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) Mangaeble (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.

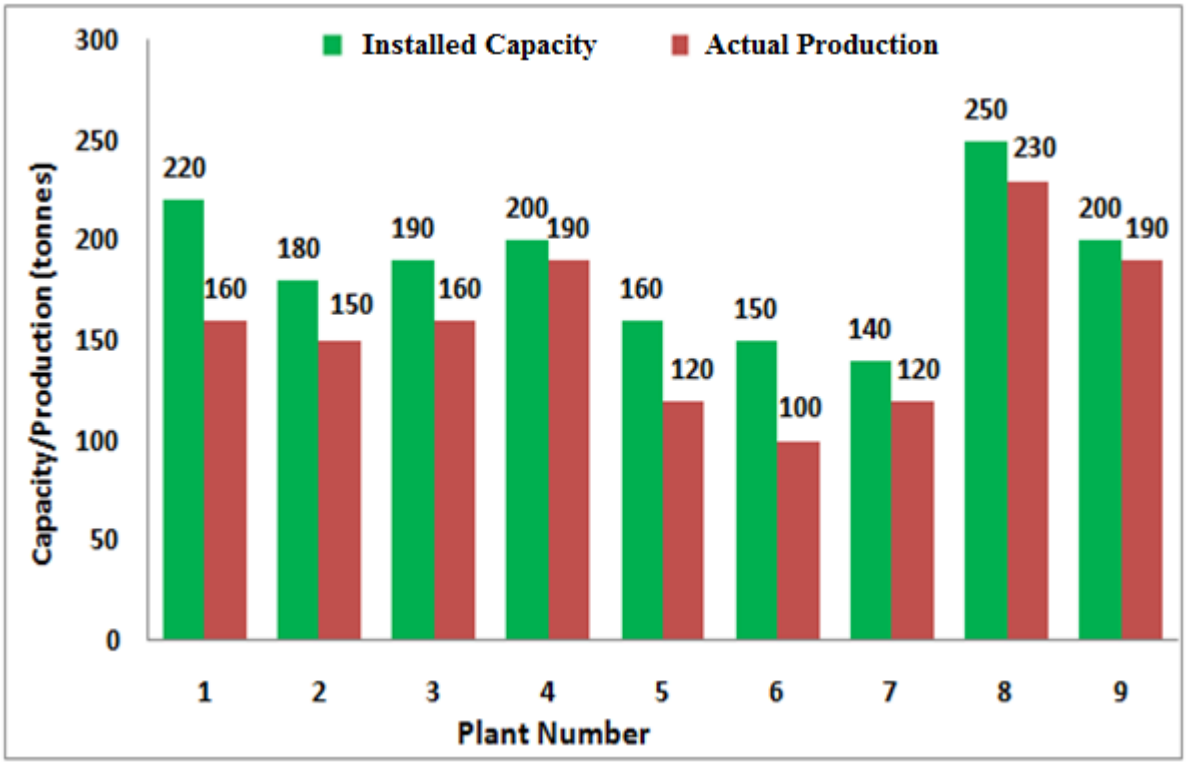
(D) Only R2D2 is a robot.

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 $211^{870} + 146^{127} \times 3^{424}$ 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 ºC) measured at a frequency of 1 Hz shows the damping peak at 110 ºC. If the measurement is made at 10^4 Hz, then the peak temperature (ºC) 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 x 10^{-4} 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 ºC. The linear thermal expansion coefficients of the polymer and steel are 80 x 10^{-6} $ºC^{-1}$ and 11 x 10^{-6} $ºC^{-1}$, respectively. The strain encountered by the polymer sample along the length will be _____ %.

END OF THE QUESTION PAPER