

POLYMER SCIENCE AND TECHNOLOGY

PART - I

Each question carries one mark.

50 × 1 = 50

1. Poise is the unit of
 - (A) Mass density
 - (B) Kinematic viscosity
 - (C) Dynamic viscosity
 - (D) Velocity gradient

2. 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

3. One bar is equal to_____.
 - (A) $10^5 \frac{\text{N}}{\text{m}^2}$
 - (B) $1000 \frac{\text{N}}{\text{m}^2}$
 - (C) 1000 Pascal
 - (D) 10^5 Pascal

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4. The hydrostatic law states that rate of increase of pressure in a vertical direction is equal to
- (A) Density of the fluid
 - (B) Specific weight of the fluid
 - (C) Weight of the fluid
 - (D) None of the above
5. Gauge pressure at a point is equal to
- (A) Absolute pressure + Atmospheric pressure
 - (B) Absolute pressure - Atmospheric pressure
 - (C) Vacuum pressure + Absolute pressure
 - (D) None of these
6. Bernoulli's equation is derived making assumption that
- (A) The flow is uniform and incompressible
 - (B) The flow is non-viscous, uniform and steady
 - (C) The flow is steady, non-viscous, incompressible and irrotational
 - (D) None of these
7. For the laminar flow through a circular pipe
- (A) $V_{\max} = 1.5 V_{\text{avg}}$
 - (B) $V_{\max} = 2 V_{\text{avg}}$
 - (C) $V_{\max} = 2.5 V_{\text{avg}}$
 - (D) None of the above

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8. The boundary layer separation takes place if
- (A) Pressure gradient is zero
 - (B) Pressure gradient is negative
 - (C) Pressure gradient is positive
 - (D) None of the above
9. Unit of viscosity in CGS system is
- (A) $\text{g.cm}^{-1}.\text{s}^{-1}$
 - (B) $\text{g.cm}^2.\text{s}^{-2}$
 - (C) $\text{g.cm}^{-2}.\text{s}^{-1}$
 - (D) g.cm.s^{-1}
10. Volumetric composition of flue gas analyzed with the orsat apparatus is: $\text{CO}_2 = 12\%$, $\text{O}_2 = 8\%$, $\text{CO} = 0\%$, $\text{N}_2 = 80\%$. This flue gas composition indicates that
- (A) Pure oxygen has been used for combustion
 - (B) Nitrogen percentage in the fuel is very high
 - (C) Excess air has been used for combustion
 - (D) Hydrogen is not present in the fuel
11. Which of the following is not a unit of pressure ?
- (A) Torr
 - (B) N / m^2
 - (C) Parsec
 - (D) Bar or Pascal

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12. A solution is prepared by dissolving x_1 moles of solute in x_2 moles of solvent. The mole fraction of solute is given by

(A) $\frac{x_1}{x_1 + x_2}$

(B) $\frac{x_2}{x_1 + x_2}$

(C) $\frac{x_2}{x_1}$

(D) $\frac{x_1}{x_2}$

13. The rate of material_____ is zero in case of steady state system.

(A) Input

(B) Output

(C) Accumulation

(D) Generation

14. One micron is equal to

(A) 10^{-4} mm

(B) 10^{-4} cm

(C) 10^{-6} cm

(D) Both (B) and (C)

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15. STP corresponds to
- (A) One atm. Absolute pressure and 15.5°C
 - (B) 760 mm mercury gauge pressure and 15.5°C
 - (C) 760 Torr and 0°C
 - (D) 101.325 kPa gauge pressure and 15.5°C
16. Heat required to raise the temperature of a body by one degree centigrade is called its
- (A) Heat capacity
 - (B) Specific heat capacity
 - (C) Thermal conductivity
 - (D) Water equivalent
17. Internal energy change of a system over one complete cycle is
- (A) Zero
 - (B) Positive
 - (C) Negative
 - (D) Dependent on the path
18. Maximum work that could be secured by expanding the gas over a given pressure range is the _____ work
- (A) Isothermal
 - (B) Adiabatic
 - (C) Isentropic
 - (D) None of these

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19. Heating of water under atmospheric pressure is an _____ process.
- (A) Isochoric
 - (B) Isobaric
 - (C) Adiabatic
 - (D) Isothermal
20. Entropy is a measure of the _____ of a system
- (A) Disorder
 - (B) Orderly behaviour
 - (C) Temperature change only
 - (D) None of these
21. For a spontaneous process, free energy
- (A) is zero
 - (B) increases
 - (C) decreases whereas entropy increases
 - (D) none of these
22. In case of condensers and evaporators operating under given terminal conditions, LMTD for counter flow as compared to that of parallel flow is
- (A) more
 - (B) less
 - (C) equal
 - (D) much more

