

Polymer Science and Engineering (XE-F)

Question Number : 100

Correct : 1 Wrong : -0.33

Poly(ethylene terephthalate) is synthesized from

- (A) Ethylene + dimethyl terephthalate
- (B) Ethylene + terephthalic acid
- (C) Glycerol + terephthalic acid
- (D) Ethylene Glycol + terephthalic acid

Question Number : 101

Correct : 1 Wrong : -0.33

Poly(vinyl chloride) has a higher T_g than polypropylene due to the presence of

- (A) Bulky side groups
- (B) Polar interactions
- (C) Restriction of bond rotation
- (D) Non-polar interactions

Question Number : 102

Correct : 1 Wrong : -0.33

The filler which would impart electrical conductivity to a polymer is

- (A) Carbon black
- (B) Talc
- (C) Glass beads
- (D) Calcium carbonate

Question Number : 103

Correct : 1 Wrong : -0.33

Which one of the following catalysts is used to prepare 'isotactic' polypropylene?

- (A) Alkyl lithium
- (B) BF_3
- (C) Ziegler-Natta
- (D) AIBN

Question Number : 104

Correct : 1 Wrong : -0.33

Novolac and Resole are A-stage low molecular weight phenolic resin products that are

- (A) Soluble and fusible
- (B) Insoluble but fusible
- (C) Insoluble and infusible
- (D) Soluble and infusible

Question Number : 105

Correct : 1 Wrong : -0.33

Which of the following reagents can act as an initiator at room temperature?

- (A) AIBN
- (B) Dicumyl peroxide
- (C) Dibenzoyl peroxide
- (D) $\text{Fe}^{2+} + \text{H}_2\text{O}_2$

Question Number : 106

Correct : 1 Wrong : -0.33

The impact strength of polystyrene can be enhanced by blending/mixing with

- (A) Carbon black
- (B) PMMA
- (C) Polybutadiene
- (D) Glass fibre

Question Number : 107

Correct : 1 Wrong : -0.33

The melt processing temperature of a semicrystalline thermoplastic polymer is

- (A) Between T_g and T_m
- (B) Equal to T_m
- (C) Lower than T_m
- (D) Higher than T_m

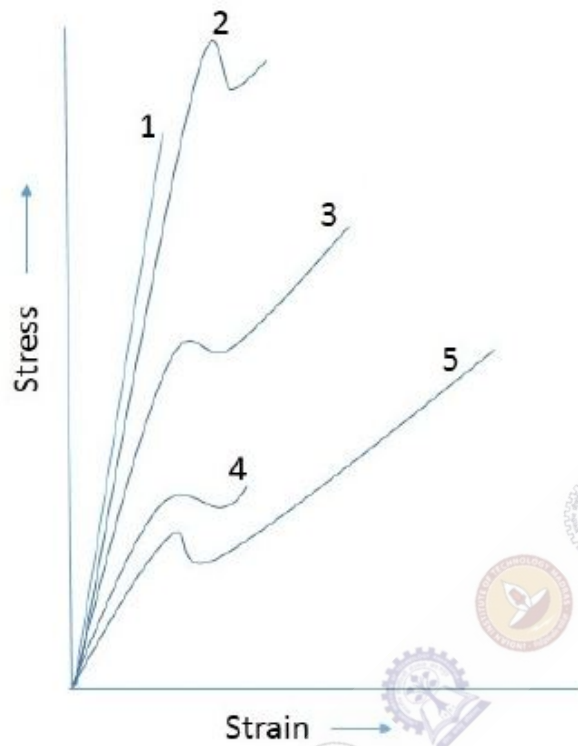
Question Number : 108

Correct : 1 Wrong : -0.33

The unit of viscosity of a polymer is expressed as

- (A) Pa.s
- (B) Pa.s⁻¹
- (C) Pa.s⁻²
- (D) Pa.s⁻³

Based on the graphs 1-5, which option best describes the stress-strain behaviour of materials listed as P, Q, R, S and T?



