

CHL 112: Chemical Process Technology

Major Examination Date: 04/05/07; Max. Marks = 40; Closed Bk/ Notes

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

1. The main reaction for the gas phase catalytic dehydrogenation of ethanol to acetaldehyde is represented by the equation - $C_2H_5OH \rightarrow CH_3CHO + H_2$; Make a level 4 flow diagram representing the entire process. (4)
2. Natural gas obtained from an LNG terminal or from a gas field has to be processed prior to pumping in a pipeline. With the aid of a block diagram, show the various unit processes before pumping gas through a pipeline. (4)
3. From an entirely chemical engineering perspective, which process for making chlor-alkali, is the best? Analyze all options, give reasons. Comment upon other factors that may influence the growth of one technology over the other. (4)
4. Make a complete flow diagram for a caustic soda – Chlorine – Hydrogen plant using the membrane cell. Take into account 50% wt Caustic Soda as your final product and caustic soda concentrations of 33% wt coming out from the cathode of the electrolytic cell. Please mention the cathodic and anodic reactions, as well. Include all unit operations necessary and feed pretreatment, and product post-treatment, before you sell Cl_2 , H_2 and NaOH into the market. (8)
5. Answer the following questions concisely:
 - a. Mention the main difference is sulfur control procedure in fluid bed coal combustion plant vs pulverized coal combustion plant. (1)
 - b. Explain what is meant by 'casing head gasoline'. Is it good enough to be used in our car – why /why not? (2)
 - c. Why is it essential to remove CO_2 from natural gas prior to recovery of ethane, propane, and butane? (1)
 - d. 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? (4)
6. Given coal as raw material, speculate and make a process flowsheet showing how coal may be operated and processed to eventually produce ammonia. Apply any logical reasoning that you feel like. Explain all your assumptions and decisions. (6)
7. 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 components like Methane (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. (6)