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23. Baffles provided on the shell side of a shell and tube heat exchanger are meant for
- (A) providing support for the tubes
 - (B) improving heat transfer
 - (C) both (A) and (B)
 - (D) to prevent fouling
24. In a counter current heat exchanger, hot fluid enters at 170°C and leaves at 150°C , while the cold fluid enters at 50°C and leaves at 70°C . The arithmetic mean temperature difference in this case is _____ $^{\circ}\text{C}$.
- (A) 20
 - (B) 60
 - (C) 120
 - (D) ∞
25. 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

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26. Total reflux in a distillation column requires minimum
- (A) reboiler load
 - (B) number of plates
 - (C) condenser load
 - (D) none of these
27. 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)
28. 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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29. Example for hetero polymers :

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

30. 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

31. 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

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32. -AAAABBBBAAAABBBB - represents
- (A) Random copolymer
 - (B) Homo polymer
 - (C) Block polymer
 - (D) Alternate copolymer
33. Which of the monomer is used in the synthesis of PAN ?
- (A) $\text{CH}_2=\text{CHNH}_2$
 - (B) $\text{CH}_2=\text{CHCN}$
 - (C) $\text{CH}_2=\text{CHCl}$
 - (D) $\text{CH}_2=\text{CHCONH}$
34. Which of the following is the hydrogen bond forming polymer ?
- (A) Polyolefines
 - (B) Cellulose acetate
 - (C) Polyamides
 - (D) Halogenated polymers
35. AIBN on thermal decomposition produces free radicals along with
- (A) CO_2
 - (B) NO
 - (C) N_2
 - (D) NH_3

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36. The starting material to prepare PET is

- (A) Adipic acid + ethylene glycol
- (B) Terephthalic acid + ethylene glycol
- (C) Terephthalic acid + butane diol
- (D) Maleic acid + ethylene glycol

37. The chain carrier in cationic polymerization is

- (A) Carbonium ion
- (B) Carban ions
- (C) Carboxylic groups
- (D) Carbonate ion

38. Polymers are

- (A) Micromolecules
- (B) Oligomers
- (C) Macromolecules
- (D) None of these

39. The unit of clamping force is _____

- (A) Pa
- (B) N
- (C) m^2
- (D) g / cc

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40. _____ polymer can be used in thermoforming.
- (A) Nylon
 - (B) HIPS
 - (C) Polyacetals
 - (D) None of these
41. Thermoset resins can be used in _____ process.
- (A) Extrusion
 - (B) Blow molding
 - (C) Compression molding
 - (D) None of these
42. _____ parts are usually produced by compression molding.
- (A) Large and complex
 - (B) Small and complex
 - (C) Large and simple
 - (D) Both (A) and (B)
43. Shark skin & surfing is related to _____ process.
- (A) I / M
 - (B) C / M
 - (C) Extrusion
 - (D) B / M

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44. PTFE cannot be extruded due to its

- (A) High melt viscosity
- (B) Low melt viscosity
- (C) Powdery form
- (D) None of these

45. Parison programming in blow molding is used to

- (A) Maintain uniform thickness
- (B) Provide thick and thin sections
- (C) Both (A) and (B)
- (D) None of these

46. Biaxial orientation of films is obtained by

- (A) Blown film extrusion
- (B) Film casting
- (C) Both (A) and (B)
- (D) None of these

47. The overall rate of polymerization is

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

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48. The fraction of functional groups as reacted at time 't' in condensation polymerization is known as

- (A) Extent of reaction
- (B) Degree of polymerization
- (C) Reactivity ratio
- (D) Initiator efficiency

49. Chemical kinetics can predict the

- (A) Rate of reaction
- (B) Feasibility of reaction
- (C) Both (A) and (B)
- (D) None of these

50. Molecularity of a reaction

- (A) May not be equal to the order of reaction
- (B) Can't have a fractional value
- (C) Both (A) and (B)
- (D) None of these

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PART -II

Each question carries two marks.

25 × 2 = 50

51. In compression molding press capacity is related to
- (A) Area of ram/hydraulic pressure
 - (B) Hydraulic pressure/Area of ram
 - (C) Area of ram × hydraulic pressure
 - (D) None of these
52. Die swell can be reduced by
- (A) Increase in land length
 - (B) Increase in temperature
 - (C) Both (A) & (B)
 - (D) None of these
53. The order of melt pressure increase in extruder is
- (A) Metering to feed to compression zone
 - (B) Feed to metering to compression zone
 - (C) Feed to compression to metering zone
 - (D) None of these
54. Simultaneous filling of multi cavity injection molding can be accomplished by
- (A) Runner and gate balancing
 - (B) Runner balancing only
 - (C) Gate location & size
 - (D) None of these

