# 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) $Fe^{2+} + H_2O_2$

**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 $T_m$

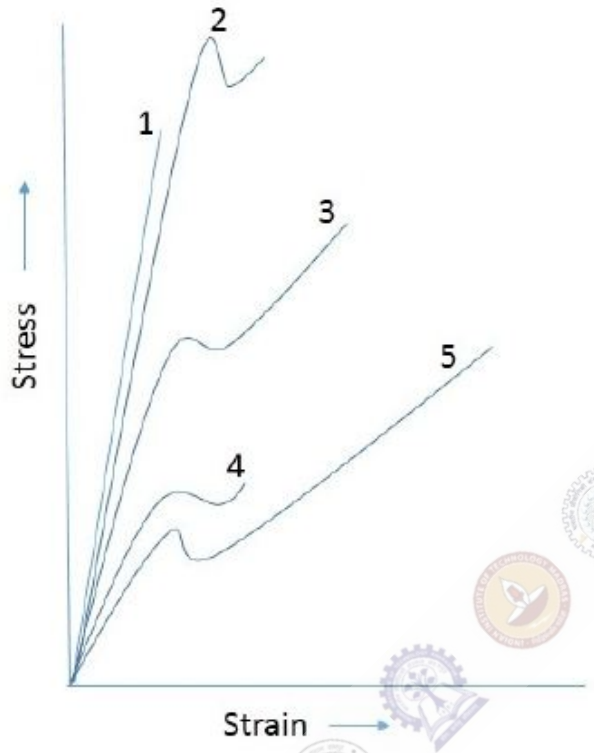
**Question Number : 108** **Correct : 1 Wrong : -0.33**

The unit of viscosity of a polymer is expressed as

(A) Pa.s (B) $Pa.s^{-1}$ (C) $Pa.s^{-2}$ (D) $Pa.s^{-3}$

**Question Number : 109** **Correct : 2 Wrong : -0.66**

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

**Question Number : 110** **Correct : 2 Wrong : -0.66**

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 gmol$^{-1}$, 300 molecules each of molecular weight 30,000 gmol$^{-1}$ and 500 molecules each of molecular weight 50,000 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** | **Function** |
|---|---|
| P. Dicumyl peroxide | 1. Ultrafast accelerator |
| Q. Pentachlorothiophenol | 2. Activator |
| R. ZnO with stearic acid | 3. Curing agent |
| S. Zinc diethyldithiocarbamate | 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** | **Processing Technique** |
|---|---|
| P. Die-swell | 1. Two roll mill mixing |
| Q. Breathing | 2. Thermoforming |
| R. Plug-assisted | 3. Extrusion |
| S. Mastication | 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** | **Column B** |
|---|---|
| P. Nylon | 1. Television cabinet |
| Q. Polyethylene | 2. Tyre |
| R. Cis-1,4-polyisoprene | 3. Mechanical gear |
| S. Acrylonitrile-butadiene-styrene | 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** | **Column B** |
|---|---|
| P. Injection Moulding | 1. 1-10 |
| Q. Extrusion | 2. 10-100 |
| R. Calendering | 3. 100-1000 |
| S. Compression Moulding | 4. 1000-10000 |

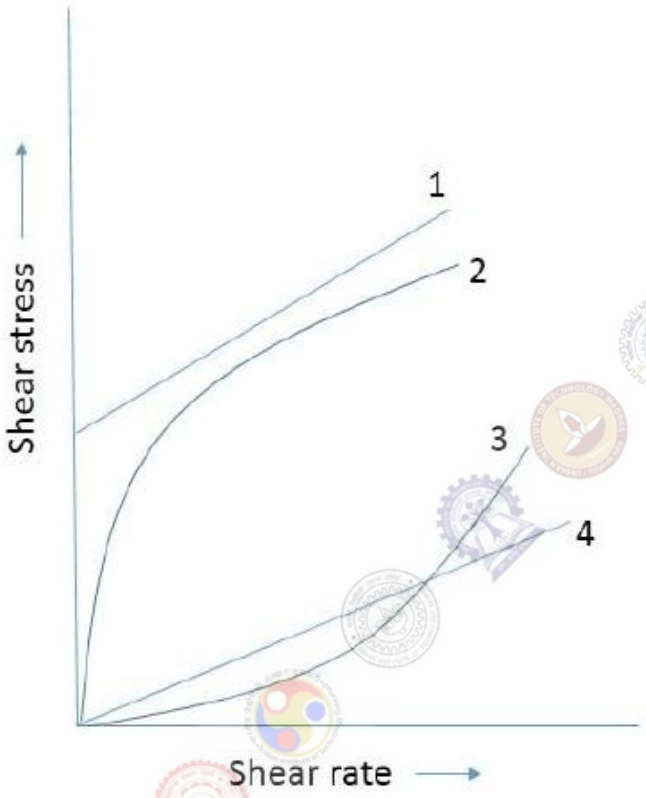
(A) P-1; Q-3; R-2; S-4
(B) P-4; Q-2; R-3; S-1
(C) P-4; Q-3; R-1; S-2
(D) P-4; Q-3; R-2; S-1

