CHL 112: Chemical Process Technology

Major Examination; Date: 29/04/08; Maximum Marks = 40; Closed Book/ Notes

Use your space wisely, you will not get extra sheets for answers

1. Match the following licensors with the production of the following chemicals –

a. Montedison	a. Urea
b. Snamprogetti	b. Ammonia
c. Dorr Oliver	c. Phosphoric acid
d. Haldor Topsoe	d. Sulfuric acid
e. Kellogg	e. Nitric Acid

(5)

2. Methanol Synthesis: Methanol is synthesized by reacting syngas together – $CO + 2H_2 \rightarrow CH_3OH$; as you all know, it is an exothermic process favored by high pressures and limited by equilibrium. Reacting CO with Hydrogen may also cause undesirable reactions like Methanation (thermodynamically favored) and several FT products and even some higher alcohols. Therefore conversion and selectivity are closely related here, in a manner, that we have explained and talked about in class.

   Make a complete level 4 process flowsheet starting from methane and finally obtaining methanol as a liquid. Highlight assumptions made. (8)

3. Suggest reasons, why the membrane process is so popular today in the Chlor alkali business and why so many mercury businesses have been replaced by the membrane process. (4)

4. Answer the following questions concisely:
   a. Mention the main difference in sulfur control procedure in fluid bed coal combustion plant vs pulverized coal combustion plant. (1)
   b. Explain the term, 'stack losses', associated with combustion of fuel. Why do liquids give higher stack losses, compared to solid fuels? Will there be any stack losses if graphite is burnt? Why/ Why not? (2)
   c. Comment upon the pre-processing of phosphate rock ores in either case – the Wet Process and the Dry process for making Phosphoric acid. What are the primary differences in pre-processing strategies? (2)
   d. Why do Triple Superphosphates contain almost 3 times the level of P content than Superphosphates? (2)

5. Given coal as raw material, speculate and make a process flowsheet showing how coal may be processed and used to eventually produce ammonia. Apply any logical reasoning that you feel like. Explain all your assumptions and decisions. (6)

6. In modern technologies for Urea manufacture using CO_2 stripping, explain via a flow diagram (block diagram is OK), the 'synthesis' section. (4)

7. This is a thought for all of you to analyze and come up with a recommendation – The ports in Western India are ideal for import of natural gas which usually is shipped as LNG in tankers. Other petroleum feedstocks such as naphtha are also available (C_6 to C_{10}) as imports. Being a port, facilities for docking of ships are very good, and large volumes of commodities, raw materials and mineral imports may also be procured via the sea.

   Use your understanding of the raw materials, products and by-products from various processes – fertilizers, chlor-alkali, mineral acids, power sector etc., to show, via a product block diagram, how an integrated chemical complex can be set up. You may ignore petroleum refining. (6)