

Instruction for MCQ tagged questions

Sample Question

6. Which of the following are prime numbers ?

MCQ : +5, -0

- (A) 2
- (B) 4
- (C) 7
- (D) 9

All MCQ questions are tagged as shown.

The correct answers are (A) and (C), then you should darken the circles for options (A) and (C) on the OMR sheet.

✓ Correct only when both (A) and (C) circles are dark	✗ Correct only when both (A) and (C) circles are dark	✗ Incorrect if only circle (C) is dark.
5 (A) (B) (C) (D)	5 (A) (B) (C) (D)	5 (A) (B) (C) (D)
6 (A) (B) (C) (D)	6 (A) (B) (C) (D)	6 (A) (B) (C) (D)
7 (A) (B) (C) (D)	7 (A) (B) (C) (D)	7 (A) (B) (C) (D)
8 (A) (B) (C) (D)	8 (A) (B) (C) (D)	8 (A) (B) (C) (D)

PART I : PHYSICS

This section contains **10 Questions (Q : 01 to Q : 10)**. Each question has four choices **(A), (B), (C) and (D)**.

1. A body starts from rest and moves with acceleration $a(t) = 2 - 0.5t$ for $t \geq 0$ until the instant when the speed becomes maximum, after which it decelerates. At what time is speed maximum and what is the displacement by then?

SCQ : +3, -1

- (A) $t = 4$ s, $s = 11$ m
 (B) $t = 4$ s, $s = 32$ m
 (C) $t = 2$ s, $s = 4$ m
 (D) $t = 2$ s, $s = 8$ m

2. Two blocks on a frictionless plane, $M = 3$ kg and $m = 2$ kg, are pushed by a force F so that the system's acceleration remains 2 m/s². What is the contact force on m due to M ?

SCQ : +3, -1

- (A) 4 N
 (B) 16 N
 (C) 8 N
 (D) 10 N

3. A U-tube manometer with mercury ($\rho_{\text{hg}} = 13,600$ kg/m³) measures the over-pressure of a gas above atmosphere using water ($\rho_w = 1000$ kg/m³) in the connected line. The observed difference between mercury columns is 12.0 cm (higher on the gas side). What is the gauge pressure of the gas in kPa?

SCQ : +3, -1

- (A) 13.6 kPa
 (B) 16.0 kPa
 (C) 12.0 kPa
 (D) 1.20 kPa

4. A v - t graph shows $v = 10$ m/s from 0-5 s, then linearly decreases to $v = -5$ m/s at $t = 10$ s. The total distance over 0-10 s is:

SCQ : +3, -1

- (A) 25 m
 (B) 50 m
 (C) 70 m
 (D) 100 m

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5. Which of the following statement/s is/ are **True(T)** or **False(F)** ?

T/F SCQ : +4, -1

- (i) For a system with zero net external impulse, total momentum is conserved.
- (ii) An object moving at constant speed in a straight line must have zero resultant force.
- (iii) Impulse equals the product of maximum force and total contact time for any variable force interaction.

Code :

- | | (i) | (ii) | (iii) |
|-----|-----|------|-------|
| (A) | F | F | T |
| (B) | T | F | T |
| (C) | T | T | F |
| (D) | T | T | T |

6. Match **Column – I** with **Column – II** and select the correct answer using the codes given below.

MTC SCQ : +4, -1

Column – I	Column – II
P. Angle of repose	1. Negative, nonconservative; reduces mechanical energy

Q. Work by friction (kinetic) on moving body

2. Angle at which a body just starts sliding on an inclined plane

R. Coefficient of limiting static friction

3. Ratio of maximum static friction to normal force

S. Banking without friction

4. $\tan\theta = v^2/rg$

Code :

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

Paragraph for Questions 07 & 08

A sledge of mass 50 kg is pulled up a straight snow slope of angle 60° by a motorized cable at constant speed v . The kinetic friction coefficient is $\mu_k = 0.10$. Air drag is modeled as $D = c v^2$ with $c = 1.2 \text{ kg/m}$. Neglect other losses; $g = 9.8 \text{ m/s}^2$. After a steady ascent at $v_1 = 6.0 \text{ m/s}$, the cable is suddenly released; the sledge then slides freely down the same slope, experiencing the same friction and air drag (drag always opposes motion).

