

CODE: AE-PL

M.Tech. Common Entrance Test, PGCET – 2010

Polymer Science

Time: 2 Hours

Max. Marks: 100

Read the following instructions before answering the test

- i) Write / Darken the particulars of your identity, Test Seat Number and affix your signature on the OMR Response Sheet before the start of the test.
- ii) All Questions have multiple choices of answers, of which only one is correct.
- iii) Mark the correct answer by completely darkening only one oval against the Question number using Black Ink Ball Point pen only.
- iv) There will be no negative evaluation with regard to wrong answers. Marks will not be awarded if multiple answers are given.
- v) Do not make any stray mark on the OMR Response sheet. For rough work, use blank page on the question paper.
- vi) Taking the question paper out of the test hall is permitted only after the full duration of the test.
- vii) Use of only non-programmable calculator is permitted.
- viii) **START ANSWERING ONLY AT THE SPECIFIED TIME WHEN THE INVIGILATOR GIVES INSTRUCTIONS.**

MARKS DISTRIBUTION

PART – I	50 Questions :	$50 \times 1 =$	50 Marks
PART – II	25 Questions :	$25 \times 2 =$	50 Marks
		Total =	100 Marks

PART – I

Each question carries one mark

50 x 1 = 50 marks

1. Newton's law of viscosity relates

- (a) Intensity of pressure and rate of angular deformation
- (b) Shear stress and rate of angular deformation
- (c) Shear stress, viscosity and rate of angular deformation
- (d) Viscosity and rate of angular deformation

2. Flow at constant rate through a tapering pipe is

- (i) Steady flow (ii) Uniform flow (iii) Unsteady flow (iv) Non- uniform flow

The correct answer is;

- (a) (i) and (ii) (b) (i) and (iv) (c) (ii) and (iii) (d) (ii) and (iv)

3. In laminar flow, maximum velocity at the centre of pipe is how many times to the average velocity?

- (a) Two (b) Three (c) Four (d) None of them

4. Reynolds number for non-circular cross section is,

- (a) $V \cdot 4P/v$ (b) $V \cdot P/v$ (c) $V \cdot 2P/4v$ (d) $V \cdot P/4v$

where, V = mean velocity, v = kinematic viscosity and P = ratio of cross section area to the wetted perimeter

5. When the relationship between Reynolds number and the friction factor is represented by a straight line, the flow is said to be,

- (a) Isentropic (b) Laminar (c) Turbulent (d) Vertex

6. Equation of continuity is based on the principle of conservation of

- (a) Mass (b) Energy (c) Momentum (d) None of the above

7. Average molecular weight of air is about

- (a) 15 (b) 59 (c) 29 (d) 23

Number of gram equivalent weight of a solute dissolved in 1 kg of solvent is referred as,

- (a) Molarity (b) Normality (c) Formality (d) Molality

The ground nut seeds containing 45% oil and 45% solids are fed to expeller, the cake coming out of expeller is found to contain 80% solid and 5% oil. Find the percentage recovery of oil.

- (a) 90.57 (b) 95.90 (c) 93.75 (d) 87.90

Moles per unit volume can be expressed

- (a) lb mol of solute/ ft³ (b) g mol of solute/lt
(c) g mol of solute/cm³ (d) All the above

A wet paper pulp is found to contain 71% water. After drying it is found that 60% of the original water has been removed. Calculate the mass of water removed per kilogram of wet pulp,

- (a) 0.326 kg (b) 0.426 kg (c) 0.526 kg (d) 0.626 kg

In a test 20 lb of C₃H₈ is burned with 400 lb of air to produce 44 lb of CO₂ and 12 lb of CO, what was the percent excess air?

- (a) 32 % (b) 20 % (c) 28 % (d) 35 %

In an open system, there is

- (a) No exchange in energy and mass of the system,
(b) Exchange of mass and energy with the surroundings
(c) Exchange of mass with the surroundings
(d) Exchange of energy with the surrounding not the mass



