



The Open University of Sri Lanka

B.Sc Degree/Stand Alone courses in Science – Level 5

Final Examination – 2008/09

CHU 3238/CHE 5238 – Polymer Chemistry – Paper II

Duration : 3 Hours

Date: Friday 19th June 2009.

Time: 1.30 p.m. – 4.30 p.m.

| | | |
|--------------------------|---|--|
| Gas Constant (R) | = | 8.314 J mol ⁻¹ K ⁻¹ |
| Avogadro Constant (L) | = | 6.023 x 10 ²³ mol ⁻¹ |
| Planks Constant (h) | = | 6.63 x 10 ⁻³⁴ Js |
| Velocity of light (C) | = | 3.0 x 10 ⁸ ms ⁻¹ |
| Atmospheric Pressure (p) | = | 10 ⁵ Pa (Nm ⁻²) |
| Faraday constant (F) | = | 96,500 C mol ⁻¹ |
| Log _e (X) | = | 2.303 log ₁₀ (X) |

Instructions to candidates.

Answer any **four** questions out of six

If more than four questions are answered **only the first four** answers will be marked.

The use of a **non-programmable** calculator is permitted.

01. (a) "Aromatic polyesters have higher melting points than aliphatic polyesters"
Explain this statement.
- (b) i. What are the chemical constituents of Ziegler Natta catalyst?
ii. What is the importance of it?
- (c) i. What do you mean by copolymers?
ii. What are different types of copolymers? Explain.
iii. What is the importance of copolymerization reactions?
- (d) How does chain polymerization differ from step growth polymerization? Explain.
- (e) i. Write a brief account on emulsion polymerization.
ii. What are the advantages and disadvantages of this polymerization technique?
02. (a) What are the common preservatives used in latex industry?
- (b) What is the consequence of using high concentration of accelerator and activator relative to sulphur in the vulcanization process.
- (c) i. What are the essential ingredients for the vulcanization of rubber? Explain their role.
ii. Why do we add two types of activators for the vulcanization process?
- (d) i. What do you mean by oxidative degradation?
ii. How do you prevent this? Explain.
- (e) Write brief accounts on
i. Ribbed smoked sheets. ii. Plasticizers. iii. Thermoplastics
03. (a) i. What do you mean by glass transition temperature, T_g ?
ii. T_g values of polypropylene and poly(vinyl alcohol) are 253K and 354K respectively. Explain the difference.
- (b) i. Discuss the variation of specific volume with temperature for amorphous polymers.
ii. Why is rubber called visco-elastic material?
- (c) Discuss the factors that affect the crystallinity of a polymer?
- (d) What happens when polymer melt is cooled? Explain.
- (e) What do you mean by internal plasticisation? What is the purpose of doing it?

04. (a) How does the end group analysis carry out to calculate the number average molar mass, \overline{M}_n , of a given polymer? Explain.
- (b) Calculate the number average molar mass, \overline{M}_n , weight average molar mass, \overline{M}_w and the polydispersity factor of a hypothetical sample that contains equal weights of polymer having molecular weights of 10,000, 20,000 and 35,000.
- (c) Write short notes on following
- Optical activity of polymers
 - Swelling of polymers
 - Amorphous polymers

05. i. How does relative viscosity differ from specific viscosity? Explain.
- ii. Viscosity measurement experiments on a solution of polyester in THF at 20°C were carried out and following data were obtained.

| Concentration of the solution(gdL ⁻¹) | Flow time (s) |
|---|---------------|
| 0.000 | 250 |
| 0.100 | 350 |
| 0.300 | 500 |

Calculate the intrinsic viscosity average molar mass. ($\alpha = 0.50$, $k = 0.0001$)

- iii. What are the factors affecting the viscosity of a dilute polymer?
06. (a) i. What is meant by ceiling temperature?
 ii. What type of reactions occurs at the ceiling temperature (310°C) of polystyrene?
- (b) What are practical limitations for cationic polymerization?
- (c) "Average molar mass of the polymer formed in anionic polymerization is smaller than those formed by the free radical polymerization." Discuss this statement.
- (d) In diacid-dialcohol polymerization reaction, 10% more diacid is used. If the percent conversion is 99.8%, calculate the degree of polymerization.