



A-1

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**POLYMER SCIENCE AND TECHNOLOGY**

**PART - 1**

**Each question carries one mark.**

**(50 × 1 = 50)**

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| <p>1. Which of the following is an intensive property ?<br/>(A) Pressure<br/>(B) Mass<br/>(C) Volume<br/>(D) None of these</p> <p>2. The process in which the pressure of system remains constant<br/>(A) Isothermal<br/>(B) Isochoric<br/>(C) Adiabatic<br/>(D) Isobaric</p> <p>3. The SI unit of pressure is<br/>(A) Pascal<br/>(B) Newton<br/>(C) Joule<br/>(D) All the three</p> | <p>4. Which of the following is path variable ?<br/>(A) Work<br/>(B) Temperature<br/>(C) Pressure<br/>(D) Both (B) &amp; (C)</p> <p>5. No work is done by the system when the reaction occurs at constant _____<br/>(A) Volume<br/>(B) Temperature<br/>(C) Pressure<br/>(D) None of these</p> <p>6. An open system exchanges _____ with the surroundings.<br/>(A) Mass<br/>(B) Energy<br/>(C) Both (A) &amp; (B)<br/>(D) None of these</p> |
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7. XLPE is the trade name of Individual heat transfer

- (A) Low density polyethylene
- (B) High density polyethylene
- (C) Linear low density polyethylene
- (D) Crosslinked polyethylene

8.  $\text{CH}_3\text{CH}=\text{CH}_2$

- (A) Isomer
- (B) Oligomer
- (C) Monomer
- (D) Dimer

9. In forced convection, the heat transfer depends on

- (A) Re, Pr
- (B) Re, Gr
- (C) Mainly Gr
- (D) Re only

10. Flow of heat associated with the movement of fluid is \_\_\_\_\_.

- (A) Conduction
- (B) Convection
- (C) Radiation
- (D) None of these

11. A system in which there may be exchange of energy but not mass is known as

- (A) Open system
- (B) Closed system
- (C) Isolated system
- (D) Insulated system

12. Internal energy of a system depends upon

- (A) Quantity of substance
- (B) Its chemical nature
- (C) Temperature, pressure and volume
- (D) All of these

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13. A state function is
- (A) Internal energy
  - (B) Free energy
  - (C) Pressure
  - (D) All of these
14. Thermodynamics can be used
- (A) To predict the feasibility of a particular process
  - (B) To provide the information regarding the time taken to reach equilibrium
  - (C) To study the rate at which a given process may proceed
  - (D) All of these
15. Study of fluid motion with the forces causing the flow is known as
- (A) Kinematics of fluid flow
  - (B) Dynamics of fluid flow
  - (C) Statics of fluid flow
  - (D) None of these
16. A flow is said to be laminar when
- (A) The fluid particles moves in a zig-zag way
  - (B) The Reynolds number is high
  - (C) The fluid particles moves in layers parallel to the boundary
  - (D) None of these
17. Fluid statics deals with
- (A) Viscous and pressure forces
  - (B) Viscous and gravity forces
  - (C) Gravity and pressure forces
  - (D) Surface tension and gravity forces
18. 1 bar is equal to \_\_\_\_\_.
- (A)  $10^5 \text{ N/m}^2$
  - (B)  $1000 \text{ N/m}^2$
  - (C) 100 Pascal
  - (D)  $10^3 \text{ Pascal}$

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19. Pascal's law states that pressure at a point is equal in all directions

- (A) In a liquid at rest
- (B) In a fluid at rest
- (C) In a laminar flow
- (D) In a turbulent flow

20. Kinematic viscosity is equal to

- (A) Dynamic viscosity  $\times$  density
- (B) Dynamic viscosity / density
- (C) Dynamic viscosity / pressure
- (D) Pressure  $\times$  density

21. Geometric isomerism is obtained in polymers is due to the presence of

- (A) C = C in polymer backbone
- (B) Hetero atom in polymer backbone
- (C) Asymmetric carbon atom
- (D) Symmetric carbon atom

22. Copolymer is nothing but

- (A) Physical mixture of two monomers
- (B) Chemical mixture of two monomers
- (C) Physical mixture of monomer and initiator
- (D) None of these

23. Example for hetero polymers

- (A) PC
- (B) PPS
- (C) PEEK
- (D) All the three

24. On addition of solute in the solvent, the \_\_\_\_\_ of the solution decreases.

- (A) Boiling point
- (B) Freezing point
- (C) Vapour pressure
- (D) Both (B) and (C)

