

The Open University of Sri Lanka

B Sc Degree/ Stand Alone courses in Science - Level 5

Final Examination - 2007/2008

CHU 3238/CHE 5238 - Polymer Chemistry - Paper II

Duration: 3 hours

Date : Saturday 10 th June 2008		Time: 1.30 pm - 4.30 pm
Gas Constant (R)	=	8.314 J K ⁻¹ mol ⁻¹
Avogadro Constant (L)	, =	6.023 x 10 ²³ mol ⁻¹
Planck Constant (h)	. · ·	$6.63 \times 10^{-34} \text{ Js}$
Velocity of light (C)	. =	$3.0 \times 10^8 \text{ ms}^{-1}$
Atmospheric Pressure (π)	· ************************************	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) If the molar mass of the polyethylene is 56,000 gmol ⁻¹ , what is polymer? Suppose that the C-C bond distance is 154 pm.	the length of the
(b) What type of initiators can be used for the polymerization of acr Discuss.	ylonitrile? (30 marks)
(c) Discuss the methods of terminating free radical polymerization r	reaction. (30 marks)
(d) What are the differences between polymers and simple molecul	es? (10 marks)
(e) i. Write a brief account on suspension polymerization. ii. What are the advantages and disadvantages of this polymerization.	ation method? (30 marks)
02. (a) Discuss the changes of physical properties of a polymer during n	nilling process. (10 marks)
(b) i. What do you mean by photodegradation? ii. How do you prevent photodegradation? Explain.	(30 marks)
(c) What are the constituents of field latex?	(10 marks)
(d) i. What is meant by storage hardening? ii. How do you prevent storage hardening? Explain.	(20 marks)
(e) Write brief notes on, 1. plastisol. 2. thermoplastics.	3. fillers.
	(30 marks)
03. (a) i. What are copolymers? ii. Discuss the types of copolymers.	(30 marks)
(b) Discuss the change of state with temperature in polymeric mat (c) i. What do you mean by glass transition temperature?	erials. (30 marks)
ii. What is the importance of it? Explain. iii. How does the chain flexibility affect the value of T_g ? Discus iv. Briefly explain an experimental method to determine T_g .	s. (40 marks)

04. (a) A polydisperse sample of polystyrene is prepared by mixing three monodisperse samples in the following proportions.

1 g 10,000 molecular weight;

2 g 50,000 molecular weight;

2 g 100,000 molecular weight

Using this information calculate the

- (i) number average molecular weight
- (ii) weight average molecular weight

(iii) poly dispersity index

of the mixture.

(70 marks)

- (b) What structural parameters influence the melting point of crystalline and amorphous polymers.
- C List the factors affecting crystallinity and T_m of a polymer.

(30 marks)

- 05. (a) Write down the mathematical expressions for the following terms;
 - (i) relative viscosity
 - (ii) specific viscosity
 - (iii) intrinsic viscosity

(30 marks)

(b) Fractions of a polymer when dissolved in an organic solvent gave the following intrinsic viscosity values at 25°C.

M/g mol ⁻¹	34,000	61,000	130,000
[ŋ]	1.02	1.60	2.75

Determine K and a.

(50 marks)

(c) Give reasons for non-ideal behaviour of polymer solutions.

(20 marks)

06. (a) Write down the basic steps involved in polymerization of monomer (M) with a free radical initiator (I).

(40 marks)

(b) The rate equation for free radical polymerization is given by,

$$\frac{-d[M]}{dt} = R_p = k_p \sqrt{\frac{k_i}{k_t}} [M][I]^{\frac{1}{2}}$$

- (i) Identify all the terms given in the above equation
- (ii) What are the four assumptions considered in deriving the rate equation for free radical polymerization.
- (iii) Give the relationship of R_p with temperature.

(60 marks)