P-Hard and brittle
 Q-Hard and tough
 R-Soft and weak
 S-Hard and strong
 T-Soft and tough

(A) P-2; Q-1; R-5; S-4; T-3
 (C) P-1; Q-2; R-5; S-3; T-4

(B) P-1; Q-3; R-4; S-2; T-5
 (D) P-2; Q-3; R-1; S-4; T-5

The two characterization techniques which can be used to determine degree of crystallinity of a polymer are

P. Scanning Electron Microscopy
 Q. Thermogravimetric Analysis
 R. Wide Angle X-Ray Diffraction
 S. Differential Scanning Calorimetry

(A) P&R

(B) Q&R

(C) R&S

(D) Q&S

Question Number : 111**Correct : 2 Wrong : 0**

The density of polyethylene crystals is 998 kg/m^3 and that of totally amorphous polyethylene is 886 kg/m^3 . If the density of a polyethylene sample is 949 kg/m^3 , the crystallinity in volume fraction is _____ % (round off final answer to two digits after decimal place).

Question Number : 112**Correct : 2 Wrong : 0**

The polydispersity index of a polymer sample containing 200 molecules each of molecular weight $10,000 \text{ gmol}^{-1}$, 300 molecules each of molecular weight $30,000 \text{ gmol}^{-1}$ and 500 molecules each of molecular weight $50,000 \text{ gmol}^{-1}$ is _____ (round off final answer to two digits after decimal place).

Question Number : 113**Correct : 2 Wrong : -0.66**

Match the following rubber additives to their function:

Additive

- P. Dicumyl peroxide
- Q. Pentachlorothiophenol
- R. ZnO with stearic acid
- S. Zinc diethyldithiocarbamate

Function

- 1. Ultrafast accelerator
- 2. Activator
- 3. Curing agent
- 4. Peptizer

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

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

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

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

Question Number : 114**Correct : 2 Wrong : 0**

A composite of polypropylene reinforced with 20% by volume of glass fibre is to be prepared. If the density of glass fibre is 2540 kg/m^3 and polypropylene is 900 kg/m^3 , then the mass of glass fibre required per kg of composite is _____ g (round off answer to the nearest whole number).

Question Number : 115

Correct : 2 Wrong : -0.66

Match the following terminology to the appropriate polymer processing technique:

Terminology

- P. Die-swell
- Q. Breathing
- R. Plug-assisted
- S. Mastication

Processing Technique

- 1. Two roll mill mixing
- 2. Thermoforming
- 3. Extrusion
- 4. Compression moulding

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

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

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

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

Question Number : 116

Correct : 2 Wrong : -0.66

Match the polymer in Column A to its application in Column B:

Column A

- P. Nylon
- Q. Polyethylene
- R. Cis-1,4-polyisoprene
- S. Acrylonitrile-butadiene-styrene

Column B

- 1. Television cabinet
- 2. Tyre
- 3. Mechanical gear
- 4. Packaging

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

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

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

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

Question Number : 117

Correct : 2 Wrong : 0

For the polycondensation of equimolar amounts of adipic acid with hexamethylene diamine, if the number average degree of polymerization is 100, then the extent of reaction is _____ %.

Question Number : 118

Correct : 2 Wrong : 0

The relaxation time for a rubber band at 23 °C is 60 days. If it is stressed to 2 MPa initially, then the time required before the stress relaxes to 1 MPa is _____ days (round off final answer to two digits after decimal point).

Question Number : 119**Correct : 2 Wrong : -0.66**

Match the processing technique in Column A to the corresponding shear rate (s^{-1}) in Column B:

Column A

- P. Injection Moulding
- Q. Extrusion
- R. Calendering
- S. Compression Moulding

