

Q. 1 – Q. 5 carry one mark each.

Q.1 The chairman requested the aggrieved shareholders to _____ him.

- (A) bare with (B) bore with (C) bear with (D) bare

Q.2 Identify the correct spelling out of the given options:

- (A) Managable (B) Manageable (C) Mangaable (D) Managible

Q.3 Pick the odd one out in the following:

13, 23, 33, 43, 53

- (A) 23 (B) 33 (C) 43 (D) 53

Q.4 R2D2 is a robot. R2D2 can repair aeroplanes. No other robot can repair aeroplanes.

Which of the following can be logically inferred from the above statements?

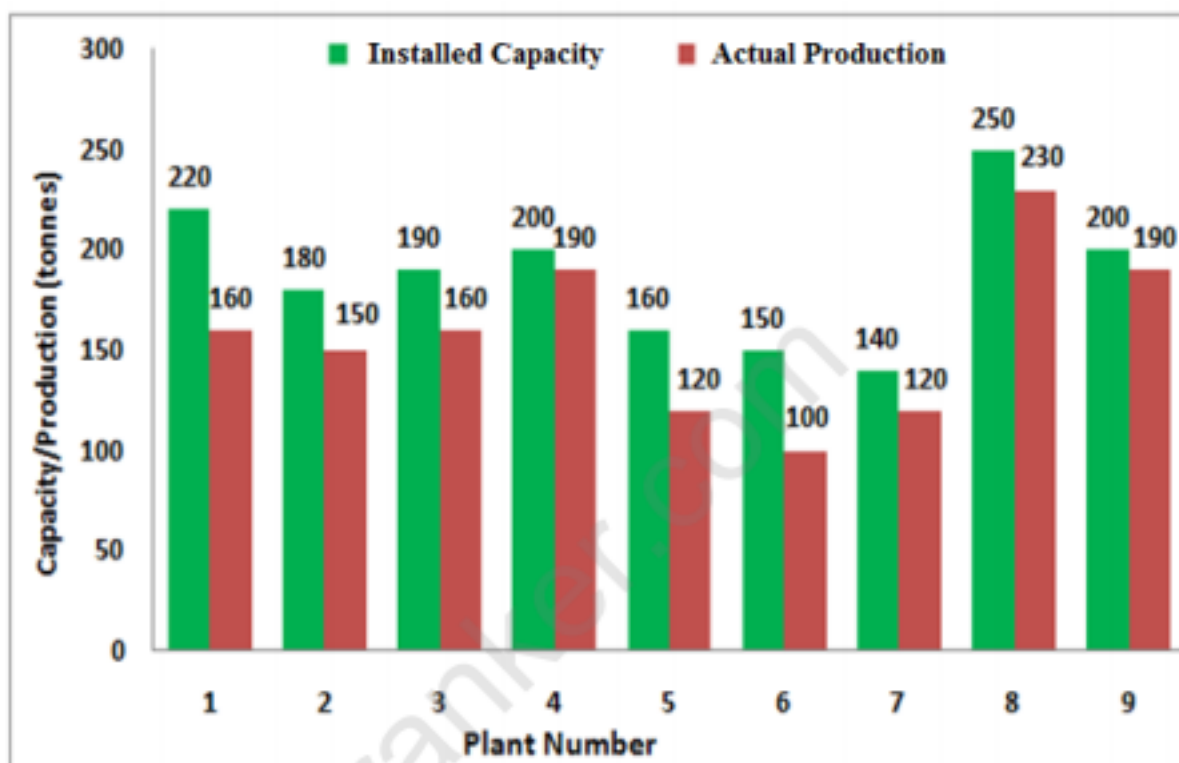
- (A) R2D2 is a robot which can only repair aeroplanes.
(B) R2D2 is the only robot which can repair aeroplanes.
(C) R2D2 is a robot which can repair only aeroplanes.
(D) Only R2D2 is a robot.

Q.5 If $|9y-6|=3$, then $y^2-4y/3$ is _____.

