RRB Group D Official Paper (Held On: 09 Jan, 2026 Shift 3) (Previous Year Paper)

RRB Group D • 2026 • 100 questions • 90 minutes • Answer key and solutions

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GENERAL SCIENCE

Q1. What is the SI unit of universal gravitational constant (G) ?

(a) N/kg^2
(b) Nm^2/kg^2
(c) Nm/kg
(d) kg/N

Q2. In a compound, the elements are combined:

(a) by filtration
(b) chemically
(c) physically
(d) by evaporation

Q3. In multicellular organisms, a lot of variation in the shape and size of cells makes an organism _____.

(a) perform poorly in adverse conditions
(b) prone to infection and death
(c) less efficient with no division of labour among the cells
(d) more efficient with different cells performing different functions

Q4. Which of the following is the phase during which reproductive tissues in humans start maturing?

(a) Menstruation
(b) Childhood
(c) Puberty
(d) Fertilization

Q5. An object is moving along a straight line with a velocity that is initially positive (+u) and non-zero, but the acceleration is non-uniform and negative, such that the velocity eventually becomes negative (-v). What does the negative final velocity signify?

(a) The object is at rest.
(b) The acceleration became positive at some point.
(c) The object is moving backward relative to its initial direction.
(d) The object has constant but negative acceleration.

Q6. Which flower parts usually shrivel and fall off after fertilisation?

(a) Embryo and cotyledon
(b) Petals, sepals, stamens, style and stigma
(c) Ovule and ovary
(d) Roots and leaves

Q7. Which of the following modifications of seeds help in wind dispersal?

(a) Spiny or hook-like outgrowths
(b) Wing-like or hairy outgrowths
(c) Thick and fibrous coat
(d) Large size

Q8. Which of the following is NOT true about kinetic energy?

(a) It depends on motion.
(b) It is a scalar quantity.
(c) It depends on direction of motion.
(d) It can never be negative.

Q9. Which of the following statements is correct?

(a) A lighter body resists change in motion more strongly.
(b) Mass and inertia are unrelated.
(c) Inertia of an object increases with its mass.
(d) A body with larger mass has less inertia.

Q10. What is the primary objective of implementing nutrient management practices in agriculture?

(a) Enhancing soil erosion
(b) Pouring polluted water on crops
(c) Mixing plastic residues into the field
(d) Improving crop productivity and quality

Q11. How are ionic compounds formed between metals and non-metals?

(a) By the formation of a sea of delocalised electrons.
(b) By sharing of electrons between atoms.
(c) By mutual attraction between positively charged nuclei
(d) By transfer of electrons from metal atoms to non-metal atoms.

Q12. Which part of the eye is responsible for converting light into electrical signals?

(a) Cornea
(b) Iris
(c) Lens
(d) Retina

Q13. What type of image is formed by a convex mirror when the object is placed at infinity?

(a) Enlarged, virtual and erect
(b) Highly diminished, virtual, erect and point-sized
(c) Enlarged, real and inverted
(d) Same size, real and inverted

Q14. In a lab, a student sees a large transparent sac filling most of a plant cell. What percentage of the cell's volume does the vacuole occupy?

(a) 100%
(b) 5–15%
(c) 50–90%
(d) 20–30%

Q15. If the potential difference between two points is V and charge q moves between them, the work done is _____.

(a) $W = q/V$
(b) $W = V^2/q$
(c) $W = V \times q$
(d) $W = V/q$

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Q16. When an acid reacts with a non-carbonated base, what are the typical products formed in a neutralisation reaction?

(a) Salt and water
(b) Only water
(c) Only a salt
(d) Carbon dioxide and water

Q17. What do we call the low-pressure area created when a vibrating object moves backward?

(a) Wavelength
(b) Compression
(c) Reflection
(d) Rarefaction

Q18. Which of the following statements is correct about Ohm's Law?

(a) It states that resistance decreases with voltage.
(b) It is valid only for metallic conductors at constant temperature.
(c) It is valid for semiconductors and electrolytes.
(d) It is valid for all conductors at all temperatures.

Q19. Which of the following is a property of liquids?

(a) No fixed shape but fixed volume
(b) Fixed shape but no fixed volume
(c) Fixed shape and fixed volume
(d) No fixed shape and no fixed volume

Q20. Refer to the two statements given below and choose the correct option.

Statement A: Sodium hydroxide is used in the manufacture of soaps and paper.

Statement B: It is a weak base and neutral in nature.

(a) Statement A is incorrect but B is correct.
(b) Statement A is correct but B is incorrect.
(c) Both statements A and B are correct.
(d) Both statements A and B are incorrect.

Q21. Non-metallic oxides are considered acidic in nature. What is the approximate pH nature of the salt formed when a non-metallic oxide reacts with a strong base?

(a) Amphoteric
(b) Basic
(c) Neutral
(d) Acidic

Q22. What is the chemical formula of aluminium oxide?

(a) AlO
(b) AlO3
(c) Al2O3
(d) Al2O

Q23. When onion bulbs of different sizes are viewed under a microscope, all show similar rectangular structures. This proves that _____.

