



Name :

Roll No. :

Invigilator's Signature :

**CS/B.TECH (CHE)/SEM-4/CHE-403/2010
2010**

MATERIALS SCIENCE AND TECHNOLOGY

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

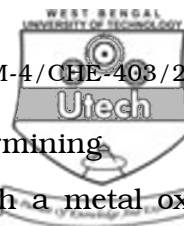
1. Choose the correct alternatives for any *ten* of the following :

$$10 \times 1 = 10$$

- i) The tiny block formed by the arrangement of small group of atoms is called
 - a) unit cell
 - b) space lattice
 - c) lattice point
 - d) none of these.
- ii) According to Bravais, there are possible types of space lattice in seven basic crystal system.
 - a) 8
 - b) 14
 - c) 20
 - d) 24.
- iii) Atomic packing factor of a simple cube is approximately equal to
 - a) 0.4
 - b) 0.42
 - c) 0.52
 - d) 0.8.



- iv) Recovery process in cold worked metal can be studied by
 - a) hardness
 - b) resistivity
 - c) fracture toughness
 - d) Young's modulus.
- v) Critical resolved shear stress in a single crystal is calculated by applying
 - a) Brag's law
 - b) Hook's law
 - c) Schmid's law
 - d) Frank-Reed law.
- vi) Pearlite is obtained when steel is
 - a) quenched in oil
 - b) cooled in still in air
 - c) slowly cooled in furnace
 - d) quenched in water.
- vii) Flux is added to ore in the smelting operation to
 - a) increase melting point of slag
 - b) decrease melting point of slag
 - c) increase melting point of gangues
 - d) decrease melting point of ore.
- viii) Sinter roasting is done for the ores
 - a) that are found in fine form
 - b) that are free flowing
 - c) that contains high % of gangues
 - d) that contains less % of gangues.



- ix) Predominant area diagram helps in determining-
- partial pressure of oxygen at which a metal oxide can be reduced to metal
 - partial pressure of sulphur dioxide at which a metal sulphide can be reduced to metal
 - stable form of any metal compound at a specific % of SO_2 & O_2
 - all of these.
- x) Iron obtained from blast furnace is known as
- wrought iron
 - cast iron
 - pig iron
 - soft iron.
- xi) Cowper stoves are provided in a blast furnace to
- provide hot air supply to it
 - supply coke to charge
 - provide a stove in which coal is burned to get coke
 - none of these.
- xii) Leaching is a unit operation associated with
- hydrometallurgy
 - electrometallurgy
 - pyrometallurgy
 - refining.

GROUP – B

(Short Answer Type Questions)

Answer any *three* from the following. $3 \times 5 = 15$

2. Establish the relationship $d = \frac{1}{\left(\frac{h^2}{a^2} + \frac{k^2}{b^2} + \frac{l^2}{c^2} \right)}$ for the

distance between adjacent planes in a crystal.



3. Write short notes on $T-T-T$ diagram.
4. Why is smelting required ? What are the differences between reduction smelting and metallothermic smelting ? Discuss the reduction smelting of iron ore. 2 + 3
5. Differentiate between cold and hot working of metals. 5
6. Differentiate between hydrometallurgy and pyrometallurgy. Show the steps in the Electrometallurgical process of extraction of aluminium. 2 + 3

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) What do you mean by powder metallurgy ?
b) State the advantages and limitations of powder metallurgy. 3 + 12
8. a) What is hardening ? Describe the process briefly.
b) What is martempering ? (4 + 6) + 5
9. Explain the property and microstructural changes during cold working and annealing of metals.
10. a) What is corrosion ? Explain different methods to prevent corrosion. 1 + 5
b) Define plastic deformation and strain hardening. Explain the mechanism of slip. (1 + 5) + 2 + 2 + 5
11. a) Why does the fatigue fracture occur ? Describe the ways by which fatigue life can be improved.
b) What is galvanic corrosion and how is it protected ? What is the role of non-metallic coating on corrosion prevention ? (2 + 2) + 6 + 5

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