

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

M.A./M.Sc. SECOND SEMESTER EXAMINATION, MAY 2016

FIRST YEAR [BATCH 2015-17]

APPLIED CHEMISTRY

Date : 23/5/2016

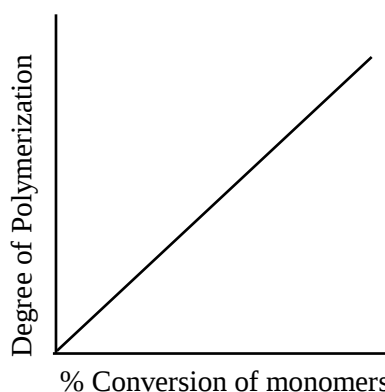
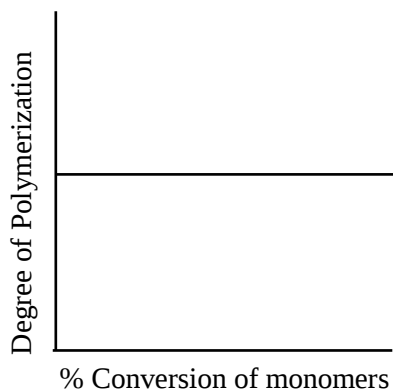
Time : 11 am – 1 pm

Paper : IX

Full Marks : 50

Answer questions no. 1 and any two from question nos. 2 to 4 :

1. a) Two different polymerizations could be characterized by the following two diagrams.



Explain them with proper reasoning.

[3+3]

- b) The kinetics of free radical polymerization is expressed as:
 $R_p = k_p/k_t^{1/2} (2fk_d)^{1/2} [I]^{1/2}[M]^{1/2}$, where the terms bear their usual meaning. Explain the auto-acceleration effect using this kinetic model. [4]
- c) Butyl acrylate and ethyl acrylate were copolymerized in toluene using AIBN as an initiator. The resultant copolymer was an oily liquid. However, when the reaction was repeated in benzene, a semi-solid polymer was isolated. Explain the phenomenon with proper reason. [3]
- d) PDI in an anionic polymerization is expressed as: $PDI = 1 + 1/X_n$. Explain, using this expression, why an anionic polymerization leads to a PDI very close to 1. [3]
- e) Arrange the following compounds in an ascending order of initiator strength in cationic polymerization.
 CF_3COOH , CH_3COOH , H_2SO_4 , $C_6H_5NO_2$, C_6H_5OH . Explain your answer. [5]
- f) You are supplied with two liquid specimens. One contains a “living” polymer while the other one contains a “dead” polymer. Both have similar microstructure and molecular weight. Explain a method of confirmation. [4]
- g) The viscosity average molecular weight of a polymer is related to its intrinsic viscosity by the following equation: $[\eta] = K [M_v]^\alpha$. You have prepared a polymer with two different architectures; one is a hyperbranched type (A) while the other one is a linear salt (B). Two sets of $[\eta]$ and α value are given in the table. The value of K is 21.6 and is fixed for both A and B.

Set	$[\eta]$	α
I	2.6	0.9
II	1.8	0.5

Calculate M_v of A and B.

[3+3]

- h) Explain with reason, which of the following compounds would act as initiator. Also mention, the type of polymerization it would preferentially initiate.
 $\text{C}_6\text{H}_5\text{CHCH}_2$, t-BuLi , AIBN, SnCl_2 , KNH_2 , H_2SO_4 , TiO_2 . [6]
- i) State whether the following statements are True or False. You don't have to cite any reason for your answer.
- i) All polymers are macromolecules while the reverse is not true always.
 - ii) At T_g , a polymer molecule shows "cooperative" movement.
 - iii) Number average molecular weight of a polymer is close to viscosity average molecular weight. [3]
2. Write brief note on the following:
- a) Termination reaction during free radical polymerization.
 - b) Degree of conversion during condensation polymerization. [3+2]
3. Differentiate between a TEM and a SEM with respect to following aspects.
- a) Working principle
 - b) Acceleration voltage [3+2]
4. Explain how the following aspects will affect the T_g of a polymer.
- a) Polarity
 - b) Branching
 - c) Crystallinity [2+1+2]

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