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7. What cable power is needed to maintain 6.0 m/s uphill?

SCQ : +3, -1

- (A) 1.0 kW
- (B) 2.0 kW
- (C) 3.0 kW
- (D) 4.0 kW

8. Immediately after release, what is the magnitude of acceleration down the slope?

SCQ : +3, -1

- (A) 8.15 m/s²
- (B) 7.13 m/s²
- (C) 6.15 m/s²
- (D) 9.13 m/s²

9. Which of the following statement are correct ?

MCQ : +5, -0

- (A) In any isolated collision (elastic or inelastic), the vector sum of momentum is conserved.
- (B) In 1D perfectly elastic collisions, relative speed of approach equals relative speed of separation.
- (C) A variable perpendicular force can change kinetic energy if its magnitude changes with time.
- (D) A time-varying force with zero average over an interval always gives zero impulse over that interval.

10. A crate of mass m is pulled on level ground by a rope making angle (α) above the horizontal with tension T . The kinetic friction coefficient is μ_k . Select all correct statements for steady motion at arbitrarily small speed.

MCQ : +5, -0

- (A) Normal reaction $N = mg - T \sin\alpha$.
- (B) Friction magnitude $f = \mu_k N$ acting opposite motion.
- (C) The minimum T for impending motion is $T = \mu_k mg / (\cos\alpha + \mu_k \sin\alpha)$.
- (D) For fixed μ_k , pulling at a higher α (up to some limit) reduces required T .

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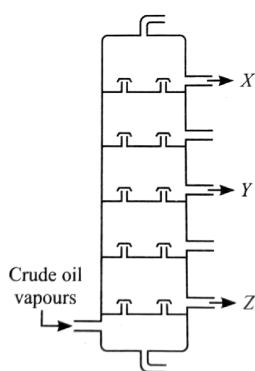
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PART II : CHEMISTRY

This section contains 10 Questions (Q : 11 to Q : 20). Each question has four choices (A), (B), (C) and (D).

11. The given diagram represents a fractionating column where petroleum is separated into various fractions. Arrange the fractions X, Y, Z in order of decreasing boiling point range and identify the fraction that condenses first.



SCQ : +3, -1

- (A) $Z > Y > X$; Y
- (B) $X > Y > Z$; Y
- (C) $Z > Y > X$; Z
- (D) $Y > Z > X$; Z

12. Fill in the blanks by choosing an appropriate option.

I are used in the manufacture of detergents, fibres, polythene and other man-made plastics.

II obtained from natural gas, is used in the production of fertilisers (urea). Petroleum is also called III due to its great commercial importance.

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SCQ : +3, -1

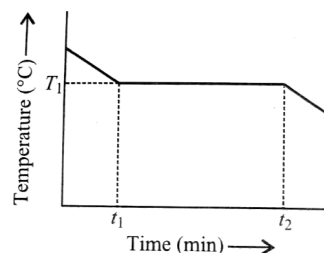
- (A) I-Fossil fuels, II-Petroleum gas, II-Black gold
- (B) I-Petrochemicals, II-Coal gas, III-Diesel
- (C) I-Petrochemicals, II-Hydrogen gas, III-Black gold
- (D) I-Coal products, II-CNG, III-Paraffin wax

13. A solution was prepared by dissolving 1.16 g of sodium chloride in water and making the solution up to 250 cm³. What is the mass of sodium chloride present in 1 dm³ (1000 cm³) of solution?

SCQ : +3, -1

- (A) 4.64 g/dm³
- (B) 2.32 g/dm³
- (C) 1.16 g/dm³
- (D) 0.58 g/dm³

14. Observe the given curve carefully and mark the correct statement.



SCQ : +3, -1

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- (A) T_1 is the melting point and dry ice changes to CO_2 gas from time t_1 to t_2
- (B) T_1 is the boiling point and water vapours change to water from time t_1 to t_2
- (C) T_1 is the freezing point and molten copper(II) sulphate changes to solid copper(II) sulphate from time t_1 to t_2
- (D) T_1 is the melting point and solid copper(II) sulphate changes to molten copper(II) sulphate from time t_1 to t_2

15. Which of the following statement/s is/are **True(T)** or **False(F)** ?

T/F SCQ : +4, -1

- (i) Particles of matter are continuously moving.
- (ii) Evaporation causes cooling because particles absorb heat energy from the surroundings.
- (iii) The melting point of ice increases when pressure is increased.

