RAMAKRISHNA MISSION VIDYAMANDIRA
(Residential Autonomous College affiliated to University of Calcutta)

SECOND YEAR [2015-18]
B.A./B.Sc. THIRD SEMESTER (July – December) 2016
Mid-Semester Examination, September 2016

Date : 10/09/2016

Time : 11 am – 1 pm

INDUSTRIAL CHEMISTRY (Honours)

Paper : III

Full Marks : 50

[Use a separate Answer Book for each group]

Group – A
[*Answer any three questions*]

1. Differentiate between seven crystal systems and Bravais Lattice. Draw (001) plane and [112] direction in a cubic crystal. [3+2]

2. a) Calculate the r/R ratio in a tetrahedral and octahedral void where r = cationic radius, R = anionic radius. [3]
   b) Calculate the c/a ratio for an ideally close packed HCP crystal. [2]

3. a) Distinguish between the single crystalline and poly crystalline material with suitable example. [2]
   b) Beryllium has HCP unit cell having c/a ratio = 1·568. If the radius of Be atom is 0·1143nm—
      i) determine the conventional unit cell volume
      ii) If the atomic weight of Be is 9·012 gm/mol, calculate its theoretical density. [3]

4. a) Write Pauling 2nd rule for coordination polyhedral. Calculate the coordination number of O^{2-} in SiO_2. [1+2]
   b) What is polymorphic transformation? Give example. [2]

5. a) Copper has atomic radius of 0·128 nm, and FCC crystal structure, and an atomic weight of 63·5g/mol. Compute its theoretical density. [2]
   b) Calculate the packing efficiency of diamond cubic. [3]

Group – B
[*Answer any three questions*]

6. Write basic principle for extraction of copper from copper pyrites ore. Give the compositions of some important copper alloys and its applications. [3+2]

7. State the Zachariasen concept of glass formation. How a glass structurally differs from crystalline substances? Cite a few glass forming systems. [2+2+1]

8. Give the chemical composition of 'Pyrex' glass. Mention various viscosity temperature dependence points in SLS glass making. What is understood by annealing of glass? [2+2+1]

9. Write short notes on (**any two**) : [2×2·5]
   a) Vycor glass
   b) Flint glass
   c) Bioglass
   d) Single bond strength and glass forming oxides

Group – C
[*Answer any two questions*]

10. Why cryolite is added in Hall-Heroult process? What are the advantages of Hydro metallurgical extraction process? What is acidic leaching? [2+2+1]

11. Why iron carbon diagram is metastable? What are the phases present in a 0·2% C steel below eutectoid temperature? Write down the eutectic reaction for iron carbon diagram? [2+2+1]

12. What are the significance of Predominance diagram and Ellingham diagram in metallurgical engineering? [2·5+2·5]

Group – D

[*Answer any two questions*]

1. Define the term "Fuel" from technocommercial View Point.

    Convert 1000 BTU into Kilocalories and KiloJoules. "Ethyl Alcohol" was used as fuel for Internal Combustion Engine during World War II in place of Motorgasoline (C_6H_{14}). Calculate heating value of each assuming complete combustion.

    [C_{HV} = 8137 Cal/g and H_{HV} = 34000 Cal/g, (HV = Heating value)] [1+1+3]

2. Write short notes highlighting occurrence, C.V and use of the following fossil fuels

    a) Peat   (b) Lignite

    A bituminous coal was found to contain moisture – 2%, volatile matter – 35% and Ash – 30%. Calculate fixed carbon %. [2+2+1]

3. What is carbonization of coal?

    What are approximate yields of Tar, $(NH_4)_2SO_4$, and Gas per ton of coal carbonized in HTC and LTC process? Mention temperature on LTC Process.

    Fill in the blank :

    Metallurgical coke, also called _____ is used for _____ of metals where the coke acts as _____ agent to convert _____ into metal. [1+3+1]

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