Roll No. .....

Question Booklet Number

O. M. R. Serial No.

M. Sc. (Industrial Chemistry) (Second Semester)

EXAMINATION, July, 2022

POLYMER CHEMISTRY

Paper Code			
MSIC	2	0	1

Questions Booklet Series
A

Time : 1:30 Hours] [*Maximum Marks : 100*

Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.
2. The booklet contains 100 questions. Examinee is required to answer any 75 questions in the OMR Answer-Sheet provided and not in the question booklet. If more than 75 questions are attempted by student, then the first attempted 75 questions will be considered for evaluation. All questions carry equal marks.
3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be got immediately replaced.

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।
2. प्रश्न-पुस्तिका में 100 प्रश्न हैं। परीक्षार्थी को किन्हीं 75 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। यदि छात्र द्वारा 75 से अधिक प्रश्नों को हल किया जाता है तो प्रारम्भिक हल किये हुए 75 उत्तरों को ही मूल्यांकन हेतु सम्मिलित किया जाएगा। सभी प्रश्नों के अंक समान हैं।
3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, तो उसे तुरन्त बदल लें।

(Remaining instructions on the last page) (शेष निर्देश अन्तिम पृष्ठ पर)

(Only for Rough Work)

1. Titanium tetrachloride organoaluminium Co-catalyst is :

(A) Free radical polymerization

(B) Cationic polymerization

(C) Melt polycondensation

(D) Coordination polymerization

2. Teflon is :

(A) $(CF)_n$

(B) $(C_4F_2)_n$

(C) $(C_2F_4)_n$

(D) None of the above

3. Which of the following is a synthetic fibre ?

(A) Silk

(B) Jute

(C) Rayon

(D) Cotton

4. LDPE is prepared by polymerising ethylene at a pressure of ..... .

(A) 100-200 atmospheres

(B) 200-400 atmospheres

(C) 400-800 atmospheres

(D) 1000-5000 atmospheres

5. The softening temperature of HDPE is :

(A) 200 K

(B) 300 K

(C) 400 K

(D) 500 K

6. Initiator used in the preparation of PVC is :

(A) Lewis acid

(B) Grignard reagent

(C) Ziegler-Natta catalyst

(D) Benzoyl peroxide

7. Functionality of lactic acid $CH_3CH(OH)COOH$ is :

(A) 2

(B) 3

(C) 4

(D) None of the above

8. Which of the following is an inorganic polymer ?

(A) Cotton

(B) Jute

(C) Glass

(D) Nylon

9. Bakelite is the condensation polymerisation product of :

(A) Urea and formaldehyde

(B) Phenol and formaldehyde

(C) Diols and isocyanate

(D) Phenol and acetaldehyde

10. Nylon belongs to :

(A) Polyester

(B) Polyamide

(C) Polyphenols

(D) None of the above

11. Which of the following biopolymers are the polymerisation product of amino acids ?

(A) Nucleic acids

(B) Cellulose

(C) Lipids

(D) Proteins

12. Balls are made by :

(A) Compression moulding

(B) Injection moulding

(C) Rotational moulding

(D) None of the above

13. Chief constituent of cotton fibre is :

(A) Protein

(B) Starch

(C) Cellulose

(D) Lignin

14. Dry spinning is used for :

(A) PVC

(B) Rayon

(C) Polyvinyl acetate

(D) None of the above

15. Which of the following additives are added to plastic to increase the flexibility ?

(A) Fillers

(B) Plasticizer

(C) Lubricants

(D) Antioxidants

16. Phenolic resins are produced by the condensation polymerisation of formaldehyde with :

(A) Phenol

(B) Urea

(C) Melamine

(D) Resorcinol

17. Polycarbonates are condensation product of :

(A) Diphenyl carbonate and bisphenol-A

(B) Methyl methacrylate

(C) Aromatic dichloride and aromatic diamines

(D) None of the above

18. Nylon-6 is manufactured from :

(A) Adipic acid and hexamethylene diamine

(B) Caprolactum

(C) ω-amino undecanoic acid

