

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.SC. THIRD SEMESTER EXAMINATION, DECEMBER 2011

THIRD YEAR

INDUSTRIAL CHEMISTRY (Honours)

Date : 16/12/2011

Time : 11 am – 2 pm

Paper : III

Full Marks : 75

[Use separate Answer Books for each group]

Group – A

1. Answer **any three** questions : [2×3]
 - a) What are materials science and materials engineering? [2]
 - b) How zeolite can exchange metal ion from the salt solution? [2]
 - c) What are point defects? Illustrate. [2]
 - d) Find out the atomic packing factor (APF) of an FCC crystal. [2]
2. Answer **any two** questions : [2×2]
 - a) Write a note on nanocrystalline material. [2]
 - b) What will be the nature of DTA curve of quartz if it is heated upto 1000°C from room temperature and then cooled to room temperature at the same rate of heating? [2]
 - c) Explain briefly the structure of alumina. [2]

Group – B

Answer **any six** questions from question no. (3-11) : [5×6]

3. 1000 Kg of glass of molar composition $3\text{Na}_2\text{O} \cdot \text{SiO}_2$ is manufactured in a tank Furnace. Raw materials are Quartz sand (96% pure) and soda ash (98% pure) cost of Quartz sand and soda ash are Rs. 2500 and Rs. 1800 per Metric Ton respectively. Calculate the batch Formula, input-out-put ratio and Raw Material cost (RMC) per Metric Ton of glass. [5]
4. What are the disadvantages of OPC for using in domestic purposes? How those disadvantages are removed now-a-days? What do you mean by high alumina cement? [3+1+1]
5. What is Glass? Write in brief the manufacturing process of common glass in a Glass Tank Furnace? What are the chemical reactions occurs during glass making? [1+3+1]
6. Mention important mineralogical phases of Portland cement clinker. Classify PC as per ASTM code into Five classes. Explain with equations how $\text{C}_3\text{S}_2\text{H}_3$ gel is formed from C_3S and C_2S during hydration of PC. [$1\frac{1}{2}+1\frac{1}{2}+2$]
7. What are the fabrication methods generally used for white ware body manufacturing? Discuss in brief for slip casting and Jigger and Jolly process. [1+4]
8. Fill up the gaps (**any five**) : [1×5]
 - a) _____ refractory is a must in steel making for removal of _____ and _____.
 - b) Basic _____ process of steel making enhances steel output.
 - c) _____ refractory is now-a-days absolute except in coke oven.
 - d) Vacuum degassing is carried out for removal of _____ from steel.
 - e) _____ gas is bubbled throughout mass of molten steel for removal of _____ from steel.
 - f) _____ refractories and/or _____ is essential for glass Tank Furnace.
9. Write with a flow chart for sheet metal processing for enameling? Write in brief the theories of Adherence of enamel. [3+2]
10. What do you mean by acid, basic, neutral, special, insulating and monolithic refractories. Give one example in each refractory. [5]

11. Bone china articles are costlier compared to other porcelain article— Justify or criticize the statement. Compare glazed ceramic Tiles with ordinary clay tiles. [3+2]

Group – C

Answer **any four** questions from question no. (12-17) : [5×4]

12. Describe briefly the importance of Ellingham Diagram for the Metallurgical Processes with suitable diagram. [5]
13. Draw the Fe-C phase diagram and mention their austenite phase and martensitic phase. [5]
14. What are the raw materials used for the manufacture of pig-iron in blast furnace? What are the chemical reactions occur in Blast furnace? [2+3]
15. Describe the process of continuous casting of steel with suitable sketches. [5]
16. How metal copper is extracted from its ore— write in brief? [5]
17. Briefly explain the advantages and disadvantages of extraction of non-ferrous metals by Pyro Metallurgy, Hydro Metallurgy and Electro Metallurgy. [5]

Group – D

Answer **any three** questions from question no. (18-22) : [5×3]

18. The following data are available for a coal mined from Jharia colliery : [5]
- | | |
|--|---------------------------------|
| Proximate analysis percent, air dried | Ultimate analysis percent, dmmf |
| Moisture – 2·20 | Hydrogen – 6·20 |
| Ash – 16·50 | |
| Volatile matter – 31·70 | |
| Gross calorific value (air dried) – 6720 Kcal/Kg | |
- Calculate Net calorific value of the coal.
19. Describe HTC process of manufacture of metallurgical coke. Highlight the major fractions of coal Tar distillate with their boiling range and chemical compositions. [5]
20. Write short notes on : [2+2+1]
- Motor gasoline
 - Diesel Fuel
 - Cetane Number
21. What do you mean by direct heating and indirect heating? What are the advantages of electrically heating furnace? What type of furnace you select for firing of silicon carbide (SiC)? [2+2+1]
22. What is water (Blue) gas? What is its calorific value? Is it higher than Producer gas? If so, why? A Refinery stack gas has the following composition; vol. percent at STP. Moisture – 2·30, CO₂ – 7·0, O₂ – 0·70, CO – 18·0, H₂ – 12·50, CH₄ = 3·0, C₂H₄ – 0·50, N₂ – 56·0 Compute the difference between its gross and net C.V. [1+1+3]