(a) cells differ in a onion
(b) only big onions have cells
(c) cork cells are living
(d) all living things are made of cells

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Q24. Which of the following is a non-biodegradable material?

(a) Plastic bag
(b) Paper
(c) Vegetable peel
(d) Cotton cloth

Q25. Which of the following statements about neutrons is correct?

(a) They revolve around the nucleus in fixed orbits.
(b) They determine the chemical properties of an atom.
(c) They are found in the nucleus of an atom.
(d) They have a positive charge.

MATHEMATICS

Q26. The marked price of a painting was Rs. 6,400, but the shopkeeper offered a double discount in a successive manner of 25% and 12%. Ultimately for how much did he sell the item?

(a) Rs. 4,320
(b) Rs. 4,224
(c) Rs. 4,291
(d) Rs. 4,161

Q27. The arithmetic mean of the observations 85, 73, 89, 29, 20, 52, 22, 25 and 55 is:

(a) 56
(b) 57
(c) 54
(d) 50

Q28. Simplify $(1/(1 - \sin A) + 1/(1 + \sin A)) \times \cos^2 A$

(a) $2 \cos^2 A$
(b) $\sec^2 A$
(c) 2
(d) $2 \sec^2 A$

Q29. The age of Ajay is 16 years more than that of Vijay. The sum of their ages 6 years ago was 56 years. Find Vijay's present age.

(a) 42 years
(b) 26 years
(c) 18 years
(d) 56 years

Q30. Two banks, A and B, offered loans at 3.5% and 7% per annum, respectively. Gopal borrowed an amount of Rs. 5,00,000 from each bank. Find the positive difference (in Rs.) between the amounts of simple interest paid to the two banks by Gopal after 3 years.

(a) 52,500
(b) 54,000
(c) 53,500
(d) 52,000

Q31. If $x = \sqrt{(30 + \sqrt{(30 + \sqrt{(30 + \ldots \infty)})})}$ and $y = \sqrt{(30 - \sqrt{(30 - \sqrt{(30 - \ldots \infty)})})}$, then what will the remainder be when the product of x and y is divided by 7

(a) 2
(b) 4
(c) 3
(d) 1

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Q32. What is the fractional value of 3. 627272727….?

(a) 399/110
(b) 351/99
(c) 399/111
(d) 359/11

Q33. The mode and median of a data are 27.5 and 23, respectively. What is the mean of the data? (Use empirical formula.)

(a) 11.95
(b) 20.75
(c) 26.8
(d) 30.7

Q34. A, B and C can do a piece of work in 3, 4 and 12 days, respectively. How long (in days) will they take to do twice the same work, working together?

(a) 6
(b) 9
(c) 4
(d) 3

Q35. The price of fuel decreases by 55%, 40% and 15% in three successive months, but increases by 60% in the fourth month. What is the percentage increase/decrease in the price of fuel in the fourth month as compared to its original price?

(a) Decreases by 68.69%
(b) Increases by 60.37%
(c) Increases by 67.93%
(d) Decreases by 63.28%

Q36. By selling a bicycle for Rs. 1,425, a shopkeeper gains 14%. If the profit is reduced to 8%, then the selling price will be:

(a) Rs. 1,410
(b) Rs. 1,350
(c) Rs. 1,390
(d) Rs. 1,360

Q37. Two trains, A and B, of lengths 402 m and 286 m are running at speeds of 6 m/s and 37 m/s, respectively, towards each other on parallel tracks. In how much time will they cross each other?

(a) 8 seconds
(b) 21 seconds
(c) 14 seconds
(d) 16 seconds

Q38. There are some rabbits and parrots in a farmhouse. The total number of animal heads is 180 and the total number of legs is 520. Find the number of rabbits in the farmhouse.

(a) 80
(b) 60
(c) 100
(d) 120

Q39. Rohit goes to a shop to purchase a truck priced at Rs. 6,900. He is offered 4 discount options by the shopkeeper. Which of these options should he opt for to gain maximum advantage of the discount offered?

(a) Single discount of 14%
(b) Two successive discounts of 14% each
(c) Two successive discounts of 38% and 46%
(d) Two successive discounts of 14% and 8%

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Q40. Pipes A and B can fill an empty cistern in 46 minutes and 32 minutes, respectively. Both Pipe A and Pipe B are opened together. After how much time should Pipe B be turned off so that the empty cistern is completely filled in a total of 23 minutes?

(a) 16 minutes
(b) 10 minutes
(c) 20 minutes
(d) 12 minutes

Q41. A room is one and a half times as long as it is wide. The cost of carpeting the floor at Rs. 18 per square metre is Rs. 3,888, and the cost of whitewashing the four walls at Rs. 9 per square metre is Rs. 4,320. Find the volume of the room in cubic metres.

(a) 1654
(b) 1782
(c) 1696
(d) 1728

Q42. Each exterior angle of a regular polygon is 24°. Find the number of diagonals in this polygon.

(a) 80
(b) 70
(c) 60
(d) 90

Q43. If 20% of a number is added to 66, then the result is the same number. 80% of the same number is:

(a) 66
(b) 76
(c) 96
(d) 86

Q44. The fourth proportional to 12, a, and 2a is 54. What is the positive value of a?