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55. Assuming that CO_2 obeys ideal gas law, calculate the density of CO_2 (in kg/m^3) at 263°C and at 2 atm.
- (A) 1
(B) 2
(C) 3
(D) 4
56. Equal masses of CH_4 and H_2 are mixed in empty container. The partial pressure of H_2 in this container is expressed as the fraction of total pressure is
- (A) $1/9$
(B) $8/9$
(C) $1/2$
(D) $5/9$
57. 1 kg of CaC_2 produces about 0.41 kg of acetylene gas on treatment with water. How many hours of service can be derived 1 kg of CaC_2 in acetylene lamp burning 35 lts of gas at NTP per hour ?
- (A) 10
(B) 5
(C) 20
(D) 1

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58. The heat flux (from outside to inside) across an insulating wall with thermal conductivity 0.4 W/m.k and thickness 0.16 m is 10 W/m^2 . The temperature of the inside wall is -5°C . The outside wall temperature is
- (A) 25°C
 - (B) 30°C
 - (C) 35°C
 - (D) 40°C
59. Keeping the pressure constant to double the volume of the given mass of an ideal gas at 27°C the temperature should be raised to _____ $^\circ\text{C}$
- (A) 270
 - (B) 327
 - (C) 300
 - (D) 540
60. 1 g mol of an alcohol whose molecular weight is 74 contains 48 g of carbon, 10 g of hydrogen and 16 g of oxygen. Its molecular formula is
- (A) $\text{C}_4\text{H}_9\text{OH}$
 - (B) $\text{C}_3\text{H}_{21}\text{OH}$
 - (C) $\text{C}_2\text{H}_4\text{OH}$
 - (D) $\text{C}_2\text{H}_{33}\text{OH}$

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61. A first order reaction is 50% completed in 20 mins. The time taken for 75 % completion is
- (A) 40 min
 - (B) 20 min
 - (C) 60 min
 - (D) 100 min
62. The average number of monomer molecules consumed by each effective free radical generated by the initiator is called
- (A) Initiator efficiency
 - (B) Reactivity ratio
 - (C) Kinetic chain length
 - (D) None of these
63. The critical value of branching coefficient for gelation, α_c is _____
- (A) $f/f+1$
 - (B) $f/f-1$
 - (C) $1/f+1$
 - (D) $1/f-1$
64. From the following four groups of polymers, identify the group in which all four polymers are semicrystalline.
- (A) PC, NR, PPS, UF, SBR
 - (B) Nylon 6, PP, PS, HDPE, PET
 - (C) PET, PVC, EPOXY, UF, PC
 - (D) Nylon66, ABS, SBR, PP, NR

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65. PTFE is used as
- (A) Non-stick coating on pots and pans
 - (B) Insulating materials for motors
 - (C) Co-axial cables
 - (D) All the above
66. In condensation polymerization, chain branching structure of polymer is possible only with
- (A) Mono functional monomers
 - (B) Di functional polymers
 - (C) Tri functional polymers
 - (D) All the above
67. PP may be syndiotactic when
- (A) All methyl groups are arranged in the same side of polymer
 - (B) Methyl groups are arranged regularly on alternative side of polymer chain
 - (C) Methyl groups are arranged randomly on both sides of the polymer chain
 - (D) All the above
68. Nature of polymer obtained in free radical polymerization is
- (A) Generally isotactic structure
 - (B) Broad molecular weight distribution
 - (C) Narrow molecular weight distribution
 - (D) None of these

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69. For laminar flow between two parallel plates

(A) $V_{\max} = 2 V_{\text{avg}}$

(B) $V_{\max} = 2.5 V_{\text{avg}}$

(C) $V_{\max} = 1.33 V_{\text{avg}}$

(D) None of these

70. Lift force is defined as the force exerted by a flowing fluid on a solid body

(A) In the direction of flow

(B) Perpendicular to the direction of flow

(C) 45° to the direction of flow

(D) None of the above

71. A body is called stream lined body when it is placed in a flow and the surface of the body

(A) Coincides with the stream line

(B) Does not coincide with the stream lines

(C) Is perpendicular to the stream lines

(D) None of the above

72. Atmospheric pressure held in terms of water column is

(A) 7.5 m

(B) 8.5 m

(C) 10.3 m

(D) 9.81 m

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73. In poly condensation, a high degree of polymerization can be obtained ----
- (A) If highly pure difunctional monomer is used
 - (B) At very high conversion
 - (C) Both (A) and (B)
 - (D) None of these
74. Advantages of emulsion polymerization is
- (A) Easy to control temperature
 - (B) High rate of process
 - (C) Homogeneity of the polymer
 - (D) All of these
75. The kinetics and degree of polymerization of polymer during emulsion polymerization depends on
- (A) Temperature and time of process
 - (B) Quality of initiator
 - (C) Intensity of agitator
 - (D) All of these

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