Code :

- | | (i) | (ii) | (iii) |
|-----|-----|------|-------|
| (A) | F | F | T |
| (B) | T | T | T |
| (C) | T | T | F |
| (D) | T | F | T |

16. Match **Column - I** with **Column - II** and select the correct answer using the codes given below.

MTC SCQ : +4, -1

Column - I	Column - II
P. Foam	1. Butter
Q. Aerosol	2. Milk of magnesia
R. Gel	3. Sponge
S. Sol	4. Automobile exhaust

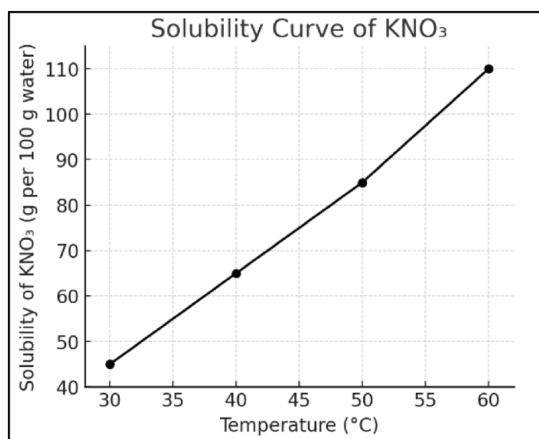
Code :

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

Paragraph for Questions 17 & 18

A group of students performed an experiment to study the solubility of potassium nitrate (KNO_3) in water at different temperatures. They prepared saturated solutions of KNO_3 at 30°C , 40°C , 50°C , and 60°C . The mass of KNO_3 that dissolved in 100 g of water was recorded and a solubility curve was plotted as shown below.

Space for rough work



17. If a saturated solution at 60 °C containing 110 g KNO₃ is cooled to 30 °C, how much KNO₃ will crystallize out?

SCQ : +3, -1

- (A) 20 g
- (B) 40 g
- (C) 65 g
- (D) 80 g

18. Which of the following best explains the shape of the curve?

SCQ : +3, -1

- (A) Solubility of solids decreases with increase in temperature.
- (B) Generally Solubility of solids increases with increase in temperature.
- (C) Solubility remains constant at all temperatures.
- (D) Solubility first increases, then decreases.

19. Which of the following statements are correct about spontaneous combustion?

MCQ : +5, -0

- (A) It is the ability of certain materials to start burning without any external flame, spark or ignition source.
- (B) Materials like white phosphorus, oily cotton rags, and coal dust may show spontaneous combustion.
- (C) It occurs when heat generated inside a material accumulates faster than it is lost.
- (D) It is the ability of materials to burn without oxygen

20. If 50 g of steam at 100 °C is condensed to water at 100 °C, the heat released is:

MCQ : +5, -0

- (A) 1.13×10^4 J
- (B) 1.13×10^5 J
- (C) 11.3×10^4 J
- (D) 1.13×10^7 J

Space for rough work

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PART III : BIOLOGY

This section contains **10 Questions (Q : 21 to Q : 30)**. Each question has four choices **(A), (B), (C) and (D)**.

21. A common characteristic feature of plant sieve tube cells, and most of mammalian mature erythrocytes is:

SCQ : +3, -1

- (A) Absence of mitochondria
- (B) Presence of cell wall
- (C) Presence of haemoglobin
- (D) Absence of nucleus

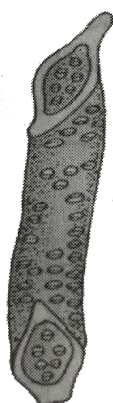
22. Tracheids -

SCQ : +3, -1

- (A) are made up of number of cells
- (B) are generally oblique and tapering
- (C) have wide lumen
- (D) Both (B) and (C)

23. Identify the given figure and select the correct option regarding it.

SCQ : +3, -1



- (A) It is a tracheary element that occurs in higher plants mostly.
- (B) It lacks secondary thickening and lignification.
- (C) It is formed from a single cell with oblique and tapering ends.
- (D) It is purely a mechanical tissue.

