



THE OPEN UNIVERSITY OF SRI LANKA

B. Sc. Degree Programme/Stand Alone Course — Level 5

Final Examinations 2008/09

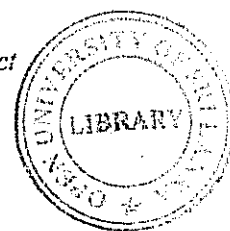
CHU 3238/CHE 5238 — Polymer Chemistry - Paper I

Duration: 2 Hours

Friday 19<sup>th</sup> June 2009

10.00 am – 12.00 noon

- Answer all 50 (fifty) questions
- Choose the most correct answer to each of question and mark your answer with a cross ["X"] on the answer script.
- Use a **PEN** (not a PENCIL) in answering.
- Any answer with more than one "X" marked will be considered as an *incorrect* answer.
- 1/6<sup>th</sup> of the marks assigned will be deducted for each incorrect answer.
- The use of a non-programmable electronic calculator is permitted.
- Logarithm tables, graph papers etc will be provided on request.



Gas constant (R)	=	8.314 J K <sup>-1</sup> mol <sup>-1</sup>
Avogadro constant (L)	=	6.023×10 <sup>23</sup> mol <sup>-1</sup>
Planck constant (h)	=	6.63×10 <sup>-34</sup> J s
Velocity of light (c)	=	3.0×10 <sup>8</sup> m s <sup>-1</sup>
Standard atmospheric pressure ( $\pi$ )	=	10 <sup>5</sup> Pa (N m <sup>-2</sup> )
Log <sub>e</sub> (X)	=	2.303 Log <sub>10</sub> (X)

01. If the molar mass of polypropylene is 8400 g/mol, the degree of polymerization is  
1. 100      2. 200      3. 300      4. 400      5. 500

02. If the C-C distance is 1.26 Å, what is the length of above polymer?  
1. 126 Å      2. 2.52 Å      3. 252 Å      4. 5.04 Å      5. 504 Å

03. Which statement is true about polymers?  
a. They have a saturation point.      b. They do not have a saturation point.  
c. They take longer time for dissolution.

The correct statement/s is/are

1. a only      2. b only      3. c only      4. a and b only      5. b and c only

04. What is the correct statement?

1. Polymers have fixed melting points.      2. Polymers form saturated solutions.  
3. Chemical properties of all polymers are the same.  
4. Physical properties of polymers are different from each other.  
5. Molar mass of a polymer is always equal to the amount of monomer used.

05. Consider the following molecules.

a.  $C_6H_5OH$       b.  $CH_3CH=CH_2$       c.  $CH_3COOH$       d.  $H_2NCH_2-COOH$   
e.  $CH_3OH$

Which molecules can act as monomers?

1. a, b & d      2. a, b & d      3. b, c & d      4. b, d & e      5. c, d & e

06. How many reactive sites are in aniline?

1. 1      2. 2      3. 3      4. 4      5. 5

07. Resins are

a. half polymerized substances.      b. completely polymerized substances.  
c. used in liquid form as adhesives.

The correct statement/s is/are

1. a only      2. b only      3. c only      4. a and c only      5. b and c only

08. Which statement is not true about chain polymerization?

1. By products are formed during polymerization.  
2. By products are not formed during polymerization.  
3. The product has the same elemental composition as that of the monomer.  
4. Self addition of monomer molecules to each other takes place.  
5. Monomers containing reactive double bonds can undergo this polymerization.

09. What type of initiators can be used to polymerize isobutene?

1. Cationic      2. Anionic      3. Free radical      4. Cationic and anionic  
5. Anionic and free radical.

10. When styrene is copolymerized with butadiene, it behaves as  
a. a solid    b. a rubber with rubbery properties    c. a rubber with plastic properties.

The correct statement/s is/are

1. a only    2. b only    3. c only    4. a and c only    5. b and c only

11. Vigorous exothermic reaction would occur in which polymerization technique?

1. Solution    2. Emulsion    3. Bulk    4. Suspension    5. Melt condensation.

12. Zinc oxide acts as

- a. an essential ingredient in the rubber formulation.  
b. an activator in the presence of fatty acids.  
c. a catalyst to reduce the vulcanization energy of the vulcanization reaction.

The correct statement/s is/are

1. a only    2. b only    3. c only    4. a and c only    5. all of above.

13. Tyres degraded during service by

- a. heat    b. mechanical stress with  $O_2$  and  $O_3$     c. atmospheric  $O_2$  and  $O_3$ .

The correct statement/s is/are

1. a only    2. b only    3. c only    4. a and c only    5. all of above.

14. Rubber is milled (masticated)

- a. to incorporate other chemicals.    b. to reduce viscosity.  
c. to reduce molar mass.    d. prevent oxidation.

The correct statements are

1. a, b & c only    2. b, c & d only    3. a, c & d only    4. a, b & d only  
5. all of above

15. Which statement/s is/are correct about monometallic mechanism.

- a. Resulting polymer is a stereo regular polymer.  
b. Resulting polymer is an isotactic polymer.  
c. An electron deficient bridged complex is formed when the catalyst & the co catalyst are mixed.

The correct statement/s is/are

1. a only    2. b only    3. c only    4. a and c only    5. all of above.

16. Field latex can be stabilized by adding

1. sulphuric acid.    2. ammonia solution.    3. acetic acid.  
4. calcium chloride solution.    5. formic acid.

