



The Open University of Sri Lanka

B.Sc Degree/Stand Alone courses in Science – 2006/2007

CHU 3238/CHE 5238 – Polymer Chemistry – Level 5

Assignment Test – II

Duration : 1½ Hours

Date : 14<sup>th</sup> December 2006

Time: 3.30 p.m. – 5.00 p.m.

- Answer all questions.
- Choose the most correct answer to each question and mark this answer with an “X” on the answer script.
- Use a **PEN** (not a pencil) in answering.
- Any question with more than one answer will NOT be counted.
- 1/6<sup>th</sup> marks will be deducted for each incorrect answer.
- The use of a **non- programmable** electronic calculator is permitted.
- Logarithm tables will be provided.

$$\text{Gas Constant (R)} = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$$

$$\text{Avogadro Constant (L)} = 6.023 \times 10^{23} \text{ mol}^{-1}$$

$$\text{Planks Constant (h)} = 6.63 \times 10^{-34} \text{ Js}$$

$$\text{Velocity of light (C)} = 3.0 \times 10^8 \text{ ms}^{-1}$$

$$\text{Atmospheric Pressure (P)} = 10^5 \text{ Pa (Nm}^{-2}\text{)}$$

$$\text{Faraday constant (F)} = 96,500 \text{ C mol}^{-1}$$

$$\text{Log}_e \text{ (X)} = 2.303 \log_{10} \text{ (X)}$$

**Part A - MCQ**

- (1) Reasons for using stearic acid with Zinc oxide are
- (a) to improve compatibilities of ZnO with rubber
  - (b) to produce  $Zn^{2+}$  ions
  - (c) to form intermediate activate complexes

The correct answers are ;

- 1) ab 2) bc 3) ac 4) abc 5) none of the above

- (2) During accelerated sulphur vulcanisation ,the types of sulphide linkages formed are

- 1) sulphides of reacting rubber, sulphur with accelerator only
- 2) monosulphides and disulphides only
- 3) cyclic ,mono and higher sulphides
- 4) ZnS
- 5) all above

- (3) Thermally stable rubber vulcanisate can be obtained by introducing

- 1) monosulphide + disulphide linkages
- 2) disulphide and trisulphide linkages
- 3) cyclic and higher sulphide linkages
- 4) presence of dienes and trienes
- 5) intermediate rubber, sulphur accelerator complex

What is the correct answer

- (4) Polymers are degraded
- a) during processing
  - b) during services
  - c) by mechanical stress heat and solar radiation
  - d) by atmospheric  $O_2 + O_3$

the correct answers are

- (1) a,b,c only (2) b,c,d only (3) a,c,d only (4) a,b,d only (5) all above

- (5) During oxidation of polymers

- (a) colour cannot be changed
- (b) molar mass increased or decreased
- (c) -aldehydes , ketones can be formed
- (d) physical properties are deteriorated

The correct answers are;

- 1) a,b,c only (2) b,c,d only (3) a,c,d only (4) a,b,d only (5) all above

- (6) (a) Polymer oxidation is a chain reaction  
 (b) Initiation, propagation and termination reactions are the key steps involved during oxidation  
 (c) Antioxidant function is to inhibit initiation and propagation steps

The correct answers are;

1) a,b only (2) b,c only (3) a,c only (4) a,b,c (5) a only

- (7) What is the incorrect answer.  
 Polytetrafluoroethylene(PTET)

- (1) is produced by emulsion polymerization  
 (2) consists of linear , highly regular helical structure  
 (3) is an oil resistant , thermally unstable polymer  
 (4) is a crystalline polymer resistant to solvents  
 (5) is produced by polymerization of  $CF_2=CF_2$

- (8) What is the wrong statement  
 Polyvinyl Chloride(PVC)

- (1) is stable above  $200^\circ C$   
 (2) degrades with the evolution of HCl  
 (3) is a hard heavy material  
 (4) difficult to process without plasticizers  
 (5) can be dissolved in dibutylphthalate

- (9) (1) field latex is used to manufacture dipped products  
 (2) rubber smoked r sheets contain phenolic antioxidants  
 (3) pale crepe is more pure than smoked sheets or latex  
 (4) quality of dry raw rubber is examined by visual appearance  
 (5) pale crepe is used to manufacture non-toxic rubber products  
 What is the incorrect answer ?