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

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

**Question Number : 121** **Correct : 2 Wrong : -0.66**

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

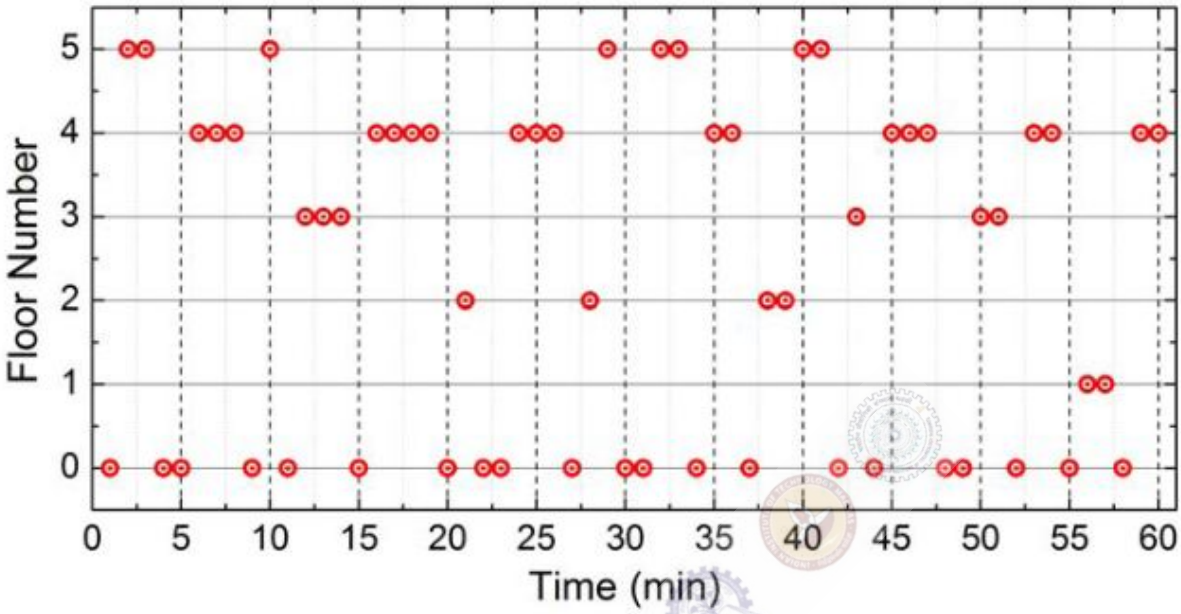
**Question Number : 174** **Correct : 2 Wrong : -0.66**

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

**Question Number : 175** **Correct : 2 Wrong : -0.66**

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

| Q. No. | Type | Section | Key | Marks |
|---|---|---|---|---|
| **1** | NAT | XE-A | 2.98 to 3.02 | 1 |
| **2** | MCQ | XE-A | D | 1 |
| **3** | NAT | XE-A | 6.98 to 7.02 | 1 |
| **4** | NAT | XE-A | 2.98 to 3.02 | 1 |
| **5** | MCQ | XE-A | C | 1 |
| **6** | NAT | XE-A | 7.98 to 8.02 | 1 |
| **7** | MCQ | XE-A | C | 1 |
| **8** | MCQ | XE-A | A | 2 |
| **9** | NAT | XE-A | 0.98 to 1.02 | 2 |
| **10** | NAT | XE-A | -0.02 to 0.02 | 2 |
| **11** | MCQ | XE-A | C | 2 |
| **12** | MCQ | XE-B | B | 1 |
| **13** | MCQ | XE-B | B | 1 |
| **14** | MCQ | XE-B | C | 1 |
| **15** | MCQ | XE-B | A | 1 |
| **16** | MCQ | XE-B | D | 1 |
| **17** | MCQ | XE-B | D | 1 |
| **18** | MCQ | XE-B | A | 1 |
| **19** | NAT | XE-B | 22.6 to 22.6 | 1 |
| **20** | MCQ | XE-B | A | 1 |
| **21** | NAT | XE-B | 72.5 to 75.0 | 2 |
| **22** | NAT | XE-B | 62 to 66 | 2 |
| **23** | MCQ | XE-B | D | 2 |
| **24** | MCQ | XE-B | C | 2 |
| **25** | NAT | XE-B | 0.66 to 0.67 | 2 |
| **26** | NAT | XE-B | 6005 to 6005 | 2 |
| **27** | NAT | XE-B | 0.05 to 0.06 | 2 |
| **28** | MCQ | XE-B | D | 2 |
| **29** | NAT | XE-B | 1.3 to 1.4 | 2 |
| **30** | NAT | XE-B | 28.9 to 31.4 | 2 |
| **31** | NAT | XE-B | 0.21 to 0.22 | 2 |
| **32** | NAT | XE-B | 7.0 to 7.2 | 2 |
| **33** | MCQ | XE-B | B | 2 |
| **34** | MCQ | XE-C | B | 1 |
| **35** | MCQ | XE-C | D | 1 |
| **36** | MCQ | XE-C | C | 1 |