24. Which of the following statements wrongly represent the nature of smooth muscle?

SCQ : +3, -1

- (A) These muscles are present in the wall of blood vessels.
- (B) These muscles have no striations.
- (C) They are involuntary muscles.
- (D) Communication among the cells is performed by an intercalated disc.

25. Which of the following statement/s is/ are **True(T)** or **False(F)** ?

T/F SCQ : +4, -1

- (i) Lysosomes have numerous hydrolytic enzymes.
- (ii) Both SER and RER contain enzymes for detoxification.
- (iii) Both chloroplast and mitochondria have naked DNA.

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Code :

(i) (ii) (iii)

- (A) F F T
- (B) T F T
- (C) T T F
- (D) T F F

26. Match **Column - I** with **Column - II** and select the correct answer using the codes given below.

MTC SCQ : +4, -1

Column - I	Column - II
P. Endoplasmic reticulum	1. Benda
Q. Lysosome	2. Porter
R. Mitochondria	3. Christian de Duve
S. Plastids	4. E. Haeckel

Code :

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

Paragraph for Questions 27 & 28

Microorganisms also play a role in maintaining the environment. Certain bacteria like Rhizobium present in root nodules of leguminous plants fix atmospheric nitrogen into the soil. This nitrogen is used by plants for growth.

Other bacteria help in decomposing dead plants and animals, releasing nutrients back into the soil. Thus, microorganisms are very important for soil fertility and nutrient recycling.

27. Microorganisms decompose dead plants and animals to:

SCQ : +3, -1

- (A) Release oxygen
- (B) Release nutrients back into the soil
- (C) Produce electricity
- (D) Kill pests

28. Microorganisms play an important role in which cycle?

SCQ : +3, -1

- (A) Ornithine cycle
- (B) Nitrogen cycle
- (C) Water cycle
- (D) Oxygen cycle

29. Select the correct statement regarding the given structure.

MCQ : +5, -0



Space for rough work

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- (A) It was first observed by Camillo Golgi.
- (B) It consists of many flat disc shaped sacs of 0.5 mm to 1.0 mm diameter.
- (C) It is capable of digesting carbohydrates.
- (D) It is an important site for formation of glycoproteins and glycolipids.

30. Which of the following are advantages of ploughing (tilling) the soil?

MCQ : +5, -0

- (A) It helps roots to penetrate deeply.
- (B) It increases aeration of soil.
- (C) It brings nutrient-rich soil to the top.
- (D) It hardens the soil surface.

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PART IV : MATHEMATICS

This section contains 20 Questions (Q : 31 to Q : 50). Each question has four choices (A), (B), (C) and (D).

31. Students of a class are made to stand in rows. If one student is extra in a row, there would be 2 rows less. If one student is less in row, there would be 3 rows more. Find out the total number of students in the class.

SCQ : +3, -1

- (A) 40
- (B) 50
- (C) 60
- (D) 30

32. One of the factors of $9x^2 - 4z^2 - 24xy + 16y^2 + 20y - 15x + 10z$ is

SCQ : +3, -1

- (A) $3x - 4y - 2z$
- (B) $3x + 4y - 2z$
- (C) $3x + 4y + 2z$
- (D) $3x - 4y + 2z$

33. Find out the total number of natural number n for which $n^2 + 96$ is a perfect square.

SCQ : +3, -1

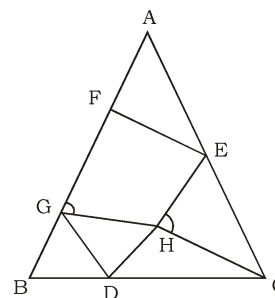
- (A) 3
- (B) 4
- (C) 5
- (D) 6

34. Find out the total number of ordered pairs of positive integers (x, y) satisfying the equation $x^2 + 4y = 3x + 16$.

SCQ : +3, -1

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

35. In $\triangle ABC$, as shown in the below figure, $AB = AC$. F is a point on side AB and E is a point on side AC such that $AF = EF$. H is a point in the interior of $\triangle ABC$, D is a point on side BC and G is a point on side AB such that $EH = CH = DH = GH = DG = BG$. Also, $\angle CHE = \angle HGF$. Find out the measure of $\angle BAC$ in degree.



