RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. (General) Degree in Applied Sciences
Third Year - Semester I Examination – June / July 2018

CHE 3203 – CHEMISTRY OF POLYMERS

Time: Two (02) hours

Answer all questions.
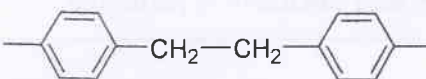Use of a non-programmable calculator is permitted.

1.　　a) Draw isotactic, syndiotactic and atactic structures of polystyrene.　　**(20 marks)**

　　　b) Define the degree of polymerization using a suitable example.　　**(20 marks)**

　　　c) Discuss the four (04) different types of copolymers using suitable molecular structures.

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　(20 marks)

　　　d) Define molar mass averages, $\bar{M}_n$, $\bar{M}_w$, and $\bar{M}_z$　　**(20 marks)**

　　　e) Calculate the number-average molar mass and the mass-average molar mass of a
　　　　mixture of two polymers, one having $M = 62$ kg mol^{-1} and the other $M = 78$ kg mol^{-1},
　　　　with their amounts (numbers of moles) in the ratio 3:2.　　**(20 marks)**

2.　　a) Write short notes on;

　　　　　i.　　Glass transition temperature

　　　　　ii.　　Melting temperature

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　(20 marks)

　　　b) What is the difference between linear polymers and cross linked polymers in terms of
　　　　their physical properties.　　**(20 marks)**

Cont.

c) Explain the effect of the backbone structure on the crystalline melting temperature of following polymer when R is substituted with the compounds A and B separately.

$$\left[\begin{array}{c} O \\ \| \\ C \end{array} - R - \begin{array}{c} O \\ \| \\ C \end{array} - O - CH_2 - CH_2 - O \right]_n$$
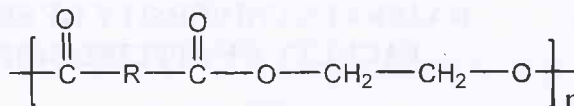
Compound	R	T_m (°C)
A		355
B		220

(20 marks)

d) Draw the stress-strain curve to differentiate the behavior of fibers, rigid plastics, flexible plastics and elastomers. **(20 marks)**

e) Young's modulus for polyethylene at room temperature is 1.2 GPa. What strain will be produced when a mass of 1.0 kg is suspended from a polyethylene thread of diameter 1.0 mm? **(20 marks)**

3. a) Explain how you determine the rate constant of the step growth polymerization for self-catalyzed systems, (Derivation of the equations are required). **(35 marks)**

b) Discuss the initiation step of cationic polymerization. **(30 marks)**

c) Gibb's free energy of polymerization ΔG_p, can be given as

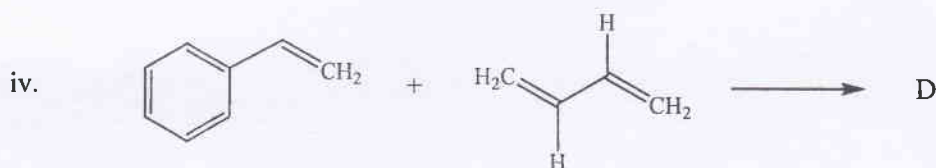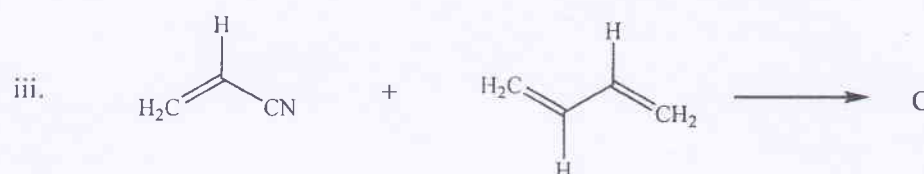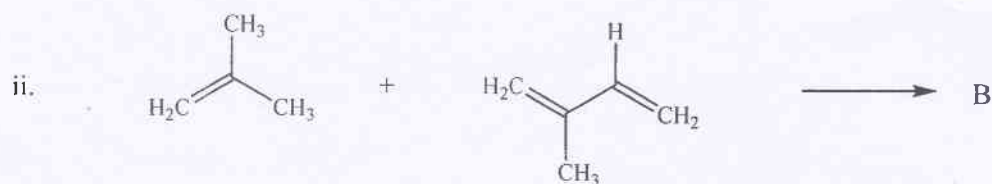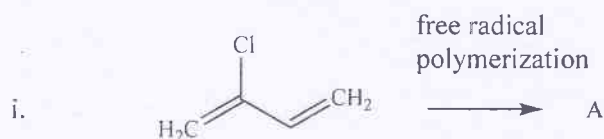$$\Delta G_p = \Delta H_p - T\Delta S_p$$

Where ΔH_p = Heat of polymerization
ΔS_p = Entropy of polymerization

Discuss the effect of temperature on the rate of polymerization. **(35 marks)**

4. a) Give the structures of polymers, A, B, C and D which are obtained from the following polymerizations.

i.

free radical polymerization → A

ii.

→ B

iii.

→ C

iv.

→ D

(20 marks)

b)

i. Write down the reaction of polycarbonate synthesis using appropriate monomers.

ii. State four (04) applications of polycarbonates.

iii. Why some polycarbonates are potential food hazardous.

(30 marks)

c) Discuss the two (02) types of phenol-formaldehyde resins. **(30 marks)**

d) List five (05) examples of natural fibers. **(20 marks)**

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