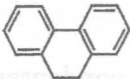

The value of gas constant, R is J/K. mole

- (a) 8.314 (b) 2.000 (c) 6.778 (d) 0.187

The effect of pressure on entropy is appreciable in

- (a) Crystals (b) Solids (c) Liquids (d) Gases

16. Third law of thermodynamics is helpful in
- (a) Calculating absolute entropies of substances at different temperatures
 - (b) Evaluating entropy changes of chemical reaction
 - (c) Both (a) and (b)
 - (d) None of the above
17. The quantitative effect of temperature on chemical equilibrium is given by;
- (a) Vant – Hoff equation
 - (b) Le – Chatlier's principle
 - (c) Arrhenius equation
 - (d) None of the above
18. In steam table, different data of steam can be arranged according to,
- (a) Saturated steam data with reference to varying temperatures
 - (b) Saturated steam data with reference to varying pressure
 - (c) Super heated steam data for different states of temperatures and different pressure
 - (d) All the above
19. Fugacity is most helpful in
- (a) Representing actual behaviour of real gasses
 - (b) Representing actual behaviour of ideal gasses
 - (c) Study of chemical equilibria involving gases at atmospheric pressure
 - (d) None of the above
20. Epoxy is an example for
- (a) Thermoset
 - (b) Elastomer
 - (c) Thermoplastic
 - (d) Composite
21. Isothermal irreversible expansion is a
- (a) Non spontaneous process
 - (b) Spontaneous process
 - (c) Steady process
 - (d) Continuous process
22. Heat is transferred by conduction, convection and radiation in,
- (a) Boiler furnaces
 - (b) Melting of ice
 - (c) Condensation of steam in condenser
 - (d) None of the above

23. With increase in temperature thermal conductivity of solid metals
- (a) Increases (b) Decreases
(c) Remain constant (d) Depend on other factors
24. Mass transfer co-efficient (K) and diffusivity (D) are related according to film theory as;
- (a) $K \propto D$ (b) $K \propto \sqrt{D}$ (c) $K \propto D^{1.5}$ (d) $K \propto D^2$
25. In steam distillation, the
- (a) Temperature is 100°C
(b) Temperature is more than 100°C
(c) Product must be immiscible with water
(d) Temperature is higher than boiling point of either component
26. Warpage of polymer products may be due to,
- (a) Long cycle time
(b) Uneven surface temperature of molds
(c) Too slow injection speed
(d) Excessive moisture in the resin
27. In stretch blow molding the part which is used to heat and stretch is called as;
- (a) Pre preg (b) Parison (c) Perform (d) None of the above
28. SMC, DMC, BMC etc., are the compounds used for:
- (a) Injection molding (b) Calendering
(c) Blow molding (d) Compression molding
29. Which processing method is; simple operative, low cost and less wastage?
- (a) Compression molding (b) Injection molding
(c) Roto molding (d) Thermoforming
30. Which of the following molecule undergoes ring opening polymerization?
- (a)  (b)  (c)  (d) 

31. Rubbers are usually useful only after
 (a) Cooling (b) Thermal Ageing (c) Vulcanization (d) Decrosslinking
32. The plastic compound is made by mixing functional additives with the plastic using,
 (a) Two roll mill (b) Compression moulding machine
 (c) Twin screw Extruder (d) Thermoforming machine
33. For a free radical polymerization the polymer formation is proportional to the,
 (a) Square root of the monomer concentration
 (b) First power of the monomer concentration
 (c) n^{th} power of the monomer concentration
 (d) First power of initiator concentration
34. Polymers are
 (a) Macromolecules (b) Micromolecules
 (c) Oligomers (d) Sub-macromolecules
35. _____ is defined as the number of monomer units consumed per active center
 (a) Rate of growth (b) Rate of polymerization
 (c) Kinetic chain length (d) Rate of termination
36. In a free radical polymerization of co-polymer, the rate of disappearance of the two types of monomer are given by
 (a) $K_{11} [M_1^0] [M_1] + K_{21} [M_2^0] [M_1]$ (b) $K_{12} [M_1^0] [M_2] + K_{22} [M_2^0] [M_2]$
 (c) Both (a) & (b) (d) None of the above
37. The degree of polymerization
 (a) Decreases with increase in temperature (b) Increases with decrease in temperature
 (c) Increases with increase in temperature (d) Unaltered
38. The degree of polymerization and kinetic chain length are
 (a) Independent (b) Interdependent
 (c) Inversely proportional to each other (d) None of the above
39. In case of second order reaction the time of half change ($t_{1/2}$) is
 (a) Independent on monomer concentration
 (b) Directly proportional to each other
 (c) Inversely proportional to monomer concentration
 (d) None of the above
40. Out of the following polymers, which one shows highest melting temperature
 (a) Polymethyl acrylate (PMA) (b) Polyethyl acrylate (PEA)
 (c) Polybutyl acrylate (PBA) (d) Polymethyl methacrylate (PMMA)