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25. The amount of steam required per unit quantity of distillate in case of steam distillation will be reduced by
- (A) Raising the temperature
  - (B) Lowering the total pressure
  - (C) Both (A) and (B)
  - (D) Neither (A) nor (B)
26. Total reflux in a distillation column requires minimum
- (A) Reboiler load
  - (B) Number of plates
  - (C) Condenser load
  - (D) None of these
27. Fenske's equation determines the
- (A) Maximum number of ideal plates
  - (B) Height of the distillation column
  - (C) Minimum number of theoretical plates
  - (D) Optimum reflux ratio
28. High pressure process uses oxygen as catalyst in the manufacture of
- (A) LDPE
  - (B) HDPE
  - (C) LLDPE
  - (D) Both (A) & (B)
29. Vinyl chloride monomer content in PVC is a measure of
- (A) Molecular weight
  - (B) Toxicity
  - (C) Morphology
  - (D) Heat stability
30. Functionality of styrene is
- (A) 3
  - (B) 1
  - (C) 2
  - (D) 4

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31. For a spontaneous process, free energy

- (A) Is zero
- (B) Increases
- (C) Decreases whereas entropy increases
- (D) None of these

32. Entropy is a measure of the \_\_\_\_\_ of a system.

- (A) Disorder
- (B) Orderly behaviour
- (C) Temperature change only
- (D) None of these

33.  $N_2O_4 \longrightarrow 2NO_2$  is example for \_\_\_\_\_ reaction.

- (A) Unimolecular
- (B) Bimolecular
- (C) Termolecular
- (D) None of these

34. Polyesterification reaction \_\_\_\_\_ polymerization.

- (A) Addition
- (B) Condensation
- (C) Poly addition
- (D) Both (B) & (C)

35. The unit of rate of first order reaction is \_\_\_\_\_.

- (A) moles/lit
- (B) moles. lit. s
- (C) moles/lit. s
- (D) None of these

36. In free radical polymerization, the rate of polymer formation is proportional to

- (A) First power of monomer concentration
- (B) Square root of initial concentration
- (C) Both (A) & (B)
- (D) Cannot be predicted

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37. Which of the following requires pre-drying before injection molding ?
- (A) PE
  - (B) PP
  - (C) PC
  - (D) None of these
38. Warpage occurs in molded plastic parts due to \_\_\_\_\_.
- (A) Non-uniform wall thickness
  - (B) Less cooling time
  - (C) Both (A) & (B)
  - (D) None of these
39. A process in which a preform is heated and blown to final shape is known as
- (A) Extrusion blow molding
  - (B) Intermittent extrusion blow molding
  - (C) Injection blow molding
  - (D) None of these
40. Crow's feet is related \_\_\_\_\_ process.
- (A) Injection molding
  - (B) Transfer molding
  - (C) Compression molding
  - (D) None of these
41. Which of the following is produced by extrusion process ?
- (A) Tumbler mats
  - (B) Insulated cables
  - (C) Floor mats
  - (D) None of these
42. \_\_\_\_\_ process generates greater amount of scrap.
- (A) Injection molding
  - (B) Blow molding
  - (C) Compression molding
  - (D) Thermoforming

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43. In compression molding \_\_\_\_\_ type gives flash free products.
- (A) Positive
  - (B) Semi-positive
  - (C) Both (A) & (B)
  - (D) None of these
44. Polyethylene terephthalate is
- (A) Terelyne
  - (B) Decron
  - (C) Both (A) & (B)
  - (D) None of these
45. An addition polymer is
- (A) Polypropylene
  - (B) Polyvinyl chloride
  - (C) Polystyrene
  - (D) All of these
46. Metals are good conductors of heat, because
- (A) Of free electrons present
  - (B) Their atoms are relatively far apart
  - (C) Their atoms collide frequently
  - (D) All of these

47. With increase in temperature, thermal conductivity of solid metals
- (A) Increases
  - (B) Decreases
  - (C) Their atoms collide frequently
  - (D) Depend on other factors
48. Mass transfer operations are used for
- (A) Separation of products from its by-products
  - (B) Purification of raw materials
  - (C) Both (A) and (B)
  - (D) None of these
49. The unit of diffusion coefficient is
- (A)  $m^2/s$
  - (B)  $m/s$
  - (C)  $mole/m^2s$
  - (D) None of these
50. Blow molding is a process to produce
- (A) Hollow articles
  - (B) Bottles
  - (C) Both (A) & (B)
  - (D) None of these