(D) None of the above

19. Which of the following is not a thermoplastic ?

(A) PVC

(B) Polythene

(C) Polypropylene

(D) Expoxy polymer

20. Stabilizers are added during processing of polymer to improve :

(A) its impact strength

(B) its thermal stability

(C) its elasticity

(D) its mechanical strength

21. Which polymer is used for making unbreakable crockery ?

(A) Polyamides

(B) Melamine

(C) PEG

(D) None of the above

22. Rayon is produced from :

(A) Starch

(B) Lignin

(C) Cellulose

(D) Polyamides

23. Which of the following is not prepared by chain growth polymerisation ?

(A) PVC

(B) Polystyrene

(C) Urea formaldehyde resins

(D) None of the above

24. Terylene is a :

(A) Polyamide

(B) Polyester

(C) Rayon

(D) None of the above

25. Which of the following is not a polymer of two different monomers ?

(A) Bakelite

(B) Phenolic resin

(C) Teflon

(D) Polyurethane

26. Thermocol is :

(A) PVC

(B) Polypropylene

(C) Polystyrene

(D) None of the above

27. Free radical polymerisation is catalyzed by :

(A) Organic peroxides

(B) Hydrochloric acid

(C) Aldehydes

(D) None of the above

28. Which of the following is generally not drawn into fibre ?

(A) Polyamide

(B) Polyesters

(C) Cellulose

(D) Polyacrylonitrile

29. Which of the following is a polymer of hexamethylene diamine and adipic acid ?

(A) Nylon 6

(B) Nylon 6, 6

(C) Nylon 6, 10

(D) None of the above

30. Condensation polymerization product of 1, 6-hexamethylene di-isocyanate and 1, 4-butane diol is :

(A) Polycarbonates

(B) Polyesters

(C) Polyurethanes

(D) Polyamides

31. Hydroquinone is used as :

(A) Initiator

(B) Reaction quencher

(C) Catalyst

(D) None of the above

32. Which of the following is not used as an additive during the moulding of a plastic ?

(A) Plasticizer

(B) Filler

(C) Lubricants

(D) Acids

33. Tick the correct order :

(A) $\overline{M}_n < \overline{M}_v < \overline{M}_w$

(B) $\overline{M}_n < \overline{M}_v > \overline{M}_w$

(C) $\overline{M}_n > \overline{M}_v > \overline{M}_w$

(D) $\overline{M}_n > \overline{M}_v < \overline{M}_w$

34. The bottles from thermoplastic polymers are made by :

(A) Injection moulding
(B) Extrusion moulding
(C) Rotational moulding
(D) Blow moulding

35. Which of the following cannot be made by compression moulding process ?

(A) Gaskets
(B) Bottles
(C) Washing machine housing
(D) None of the above

36. In which of the following a die is used ?

(A) Injection moulding
(B) Extrusion moulding
(C) Compression moulding
(D) None of the above

37. Coating of electrical wires is done with :

(A) Injection moulding
(B) Compression moulding
(C) Extrusion moulding
(D) Blow moulding

38. A hot softened thermoplastic tube, placed inside a two-piece hollow mould in blow moulding is known as :

(A) Garison
(B) Parison
(C) Harison
(D) None of the above

39. Thermoforming is a highly useful process for fabricating :

(A) Three-dimensional articles from plastic sheets
(B) Coating material
(C) Hollow articles
(D) None of the above

40. Feed zone, compression zone, metering zone are the parts of the machine of :

(A) Blow moulding
(B) Extrusion moulding
(C) Thermoforming
(D) Compression moulding

41. Which of the following techniques employs a multiple headed gun ?

(A) Filament-winding technique
(B) The hand lay-up technique
(C) Spray up technique
(D) Pultrusion technique

42. Which of the following is not a reinforcing technique ?

(A) Fibre spinning
(B) Spray up technique
(C) The hand lay-up technique
(D) Filament-winding technique

