BITS, PILANI-DUBAI, ACADEMIC CITY, DUBAI

SECOND SEMESTER 2008-2009

CHE C322 Chemical Process Technology

Third Year Chemical Engineering

COMPREHENSIVE EXAMINATION

(Closed Book)

01.06.09

DURATION: 3 Hours **MAXIMUM MARKS: 120**

Attempt ALL questions

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1. a) Describe briefly how Frasch process is used in extraction sulphur from the natural deposits. (5M)
   b) What is the main reaction in Contact Process of sulphuric acid; give the conditions in both the stages. (2+3M)

2 a) Name three important phosphate based fertilizers. (3M)
   b)) How is Ammonium phosphate manufactured?
   Give the key step. Highlight the unit operations carried out till it is packed for shipping. (2+5M)

3 a) Discuss with a clearly labeled flow sheet how NG/LPG is purified.
   (flow sheet – 5 marks, process description - 3 marks, MEP – 2 marks) (10M)
   b) Give the three steps in Nitric acid production.
   c) Give the block diagram of recycle process for urea manufacture by CO_2 –stripping (3+5M)

4 a) Enumerate how the wood is digested in the Kraft process up until the pulp is obtained.
   (Process description=5 marks + conditions. = 2marks) (7M)
   b) Discuss the role of 'fillers' in paper making.
   c) Name any two chemical by-products obtained from pulp industry.
   (3+2M)

5 a) What is 'froth floatation?"
   b) Discuss in detail the process and reactions in a cement Kiln.
   (4+8M)

6 a) How do soaps and detergents differ in their composition? Discuss by

giving an example.

b) Biodiesel, like methyl oleate, is produced by transesterification. Elucidate how biodiesel is produced starting from a triglyceride. (6+7M)

7 a) Illustrate with a neat flow diagram, the manufacture of vinyl chloride, monomer by the pyrolysis of ethylene dichloride method. Mention any one major engineering problem faced.
(flow sheet – 5 marks, process description - 3 marks, MEP – 2 marks) (10M)

b) Write the conversion of ethylene oxide to mono ethanolamine.

c) Name any two useful chemicals derived from propylene. (2+3M)

8. a) Name the four methods of classification of polymers.

b) How is the process developed by Ziegler-Natta for the production of high density polyethylene better than the old, original process developed by ICI?

c) Discuss briefly how Nylon-6 is synthesized. (6+4+5M)

9. a) Give any three significant features of a Pharmaceutical Industry.

b) Name any two major drug categories (other than antibiotics) and give an example in each. (3+4M)

c) Draw a labeled sketch of a bio fermenter as used in the production of penicillin. Discuss the medium used for growth and the importance of regulating the various parameters. (4+4M)

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Test - 2

(Open Book)

26.04.09

DURATION: 50 MINUTES **MAXIMUM MARKS: 60**

Attempt ALL questions

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1. a) Give any two uses of Phosphoric acid and specify their grades
   b) Though both the edible and essential oils come from the same sources, their uses are different. State them.
   c) What is the preferred method for extracting soya bean oil? Discuss briefly. (3+2+5M)

2. a) Phosphate free detergent builder.....
   b) How is glycerin produced from natural sources?
   c) Give one synthetic route to glycerin.
   d) Through chemical equations, explain Alfol process. (1+2+2+3M)

3. a) How is the wood digested in the Kraft process? Give equation.
   b) Draw the digester vessel and indicate the conditions.
   c) How does this process overcome one of the major engineering problems faced by this industry? (3+2+2M)

4. a) What is cement?
   b) Which is the preferred process dry or wet? Why?
   c) Give the sequence of Portland cement manufacture. (2+3+5)

5. How does one 'unlock' the energy value of the coal through gasification? Give a labeled sketch (5+5M)

6. a) Give the block diagram for the older, once-through process for urea production.
   b) Discuss briefly aided by a sketch, the features of Stamicarbon process for urea, involving CO_2 stripping.
   c) What is the major advantage of stripping processes? (5+7+3M)

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Test - 1

(Closed Book)

15.03.09

DURATION: 50 MINUTES **MAXIMUM MARKS: 60**

Attempt ALL questions

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1. Water gas mainly consists of (1 mark)

   a) CO, N_2, H_2 b) CO, H_2 c) H_2, CH_4 d) CO_2, N_2

2. In a reaction $2SO_2 + O_2 \leftrightarrow 2SO_3$, the reverse reaction becomes appreciable at a temperature of (1 mark)
   a)400°C b) 450°C c) 550°C d) 650°C

3. Red fuming nitric acid is concentrated acid having; (1 mark)
   a) Catalyst impurities b) H_2SO_4 and SO_3 c) Oxides of nitrogen
   d) Nitrating mixture of H_2SO_4 and HNO_3 e) None of the above .