- Which of the following polymer is water soluble?
- (a) Polyvinyl ester (b) Polyvinyl alcohol
(c) Polyether ether ketone (d) Chitosan
- The group of polymers consisting of PC, PEO, PPO, PPS, nylons and PEEK is best categorized as;
- (a) Engineering polymers (b) Natural polymers
(c) Biodegradable polymers (d) Commodity polymers
- AIBN on thermal decomposition produces free radicals along with
- (a) CO_2 (b) NO (c) N_2 (d) NH_3
- Monomer to prepare polyacrylonitrile (PAN) is;
- (a) $\text{CH}_2=\text{CH}_2$ (b) $\text{CH}_2=\text{CHCN}$ (c) $\text{CFCl}=\text{CF}_2$ (d) $\text{CF}_2=\text{CF}_2$
- In polycondensation to prepare polyamide, the reaction takes place between
- (a) Diacids and Diols (b) Diisocyanates and polyols
(c) Diacids and Diamines (d) Diols and diols
- The chain carrier in case of cationic polymerization are,
- (a) Carbonium ions (b) Hydroxyl ions (c) Carbanions (d) Carbonyl ions
- If the repeat units are joined in a 3-dimensional array, the resulting polymer will be
- (a) Linear polymer (b) Branched polymer
(c) Cross linked polymer (d) None of these
- Atactic polymers are,
- (a) High melting and highly soluble (b) Low melting and easily soluble
(c) High melting and less soluble (d) None of these
- Which of the following is a branched chain polymer,
- (a) HDPE (b) LDPE (c) UHMWPE (d) XLPE
- Addition polymerization is nothing but,
- (a) Condensation polymerization (b) Step polymerization
(c) Chain polymerization (d) Interfacial polymerization

PART – II

Each Question carries two marks

25 x 2 = 50 marks

51. The dilute acid containing 25% H_2SO_4 is concentrated by commercial grade sulphuric acid containing 98% H_2SO_4 to obtain desired acid contain 65% H_2SO_4 . Find the quantities of the acids required to make 1000 kg of desired acid,
- (a) Dilute acid – 452 kg, commercial grade – 548 kg
 - (b) Dilute acid – 548 kg, commercial grade – 452 kg
 - (c) Dilute acid – 600 kg, commercial grade – 758 kg
 - (d) Dilute acid – 758 kg, commercial grade – 600 kg
52. A sample of coal is found to contain 67.2 % carbon and 22.3 % ash on weight basis. The reflux obtained at the end of combustion is analyzed to contain 7.1 % by weight carbon and the rest is ash. Calculate the percent of original carbon remaining unburnt in reflux,
- (a) 4.002
 - (b) 1.681
 - (c) 6.217
 - (d) 2.535
53. If a bucket holds 4.00 lb of NaOH (mol wt - 40.0). How many pound moles of NaOH does it contain?
- (a) 0.100 lb mol NaOH
 - (b) 1.000 lb mol NaOH
 - (c) 0.025 lb mol NaOH
 - (d) 0.050 lb mol NaOH
54. Match the following:
- | <u>Column A</u> | <u>Column B</u> |
|-----------------------------|----------------------------------|
| (p) $\Delta H - T \Delta S$ | 1. Efficiency of a Carnot engine |
| (q) $1 - T_2/T_1$ | 2. Gibbs energy |
| (r) $U + PV$ | 3. Universal gas constant |
| (s) $C_p - C_v$ | 4. Enthalpy |
- (a) (p) –2; (q) –1; (r) –4; (s) –3
 - (b) (p) –1; (q) –2; (r) –3; (s) –4
 - (c) (p) –3; (q) –4; (r) –1; (s) –1
 - (d) (p) –4; (q) –3; (r) –1; (s) –2

From the following four groups of polymers, identify the group in which all four polymers are semi crystalline;

- (a) HDPE, NR, PP, PS, UF
- (b) PET, PVC, epoxy, UF, PC
- (c) Nylon 6, PP, PS, HDPE, PET
- (d) Nylon 66, ABS, SBR, PP, NR

Match the items given in the following two columns using appropriate combination

Column A

- P. Sodium lauryl sulphate
Q. Benzoyl peroxide
R. $TiCl_4 + Al(C_2H_5)_3$
S. Polyvinyl alcohol

Column B

1. Initiator
2. Suspending agent
3. Emulsifier
4. Zeigler- Natta catalyst

- (a) P-1; Q-3; R- 4; S-2
- (b) P-1; Q-2; R- 3; S-4
- (c) P-4; Q-3; R- 2; S-1
- (d) P-3; Q-1; R- 4; S-2

Match the following additives for plastics with their respective functions

Additives

- P. Dioctyl phthalate.
Q. Sodium bicarbonate
R. Aluminium tri hydrate (ATH)
S. Silica

Functions

1. Blowing Agent
2. Flame retardant
3. Filler
4. Plasticizer

- (a) P-4; Q-1; R- 2; S-3
- (b) P-1; Q-2; R- 3; S-4
- (c) P-4; Q-3; R- 2; S-1
- (d) P-3; Q-1; R- 4; S-2

What are the molecular weights of polyethylene (PE) and polypropylene (PP), when their D_p is 1000?