43. The technique that is used to produce polymeric film is :

(A) Casting

(B) Moulding

(C) Spinning

(D) None of the above

44. Calendering is the process to produce :

(A) Hollow articles

(B) Films and sheets

(C) Toys

(D) None of the above

45. 'Male' and 'Female' moulds are related to :

(A) Calendering

(B) Compression moulding

(C) Injection moulding

(D) Blow moulding

46. In compression moulding, the excess material flows out of the mould as a thin film is known as :

(A) Mash

(B) Flash

(C) Foam

(D) Parison

47. Which of the following materials is not made by injection moulding ?

(A) Nuts

(B) Electrical fittings

(C) Car handles

(D) Tubes

48. Injection moulding is the ideal method of processing ..... .

(A) Thermoplastics

(B) Thermosetting materials

(C) Plastics

(D) All of the above

49. Compression moulding is the ideal method of processing ..... .

(A) Thermoplastics

(B) Thermosetting polymers

(C) Plastics

(D) None of the above

50. Which of the following types of polymers is a co-polymer ?

(A) Linear

(B) Branched

(C) Graft

(D) All of the above

51. Which of the following is a cross linked polymer ?

(A) Polyester

(B) Novlac

(C) Bakelite

(D) Nylon-6

52. The number of repeating units in a polymer is called :

(A) Molecular weight of polymer

(B) Polydispersity index

(C) Degree of polymerisation

(D) None of the above

53. The phenomena of 'autoacceleration' occurs in :

(A) Bulk polymerisation

(B) Solution polymerisation

(C) Emulsion polymerisation

(D) Suspension polymerisation

54. Polymer forms in the form of beads in :

(A) Bulk polymerisation

(B) Solution polymerisation

(C) Emulsion polymerisation

(D) Suspension polymerisation

55. Plexiglass is :

(A) PAN

(B) PMMA

(C) PS

(D) PTFE

56. Non-stick utensils are coated with :

(A) Nylon

(B) Dacron

(C) Rayon

(D) Teflon

57. Which of the following is not a commonly used spinning method ?

(A) Dry spinning

(B) Wet spinning

(C) Melt spinning

(D) Spraying up

58. Epichlorohydrin and bisphenol-A polymerise to give :

(A) Polycarbonates

(B) Polyurethanes

(C) Epoxy resin

(D) Amino resin

59. The temperature below which an amorphous polymer becomes hard, brittle and breaks like glass is called :

(A) Melting temperature

(B) Glass transition temperature

(C) Softening temperature

(D) Heat distortion temperature

60. Dilatometric method is used to measure :

(A) Melting point of a polymer

(B) Flow temperature of a polymer

(C) Glass transition temperature of a polymer

(D) None of the above

61. Mark-Houwnik equation is :

(A) $[\eta] = K\overline{M}^{a}$

(B) $K = [\eta]\overline{M}^{a}$

(C) $[\eta] = \frac{K}{\overline{M}^{a}}$

(D) $\overline{M}^{a} = [\eta]K$

62. In Mark-Houwnik equation $[\eta]$ represents to :

(A) relative viscosity of polymer

(B) inherent viscosity

(C) intrinsic viscosity

(D) absolute viscosity

63. Relation between T_g and melting point is :

(A) $\frac{1}{2} < T_g / T_m > \frac{2}{3}$

(B) $\frac{1}{2} > T_g / T_m > \frac{2}{3}$

(C) $\frac{1}{2} < T_g / T_m < \frac{2}{3}$

(D) None of the above

64. The narrow temperature range over which a polymer get distorted to a fixed extent under a given load is known as :

(A) Glass transition temperature

(B) Softening temperature

(C) Melting temperature

(D) Heat distortion temperature

65. Which of the following polymers cannot crystallise ?

(A) Atactic

(B) Syndiotactic

(C) Isotactic

(D) All of the above

66. Which of the following statements is true ?

(A) Natural rubber is more crystalline than Gutta Percha.