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|---|---|---|---|---|
| **37** | MCQ | XE-C | B | 1 |
| **38** | MCQ | XE-C | A | 1 |
| **39** | MCQ | XE-C | C | 1 |
| **40** | MCQ | XE-C | D | 1 |
| **41** | MCQ | XE-C | B | 1 |
| **42** | MCQ | XE-C | D | 1 |
| **43** | NAT | XE-C | 0.990 to 1.010 | 2 |
| **44** | NAT | XE-C | 53.0 to 53.2 | 2 |
| **45** | MCQ | XE-C | A | 2 |
| **46** | MCQ | XE-C | A | 2 |
| **47** | NAT | XE-C | 7.5 to 7.7 | 2 |
| **48** | NAT | XE-C | 37.5 to 38.5 | 2 |
| **49** | MCQ | XE-C | B | 2 |
| **50** | NAT | XE-C | 7.50 to 7.80 | 2 |
| **51** | NAT | XE-C | 172 to 174 | 2 |
| **52** | MCQ | XE-C | D | 2 |
| **53** | NAT | XE-C | 1.35 to 1.37 | 2 |
| **54** | MCQ | XE-C | C | 2 |
| **55** | MCQ | XE-C | A | 2 |
| **56** | NAT | XE-D | 69 to 73 | 1 |
| **57** | MCQ | XE-D | B | 1 |
| **58** | MCQ | XE-D | C | 1 |
| **59** | MCQ | XE-D | C | 1 |
| **60** | MCQ | XE-D | A | 1 |
| **61** | MCQ | XE-D | B | 1 |
| **62** | MCQ | XE-D | A | 1 |
| **63** | NAT | XE-D | 0.26 to 0.28 | 1 |
| **64** | MCQ | XE-D | A | 1 |
| **65** | MCQ | XE-D | D | 2 |
| **66** | NAT | XE-D | 134 to 136 | 2 |
| **67** | NAT | XE-D | 0.55 to 0.65 | 2 |
| **68** | NAT | XE-D | 1785 to 1792 | 2 |
| **69** | NAT | XE-D | 0.45 to 0.50 | 2 |
| **70** | NAT | XE-D | 32 to 35 | 2 |
| **71** | NAT | XE-D | 10 to 10 | 2 |
| **72** | NAT | XE-D | 02 to 02 | 2 |
| **73** | MCQ | XE-D | A | 2 |

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|---|---|---|---|---|
| **74** | NAT | XE-D | 17 to 18 | 2 |
| **75** | MCQ | XE-D | C | 2 |
| **76** | MCQ | XE-D | B | 2 |
| **77** | MCQ | XE-D | B | 2 |
| **78** | MCQ | XE-E | B | 1 |
| **79** | MCQ | XE-E | C | 1 |
| **80** | MCQ | XE-E | C | 1 |
| **81** | NAT | XE-E | 0.17 to 0.18 | 1 |
| **82** | MCQ | XE-E | B | 1 |
| **83** | MCQ | XE-E | D | 1 |
| **84** | MCQ | XE-E | A | 1 |
| **85** | MCQ | XE-E | B | 1 |
| **86** | NAT | XE-E | 499 to 501 | 1 |
| **87** | NAT | XE-E | 53 to 55 | 2 |
| **88** | MCQ | XE-E | D | 2 |
| **89** | NAT | XE-E | 0.026 to 0.030 | 2 |
| **90** | NAT | XE-E | 73.5 to 73.8 | 2 |
| **91** | NAT | XE-E | 2.2 to 2.2 | 2 |
| **92** | NAT | XE-E | 0.140 to 0.150 | 2 |
| **93** | MCQ | XE-E | C | 2 |
| **94** | MCQ | XE-E | A | 2 |
| **95** | MCQ | XE-E | A | 2 |
| **96** | NAT | XE-E | 2225 to 2230 | 2 |
| **97** | NAT | XE-E | 0.76 to 0.82 | 2 |
| **98** | NAT | XE-E | 29.0 to 30.0 | 2 |
| **99** | NAT | XE-E | 60.5 to 61.5 | 2 |
| **100** | MCQ | XE-F | D | 1 |
| **101** | MCQ | XE-F | B | 1 |
| **102** | MCQ | XE-F | A | 1 |
| **103** | MCQ | XE-F | C | 1 |
| **104** | MCQ | XE-F | A | 1 |
| **105** | MCQ | XE-F | D | 1 |
| **106** | MCQ | XE-F | C | 1 |
| **107** | MCQ | XE-F | D | 1 |
| **108** | MCQ | XE-F | A | 1 |
| **109** | MCQ | XE-F | B | 2 |
| **110** | MCQ | XE-F | C | 2 |