17. When adipic acid is polycondensed with pentamethylene diamine, the resultant polymer is

1. Nylon 6      2. Nylon 6,6      3. Nylon 5,6      4. Nylon 6,5      5. Nylon 5

18. Nitrile rubber is

- a. a copolymer.      b. produced by emulsion polymerization of butadiene with styrene.  
c. produced by polycondensation of phenol with formaldehyde.

The correct statement/s is/are

1. a only      2. b only      3. c only      4. a and b only      5. all of above.

19. Thermoplastics

1. are formed by addition polymerization.  
2. are formed by condensation polymerization.  
3. cannot be softened by heating.  
4. are hard and brittle.  
5. insoluble in any solvent.

20. The efficiency of plasticizer depends on the

- a. polarity.      b. density.      c. solubility parameters.

The correct statement/s is/are

1. a only      2. b only      3. c only      4. a and c only      5. all of above.

21. What method can not be used to determine  $T_g$ ?

1. NMR spectroscopy      2. Differential thermal analysis.      3. Dilatometry method.  
4. Ultra violet spectroscopy      5. Infra red spectroscopy.

22. Above  $T_g$ , the polymer material is in the

- a) visco-fluid state.      b. rubbery state.      c. visco-elastic state.      d. glassy or solid state.

The correct statement/s is/are

1. a only      2. b and c only      3. d only      4. a and c only      5. all of above.

23. Chain flexibility

- 1) increases      2) decreases      3. does not affect      4. doubles      5. tribbles  
the value of  $T_g$ .

24. For asymmetrical polymers, the  $T_g$  and  $T_m$  can be correlated as,

1.  $T_g = 2T_m$       2.  $T_g = \frac{1}{2}T_m$       3.  $T_g = \frac{2}{3}T_m$       4.  $T_g = 3T_m$       5.  $T_g = T_m$

25. Intermolecular bonding

- 1) increases      2) decreases      3. does not affect      4. doubles      5. tribbles  
the value of  $T_m$ .

26. Syndiotactic polymers form

- a. amorphous polymers      b. semi-crystalline polymers.      c. crystalline polymers.

The correct statement/s is/are

1. a only      2. b only      3. c only      4. a and c only      5. b and c only..

27. In dilatometry method,

1. the flow time is measured at different concentrations.
2. the capillary difference is measured at different concentrations.
3. the capillary difference is measured at different temperatures.
4. the volume change is measured at different temperatures.
5. the volume change is measured at different concentrations.

28. If the polyethylene sample having C-C distance of 1.26 Å and the degree of polymerization is 100, the root mean square distance is

1. 12.6 nm.      2. 12.6 Å      3. 126 nm      4. 126 Å      5. cannot be calculated.

29. The full extend length of above molecule is

1. 12.6 nm.      2. 12.6 Å      3. 126 nm      4. 126 Å      5. cannot be calculated.

30. Nitrile rubber is widely used to manufacture

1. electrical switches.      2. microwave safe cups.      3. oil seals.  
4. shoe soles.      5. none of the above.\

31. Stereoregular polymers are.

- a. atactic      b. isotactic      c. syndiotactic

The correct statement/s is/are

1. a only      2. b only      3. b and c only      4. a and c only      5. all of above.

32. Which statement is incorrect?

1. Light scattering method is used to determine weight average molar mass.
2. Ultra centrifuge technique is used to determine number average molar mass.
3. Viscometry is used to determine intrinsic viscosity.
4. End group analysis is used to determine number average molar mass.
5. Osmometry is used to determine number average molar mass.

33. Swelling of polymers does not depend on

1. polymer-polymer interactions.
2. type of the solvent used.
3. force of interaction between solvent and polymer molecule.
4. surface area of the polymer sample.
5. stirring and temperature.



44. Kinetic chain length of the polymer  $\nu$ , is defined as the

1. rate of initiation/rate of propagation.
2. rate of initiation/rate of termination.
3. rate of propagation/rate of initiation.
4. rate of propagation/ rate of termination.
5. rate of initiation.

45. In a diacid-dialcohol polymerization, if the diacid acts as a catalysts for the reaction too, the order of the reaction is

1. 0      2. 1      3. 2      4. 3      5. 4

46. It was found that the degree of polymerization of a sample is twice of the kinetic chain length. The reaction could be explained using

- a. a cationic mechanism.    b. an anionic mechanism.    c. a free radical mechanism.

The correct statement/s is/are

1. a only      2. b only      3. c only      4. a and b only      5. all of above.

47. In the free radical polymerization, the chain length of the polymer

- 1) increases      2) decreases      3. does not affect      4. doubles      5. tribbles  
when transfer agents are used at the termination step.

48. In cationic polymerization, the degree of polymerization is given by

1.  $\frac{k_p}{k_t} [2M]$       2.  $\frac{k_p}{k_t} [3M]$       3.  $\frac{k_p}{k_t} [M]$       4.  $\frac{k_t}{k_p} [M]$       4.  $\frac{k_t}{k_p} [2M]$

49. Polycarbonates are

1. polyamides of primary amines and carboxylic acids.
2. polyesters of phenols and carbonic acids.
3. polyesters of alcohols and carboxylic acids.
4. polyamides of dicarboxylic acids and diamines.
5. polyesters of dicarboxylic acids and diols.

50. Poly(vinyl acetate) can be prepared by

- a. bulk polymerization    b. emulsion polymerization    c. suspension polymerization.

The correct statement/s is/are

1. a only      2. b only      3. c only      4. a and b only      5. all of above.