(B) Gutta Percha is more crystalline than natural rubber.

(C) Natural rubber is a trans isomer.

(D) Gutta Percha is a cis isomer.

67. Choose the correct statement :

(A) Nylon is amorphous.

(B) Polyvinyl carbazole is highly crystalline.

(C) Polyvinyl alcohol does not crystallise easily.

(D) Linear polyethene is more crystalline than branched polythene.

68. On increasing the crystallinity of polymer, permeability :

(A) Increases

(B) Decreases

(C) Is not affected

(D) May be increase or decrease

69. Degree of crystallinity of polymer sample can be computed (in terms of density) as :

(A) $X_v = \frac{d_a - d}{d_a - d_c}$

(B) $X_v = \frac{d_a - d}{d_c - d_a}$

(C) $X_v = \frac{d - d_a}{d_c - d_a}$

(D) $X_v = \frac{d - d_a}{d_a - d_c}$

70. Mathematical relation between T_g and molecular weight is computed as :

(A) $T_g = T_g^{\infty} + \frac{M_n}{K}$

(B) $T_g = T_g^{\infty} - \frac{M_n}{K}$

(C) $T_g = T_g^{\infty} - \frac{K}{M_n}$

(D) None of the above

71. The crystalline behaviour of polymer is studied by using :

(A) TGA

(B) DSC

(C) DTA

(D) X-ray and electron diffraction method

72. In chain growth polymerisation the chains are not active :

(A) Before termination

(B) After termination

(C) In starting

(D) In between of termination and starting

73. 'Living polymer' is obtained at the end of :

(A) Cationic polymerisation

(B) Anionic polymerisation

(C) Free radical polymerisation

(D) Condensation polymerisation

74. The temperature at which the rates of propagation as well as depropagation are equal is called the :

(A) Heat distortion temperature

(B) Melting temperature

(C) Ceiling temperature

(D) Glass transition temperature

75. The average number of monomer molecules consumed by each effective free radical generated by the initiator is called as :

(A) Kinetic chain length

(B) Degree of polymerisation

(C) Molecular weight

(D) None of the above

76. Tensile and impact strength of polymer ..... with increase in molecular weight upto a limit.

(A) increases

(B) decreases

(C) remains unchanged

(D) sometimes increases and decreases

77. In which polymerisation process, monomer is taken in the liquid state and the initiator and chain transfer agent dissolved in it ?

(A) Bulk polymerisation

(B) Solution polymerisation

(C) Emulsion polymerisation

(D) Suspension polymerisation

78. In which polymerisation technique, the monomer is dissolved in an inert solvent along with the chain transfer agent ?

(A) Bulk polymerisation

(B) Melt polycondensation

(C) Solution polymerisation

(D) Emulsion polymerisation

79. Which of the following polymers is prepared by suspension polymerisation ?

(A) Polyacrylonitrile

(B) Polyisobutylene

(C) Expandable polystyrene beads

(D) All of the above

80. Combination, disproportionation and chain transfer are related to :

(A) Initiation step

(B) Propagation step

(C) Termination step

(D) Retardation step

81. Finishing operation during the manufacture of fibre by washing it with detergent is called as :

(A) Scouring

(B) Sizing

(C) Dyeing

(D) None of the above

82. Sizing of a fibre after manufacture is a process of :

(A) giving a protective coating

(B) dyeing

(C) washing with soap and detergent

(D) lubrication

83. The polymers having extensive conjugation in the backbone which is responsible for conductance are called as :

(A) Extrinsically conducting polymers

(B) Intrinsically conducting polymers

(C) Polymer blends

(D) Non-conducting polymers

84. *p*-doping in conducting polymer is done by :

(A) Oxidation process

(B) Reduction process

(C) Blending

(D) All of the above

85. *n*-doping of a conducting polymer is done by :