(a) 20
(b) 19
(c) 18
(d) 17

Q45. A person who spends 60% of his monthly income is able to save Rs. 8,242 per month. His monthly expenses (in Rs.) are:

(a) 12,285
(b) 12,363
(c) 12,379
(d) 12,268

Q46. The salaries of P, Q and R are in the ratio 10:8:2. If the increments of 11%, 20% and 35% are allowed, respectively, in their salaries, then what will be the new ratio of their salaries?

(a) 37:32:9
(b) 37:23:19
(c) 34:34:15
(d) 40:39:14

Q47. Simplify the expression: (7a + 4b)(7a - 4b)

(a) $49a^2 + 16b^2$
(b) $49a^2 - 16b^2$
(c) $21a^2 - 16b^2$
(d) $49a^2 - 8b^2$

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Q48. A circle of radius 3 cm is drawn with its centre at one of the vertices of a regular hexagon of side 6 cm. What is the area (in cm²) of the hexagon which is NOT overlapping with the circle?

(a) 54√2 + 2π
(b) 54√3 - 3π
(c) 54√2 - 2π
(d) 54√(3) + 3π

Q49. A car covers 100 km in the first hour, 150 km in the second hour, and 50 km in the third hour. If it continues at a speed of 60 km/hr for the next 2 hours, what is the average speed for the entire journey?

(a) 86 km/hr
(b) 80 km/hr
(c) 82 km/hr
(d) 84 hm/hr

Q50. If a four-digit number 34X1 is divisible by 7, then X² is:

(a) 49
(b) 36
(c) 25
(d) 16

GENERAL INTELLIGENCE & REASONING

Q51. Seven boxes, A, B, C, D, E, F and G, are kept one over the other, but not necessarily in the same order.

Only three boxes are kept above G. Only one box is kept between B and G. Only three boxes are kept between B and C. C is kept at some place above G. F is kept immediately below C. E is kept at one of the places above D. A is not kept immediately above or below B.

How many boxes are kept below E?

(a) 2
(b) 3
(c) 4
(d) 1

Q52. Nayan starts from Point A and drives 45 km towards the north. He then takes a right turn, drives 37 km, turns right and drives 60 km. He then takes a right turn and drives 56 km. He takes a final right turn, drives 15 km and stops at Point P. How far (shortest distance) and towards which direction should he drive in order to reach Point A again? (All turns are 90-degree turns only unless specified.)

(a) 22 km to the west
(b) 19 km to the east
(c) 21 km to the west
(d) 20 km to the east

Q53. Refer to the following number series and answer the question that follows. Counting to be done from left to right only. (All numbers are single-digit numbers only.)

(Left) 2 4 8 4 7 1 5 7 4 3 4 2 8 7 4 3 6 8 5 4 9 1 6 9 3 5 2 4 8 (Right)

How many such odd numbers are there, each of which is immediately preceded by an odd number and also immediately followed by an even number?

(a) One
(b) Two
(c) Three
(d) More than three

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Q54. In a certain code language,

A + B means ‘A is the son of B’,

A - B means ‘A is the brother of B’,

A x B means ‘A is the wife of B’,

and A & B means ‘A is the father of B’.

How is K related to V if ‘K-T+R&ZxV’?

(a) Wife's father
(b) Father
(c) Brother
(d) Wife's brother

Q55. Six people, A, B, C, D, E and F, are sitting in a row, facing north. A sits to the immediate right of E. B sits fourth to the left of E. Only one person sits between B and F. C sits to the immediate left of F. D sits second to the left of A. Three of the following four are alike in a certain way based on the given arrangement and thus form a group. Which is the one that does NOT belong to that group?

(a) FD
(b) BA
(c) DE
(d) CF

Q56. Refer to the following series and answer the question that follows (all numbers are single digit numbers only). Counting to be done from left to right only.

(Left) 1 8 9 1 3 8 3 8 9 9 5 9 6 5 5 1 7 7 4 2 3 1 6 (Right)

How many such even digits are there each of which is immediately preceded by an even digit and also immediately followed by an even digit?1749

(a) None
(b) One
(c) Three
(d) Two

Q57. What should come in place of the question mark (?) in the given series?

210 212 209 213 208 ?

(a) 209
(b) 210
(c) 214
(d) 213

Q58. Select the set in which the numbers are related in the same way as are the numbers of the following sets.

(NOTE: Operations should be performed on the whole numbers, without breaking down the numbers into their constituent digits. E.g. 13 – Operations on 13 such as adding to/subtracting from/multiplying with 13 can be performed. Breaking down 13 into 1 and 3 and then performing mathematical operations on 1 and 3 is not allowed.)

(5, 18, 11)

(9, 26, 19)

(a) (10, 12, 5)
(b) (7, 22, 15)
(c) (8, 24, 31)
(d) (25, 58, 50)

Q59. What will come in the place of the question mark (?) in the following equation, if ‘+’ and ‘−’ are interchanged and ‘×’ and ‘÷’ are interchanged?

89 ÷ 8 + 684 × 6 − 87 = ?

(a) 692
(b) 615
(c) 685

(d) 634

Q60. In a certain code language, ‘LEMA’ is coded as ‘4753’ and ‘MALT’ is coded as ‘3479’. What is the code for ‘T’ in the given code language?