- (a) 28000 & 410000
- (b) 20000 & 40000
- (c) 30000 & 42000
- (d) 28000 & 42000

A small molecule is eliminated as a byproduct during the synthesis of;

- (a) Acrylonitrile-butadiene-styrene copolymer
- (b) Polycaprolactone
- (c) Polyvinylidene chloride
- (d) Poly (ethylene terephthalate)

Toughness of a plastic material can be judged from the area under the stress- strain curve obtained from tensile test. The plastic having the highest toughness exhibits,

- (a) High tensile strength and low elongation
- (b) Low tensile strength and high elongation
- (c) High tensile strength and high elongation
- (d) Low tensile strength and low elongation

61. Functionality of acetylene and diisocyanate are;

- (a) 2 & 4 (b) 2 & 2 (c) 4 & 4 (d) 4 & 2

62. T_g of PMMA and NR are;

- (a) 80 and -55°C (b) 80 and 55°C (c) -80 and -55°C (d) 80 and -5°C

63. The natural rubber/carbon black composite contains 60 wt % of carbon black. The density of carbon black is 1.6 g/cc and that of the natural rubber is 0.8 g/cc. The density of the rubber composite in the units of g/cc is;

- (a) 1.688 (b) 1.280 (c) 2.400 (d) 1.400

64. The advantages of emulsion polymerization process are;

- (i) High molecular weight polymer product
- (ii) High purity product
- (iii) Temperature and viscosity can be controlled throughout the polymerization reaction
- (iv) Pearl or bead type product

- (a) (i) & (ii) (b) (i) & (iii) (c) (i) & (iv) (d) (ii) & (iii)

65. Match the items given in the following two columns using appropriate combination

Column A

P. PP, HDPE, LDPE

Q. Styrene, acetylene, ethylene, acrylonitrile

R. Epoxy, PF, UF

S. NBR, NR, SBR, EPDM

Column B

1. Elastomers

2. Thermosets

3. Polyolefines

4. Monomers

(a) P-1; Q-2; R- 3; S-4

(c) P-4; Q-3; R- 2; S-1

(b) P-1; Q-2; R- 3; S-4

(d) P-3; Q-4; R- 2; S-1

66. Co-ordination polymerization is also known as

- (i) Insertion polymerization
- (ii) Polycondensation polymerization
- (iii) Interfacial polymerization
- (iv) Stereo specific polymerization

- (a) (i) & (ii) (b) (ii) & (iv) (c) (i) & (iv) (d) (iii) & (iv)

67. How many gram moles of sodium hydroxide are present in 1 kg of sodium hydroxide?

- (a) 40.00 (b) 25.00 (c) 50.50 (d) 18.00

8. A gaseous mixture contains 16 kg of oxygen, 1 kg of hydrogen and 14 kg of nitrogen. The mole fraction of nitrogen is,
- (a) 0.14 (b) 1.6 (c) 0.33 (d) 0.31
9. BF_3 , AlCl_3 , SnCl_4 and TiCl_4 are the examples for,
- (a) Initiators for cationic polymerization (b) Inhibitor
(c) Initiators for free radical polymerization (d) Chain transferring agents
10. -ABBBABAABABBABBABAAB- represents
- (a) Block copolymer (b) Random copolymer
(c) IPNs (d) Alternate copolymer
11. The density of nylon 66 is 1220 kg/m^3 , its value in g/lit, will be equal to
- (a) 0.1220 (b) 1.220 (c) 1220 (d) 12.20
12. How much nitrogen can be obtained from 85 kg of ammonia?
- (a) 14 kg (b) 28 kg (c) 85 kg (d) 70 kg
13. Avogadro's number is equal to
- (a) 6.023×10^{26} molecules/g.mole (b) 6.023×10^{26} molecules/kg.mole
(c) 6.023×10^{20} molecules/g.mole (d) 6.023×10^{13} molecules/g.mole
14. Living polymers are formed by
- (a) Coordination polymerization (b) Anionic polymerization
(c) Condensation polymerization (d) Free radical polymerization
15. The starting material to prepare polyethylene terephthalate is,
- (a) Terephthalic acid + Ethylene glycol (b) Terephthalic acid + Butane-diol
(c) Maleic acid + Ethylene glycol (d) Terephthalic acid + Adipic acid

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