SCQ : +3, -1

- (A) 20
- (B) 40
- (C) 60
- (D) 80

Space for rough work

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36. If $a + b + c = 0$, then find out the value

$$\text{of } \frac{(a^2 + b^2 + c^2)^2}{a^4 + b^4 + c^4}.$$

SCQ : +3, -1

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

37. Three positive integers a, b, c with

$a > c$ satisfy the following equations :

$$ac + b + c = bc + a + 66, a + b + c = 32.$$

Find out the value of a .

SCQ : +3, -1

- (A) 17
- (B) 18
- (C) 19
- (D) 20

38. The ratio of an interior angle to the

exterior angle of a regular polygon is

$5 : 1$. Find out the total number of sides

of the regular polygon.

SCQ : +3, -1

- (A) 11
- (B) 12
- (C) 13
- (D) 14

39. Which of the following statement/s is/ are **True(T)** or **False(F)** and select the correct answer using the code given below :

If O is any point in the interior of $\triangle ABC$, then

T/F SCQ : +4, -1

- (i) $AB + AC > OB + OC$
- (ii) $AB + BC + CA > OA + OB + OC$
- (iii) $OB + OC + OA < \frac{1}{2} (AB + BC + CA)$

Code :

(i) (ii) (iii)

- (A) F F F
- (B) T T T
- (C) T T F
- (D) F T T

40. Which of the following statement/s is/ are **True(T)** or **False(F)** and select the correct answer using the code given below :

T/F SCQ : +4, -1

- (i) $\sqrt[3]{9} < \sqrt[4]{17} < \sqrt[4]{11}$
- (ii) $\sqrt[9]{4} < \sqrt[9]{3} < \sqrt[3]{2}$
- (iii) $\sqrt{11} - \sqrt{6} < \sqrt{17} - \sqrt{12}$

Code :

(i) (ii) (iii)

- (A) F F F
- (B) F T F
- (C) T T F
- (D) F T T

Space for rough work

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41. Match **Column - I** with **Column - II** and select the correct answer using the codes given below.

On a clock, there are two instants between 12 noon and 1 PM, when the hour hand and the minute hand are at right angles. The difference in minutes between these two instants is written as $a + \frac{b}{c}$, where a, b, c are positive integers, with $b < c$ and in the reduced form.

MTC SCQ : +4, -1

Column - I	Column - II
P. $a + b$	1. 40
Q. $b + c$	2. 19
R. $c + a$	3. 43

Code :

P	Q	R
(A) 2	1	3
(B) 3	2	1
(C) 1	2	3
(D) 2	3	1

42. Match **Column - I** with **Column - II** and select the correct answer using the codes given below.

The number $\sqrt{104\sqrt{6} + 468\sqrt{10} + 144\sqrt{15} + 2006}$ can be written as $a\sqrt{2} + b\sqrt{3} + c\sqrt{5}$, where a, b and c are positive integers.

MTC SCQ : +4, -1

Column - I	Column - II
P. $a - b + c$	1. 34
Q. $ab - c$	2. 31
R. $a + c$	3. 27

Code :

P	Q	R
(A) 3	1	2
(B) 3	2	1
(C) 1	3	2
(D) 2	1	3

Paragraph for Questions 43 & 44

An Infinite Sequence of positive numbers $x_1, x_2, x_3, \dots, x_n, x_{n+1}, \dots$ satisfies $x_n^2 = (3n + 7) + (n - 3)x_{n+1}$, where x_n is the n th term of the sequence.