- (A) 0 (B) $+1/3$ (C) $-1/3$ (D) undefined

Q. 6 – Q. 10 carry two marks each.

- Q.6 The following graph represents the installed capacity for cement production (in tonnes) and the actual production (in tonnes) of nine cement plants of a cement company. Capacity utilization of a plant is defined as ratio of actual production of cement to installed capacity. A plant with installed capacity of at least 200 tonnes is called a large plant and a plant with lesser capacity is called a small plant. The difference between total production of large plants and small plants, in tonnes is _____.



- Q.7 A poll of students appearing for masters in engineering indicated that 60 % of the students believed that mechanical engineering is a profession unsuitable for women. A research study on women with masters or higher degrees in mechanical engineering found that 99 % of such women were successful in their professions.

Which of the following can be logically inferred from the above paragraph?

- (A) Many students have misconceptions regarding various engineering disciplines.
- (B) Men with advanced degrees in mechanical engineering believe women are well suited to be mechanical engineers.
- (C) Mechanical engineering is a profession well suited for women with masters or higher degrees in mechanical engineering.
- (D) The number of women pursuing higher degrees in mechanical engineering is small.

- Q.8 Sourya committee had proposed the establishment of Sourya Institutes of Technology (SITs) in line with Indian Institutes of Technology (IITs) to cater to the technological and industrial needs of a developing country.

Which of the following can be logically inferred from the above sentence?

Based on the proposal,

- (i) In the initial years, SIT students will get degrees from IIT.
- (ii) SITs will have a distinct national objective.
- (iii) SIT like institutions can only be established in consultation with IIT.
- (iv) SITs will serve technological needs of a developing country.

- (A) (iii) and (iv) only. (B) (i) and (iv) only.
(C) (ii) and (iv) only. (D) (ii) and (iii) only.

- Q.9 Shaquille O' Neal is a 60% career free throw shooter, meaning that he successfully makes 60 free throws out of 100 attempts on average. What is the probability that he will successfully make exactly 6 free throws in 10 attempts?

- (A) 0.2508 (B) 0.2816 (C) 0.2934 (D) 0.6000

- Q.10 The numeral in the units position of $211^{870} + 146^{137} \times 3^{424}$ is ____.

END OF THE QUESTION PAPER

F : Polymer Science and Engineering

Q. 1 – Q. 9 carry one mark each.

- Q.1 The polymer with minimum number of branches is
(A) HDPE (B) VLDPE
(C) LDPE (D) LLDPE
- Q.2 Nitrile rubber is a copolymer of
(A) isoprene and acrylonitrile (B) butadiene and acrylonitrile
(C) cyclopentadiene and acrylonitrile (D) isobutylene and acrylonitrile
- Q.3 The functionality of 1,4-divinylbenzene in reactions involving addition across carbon-carbon double bond is
(A) 1 (B) 2 (C) 3 (D) 4
- Q.4 The comonomer common to Nylon 66 and Nylon 46 is
(A) hexamethylene diamine (B) butylene diamine
(C) adipic acid (D) octane dicarboxylic acid
- Q.5 Polyethylene and polypropylene form an immiscible blend mainly due to
(A) entropy factor (B) enthalpy factor
(C) crystallinity (D) solubility
- Q.6 Rubber modulus is
(A) ratio of stress to strain (B) same as Young's modulus
(C) stress at specified strain (D) stress at break
- Q.7 The solubility parameter is determined by using
(A) Bragg's equation (B) Fox equation
(C) Hildebrand equation (D) Carother's equation
- Q.8 'Roller die' consists of a combination of
(A) a two-roll calender with internal mixer feeding
(B) a two-roll calender with open mill feeding
(C) a three-roll vertical calender with two-roll mixer feeding
(D) a two-roll calender with extruder feeding
- Q.9 Resole is an example of
(A) thermoplastic polymer (B) thermosetting polymer
(C) natural polymer (D) thermoplastic elastomer

Q. 10 – Q. 22 carry two marks each.

Q.10 Match the processing technique to the appropriate product listed below:

Processing Technique	Product
P. Blow molding	1. Bucket
Q. Co-extrusion	2. Blister packaging
R. Injection molding	3. Bottles
S. Thermoforming	4. Multilayered sheets

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

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

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

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

Q.11 For a high molecular weight polymer sample with a viscosity of 6×10^{11} Poise and a stress relaxation modulus of 3×10^6 dyne cm^{-2} at a given temperature, the relaxation time will be _____ hours.

