



**KENYATTA UNIVERSITY**  
**UNIVERSITY EXAMINATIONS 2011/2012**  
**SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE**  
**SCH 325: PETROCHEMICAL INDUSTRIES**

**DATE: WEDNESDAY, 4<sup>TH</sup> APRIL 2012**

**TIME: 11.00 A.M. – 1.00 P.M.**

**INSTRUCTIONS: Answer All Questions.**

Q1.

- a) Crude oil is separated into various fractions in an industrial refinery. What are the various fractions obtained and their temperature range, hydrocarbon composition and uses?
- b) Describe the composition of grease. How does it differ from that of lubricating oil?
- c) Fractions obtained from the refinery can be further modified to make them suitable as fuels or for the petrochemical industry. Using suitable examples explain how isomerization can be used to improve the quality of petrol.
- d) Show the reactions for:
  - (i) hydrodenitrogenation of quinoline and indole
  - (ii) Dehydrocracking of naphthalene
  - (iii) Alkylation of benzene with propene and 2-methyl propane (isobutane) with ethene.

Q2. (i) Ethene and propene are common starting materials for a wide variety of petrochemical monomers. Describe how you would prepare the following monomers:

- (a) Ethylene oxide and ethylene glycol
- (b) Vinyl chloride and vinyl acetate
- (c) Acrylic acid

(ii) HDPE and LDPE are two of the 'Big Six' monomers. Distinguish the polymers made by these monomers in terms of structure, properties and uses.

(iii) Polycarbonate of bisphenol A is thermoplastic while polycarbonate used in eyeglasses is a thermoset. What does this mean?

Show the reactions for the preparation of each polymer and explain how their structures affect their properties.

(iv) Nylon 6, a polyamide, is manufactured by the polyaddition of the monomer caprolactam. Suggest how you would prepare Nylon 6 starting from phenol.

Q3. Biodiesel and synthetic gas (syngas) are alternative fuels. Discuss what they are, how they are produced (value chain) and their applications in various industries. Suggest Business opportunities in the area of feedstock suppliers and Service Opportunities.

Q4. Combustion of petroleum products causes global warming – discuss.

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