Based on the above information, answer the following questions :

43. Find out the value of x_1 .

SCQ : +3, -1

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

44. Find out the value of $2x_2$.

SCQ : +3, -1

- (A) 2
- (B) 4
- (C) 6
- (D) 8

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PART V : LOGICAL REASONING & IQ

This section contains **10 Questions (Q : 51 to Q : 60)**. Each question has four choices **(A), (B), (C) and (D)**.

51. In a row of girls, there are 16 girls between Priya and Natasha. Priya is 32nd from the left. If Priya is closer to right end than Natasha, then how far is Natasha from the left end?

SCQ : +3, -1

- (A) 14th
- (B) 16th
- (C) 17th
- (D) 15th

52. Select the correct combination of mathematical signs to sequentially replace the “*” signs and balance the given equation.

$$86 * 54 * 34 * 68 * 2 * 33$$

SCQ : +3, -1

- (A) -, +, ÷, ×, =
- (B) ÷, -, +, ×, =
- (C) ×, ÷, ×, -, =
- (D) +, ÷, ×, -, =

53. In this question, the relationship between different elements is shown in the statements. The statements are followed by two conclusions. Choose the correct answer on the basis of the information given below.

Statement:

- I. $R > P \geq U = S$
- II. $P < W = Y$

Conclusion:

- I. $R > W$
- II. $U < W$

- (A) Only conclusion I is true.
- (B) Only conclusion II is true.
- (C) Either conclusion I or II is true.
- (D) Both conclusions I and II are true.

54. A question is given, followed by two statements numbered (I) and (II). You have to decide whether the data provided in the statements is sufficient to answer the question. Read both the statements and select the appropriate answer.

SCQ : +3, -1

Question :

Four people- A, B, C and D are sitting in a straight line and all are facing towards South. Who is sitting at the right end?

Statements:

- (I) Only two people sit between B and D. A sits to the immediate left of B.
- (II) Only one person sits between B and C. A does not sit at any end.

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- (A) Data in statement I alone is sufficient to answer the question while data in statement II is not
- (B) Data in statement II alone is sufficient to answer the question while data in statement I is not
- (C) Data in either statement I alone or statement II alone is sufficient to answer the question
- (D) Data in statements I and II together is sufficient to answer the question

55. Six identical boxes of different colours, Purple, Black, Yellow, Green, Cyan and Magenta are arranged one over the other in the following manner:
Only three boxes are kept between the Cyan and Purple boxes. The Yellow box is kept at the bottom most position. Only the Black colour box is kept between the Magenta and Green colour boxes. What coloured box is kept at the third position from the top?

SCQ : +3, -1

- (A) Cyan
- (B) Magenta
- (C) Green
- (D) Black

56. What should come in place of the '?' in the given series?

36, 108, 54, ?, 81, 243

SCQ : +3, -1

- (A) 82
- (B) 88
- (C) 162
- (D) 170

57. Select the combination of letters that when sequentially placed in the blanks of the given series will complete the series.

K _ _ N L _ N K _ N _ L N K _ M _ L M _

SCQ : +3, -1

- (A) L, M, M, M, K, L, K, N
- (B) L, M, M, K, K, L, N, N
- (C) L, M, M, K, N, L, N, N
- (D) L, M, M, K, K, M, K, N

58. Shweta starts walking from her office and walks 150m towards the South, then she turns right and walks 80m, and then she turns left and walks 60m. Finally she turned to left and walks 280m to reach a bank. What is the shortest distance between her office and the bank?

SCQ : +3, -1

- (A) 280 m
- (B) 290 m
- (C) 410 m
- (D) 370 m

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59. P is to the North of Q. T is to the East of Q and S is to the East of P. S is to the North-East of T and South-West of R. What is the position of R with respect to Q?

SCQ : +3, -1

- (A) North-East
- (B) South-West
- (C) East
- (D) South

60. Among seven friends Akash, Viraj, Chandan, Dharmesh, Imran, Faisal, and Gautam, Viraj is taller than only Dharmesh. Only one person is taller than Faisal. The height of exactly two friends lies in between Akash and Chandan. Imran is taller than Gautam. Who is the third tallest person in the group?

SCQ : +3, -1

- (A) Gautam
- (B) Imran
- (C) Faisal
- (D) Dharmesh

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Space for rough work

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