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# SARDAR PATEL UNIVERSITY
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## M.Sc.(Chemistry) Examination, I$^{st}$ Semester under CBCS
### Polymer Chemistry-I

Date: 25/11/2019 Monday     PS01ECHE22     10.00am -01.00 pm

Total Marks: /70/

**Note: Figures to the right indicates maximum marks.**

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**QUE.1**   Give the appropriate answer of the following Multi Choice Question.    8
*[Strictly follow the given pattern to write answer: - Ans.1: (i) b; (ii) d; etc.]*

i.   Monomer should have minimum _____ functional group(s) for the polymerization.
(a) one; (b) two; (c) three; (d) four;

ii.   "The temperature at which polymer become soft and below which hard and brittle."
(a) Celling temperature; (b) Melting temperature;
(c) Glass transition temperature ;(d) Degradation temperature.

iii.   The following reaction shows _____ termination mechanism.

$$R\text{-}(CH_2\text{-}CH)\text{-}CH_2\text{-}CH^* + R_1H \longrightarrow R\text{-}(CH_2\text{-}CH)\text{-}CH_2\text{-}CH_2 + R_1{}^*$$

(a) chain transfer or transfer; (b) linear;
(c) disproportionation; (d) radical or chain coupling;

iv.   When the vacant *d*-orbital is regenerated at the same position all the time, the incoming monomer units will be inserted with the same spatial arrangement, resulting in the formation of _____ polymer.
(a) an atactic; (b) an isotactic; (c) syndiotactic; (d) an amorphous;

v.

$$\underline{\quad\quad} + \underline{\quad\quad} \rightleftharpoons \left(NH\text{-}(CH_2)_6\text{-}NH\text{-}\overset{O}{\overset{\|}{C}}\text{-}(CH_2)_4\text{-}\overset{O}{\overset{\|}{C}}\right)_n$$

(a) hexamethylene diamine + ethanoic acid; ( b) hexamethylene diamine + acetic acid;
(c) hexamethylene diamine + sebacic acid; (d) hexamethylene diamine + adipic acid;

vi.   The reactivity ratio $r_1$ and $r_2$ for any given pair of monomers are purely dependent on-
(a) nature of the two monomers and temperature; (b) solvent;
(c) initiator; (d) chain transfer agent;

vii.   In which polymerization technique, the problems of dissipating heat of polymerization occurs and which may lead to auto acceleration?
(a)Bulk polymerization; (b) Solution polymerization;
(c) Suspension polymerization; (d) Emulsion polymerization;

viii.   The given compound can be used as _____in the plastic materials→
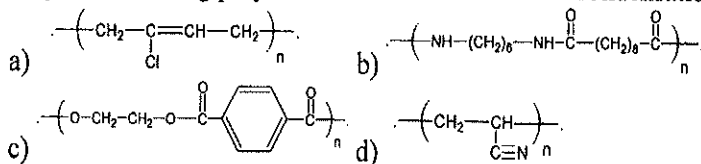(a) plasticizer; (b) antioxidant;
(c) UV-stabilizer; (d) flame retardant;
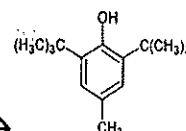
**QUE.2  Answer the following questions in short (Any Seven).**                     **14**

i. Classify the following polymers based on addition and condensation polymerization.

a) $-(-CH_2-\underset{Cl}{C}=CH-CH_2-)_n-$

b) $-(-NH-(CH_2)_6-NH-\overset{O}{\overset{\|}{C}}-(CH_2)_8-\overset{O}{\overset{\|}{C}}-)_n-$

c) $-(-O-CH_2-CH_2-O-\overset{O}{\overset{\|}{C}}-\langle\text{benzene}\rangle-\overset{O}{\overset{\|}{C}}-)_n-$

d) $-(-CH_2-\underset{C\equiv N}{CH}-)_n-$

ii. What is inorganic polymer? Give at least two examples.

iii. Write the expressions for the values of the molecular weights of the polymer on the basis of number fraction and weight fraction.

iv. Write the thermal decomposition reaction of initiator, benzoyl peroxide ($Bz_2O_2$) and azo-bis-isobutyronitrile (AIBN).

v. Give the examples of chain transfer agent and how it works on growing polymer chain.

vi. Explain the ring opening polymerization of ethylene oxide by sodium methoxide.

vii. Calculate the $X_n$ (number average degree of polymerization) of an equimolecular mixture of hexamethylene diamine and sebacic acid for the extent of reaction (p):0.5, 0.8, 0.9 and 0.995.

viii. Give merits and demerits of bulk and solution polymerization.

ix. What is the function of UV-stabilizers in plastics? Give two examples.

**QUE.3**                                                                             **12**

A. Discuss about the classification of polymers based on (i) Tacticity (ii) Mode of synthesis (i.e. Addition and Condensation polymers, Homopolymers and Copolymers,).

B. Calculate $\overline{Mn}$, $\overline{Mw}$, $\overline{Mz}$ for polymer consisting of three fraction with molecular weight $1\times10^5$, $2\times10^5$ and $3\times10^5$ gm/mole. The mole fractions of these fractions are found to be 1, 1, 1 respectively.

**OR**

B. Name the methods for determining polymer molecular weight depending on colligative properties and size (weight).Discuss in detail high speed membrane osmometry.

**QUE.4**                                                                             **12**

A. Elaborate the "kinetics of free radical polymerization" with respect to initiation, propagation and termination.

B. What are Inhibitors and Retarders? Explain by giving suitable examples.

**OR**

B. Derive the Mayo equation for the average kinetic chain length ($\upsilon$) by incorporating the chain transfer reaction in to the kinetic scheme of free radical polymerization.

**QUE.5**                                                                             **12**

A. Explain the Kinetics of acid-catalyzed polycondensation reaction.

B. What are copolymers? Elaborate the reactivity ratio and its copolymerization behavior for free radical copolymerization.

**OR**

B. Derive the Q-e Scheme of Alfrey and Price for the semi quantitative relationship to compute the reactivity ratios of various monomers.

**QUE.6**                                                                             **12**

A. Discuss the emulsion polymerization technique with its advantages and disadvantages.

B. Write a note on organo-metallic and ion containing polymers.

**OR**

B. Why additives are incorporated in plastics? Write about plasticizer, stabilizer and fillers.

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