Column B

- 1. 1-10
- 2. 10-100
- 3. 100-1000
- 4. 1000-10000

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

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

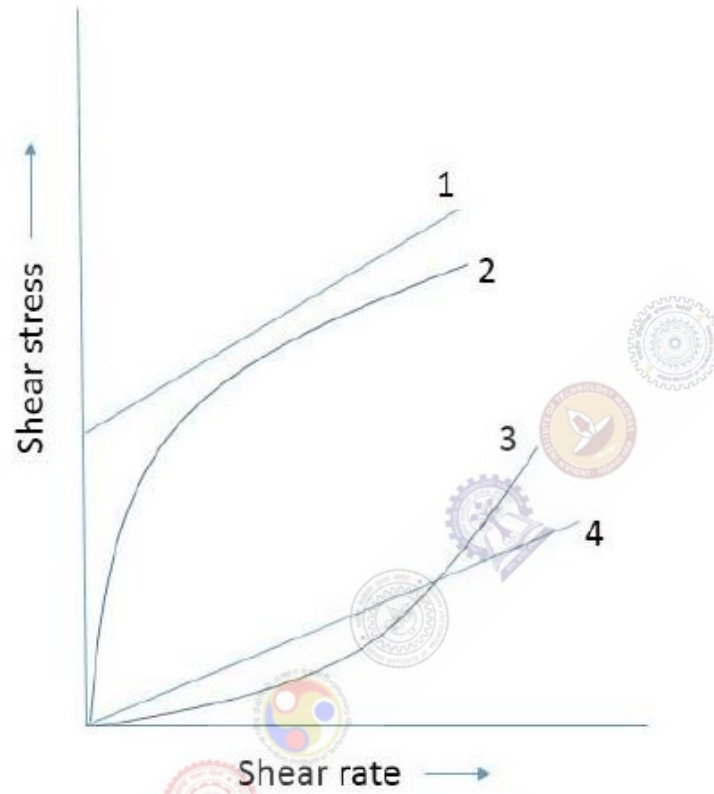
(B) P-4; Q-2; R-3; S-1

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

Question Number : 120**Correct : 2 Wrong : 0**

Given T_g of polymer A is $100\text{ }^\circ\text{C}$ and that of polymer B is $-100\text{ }^\circ\text{C}$, then the T_g of a miscible blend of A and B containing 30 wt% of A is _____ $^\circ\text{C}$ (round off final answer to a single digit after decimal point).

Match plots 1-4 given in the figure below with the correct flow behavior of polymeric fluid listed as P, Q, R & S:



- P. Newtonian
- Q. Shear thickening
- R. Pseudoplastic
- S. Bingham plastic

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

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

General Aptitude

Question Number : 166

Correct : 1 Wrong : -0.33

The event would have been successful if you _____ able to come.

(A) are

(B) had been

(C) have been

(D) would have been

Question Number : 167

Correct : 1 Wrong : -0.33

There was no doubt that their work was thorough.

Which of the words below is closest in meaning to the underlined word above?

(A) pretty

(B) complete

(C) sloppy

(D) haphazard

Question Number : 168**Correct : 1 Wrong : -0.33**

Four cards lie on a table. Each card has a number printed on one side and a colour on the other. The faces visible on the cards are 2, 3, red, and blue.

Proposition: If a card has an even value on one side, then its opposite face is red.

The cards which **MUST** be turned over to verify the above proposition are

- (A) 2, red (B) 2, 3, red (C) 2, blue (D) 2, red, blue

Question Number : 169**Correct : 1 Wrong : -0.33**

What is the value of x when $81 \times \left(\frac{16}{25}\right)^{x+2} \div \left(\frac{3}{5}\right)^{2x+4} = 144$?

- (A) 1 (B) -1 (C) -2 (D) Cannot be determined

Question Number : 170**Correct : 1 Wrong : -0.33**

Two dice are thrown simultaneously. The probability that the product of the numbers appearing on the top faces of the dice is a perfect square is

- (A) 1/9 (B) 2/9 (C) 1/3 (D) 4/9

Question Number : 171**Correct : 2 Wrong : -0.66**

Bhaichung was observing the pattern of people entering and leaving a car service centre. There was a single window where customers were being served. He saw that people inevitably came out of the centre in the order that they went in. However, the time they spent inside seemed to vary a lot: some people came out in a matter of minutes while for others it took much longer.

From this, what can one conclude?

- (A) The centre operates on a first-come-first-served basis, but with variable service times, depending on specific customer needs.
(B) Customers were served in an arbitrary order, since they took varying amounts of time for service completion in the centre.
(C) Since some people came out within a few minutes of entering the centre, the system is likely to operate on a last-come-first-served basis.
(D) Entering the centre early ensured that one would have shorter service times and most people attempted to do this.