(a) 4
(b) 9
(c) 3
(d) 7

Q61. What should come in place of the question mark (?) in the given series?

3 6 ? 144 1152 11520

(a) 28
(b) 24
(c) 20
(d) 22

Q62. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

All tables are golds.

No table is a helmet.

Conclusions:

(I): Some helmets are golds.

(II): All golds are helmets.

(a) Only conclusion (II) follows
(b) Neither conclusion (I) nor (II) follows
(c) Only conclusion (I) follows
(d) Both conclusions (I) and (II) follow

Q63. What should come in place of the question mark (?) in the given series based on the English alphabetical order?

ARJ KBT ULD EVN ?

(a) OFX
(b) OXD
(c) OXS
(d) OOX

Q64. Which of the following terms will replace the question mark (?) in the given series to make it logically complete?

EQL 2 GMN 6 IIP 18 KER 54 ?

(a) MAT 162
(b) MBT 158
(c) MBS 158
(d) MAS 168

Q65. Seven boxes, D, E, F, U, V, W and X, are kept one over the other, but not necessarily in the same order. D is kept immediately above V. W is kept immediately above F. Only U is kept above E. Only one box is kept between U and D. W is not kept at the third position from the bottom. How many boxes are kept between X and U?

(a) Two
(b) Four
(c) Three
(d) One

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Q66. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

All soaps are oils.

All oils are dispensers.

Some dispensers are towels.

Conclusions:

(I) Some soaps are towels.

(II) Some oils are towels.

(a) Only conclusion (II) follows
(b) Only conclusion (I) follows
(c) Neither conclusion (I) nor (II) follows
(d) Both conclusions (I) and (II) follow

Q67. In a certain code language, 'SKATE' is coded as '51324' and 'ASKEW' is coded as '47315'. How is 'W' coded in that language?

(a) 5
(b) 4
(c) 7
(d) 3

Q68. Based on the English alphabetical order, three of the following four letter-cluster pairs are alike in a certain way and thus form a group. Which letter-cluster pair DOES NOT belong to that group?

(Note: The odd one out is not based on the number of consonants/vowels or their position in the letter-cluster.)

(a) YX−WV
(b) FE−DC
(c) UT−RT
(d) BA−ZY

Q69. If 1 is added to each even digit and 1 is subtracted from each odd digit in the number 542816379, how many digits will appear more than once in the new number thus formed?

(a) Two
(b) Three
(c) None
(d) One

Q70. If 1 is added to each even digit and 1 is added to each odd digit in the number 321854, what will be the sum of the first and last digits in the new number thus formed?

(a) 8
(b) 9
(c) 12
(d) 10

Q71. GWCL is related to PFLU in a certain way based on the English alphabetical order. In the same way, QGMV is related to ZPVE. To which of the given options is RHNW related, following the same logic?

(a) AQWF
(b) AQWE
(c) QAWE
(d) AQDF

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Q72. Select the pair which follows the same pattern as that followed by the two pairs given below. Both pairs follow the same pattern.

DHL : FKN

QJM : SMO

(a) VTS:SDR
(b) MPS:ASY
(c) AWN:CZP
(d) SDK:LGI

Q73. MKBZ is related to SQHF in a certain way based on the English alphabetical order. In the same way, PDRW is related to VJXC. To which of the given options is UFLQ related, following the same logic?

(a) ALRW
(b) XIOT
(c) YZPU
(d) WHNS

Q74. Seven people, A, B, C, D, E, F and G, are sitting in a straight line, facing the north.

A sits third from the left end of the line. Only one person sits between A and B. Only three people sit between C and B. E sits to the immediate right of C. D sits to the immediate right of G.

How many people sit to the right of F?

(a) Three
(b) One
(c) None
(d) Two

Q75. Six people, A, B, C, D, E and F, are sitting in a row, facing north. D sits to the immediate left of F. C sits third to the left of B. F is an immediate neighbour of C. E sits second to the right of C. A sits to the immediate left of E. Who sits at the extreme right end of the row?

(a) E
(b) B
(c) F
(d) A

Q76. What should come in place of the question mark (?) in the given series?

48 66 83 99 114 ?

(a) 128
(b) 127
(c) 123
(d) 126

Q77. Refer to the following number series and answer the question that follows (all numbers are single digit numbers only). Counting to be done from left to right only.

(Left) 9 9 3 9 2 4 4 1 9 1 6 9 4 9 9 6 3 2 6 1 7 9 8 3 9 8 7 (Right)

How many such odd numbers are there, each of which is immediately preceded by an odd number and also immediately followed by an odd number?

(a) 6
(b) 4
(c) 3
(d) 5

Q78. Based on the English alphabetical order, three of the following four letter-clusters are alike in a certain way and thus form a group. Which letter-cluster DOES NOT belong to that group?

(Note: The odd one out is not based on the number of consonants/vowels or their position in the letter-cluster.)