- (10) carbon fiber can be prepared by heating under controlled condition of poly,

- (1) acrylo nitrile( $-CH_2-CH(CN)-$ )  
 (2) vinyl Chloride( $-CH_2-CH(Cl)-$ )  
 (3) vinyl Acetali( $-CH_2-CH(OCOEt)-$ )  
 (4) vinyl alcohol( $-CH_2-CH(OH)-$ )  
 (5) methyl methacrylate( $-CH_2-C(CH_3)COOEt-$ )

- (11) Urea Formaldehyde

- (a) resin is water soluble  
 (b) resin is an adhesive used in plywood industry  
 (c) is polymerized by addition polymerization  
 (d) resin can be formed by reacting 1:2 mole ratio of urea and formaldehyde

The correct answers are;

1) a,b,c only (2) a,b,d only (3) b,c,d only (4) a,c,d only(5) all above

(12) Storage hardening of rubber,

- (a) results increase in viscosity
- (b) is due to a cross linking reaction
- (c) results lowering molar mass

The correct statements are;

- 1) a,b (2) a,c (3) b,c (4) a,b,c (5) a only

(13) Polyurethane foam,

- (a) is produced by reacting diisocyanate with water
- (b) cellular structure is due to liberation of  $\text{NO}_2$
- (c) is used in automobile and building industry

The correct statements are;

- 1) a,b (2) a,c (3) b,c (4) a,b,c (5) a only

(14) Molar masses of polymer samples drawn from polymerization flask at various times are given below

- (1) 1400 (2) 2100 (3) 2800 (4) 3500 (5) 4200

Which sample has the highest  $T_g$  and hardness?

(15) Following changes may occur at the glass transition temperature ( $T_g$ )

- (a) changes in vibrational, rotational and translational motions
- (b) changes in Physical properties
- (c) changes in Chemical properties

The correct answers are;

- 1) a,b,c only (2) a,b,d only (3) b,c,d only (4) a,c,d only (5) a,b,c,d

(16) When an amorphous polymer is changed to crystalline polymer which of the following properties do not change,

- (1) density (2) optical properties (3) solubility (4) permeability (5) heat resistivity

(17) To improve the thermal stability,

- (1) benzene rings are introduced to the main chain.
- (2) ring structures are introduced like a ladder.
- (3) polymers are cross linked
- (4) bulky pendent groups are introduced
- (5) aromaticity of the back bone is reduced

What is the incorrect statement?

(18) What is the wrong statement among the followings,

- (1) polymers can be made 100% crystalline.
- (2) natural rubber can be broken like glasses below  $-70^{\circ}\text{C}$ .
- (3) elasticity increases with increase of the temperature.
- (4) hardness decreases with decrease of the temperature.
- (5) crystalline polymers do not have fixed melting point.

(19) What is the percentage increase in crystallinity of fully amorphous polymer of density  $0.910\text{ gr/cc}$  is converted to semicrystalline polymer of density  $0.937\text{ gr/cc}$ . Assume the density of 100% crystalline polymer is  $1.0\text{ gr/cc}$

- (1) 30% (2) 40% (3) 97% (4) 3% (5) 70%

(20) (a) crystalline polymer can be obtained by sudden cooling of polymer melt,  
(b) amorphous polymer can be obtained by sudden cooling of polymer melt,  
(c) density of 100% crystalline polymer can be determine by X-ray diffraction method,  
(d) density of 100% amorphous polymer can be determine by normal methods

The correct statements are;

- 1) a,b,c,d (2) a,b,c (3) a,b,d (4) b,c,d (5) a,d,c