(A) Oxidation

(B) Reduction

(C) Blending

(D) Filling of a conductive filament

86. Which of the following is a conducting polymer ?

(A) Polycarbonates

(B) Bakelite

(C) Polyaniline

(D) None of the above

87. Which of the following is not a natural polymer ?

(A) Alginate

(B) Chitosan

(C) Albumin

(D) Polylactic acid

88. Which of the following is a non-biodegradable polymer ?

(A) Starch

(B) Cellulose

(C) Nylon

(D) Silk

89. Spherulite is a :

(A) rod-shaped structure

(B) polymer single crystal

(C) birefringent structure

(D) None of the above

90. Formula of viscosity average molecular weight is :

(A) $\overline{M}_v = \left[\frac{\Sigma n_i M_i^{1+a}}{\Sigma n_i M_i} \right]^{\frac{1}{a}}$

(B) $\overline{M}_v = \left[\frac{\Sigma n_i^2 M_i^{1+a}}{\Sigma n_i M_i^2} \right]^{\frac{1}{a}}$

(C) $\overline{M}_v = \left[\frac{\Sigma n_i M_i^3}{\Sigma n_i M_i^2} \right]^{\frac{1}{a}}$

(D) $\overline{M}_v = \left[\frac{\Sigma n_i M_i^{1+a}}{\Sigma n_i M_i^2} \right]^{\frac{1}{a}}$

91. Calculate the maximum percentage of sulphur that can be present in vulcanized rubber :

(A) 8%

(B) 16%

(C) 32%

(D) 64%

92. The presence of aromatic groups on polymer chain :

(A) Increases the T_g value

(B) Decreases the T_g value

(C) Does not affect the T_g value

(D) None of the above

93. When termination occurs by coupling, the degree of polymerisation is :

(A) $\overline{D}_p = \upsilon$

(B) $\overline{D}_p = 2\upsilon$

(C) $\overline{D}_p = 3\upsilon$

(D) $\overline{D}_p = \frac{\upsilon}{N}$

94. The rate of formation of polymer in free radical polymerisation is given by the equation :

(A) $R_p = \frac{K_t^{1/2}}{K_d^{1/2}} K_p (f[I])^{1/2}[M]$

(B) $R_p = K_p \frac{K_d^{1/2}}{K_t^{1/2}} (f[I])[M]^{1/2}$

(C) $R_p = K_p \frac{K_d^{1/2}}{K_t^{1/2}} (f[I])^{1/2}[M]$

(D) None of the above

95. Which of the following is a non-electrically conducting polymer ?

(A) Polyaniline

(B) Polypyrrole

(C) Bakelite

(D) None of the above

96. Contact lenses are made up of :

(A) Polycarbonates

(B) P-HEMA

(C) P-MMA

(D) None of the above

97. Which statement is incorrect regarding solubility of polymers ?

(A) Crystallinity decreases solubility

(B) Crystallinity increases solubility

(C) Cross-linking eliminates solubility

(D) Solubility will decrease with increasing molecular weight at constant temperature.

98. Which equation is correct for solubility ?

(A) $\Delta G_m = \Delta H_m - T\Delta S_m < 0$

(B) $\Delta G_m = \Delta H_m + T\Delta S_m < 0$

(C) $\Delta G_m = \Delta H_m - T\Delta S_m > 0$

(D) $\Delta G_m = \Delta H_m + T\Delta S_m > 0$

99. The rate of termination of a free radical polymerisation is given by the equation :

(A) $+\frac{d[M^*]}{dt} = 2K_t[M^*][M]$

(B) $-\frac{d[M^*]}{dt} = 2K_t[M^*][M^*]$

(C) $-\frac{d[M^*]}{dt} = 2K_t[M^*][M]$

(D) None of the above

100. The chain length of cationically polymerised polymer is :

(A) The ratio of rate of polymerisation and rate of initiation.

(B) The ratio of polymerisation and rate of propagation.

(C) The ratio of polymerisation and rate of termination.