(a) NRTX

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(b) HLNR
(c) PTWZ
(d) QUWA

Q79. Rohit starts from Point A and drives 15 km towards west. He then takes a left turn, drives 11 km, turns left and drives 18 km. He then takes a left turn and drives 14 km. He takes a final left turn, drives 3 km and stops at Point P. How far (shortest distance) and towards which direction should he drive in order to reach Point A again?

(Note: All turns are 90° turns only unless specified.)

(a) 4 km to the north
(b) 3 km to the north
(c) 3 km to the south
(d) 4 km to the south

Q80. Refer to the following number series and answer the question that follows (all numbers are single-digit numbers only). Counting to be done from left to right only.

(Left) 5 5 7 8 2 3 3 2 3 3 9 5 5 7 9 8 5 6 3 5 3 8 3 5 5 8 9 (Right)

How many such odd numbers are there, each of which is immediately preceded by an odd number and also immediately followed by an even number?

(a) 6
(b) 7
(c) 5
(d) 4

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. According to the second edition of the North Eastern Region District SDG Index (2023-24) released in July 2025, which district recorded the highest SDG score in North East India, with a score of 81.43?

(a) Aizawl
(b) Kohima
(c) Hnahthial
(d) Gomati

Q82. The Wisden Cricketers' Almanack 2025 named Jasprit Bumrah as the Leading Cricketer of the Year along with:

(a) Harmanpreet Kaur
(b) Rohit Sharma
(c) Smriti Mandhana
(d) Virat Kohli

Q83. Which retired Chief Justice of India was awarded the Padma Vibhushan in 2025 for Public Affairs?

(a) Dipak Misra
(b) Ranjan Gogoi
(c) Jagdish Singh Khehar
(d) HL Dattu

Q84. Who won the 'Best FIFA Men's Player' award for the 2024 season at the Best FIFA Football Awards in December 2024?

(a) Rodri
(b) Jude Bellingham
(c) Vinícius Jr.
(d) Erling Haaland

Q85. The Sachet App, promoted in April 2025, was launched by _____.

(a) National Institution for Transforming India (NITI) Aayog
(b) National Disaster Management Authority
(c) Indian Meteorological Department

(d) Ministry of Electronics and Information Technology

Q86. Which of the following agreements did India sign in March 2024 with the European Free Trade Association (EFTA) countries (Iceland, Liechtenstein, Norway, Switzerland) that includes a commitment of US $100 billion investment over 15 years?

(a) India-EFTA Trade and Economic Partnership Agreement
(b) India-EFTA Trade Exchange Agreement
(c) India-EFTA Financial Services Pact
(d) India-EFTA Defence Cooperation Treaty

Q87. Where was the 71^(st) Senior National Men's Kabaddi Championship 2025 held?

(a) Kalinga Stadium, Bhubaneswar
(b) Gachibowli Indoor Stadium, Hyderabad
(c) Indira Gandhi Indoor Stadium, Delhi
(d) Jawaharlal Nehru Indoor Stadium, Cuttack

Q88. In August 2025, who among the following was appointed as the Executive Director at the International Monetary Fund (IMF) for a period of three years?

(a) Urjit Patel
(b) Raghuram Rajan
(c) Krishnamurthy Subramanian
(d) Shaktikanta Das

Q89. Which of the following cities served as the venue for the two-day FIBAC banking conference on ‘Charting New Frontiers’, co-hosted by FICCI and the Indian Banks’ Association (IBA) on 25 and 26 August 2025?

(a) Mumbai
(b) Chennai
(c) New Delhi
(d) Kolkata

Q90. Which agency is investigating the Mithi River Desilting Scam?

(a) Delhi Police
(b) Central Bureau of Investigation
(c) Mumbai Police
(d) Enforcement Directorate

Q91. What was India's unemployment rate in May 2025, according to the Periodic Labour Force Survey (PLFS)?

(a) 7.0%
(b) 5.1%
(c) 6.0%
(d) 5.6%

Q92. Which of the following agencies operates the Satish Dhawan Space Centre (SDSC), from where the NASA-ISRO Synthetic Aperture Radar (NISAR) mission was launched in July 2025?

(a) North-Eastern Space Applications Centre (NESAC)
(b) Indian Space Research Organisation (ISRO)
(c) Defence Research and Development Organisation (DRDO)
(d) National Remote Sensing Centre (NRSC)

Q93. Who received the P C Chandra Puraskaar 2025 in Kolkata?

(a) Mary Kom
(b) Leander Paes
(c) Amjad Ali Khan
(d) Kapil Dev

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Q94. According to the UNDP Human Development Report 2025 (based on 2023 data), what is India's rank in the Human Development Index (HDI)?

(a) 138
(b) 125
(c) 130
(d) 141

Q95. In June 2025, which of the following organisations launched NACH 3.0 to enable faster salary and EMI processing?

(a) State Bank of India (SBI)
(b) Reserve Bank of India (RBI)
(c) National Payments Corporation of India (NPCI)
(d) Securities and Exchange Board of India (SEBI)

Q96. In May 2025, Union Sports Minister Mansukh Mandaviya opened a new multi-purpose Khelo India Hall in Kamle district. In which state is Kamle district located?

(a) Nagaland
(b) Arunachal Pradesh
(c) Manipur
(d) Assam

Q97. Where was India's first-ever Astro Tourism Festival successfully held in 2025?