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**PART – 2**

**Each question carries two marks**

**(25 × 2 = 50)**

51. The group of polymers consisting of PC, PEO, PPO, PPS and Nylons are best categorized as
- (A) Engineering polymers
  - (B) Natural polymers
  - (C) Biodegradable polymers
  - (D) Commodity polymers
52. Examples for ring opening polymerization
- (A) Epoxy group
  - (B) Caprolactum
  - (C) Lactide
  - (D) All of these
53. A gas at 0 °C is cooled at constant pressure until its volume becomes half the original volume. The temperature of the gas at this state will be
- (A) -136.5 °C
  - (B) -136.5 K
  - (C) -273 °C
  - (D) 0 °C
54. Which of the following polymer produced by condensation polymerization ?
- (A) PU
  - (B) Polycarbonate
  - (C) EVA
  - (D) PMMA
55. What is the degree of freedom for a system comprising of liquid water equilibrium with its vapour ?
- (A) Zero
  - (B) One
  - (C) Two
  - (D) Three
56. The repeat unit in polyurethane is
- (A)  $-\text{NH} - \text{CO} - \text{NH}(\text{CH}_2)_5 -$
  - (B)  $-\text{CO} - (\text{CH}_2)_5 - \text{NH} -$
  - (C)  $-\text{CO} - (\text{CH}_2)_5 - \text{NH}_2 -$
  - (D)  $-\text{COO} - (\text{CH}_2)_5 - \text{NH} -$

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57.  $N_2$  content in urea sample is 42%.  
What is the urea content of the sample  
(MW of urea is 60) ?
- (A) 80%  
(B) 90%  
(C) 95%  
(D) 98%
58. One Newton equals to \_\_\_\_\_  
dynes.
- (A)  $10^2$   
(B)  $10^3$   
(C)  $10^4$   
(D)  $10^5$
59.  $CaCO_3$  contains \_\_\_\_\_  
percentage of Ca by weight.
- (A) 40  
(B) 48  
(C) 96  
(D) 12
60. In a solution containing 0.3 k mole of  
solute and 600 kg of solvent, the  
molality
- (A) 0.5  
(B) 0.6  
(C) 2  
(D) 1
61. The weight average degree of  
polymerization for an equimolar  
mixture of a diacid and glycol at an  
extent of reaction 0.99 is \_\_\_\_\_.
- (A) 100  
(B) 199  
(C) 19.9  
(D) 10
62. Which of the following is an example  
for crystalline and amorphous polymer  
respectively ?
- (A) Isotactic PP & HDPE  
(B) Isotactic PP & PS  
(C) PS and HDPE  
(D) PS & PF

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63. Which of the following group belongs to polyester, polyamide and polyether family respectively ?

- (A) PET, Nylon & PEO
- (B) PET, Kevlar & DGEBA
- (C) PET, Nylon & PF
- (D) PET, PU & PEG

64. 1 g mol of methane contains

- (A)  $6.02 \times 10^{23}$  atoms of hydrogen
- (B) 4 g mol of hydrogen
- (C)  $3.01 \times 10^{23}$  molecules of methane
- (D) 3 g of carbon

65. Which of the following statement is not true for addition polymerization ?

- (A) Elemental composition of reactant and product are same.
- (B) Polymerization occurs without byproducts.
- (C) New functional group forms after polymerization.
- (D) Is a single step polymerization.

66. Which of the following statement is not true with respect to Nylon 6,6 ?

- (A) Obtained from condensation polymerization
- (B) Fiber forming polymer
- (C) Sensitive to moisture
- (D) Chemically inert & flame retardant

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67. Chain polymerization is also known as

- (A) Vinyl polymerization
- (B) Poly addition polymerization
- (C) Condensation polymerization
- (D) Insertion polymerization

68. Functionality of acetylene and butadiene is

- (A) 4 & 4
- (B) 2 & 2
- (C) 2 & 4
- (D) 4 & 2

69. If the degree of polymerization of PP is 500, the molecular weight of PP is \_\_\_\_\_.

- (A) 21,000
- (B) 23,000
- (C) 42,000
- (D) 22,000

70. \_\_\_\_\_ is example for natural polymer.

- (A) Chitosan
- (B) Starch
- (C) Cellulose
- (D) All the three

71. In an extruder, the compression zone can be identified by

- (A) Gradual increase in root dia and decrease in flight depth of screw
- (B) Gradual decrease in root dia and increase in flight depth of screw
- (C) Gradual decrease in root dia and decrease in flight depth of screw
- (D) Gradual increase in root dia and increase in flight depth of screw

Space For Rough Work



72. In plug-assist forming process, the plug is used to

- (A) Eject the part
- (B) Force the material into the mold cavity
- (C) Heat the material
- (D) None of these

73. Rotomolding process is used to make \_\_\_\_\_ hollow articles.

- (A) Very large
- (B) Seamless
- (C) Both (A) & (B)
- (D) None of these

74. The steady state assumption in free radical polymerization is

- (A)  $R_i = R_t$
- (B)  $R_i + R_t$
- (C)  $R_p = R_t$
- (D)  $R_p + R_t$

75. The rate constant of a first order reaction is  $3.5 \times 10^{-2} \text{ min}^{-1}$ . The half life of the reaction is \_\_\_\_\_.

- (A) 19.8 sec
- (B) 19.8 min
- (C) 198 min
- (D) 1980 min

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A-1

16

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