) Manganese
   d) Phosphorus

2. Tensile strength of steel can be safely increased by
   a) Adding Carbon up to 2.8%
   b) Adding Carbon up to 6.3%
   c) Adding Carbon up to 0.83%
   d) Adding small quantities of Copper

3. Which of the following metal is used for Nuclear energy?
   a) Uranium
   b) Thorium
   c) Niobium
   d) All of these

4. Cemented carbide bods are not found to be suitable for cutting.
   a) Brass
   b) Cast iron
   c) Aluminium
   d) Steel

5. Brass (alloy of Copper and Zinc) is an example of
   a) Substitutional solid solution
   b) Interstitial solid solution
   c) Intermetallic compounds
   d) All of the above

6. Pick up the wrong statement Nickel and Chromium in Steel help in
   a) Providing corrosion resistance
   b) Improving machining properties
   c) Providing high strength
   d) At elevated temperature

7. Which of the following has a fine Gold colour and is used for imitation jewellery?
   a) Silicon bronze
   b) Aluminium bronze
   c) Gun metal
   d) Babbitt metal

8. Steel contains
   a) 80% or more Iron
   b) 50% or more Iron
   c) Alloying elements like Chromium, Tungsten, Nickel and Copper
   d) Elements like Phosphorus, Sulphurand Silicon in varying quantities

9. Normalizing of Steel is done to
   a) Refine the grain structure
   b) Remove strains caused by cold working
   c) Remove dislocations caused in the internal structure due to hot working
   d) All of the above

10. Amorphous material is one
   a) In which atoms align themselves in ageometric pattern upon solidification
   b) In which there is no definite atomicstructure and atoms exist in a random pattern just as in a liquid
   c) Which is not attacked by Phosphorous
   d) Which emits fumes on melting

ANSWERS:

1) b 2) c 3) d 4) d 5) a 6) b 7) b 8) b 9) d 10) b

TWO MARKS

11. What is Metallic glass?
12. Define Fiber reinforced metals.
13. Define SAW materials.
14. What is Biomaterials?
15. Define Ceramic.

16. Define Nano phase materials.
17. Define Smart materials.
18. What are Optical materials?
19. Define Fiber optic materials.
20. What is Nuclear engineering material?

FIVE MARKS

21. Explain the Metallic glass and its applications.
22. Explain the Fiber reinforced metals.
23. Explain the SAW materials.
24. Discuss the Biomaterials.
25. Explain the Nano phase materials.
26. Write a short note on Smart materials.
27. Give a brief explanation on conducting polymers.
28. Explain the Optical materials.
29. Explain the Nuclear engineering materials.
30. Explain the Fiber optic materials.

TEN MARKS

31. Explain the Metallic glass and its applications.
32. Explain the Fiber reinforced metals and SAW materials.
33. Explain the Saw materials and its applications.
34. Explain the Biomaterials and Ceramic.
35. Discuss in detail Nuclear engineering materials.
36. Briefly explain the Nano phase materials.
37. Explain the Smart materials.
38. Explain the conducting polymers.
39. Explain the Optical materials.
40. Explain the Fiber optical materials and their applications.

UNIT- V
(MECHANICAL BEHAVIOR OF MATERIALS)

CHOOSE THE CORRECT ANSWER

1. The tendency of a deformed solid to regain its actual proportions instantly upon unloading known as
   a) Perfectly elastic
   b) Delayed elastic
   c) Inelastic effect
   d) Plasticity

2. How is young's modulus of Elasticity defined?
   a) (P/A)
   b) (Δl/l)
   c) (Pl/ΔlA)
   d) (m/V)

3. The permanent mode of deformation of a material is known as
   a) Elasticity
   b) Plasticity
   c) Slip deformation
   d) Twining deformation

4. The ability of materials to develop a characteristic behavior under repeated loading known as
   a) Toughness
   b) Resistance
   c) Hardness
   d) Fatigue

5. What is the unit of Tensile strength of a material?
   a) $\frac{\sigma}{\epsilon}$
   b) Kg/cm^2
   c) $\frac{\epsilon}{\sigma}$
   d) cm^2/Kg

6. Which of the following factors affect the mechanical properties of a material under applied loads?
   a) Content of alloys
   b) Grain size
   c) Imperfection and defects
   d) Shape of material

7. The ability of a material to resist plastic deformation known as
   a) Tensile strength
   b) Yield strength
   c) Modulus of elasticity
   d) Impact strength

8. The ability of a material to be formed by hammering or rolling is known as
   a) Malleability
   b) Ductility
   c) Harness
   d) Brittleness

9. Deformation that occurs due to stress over a period of time is known as
   a) Wear resistance
   b) Fatigue
   c) Creep
   d) Fracture

10. What type of Wear occurs due to an interaction of surfaces due to adhesion of the metals?
    a) Adhesive Wear
    b) Abrasive Wear
    c) Fretting Wear
    d) Erosive Wear

ANSWERS:

1) a 2) c 3) b 4) d 5) b 6) d 7) b 8) a 9) c 10) a

TWO MARKS

11. Define Mechanical properties.
12. Define Creep.
13. Define Fracture.
14. What are the Technological properties?

15. Define Factors.
16. What is Heat treatment?
17. Define Cold.
18. Define Hot.
19. What are Mechanical tests?
20. Define metal forming process.

FIVE MARKS

21. Explain the different Mechanical properties of engineering materials.
22. Explain the Technological properties.
23. Explain the factors affecting Mechanical properties of material.
24. Write a short note on Heat treatment.
25. Explain the Cold and Hot working.
26. Explain the types of Mechanical tests.
27. Explain the metal forming process deformation of metals.
28. Explain the deformation of Crystals.
29. Explain the polycrystalline materials.
30. Write a short note on Creep and Fracture.

TEN MARKS

31. Explain the Mechanical properties of engineering materials.
32. Explain the Technological properties.
33. Explain the factors affecting Mechanical properties of material.
34. Explain the Heat treatment and Creep.
35. Explain the Cold and Hot working.
36. Briefly explain the types of Mechanical tests.
37. Explain the metal forming process.
38. Explain the deformation of metals.
39. Explain the deformation of Crystals.
40. Explain the polycrystalline materials.