(a) Kargil
(b) Spiti Valley
(c) Leh, Ladakh
(d) Gulmarg

Q98. What did the Supreme Court say about Group A CAPF (Central Armed Police Forces) officers in May 2025?

(a) They cannot get promotions.
(b) They are part of "Organised Services".
(c) They are not important.
(d) They are part of "Unorganised Services".

Q99. Where was the 2025 NATO Summit held on 24–25 June?

(a) Berlin, Germany
(b) Brussels, Belgium
(c) Paris, France
(d) The Hague, Netherlands

Q100. In January 2025, which of the following Indian institutes/universities was selected as SDG Hub 6 (Clean Water & Sanitation) Co-Chair for the 2025–2027 term?

(a) Shiv Nadar University, Delhi NCR
(b) Indian Institute of Science, Bangalore
(c) Indian Institute of Technology, Madras
(d) Jawaharlal Nehru University, New Delhi

ANSWER KEY

1	b	2	b	3	d	4	c	5	c	6	b	7	b	8	c	9	c	10	d
11	d	12	d	13	b	14	c	15	c	16	a	17	d	18	b	19	a	20	b
21	b	22	c	23	d	24	a	25	c	26	b	27	d	28	c	29	b	30	a
31	a	32	a	33	b	34	d	35	d	36	b	37	d	38	a	39	c	40	a
41	d	42	d	43	a	44	c	45	b	46	a	47	b	48	b	49	d	50	c
51	a	52	b	53	c	54	d	55	b	56	a	57	c	58	b	59	c	60	b

61	b	62	b	63	a	64	a	65	c	66	c	67	c	68	c	69	c	70	b
71	a	72	c	73	a	74	a	75	b	76	a	77	b	78	c	79	c	80	c
81	c	82	c	83	c	84	c	85	b	86	a	87	d	88	a	89	a	90	d
91	d	92	b	93	b	94	c	95	c	96	b	97	c	98	b	99	d	100	a

SOLUTIONS

Q1. Answer: (b) Nm²/kg²

The correct answer is Nm²/kg².

Key Points

• The Universal Gravitational Constant (G) is a physical constant involved in the calculation of gravitational effects in Sir Isaac Newton's Law of Universal Gravitation.

• According to the law, the gravitational force (F) between two bodies is directly proportional to the product of their masses (m1 and m2) and inversely proportional to the square of the distance (r) between them: F = G(m1m2/r²).

• To find the SI unit of G, we rearrange the formula: G = (F × r²) / (m1 × m2).

• In the SI system, the unit of force (F) is the Newton (N), the unit of distance (r) is the meter (m), and the unit of mass (m) is the kilogram (kg).

• Substituting these units into the rearranged formula gives: Newton × meter² / (kilogram × kilogram), which simplifies to Nm²/kg² (or Nm²kg^-²). Hence, the correct option is Nm²/kg².

Additional Information

• Value of G: The accepted value of the Universal Gravitational Constant is approximately 6.674 × 10^-¹¹ Nm²/kg². This value is extremely small, which explains why gravitational forces between everyday objects are not easily noticeable.

• Henry Cavendish: The first person to accurately measure the value of G in a laboratory setting was the English scientist Henry Cavendish in the year 1798 using a torsion balance experiment.

• Universal Nature: Unlike the acceleration due to gravity (g), G is a scalar quantity and is a universal constant. This means its value remains the same everywhere in the universe, regardless of the medium or the bodies involved.

• Dimensional Formula: The dimensional formula for the universal gravitational constant G is [M^-¹ L³ T^-²].

Important Points

• Difference between G and g: It is important to distinguish between G (Universal Gravitational Constant) and g (Acceleration due to gravity).

• G is constant throughout the universe, while g varies from place to place (e.g., g is approximately 9.8 m/s² on Earth but about 1.6 m/s² on the Moon).

• The relationship between them is given by the formula g = GM/R², where M is the mass of the celestial body and R is its radius.

• Newton's Principia: The concepts of universal gravitation were first published by Isaac Newton in his work Philosophiæ Naturalis Principia Mathematica in 1687.

• Weak Force: Gravity is considered the weakest of the four fundamental forces of nature (the others being electromagnetism, the strong nuclear force, and the weak nuclear force), yet it dominates the large-scale structure of the universe.

Q2. Answer: (b) chemically

The correct answer is chemically.

Key Points

• A compound is a pure substance formed when two or more elements are chemically combined in a fixed proportion by mass. Hence, the correct option is chemically.

• The process of forming a compound involves chemical bonding, where atoms of different elements interact through the sharing or transfer of electrons to achieve stability.

• In a compound, the constituent elements lose their original physical and chemical properties and acquire entirely new properties. For example, Sodium (Na), a highly reactive metal, and Chlorine (Cl), a toxic gas, combine to form Sodium Chloride (NaCl), which is common table salt.

• The components of a compound cannot be separated by physical methods such as filtration, hand-picking, or evaporation. They can only be broken down into simpler substances through chemical reactions or electrochemical methods like electrolysis.

• The composition of a compound is always homogeneous, meaning every part of the compound has the same properties and composition.