4. Give any four uses of Sulfuric acid. (2 mark)

5. State clearly the difference between unit process and unit operation. Sketch the schematic representation for the following unit operations.
   A Spray drier (2 + 3 = 5 marks)
   B Centrifugal pump
   C Wet scrubber

6. Which unit has been introduced in the modern Nitric acid plant to be able to keep the effluent gases from having <50 ppm levels of NOX? (5 marks)

7. Explain the importance of drying SO_2 gas before it is lead into the catalytic convertor. (5 marks)

8. What is coking of coal?
   Which are the major impurities removed from the gas evolved by coking; list them along with the equipment used in removing them. (5 marks)

9. Sketch the flow sheet of the last stage of purification of natural gas. Which is the preferred chemical used in scrubbing H_2S gas and why? (5 marks)

10. What are the major engineering problems faced when producing Sulfur from oxidation-reduction of H_2S? (5marks)

11. Water gas can be produced in a regenerative process. Explain. (5marks)

12. Describe in detail the production of nitric acid with a neat flow sheet. Discuss the critical parameters involved in the reactions. (20 marks)

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SECOND SEMESTER 2007-2008

CHE UC322 Chemical Process Technology
Third Year Chemical Engineering
Surprise Quiz-3

DURATION: 15 MINUTES MAXIMUM MARKS: 15

1. a) After liquefaction of coal, the solids (carbon particles) are separated using this equipment.....

   b) How are carboxylic acids produced directly from coal?

   c) Hydrogenation of coal produces .... (1+2+1)

2. a) What is the main component of crude oil?

   b) Refinery crude petroleum is classified into three bases. Name any two of them.

   c) State the significance of octane number.

   d) Name any two allied industries fed by petroleum refineries.

   e) Give a chemical reaction occurring during catalytic cracking of petroleum. Give equation. (1+1+2+1+2)

PTO

3. a) Methane, a C_1 petrochemical compound is converted to this bulk chemical. Name it and state any one chemical it is, in turn, used to produce, give equation.

b) Two uses of ethylene.

(1+2+1)

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SECOND SEMESTER 2007-2008

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Surprise Quiz-2

DURATION: 15 MINUTES MAXIMUM MARKS: 15

1. a) Name the two different types of sulfuric acid based (wet) processes for the production of phosphoric acid.

   b) They are basically different in the way its by-product ..... is disposed.

   c) USP grade of phosphoric acid is used in ..... Industry.

   d) The phosphate rock deposits contain ..... range of fluorine. During the manufacturing process, the two main fluorine-based volatile gases formed are ..... and .....

   (2+1+1+1½)

2. a) Urea production is based on two approaches. Name them.

   b) Give the equation for ammonium carbamate decomposition. Does it happen in lower or higher pressure?

   c) Name the modern urea process which operates by CO_2 stripping.

   d) Name the side product formed during prilling. How can it be prevented from forming?

   (2+2+1+1½)

3. a) How does superphosphate fertilizer differ from triple super phosphate?

b) Phosphoric acid when neutralized with ammonia gives ..... fertilizer.

c) Name a typical unit operation done in a fertilizer plant.

(1+1+1)

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SECOND SEMESTER 2007-2008

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Surprise Quiz-1

23-02-09

DURATION: 15 MINUTES MAXIMUM MARKS: 15

1. a) Name two energy sources commonly utilized in chemical industries.

(1+1+1M)

b) Give the equation depicting the unit process of oxidation/combustion.

c) A major factor of consideration while choosing a route for making a chemical product.

2. Which property of sulfur is used in its extraction in Frasch Process? Give the raw materials involved in the process. (3M)

3. Give the chemical reactions involved in obtaining S from H_2S. (2M)

4. Give the material of construction (MOC) in the Chamber process.

What is the maximum concentration of sulfuric acid obtainable?

(2M)

5. In the Contact Process for manufacturing sulfuric acid:
   a) Which is the catalyst presently used and why? (2+1+2M)
   b) Optimum temperature range for oxidizing SO_2 to SO_3.
   c) How is DCDA Process better than the original Contact Process?