CHL 112: Chemical Process Technology

Major Examination; Date: 02/05/09; 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 – (5)

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

2. 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why the membrane process is so popular today in the Chlor alkali business and why so many mercury businesses have been replaced by the membrane process.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)

3. Answer the following questions concisely:
   a. 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)
   b. Why do Triple Superphosphates contain almost 3 times the level of P content than Superphosphates? (2)
   c. Why is the Stripping process important in urea production? What is being stripped from what? (2)

4. 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-network block diagram, how an integrated chemical complex can be set up. You may ignore petroleum refining. (5)

5. For the following processes, put forth a flow sheet showing <u>your best possible heat integration</u> scheme -
   a. An Ammonia Plant from Natural Gas feedstock (5)
   b. A Methanol Plant from Natural Gas feedstock ($CO + 2H_2 \leftrightarrow CH_3OH$) (5)
   c. A Sulfuric Acid Plant, using Cold Shot feed to the SO_2 converter (5)
   d. A Dual Pressure Nitric Acid Plant (5)

   Please give reasons, for your choice, too, very concisely.

   Additional Info. – In case of Methanol, Conversions do not go up to 100% per pass; therefore, recycling of syngas is essential