RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. FIFTH SEMESTER EXAMINATION, MARCH 2021
THIRD YEAR [BATCH 2018-21]

Date : 13/03/2021

Time : 11 am - 1 pm

INDUSTRIAL CHEMISTRY (Honours)

Paper : V [Gr. A]

Full Marks : 50

Unit - I

Answer **any five** questions: [5 × 5]

1. a) What is polymorphic transformation? Write the polymorphic transformation for silica.

    b) Write a short note on Pyrometric cone equivalent. [3+2]

2. a) Define the sintering & what is the driving force of sintering?

    b) What are the advantages of monolithic refractories over shaped refractories? [3+2]

3. a) What are disadvantages of conventional castable refractories?

    b) Write the importance of XRD analysis for refractory technology?

    c) Why 20% Al_2O_3 remaining SiO_2 is avoided for refractory manufacturing? [1+2+2]

4. a) Explain the differences between acidic and basic refractories with suitable examples.

    b) Give an example of a binary system for refractories materials. (Draw the phase diagram). [2+3]

5. a) Mention the properties and uses of alumina refractories.

    b) Draw & explain the alumina-silica phase diagram & mention the mullite formation region. [2+3]

6. a) What is the new heating scheduled of castable refractories followed by industries?

    b) Calculate the percent volume change as zirconia transforms from a tetragonal to a monoclinic structure. The lattice constants for the monoclinic unit cells are: a=0.5156 nm, b=0.5191 nm and c=0.5304 nm respectively. The angle β for monoclinic unit cell is 98.90. The lattice constants for the tetragonal unit cell are a=0.5094 nm and c=0.5304 nm. [2+3]

7. Write a Short note on Magnesia-Alumina phase diagram & explain the importance $MgAl_2O_4$ in the refractories application. [3+2]

Unit - II

Answer **any five** questions: [5 × 5]

8. a) Briefly discuss the Zachariasen's structural model of glass formation.

    b) Draw the viscosity versus temperature plot of the commercial soda-lime –silica glass and define annealing point, strain point and working point. [2+3]

9. a) Draw and explain the T-T-T diagram of glassy melt. Define the critical cooling rate (CCR) from this diagram.

    b) Why boro-silicate glasses have better thermal shock resistance and better chemical durability than soda-lime silica glass? [(2+1)+2]

10. a) Write the difference between crystal and glass.

    b) Explain why GeO_2 is a good network former with the help of this model.   [2+3]

11. a) Determine the final batch composition for the production of glass composition: $20Na_2O$-$5Al_2O_3$-$75SiO_2$

    b) Why glass is called a 'Super cooled liquid'?   [3+2]

12. a) Describe the structure of vitreous silica.

    b) Why alkali addition increases the coefficient of expansion and density of glass.   [2+3]

13. a) Which is the best nucleating oxide for ceramization of glass?

    b) A day Tank Furnace is charged with an intimately ground mixture of 1200 kg Quartz Powder, 770 Kg Lime Stone, 420 Kg Potash Feldspar and 530 kg soda Ash. Calculate the quantity of glass Produced and its composition in % of oxides basis.   [1+4]

14. a) Define glass from physical and chemical view points.

    b) What is annealing of glass?

    c) Write a short note about optical glass.   [1+1+3]

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