Q.12 Match the following polymer additives to their function:

Additive	Function
P. Azocarbonamide	1. Chemical plasticizer
Q. Antimony trioxide	2. Accelerator
R. Pentachlorothiophenol	3. Flame retardant
S. Mercaptobenzothiazole	4. Blowing agent

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

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

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

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

Q.13 Tensile force of 165 N is applied to a piece of vulcanized rubber of dimension 4 mm x 4 mm x 30 mm. If the sample is elongated by 50% of its original length under the same applied force, the true stress will be _____ MPa.

Q.14 The order of glass transition temperature for the given polymers is [NR=natural rubber; PP=polypropylene; PE=polyethylene; PMMA=poly(methyl methacrylate)]

(A) NR < PE < PP < PMMA

(B) PE < NR < PP < PMMA

(C) PE < PP < NR < PMMA

(D) NR < PP < PE < PMMA

Q.15 Dynamic mechanical analysis of polystyrene ($T_g = 100^\circ\text{C}$) measured at a frequency of 1 Hz shows the damping peak at 110°C . If the measurement is made at 10^4 Hz, then the peak temperature ($^\circ\text{C}$) will be

(A) 123.2

(B) 133.2

(C) 143.2

(D) 153.2

Q.16 Match the product to the most suitable plastic listed below:

Product	Plastic
P. Baby feeding bottle	1. Polypropylene
Q. Tiffin box	2. Poly(ethylene terephthalate)
R. Water bottle	3. Poly(vinyl chloride)
S. Blood bag	4. Polycarbonate

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

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

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

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

- Q.17 The number average molecular weight for the polymerization of adipic acid and ethylene glycol (feed ratio 1:1) at 99 percent conversion is _____ g mol^{-1} .
- Q.18 A composite material contains 30 % by volume of uniaxially aligned glass fibres in a matrix of alkyd resin. The tensile moduli of the glass fibre and alkyd resin are 76 GPa and 3 GPa, respectively. If a tensile stress of 100 MPa is applied parallel to the fibres, the percentage longitudinal strain is _____.
- Q.19 Match the elastomers listed below to the appropriate curing agent:

Elastomer	Curing Agent
P. Silicone rubber	1. Zinc oxide + ethylene thiourea
Q. Natural rubber	2. Diamine
R. Chloroprene rubber	3. Sulfur
S. Acrylate elastomer	4. Dicumyl peroxide

- (A) P-4; Q-3; R-1; S-2
(B) P-3; Q-4; R-1; S-2
(C) P-4; Q-1; R-3; S-2
(D) P-2; Q-3; R-4; S-1
- Q.20 The weight of graphite fiber (density = 1800 kg m^{-3}) that should be added to 1.00 kg of vinyl ester resin (density = 1250 kg m^{-3}) to produce a composite with a density of 1600 kg m^{-3} is _____ kg.
- Q.21 If the values of K and a in the Mark-Houwink equation are $1.5 \times 10^{-4} \text{ dL g}^{-1}$ and 0.60, respectively, the viscosity average molecular weight of a polymer having an intrinsic viscosity of 0.05 dL g^{-1} is _____ kg mol^{-1} .
- Q.22 A rectangular polymer bar of length 40 mm fits exactly into a steel mold cavity and the entire assembly was heated from 20 to 100°C . The linear thermal expansion coefficients of the polymer and steel are $80 \times 10^{-6} ^\circ\text{C}^{-1}$ and $11 \times 10^{-6} ^\circ\text{C}^{-1}$, respectively. The strain encountered by the polymer sample along the length will be _____ %.

END OF THE QUESTION PAPER