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|---|---|---|---|---|
| **111** | NAT | XE-F | 55.95 to 56.55 | 2 |
| **112** | NAT | XE-F | 1.14 to 1.24 | 2 |
| **113** | MCQ | XE-F | C | 2 |
| **114** | NAT | XE-F | 410 to 418 | 2 |
| **115** | MCQ | XE-F | B | 2 |
| **116** | MCQ | XE-F | A | 2 |
| **117** | NAT | XE-F | 98.5 to 99.5 | 2 |
| **118** | NAT | XE-F | 41.00 to 42.20 | 2 |
| **119** | MCQ | XE-F | D | 2 |
| **120** | NAT | XE-F | -67.3 to -66.3 | 2 |
| **121** | MCQ | XE-F | B | 2 |
| **122** | MCQ | XE-G | B | 1 |
| **123** | MCQ | XE-G | B | 1 |
| **124** | MCQ | XE-G | D | 1 |
| **125** | MCQ | XE-G | B | 1 |
| **126** | NAT | XE-G | 1000 to 1000 | 1 |
| **127** | MCQ | XE-G | A | 1 |
| **128** | NAT | XE-G | 2078 to 2086 | 1 |
| **129** | NAT | XE-G | 0.80 to 0.90 | 1 |
| **130** | MCQ | XE-G | A | 1 |
| **131** | MCQ | XE-G | C | 2 |
| **132** | MCQ | XE-G | B | 2 |
| **133** | MCQ | XE-G | D | 2 |
| **134** | NAT | XE-G | 25550 to 25650 | 2 |
| **135** | MCQ | XE-G | D | 2 |
| **136** | NAT | XE-G | 53.30 to 55.25 | 2 |
| **137** | NAT | XE-G | 64.0 to 64.0 | 2 |
| **138** | NAT | XE-G | 0.14 to 0.18 | 2 |
| **139** | MCQ | XE-G | D | 2 |
| **140** | NAT | XE-G | 6.80 to 7.20 | 2 |
| **141** | NAT | XE-G | 10.80 to 11.20 | 2 |
| **142** | NAT | XE-G | 9000 to 9000 | 2 |
| **143** | NAT | XE-G | 0.30 to 0.40 | 2 |
| **144** | MCQ | XE-H | B | 1 |
| **145** | MCQ | XE-H | C | 1 |
| **146** | NAT | XE-H | 98.9 to 100.5 | 1 |
| **147** | MCQ | XE-H | D | 1 |

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|---|---|---|---|---|
| **148** | MCQ | XE-H | B | 1 |
| **149** | MCQ | XE-H | D | 1 |
| **150** | MCQ | XE-H | C | 1 |
| **151** | MCQ | XE-H | A | 1 |
| **152** | MCQ | XE-H | B | 1 |
| **153** | NAT | XE-H | 22.05 to 22.15 | 2 |
| **154** | NAT | XE-H | 0.59 to 0.61 | 2 |
| **155** | NAT | XE-H | 286.55 to 287.55 | 2 |
| **156** | MCQ | XE-H | C | 2 |
| **157** | NAT | XE-H | -4.10 to -3.90 | 2 |
| **158** | NAT | XE-H | 0.42 to 0.46 | 2 |
| **159** | NAT | XE-H | 51 to 52 | 2 |
| **160** | MCQ | XE-H | B | 2 |
| **161** | MCQ | XE-H | A | 2 |
| **162** | NAT | XE-H | 199 to 205 | 2 |
| **163** | MCQ | XE-H | D | 2 |
| **164** | MCQ | XE-H | C | 2 |
| **165** | MCQ | XE-H | B | 2 |
| **166** | MCQ | GA | B | 1 |
| **167** | MCQ | GA | B | 1 |
| **168** | MCQ | GA | C | 1 |
| **169** | MCQ | GA | B | 1 |
| **170** | MCQ | GA | B | 1 |
| **171** | MCQ | GA | A | 2 |
| **172** | MCQ | GA | C | 2 |
| **173** | MCQ | GA | C | 2 |
| **174** | MCQ | GA | D | 2 |
| **175** | MCQ | GA | D | 2 |