RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

M.A./M.SC. SECOND SEMESTER EXAMINATION, MAY 2012

FIRST YEAR

Date : 30/05/2012 **APPLIED CHEMISTRY**

Time : 11 am – 1 pm Paper : IX Full Marks : 50

1. Choose the right option (**any ten**) : [10×1]

A) The polymerization method which gives PDI close to unity is
a) anionic b) condensation c) radical polymerization

B) T_g of raw natural rubber is:
a) -70^0 C b) -10^0 C c) 0^0 C d) $+30^0$ C.

C) AIBN is an initiator used in the free radical polymerization of methyl methacrylate (MMA). When the concentration of AIBN is doubled maintaining MMA concentration unchanged the rate of propagation
a) is doubled b) increases by a factor of $2^{1/2}$
c) is reduced by half d) decreases by a factor of $2^{1/2}$.

D) For the copolymerization of MMA with vinyl chloride, the monomer reactivity ratios were found to be 10 and 0.1 respectively. The resulting polymer is most likely to be
a) an alternating copolymer b) an ideal copolymer
c) a block copolymer d) a branched copolymer.

E) Crystallinity of three different types of PE follows the order:
a) HDPE>LLDPE>LDPE b) LDPE>HDPE>LLDPE
c) HDPE>LDPE>LLDPE d) LLDPE>HDPE>LDPE.

F) The notched izod impact strength of ABS, PP, PC and PF follows the order
a) PC<ABS<PP<PF b) ABS<PF<PC<PP c) PP<PC<ABS<PF d) PF<PP<ABS<PC.

G) A flexible garden hose pipe made of PVC was observed to get hardened after a length of time. The observation is most likely due to
a) chain scission b) loss of plasticizer
c) loss of UV stabilizer d) loss of thermal stabilizer.

H) Based on the solubility parameter (δ) the best solvent for polyethylene (δ- 16.2 $MPa^{1/2}$) is
a) THF (δ= 20.3 $MPa^{1/1}$) b) toluene (δ= 18.3 $MPa^{1/2}$)
c) acetone (δ= 19.9 $MPa^{1/2}$) d) methanol (δ= 29.7 $MPa^{1/2}$).

I) If η represents viscosity of polymer solution and η_0 represents viscosity of pure solvent then the specific viscosity (η_{sp}) of the polymer solution is expressed as:
a) η/η_0 b) $(\eta/\eta_0)-1$ c) $(\eta_0/\eta)-1$ d) $\eta_{0/}\eta$.

J) A small molecule is eliminated as a by-product during the synthesis of
a) polyethylene b) poly (ethylene terephthalate)
c) styrene-butadiene copolymer d) polytetrafluoroethylene.

K) The T_g is governed by
a) translational motion of entire molecule
b) long cooperative wriggling motion of 40-50 C-C bonds
c) short cooperative motion of 5-6 bonds of the molecules
d) vibration of carbon atoms of the polymer molecules.

L) Which of the following monomers is used to synthesise poly (vinyl alcohol)-
a) CH_3CH_2OH b) CH_2=CH(OH) c) CH_2=CH-O-CO-CH_3 d) CH_2=CH.COOH.

2. Match the following (**any five**) : [5×2]

A) a) X-ray diffraction	i) Functional groups
b) Differential thermal analysis	ii) Crystallinity
c) Infrared spectroscopy	iii) Morphology
d) Microscopy	iv) Enthalpy

B)	a) Benzyl lithium	i) Emulsion polymerization
	b) Tropylium chloride	ii) Anionic polymerization
	c) AIBN	iii) Cationic polymerization
	d) $(NH_4)_2S_2O_8$	iv) Radical polymerization
C)	a) Bakelite	i) Bathroom doors
	b) E-PVC	ii) Toys
	c) HIPS	iii) Electrical switches
	d) PC	iv) Compact Disc
D)	a) M_n	i) Viscometry
	b) M_w	ii) Centrifugation
	c) M_v	iii) Osmometry
	d) M_z	iv) SLS
E)	a) Bulk polymerization	i) Clay
	b) Solution polymerization	ii) Fastest rate
	c) Suspension polymerization	iii) Hot spot
	d) Emuslsion polymerization	iv) Chain transfer
F)	a) PF synthesis	i) 1-butene
	b) HIPS synthesis	ii) Acrylonitrile
	c) LLDPE synthesis	iii) Acetylene
	d) PVC synthesis	iv) Phosphoric acid

3. Solve the following problems (**any three**) : [3×5]

a) For the polyesterification of $OH(CH_2)_{14}COOH$, the number average degree of polymerization, X_n is given by (1+r)/(1+r-2rp), where r is the stoichiometric imbalance and p is the extent of reaction. Calculate (a) X_n for 100% polyesterification and (b) the percentage conversion of functional groups required to obtain polyester with a molecular weight of 24000 g/mol. [2.5+2.5]

b) A polydisperse polymer consists of the following three different fractions

	I	II	III
Mass of polymer (%)	30	20	50
Molecular weight (g/mol)	30,000	80,000	1,50,000

Calculate— i) number average molecular weight and
ii) Polydispersity index. [2+3]

c) We have three moles phthalic anhydride to react with three moles glycerol. Calculate—
i)average functionality and
ii)average degree of polymerization for 98% conversion. [1+4]

d) Weight average molecular weight of five different fractions of polystyrene are 50,000, 60,000, 70,000, 80,000 and 90,000. Corresponding intrinsic viscosities are 1.12, 1.28, 1.32, 1.34 and 1.38 dl/g in toluene at room temperature (27^0 C). Evaluate Mark-Howink constants. [5]

4. Answer **any three** questions : [3×5]

a) Differentiate between addition and condensation polymerization with respect to reaction rate, molecular weight distribution and termination. [1+2+2]

b) Explain the differences between novolac and resol. State important uses of polycarbonate. [4+1]

c) What are the concepts of ceiling temperature and floor temperature in polymerization? Give example of a suitable inhibitor. [4+1]

d) Classify polymers according to tacticity. Explain variation in crystallinity, mechanical properties and solubility among them. [2+3]

e) Mention important properties of Styrene-Butadiene rubbers and polychloroprene rubbers. [2·5+2·5]