Question Number : 172

Correct : 2 Wrong : -0.66

A map shows the elevations of Darjeeling, Gangtok, Kalimpong, Pelling, and Siliguri. Kalimpong is at a lower elevation than Gangtok. Pelling is at a lower elevation than Gangtok. Pelling is at a higher elevation than Siliguri. Darjeeling is at a higher elevation than Gangtok.

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

- i. Pelling is at a higher elevation than Kalimpong
- ii. Kalimpong is at a lower elevation than Darjeeling
- iii. Kalimpong is at a higher elevation than Siliguri
- iv. Siliguri is at a lower elevation than Gangtok

(A) Only ii (B) Only ii and iii (C) Only ii and iv (D) Only iii and iv

Question Number : 173

Correct : 2 Wrong : -0.66

P, Q, R, S, T and U are seated around a circular table. R is seated two places to the right of Q. P is seated three places to the left of R. S is seated opposite U. If P and U now switch seats, which of the following must necessarily be true?

- (A) P is immediately to the right of R
- (B) T is immediately to the left of P
- (C) T is immediately to the left of P or P is immediately to the right of Q
- (D) U is immediately to the right of R or P is immediately to the left of T

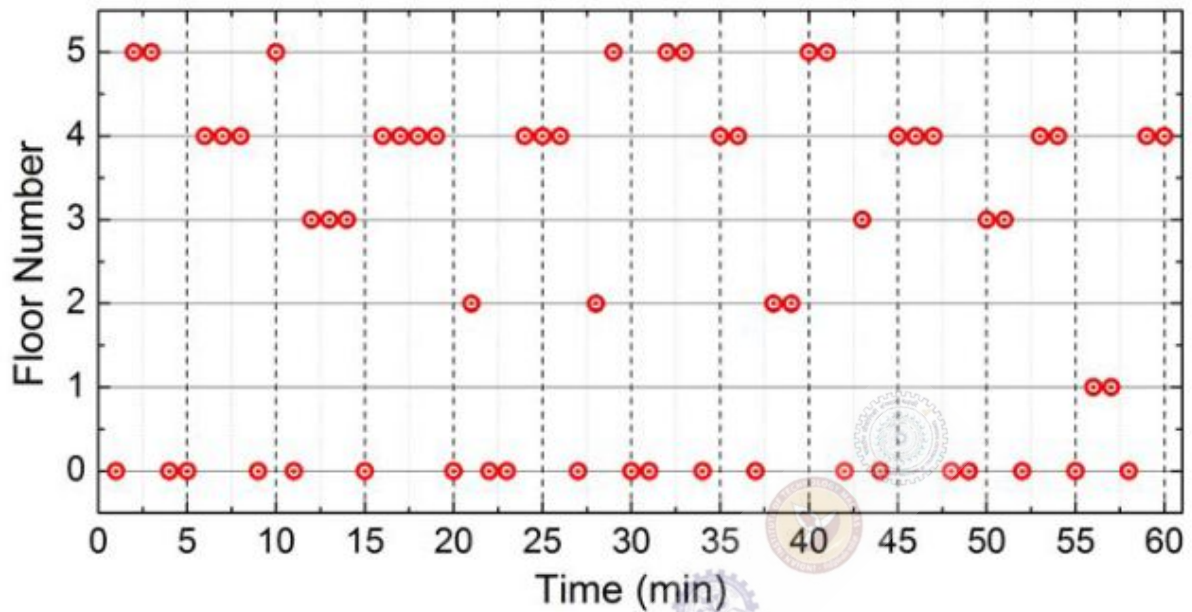
Question Number : 174

Correct : 2 Wrong : -0.66

Budhan covers a distance of 19 km in 2 hours by cycling one fourth of the time and walking the rest. The next day he cycles (at the same speed as before) for half the time and walks the rest (at the same speed as before) and covers 26 km in 2 hours. The speed in km/h at which Budhan walks is

(A) 1 (B) 4 (C) 5 (D) 6

The points in the graph below represent the halts of a lift for durations of 1 minute, over a period of 1 hour.



Which of the following statements are correct?

- i. The elevator never moves directly from any non-ground floor to another non-ground floor over the one hour period
- ii. The elevator stays on the fourth floor for the longest duration over the one hour period

(A) Only i

(B) Only ii

(C) Both i and ii

(D) Neither i nor ii