Additional Information

• Filtration: This is a physical separation technique used to separate an insoluble solid from a liquid or gas. It is applicable to

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heterogeneous mixtures like sand and water. Hence, statement 1 is incorrect.

• Mixtures: When elements or substances are combined physically without any chemical bond, they form a mixture. Unlike compounds, mixtures retain the properties of their constituents and do not have a fixed ratio. Hence, statement 3 is incorrect.

• Evaporation: This is a physical process used to separate a soluble solid from its solvent (liquid). For example, common salt is obtained from seawater using this method. Hence, statement 4 is incorrect.

• Distillation: Another physical method used to separate components of a mixture based on differences in their boiling points. It is commonly used to purify water or separate alcohol from water.

Important Points

• Law of Definite Proportions: Proposed by Joseph Proust in 1799, this law states that a chemical compound always contains its component elements in a fixed ratio by mass, regardless of its source or method of preparation.

• Law of Multiple Proportions: Proposed by John Dalton in 1803, it states that if two elements form more than one compound, the masses of one element that combine with a fixed mass of the other are in a ratio of small whole numbers.

• Energy Change: The formation of a compound is almost always accompanied by an energy change, either exothermic (releasing heat) or endothermic (absorbing heat).

• Common Examples:

• Water (H_2O): Formed by 2 atoms of Hydrogen and 1 atom of Oxygen.

• Carbon Dioxide (CO_2): Formed by 1 atom of Carbon and 2 atoms of Oxygen.

• Methane (CH_4): A primary component of natural gas.

Q3. Answer: (d) more efficient with different cells performing different functions

The correct answer is more efficient with different cells performing different functions.

Key Points

• Multicellular organisms are composed of more than one cell, which allows for a high degree of complexity and functional specialization.

• The variation in shape and size of cells is a direct result of cell differentiation. This ensures that cells are structurally adapted to perform specific tasks effectively.

• One of the most critical advantages of this variation is the division of labour. In a multicellular body, different groups of cells are assigned specific roles such as digestion, respiration, or nervous coordination.

• This specialization makes the organism more efficient. Unlike unicellular organisms where a single cell must manage all life processes, multicellular organisms delegate tasks to specialized cells, optimizing energy use and performance. Hence, the correct option is more efficient with different cells performing different functions.

• For instance, the elongated shape of a nerve cell (neuron) is designed for transmitting electrical impulses over long distances, while the biconcave shape of Red Blood Cells (RBCs) provides a larger surface area for oxygen transport.

Additional Information

• Levels of Organization: In multicellular entities, life is organized into a hierarchy: Cells → Tissues → Organs → Organ Systems → Organism. This hierarchical structure allows for sophisticated biological processes.

• Cell Differentiation: This is the biological process by which a less specialized cell becomes a more specialized cell type. This is governed by gene expression, where certain genes are turned on or off to dictate the cell's ultimate function and form.

• Examples of Specialized Cells:

• Muscle Cells: These are typically spindle-shaped or cylindrical and contain contractile proteins like actin and myosin to facilitate movement.

• Guard Cells: In plants, these kidney-shaped cells control the stomata, regulating transpiration and gas exchange.

• White Blood Cells (WBCs): Some, like amoeboid leucocytes, can change shape to engulf pathogens through phagocytosis.

• Efficiency and Survival: Because cells are specialized, the organism can adapt to diverse environments. If one group of cells is damaged, the entire organism does not necessarily perish, providing an evolutionary advantage over simpler forms of life.

Important Points

• Unicellular vs. Multicellular: In unicellular organisms (like Amoeba or Paramecium), a single cell performs all metabolic activities. This limits their size and efficiency compared to multicellular organisms.

• Size Limitation: The Surface Area to Volume Ratio is a key factor. As a cell grows larger, its volume increases faster than its surface area, making it difficult to transport nutrients. Multicellularity solves this by having many small, specialized cells.

• Regeneration: Many multicellular organisms possess stem cells, which are unspecialized cells capable of giving rise to various specialized cell types, aiding in growth and repair.

Q4. Answer: (c) Puberty

The correct answer is Puberty.

Key Points

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• Puberty is defined as the period during which the reproductive tissues in humans start maturing and the body undergoes various physiological changes to reach sexual maturity.

• During this phase, the gonads (testes in males and ovaries in females) begin to produce gametes (sperm and ova) and secrete sex hormones.

• In girls, puberty generally begins between the ages of 10 to 14, whereas in boys, it typically starts between the ages of 12 to 16.

• The process is initiated by the release of Gonadotropin-Releasing Hormone (GnRH) from the hypothalamus, which subsequently stimulates the pituitary gland.

• Puberty marks the transition from childhood to adolescence, making the individual capable of reproduction. Hence, the correct answer is Puberty.

Additional Information

• Menstruation:

• It is the periodic shedding of the uterine lining (endometrium) and blood through the vagina in females.

• The first occurrence of menstruation is called menarche, which is a major milestone of puberty.

• It signifies that the female body has reached a stage where ovulation is occurring, but it is a specific biological process within the reproductive cycle rather than the phase of maturation itself.

• Childhood:

• This is the stage of human development from infancy until the onset of puberty.

• During this period, the reproductive organs are present but remain in a dormant or immature state.

