



Name :

Roll No. :

Invigilator's Signature :

CS/B.Tech(CHE-OLD)/SEM-5/CHE-503/2012-13

2012

CHEMICAL PROCESS TECHNOLOGY – I

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 × 1 = 10

- i) Raw materials for Modified Solvay process for manufacturing soda ash are
- a) Ammonia, salt, limestone
 - b) Ammonia, limestone, coke/coal
 - c) salt, limestone, coke/coal
 - d) none of these.

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- ii) Mercury cell process for caustic production compared to diaphragm cell process
- a) requires low initial investment
 - b) requires more power
 - c) produces lower concentrated NaOH
 - d) none of these.
- iii) Cement contains mainly
- a) CaO , SiO_2 , Al_2O_3
 - b) MgO , SiO_2 , K_2O
 - c) Al_2O_3 , MgO , Fe_2O_3
 - d) CaO , MgO , K_2O .
- iv) In the production of HNO_3 , high space velocity of the reactants is maintained to
- a) get high production rate
 - b) avoid temperature runaway due to highly exothermic reaction
 - c) avoid decomposition of ammonia
 - d) facilitate formation of NO_2 .



- v) In the Triple superphosphate, which of the following is three times that of Single superphosphate ?
- a) phosphorus content
 - b) phosphoric acid content
 - c) phosphorus pentoxide content
 - d) phosphorus trioxide content.
- vi) In pot transfer method of glass melt production the pots are generally made of
- a) terra-cotta
 - b) high alumina fireclay
 - c) china clay
 - d) porcelain.
- vii) Silica bricks is a type of refractory.
- a) Acidic
 - b) Basic
 - c) Neutral
 - d) none of these.
- viii) Which of the following chemical conversions is catalyzed by vanadium pentoxide for the manufacture of sulfuric acid by contact process ?
- a) $S(s) + O_2(g) = SO_2(g)$
 - b) $SO_2(g) + \frac{1}{2}O_2(g) = SO_3(g)$
 - c) $SO_3(g) + H_2O(l) = H_2SO_4(l)$
 - d) none of these.



- ix) Feed gas for SO_2 (g) to SO_3 (g) converter in a sulfuric acid manufacturing plant by contact process typically contains about
- a) 1-3% SO_2 (g) b) 7-10% SO_2 (g)
- c) 25-30% SO_2 (g) d) 50-55% SO_2 (g).
- x) Silica gel is used with vanadium pentoxide catalyst in the sulfuric acid manufacturing plant as
- a) a porous carrier
- b) an active catalytic agent
- c) a promoter
- d) none of these.
- xi) Catalyst used in Haber's process for ammonia is
- a) reduced iron oxide b) nickel
- c) oxidized iron oxide d) iron sulfate.
- xii) lacquers are paint constituents which are used as
- a) Pigments b) Volatile vehicles
- c) Nonvolatile vehicles d) Accelerators.



GROUP – B

(Short Answer Type Questions)

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

2. Show the construction of a diaphragm cell with proper cell notation and respective cell reactions. 5
3. Discuss about the characteristics of cement kilns. What parameters are strictly monitored during kiln feed operation ? 2 + 3
4. What are the major engineering problems associated with the ammonia synthesis in Haber's process ? 5
5. Mention different zones inside the converter with respect to mode of reactions in Ostwald's process of nitric acid manufacturing. Comment on the advantages of using $Mg(NO_3)$ for concentration of HNO_3 by extractive distillation. 3 + 2
6. Why is a refractory characterized by fusion point not by melting point ? What are the options for developing porosity of high temperature insulating bricks ? 2 + 3



GROUP – C

(Long Answer Type Questions)

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

7. a) How Solvay process of soda ash production has been modified in Dual process ? With a neat sketch, explain different steps of operation sequentially for Dual process of soda ash manufacturing. 2 + 6
- b) Briefly discuss about the role of 'over-voltage' in the electrolysis of brine solution. Make a comparative study of mercury cell and membrane cell process for NaOH and Cl₂ production with an eye of product purity and cost of production. 3 + 4
8. a) From physicochemical principles for the oxidation of SO₂ to SO₃, justify the optimum operational conditions of DCDA converter. 5
- b) In urea manufacturing process, how is biuret formation prevented ? Explain the chance of ammonium carbonate formation instead of desired ammonium carbamate. Briefly discuss about the engineering problems associated in the urea manufacturing unit. 3 + 2 + 5



9. a) Explain about the consolidated production technology of Phosphoric acid manufacturing (wet process) from rock phosphate with the technology of gypsum recovery and production of mixed fertilizer. 10
- b) What is triple-superphosphate ? Mention the necessary conditions of its manufacturing with related chemical reaction. 1 + 4
10. a) Name different constituents of paints with their principal functions. How is modern paint formulated with the concept of pigment volume concentration (PVC). 5 + 3
- b) Explain briefly about the manufacturing process of TiO_2 . 7
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