(D) None of the above

4. Four alternative answers are mentioned for each question as—A, B, C & D in the booklet. The candidate has to choose the most correct/appropriate answer and mark the same in the OMR Answer-Sheet as per the direction :

Example :

Question :

Q. 1 (A) ● (C) (D)
Q. 2 (A) (B) ● (D)
Q. 3 (A) ● (C) (D)

Illegible answers with cutting and over-writing or half filled circle will be cancelled.

5. Each question carries equal marks. Marks will be awarded according to the number of correct answers you have.

6. All answers are to be given on OMR Answer sheet only. Answers given anywhere other than the place specified in the answer sheet will not be considered valid.

7. Before writing anything on the OMR Answer Sheet, all the instructions given in it should be read carefully.

8. After the completion of the examination candidates should leave the examination hall only after providing their OMR Answer Sheet to the invigilator. Candidate can carry their Question Booklet.

9. There will be no negative marking.

10. Rough work, if any, should be done on the blank pages provided for the purpose in the booklet.

11. To bring and use of log-book, calculator, pager and cellular phone in examination hall is prohibited.

12. In case of any difference found in English and Hindi version of the question, the English version of the question will be held authentic.

Impt. : On opening the question booklet, first check that all the pages of the question booklet are printed properly. If there is ny discrepancy in the question Booklet, then after showing it to the invigilator, get another question Booklet of the same series.

4. प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार सम्भावित उत्तर— A, B, C एवं D हैं। परीक्षार्थी को उन चारों विकल्पों में से एक सबसे सही अथवा सबसे उपयुक्त उत्तर छाँटना है। उत्तर को OMR आन्सर-शीट में सम्बन्धित प्रश्न संख्या में निम्न प्रकार भरना है :

उदाहरण :

प्रश्न :

प्रश्न 1 (A) ● (C) (D)
प्रश्न 2 (A) (B) ● (D)
प्रश्न 3 (A) ● (C) (D)

अपठनीय उत्तर या ऐसे उत्तर जिन्हें काटा या बदला गया है, या गोले में आधा भरकर दिया गया, उन्हें निरस्त कर दिया जाएगा।

5. प्रत्येक प्रश्न के अंक समान हैं। आपके जितने उत्तर सही होंगे, उन्हीं के अनुसार अंक प्रदान किये जायेंगे।

6. सभी उत्तर केवल ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर ही दिये जाने हैं। उत्तर-पत्रक में निर्धारित स्थान के अलावा अन्यत्र कहीं पर दिया गया उत्तर मान्य नहीं होगा।

7. ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर कुछ भी लिखने से पूर्व उसमें दिये गये सभी अनुदेशों को सावधानीपूर्वक पढ़ लिया जाये।

8. परीक्षा समाप्ति के उपरान्त परीक्षार्थी कक्ष निरीक्षक को अपनी OMR Answer Sheet उपलब्ध कराने के बाद ही परीक्षा कक्ष से प्रस्थान करें। परीक्षार्थी अपने साथ प्रश्न-पुस्तिका ले जा सकते हैं।

9. निगेटिव मार्किंग नहीं है।

10. कोई भी रफ कार्य, प्रश्न-पुस्तिका के अन्त में, रफ-कार्य के लिए दिए खाली पेज पर ही किया जाना चाहिए।

11. परीक्षा-कक्ष में लॉग-बुक, कैलकुलेटर, पेजर तथा सेल्युलर फोन ले जाना तथा उसका उपयोग करना वर्जित है।

12. प्रश्न के हिन्दी एवं अंग्रेजी रूपान्तरण में भिन्नता होने की दशा में प्रश्न का अंग्रेजी रूपान्तरण ही मान्य होगा।

महत्वपूर्ण : प्रश्नपुस्तिका खोलने पर प्रथमतः जाँच कर देख लें कि प्रश्न-पुस्तिका के सभी पृष्ठ भलीभाँति छपे हुए हैं। यदि प्रश्नपुस्तिका में कोई कमी हो, तो कक्षनिरीक्षक को दिखाकर उसी सिरीज की दूसरी प्रश्न-पुस्तिका प्राप्त कर लें।