• The primary focus of growth during childhood is on physical height, weight, motor skills, and cognitive development.

• Fertilization:

• It is the process by which a male spermatozoon fuses with a female ovum to form a zygote.

• This event can only take place after reproductive maturity has been achieved through puberty.

• It is a reproductive event that leads to pregnancy, not a developmental phase of tissue maturation.

• Secondary Sexual Characteristics:

• During puberty, humans develop traits that distinguish the sexes but are not directly part of the reproductive system, such as facial hair and deepening of the voice in males, and breast development in females.

• These changes are driven by hormones like testosterone in males and estrogen in females.

Important Points

• The onset of puberty is influenced by various factors including genetics, nutrition, and environmental conditions.

• The pituitary gland plays a master role by secreting Follicle-Stimulating Hormone (FSH) and Luteinizing Hormone (LH), which signal the gonads to begin the maturation process.

• In modern data, there is a noted trend of earlier onset of puberty in many populations, often attributed to improved nutrition and health standards.

Q5. Answer: (c) The object is moving backward relative to its initial direction.

The correct answer is The object is moving backward relative to its initial direction.

Key Points

• Velocity is defined as a vector quantity, which means it possesses both magnitude (speed) and direction. In one-dimensional motion, the direction is represented by positive (+) and negative (-) signs.

• When the initial velocity is positive (+u), it implies the object is moving in the chosen reference direction (often called "forward").

• The acceleration is stated to be negative. When acceleration and velocity have opposite signs, the object undergoes retardation (slowing down). Because the acceleration remains negative, the object eventually reaches a velocity of zero.

• After the object momentarily comes to rest, the continued negative acceleration causes the object to start moving in the opposite direction. As it gains speed in this new direction, its velocity becomes negative (-v).

• A negative final velocity signifies that the direction of motion has reversed. Therefore, the object is now moving backward relative to its initial direction. Hence, statement 3 is correct.

• The final velocity -v is non-zero; therefore, the object cannot be at rest at the end of the described motion. Hence, statement 1 is incorrect.

• The transition from a positive velocity to a negative velocity occurs because of the persistent negative acceleration. There is no requirement for the acceleration to become positive to achieve a negative velocity. Hence, statement 2 is incorrect.

• The problem explicitly mentions that the acceleration is non-uniform. While the acceleration is negative, its magnitude changes over time, meaning it is not constant. Hence, statement 4 is incorrect.

Additional Information

• Vector vs Scalar: Speed is a scalar (always positive or zero), while velocity is a vector. A change in the sign of velocity always indicates a 180-degree change in the direction of motion in a straight line.

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• Non-Uniform Acceleration: This occurs when the velocity of an object does not change by equal amounts in equal intervals of time. On a velocity-time graph, non-uniform acceleration is represented by a curve rather than a straight line.

• Retardation: This is specifically negative acceleration relative to the direction of velocity. If an object moves in the negative direction and has negative acceleration, it actually speeds up (accelerates) in the negative direction.

• Reference Frame: The choice of which direction is positive is arbitrary. However, once fixed, all vectors like displacement, velocity, and acceleration must follow that coordinate system.

Important Points

• Instantaneous Rest: At the exact moment the object changes direction (switching from +u to -v), its instantaneous velocity must be 0. This is a crucial characteristic of motion reversal.

• Real-world Example: Consider a ball thrown vertically upward. The initial velocity is positive (upward). Gravity provides a negative acceleration (downward). The ball slows down, stops at the maximum height, and then moves downward with a negative velocity.

• Sign Convention: In most physics problems, rightward or upward is taken as positive (+), while leftward or downward is taken as negative (-).

• Calculus Aspect: Acceleration is the derivative of velocity with respect to time (a = dv/dt). If a is always negative, the slope of the velocity-time graph is always downward, eventually crossing the time-axis into the negative region.

Q6. Answer: (b) Petals, sepals, stamens, style and stigma

The correct answer is Petals, sepals, stamens, style and stigma.

Key Points

• In angiosperms (flowering plants), fertilisation is the fusion of male and female gametes to form a zygote. Once this process is complete, the primary reproductive functions of several floral parts are fulfilled.

• The petals, sepals, stamens, style, and stigma usually wither, shrivel, and fall off because they are no longer needed to attract pollinators or facilitate the transfer of pollen. Hence, statement 2 is correct.

• The embryo and cotyledon are internal structures that develop within the seed as a result of fertilisation. They do not fall off but rather grow to form the next generation of the plant. Hence, statement 1 is incorrect.

• The ovule and ovary do not fall off; instead, they undergo transformation. The ovule develops into the seed, and the ovary matures into the fruit. Hence, statement 3 is incorrect.

• Roots and leaves are vegetative parts of the plant. They do not shrivel or fall off due to the fertilisation of a flower; they continue to support the plant's growth and photosynthesis. Hence, statement 4 is incorrect.

• Hence, the correct answer is Petals, sepals, stamens, style and stigma.

Additional Information

• Post-Fertilisation Changes:

• After fertilisation, the zygote divides repeatedly to form an embryo within the ovule. The ovule develops a tough coat and is gradually converted into a seed.

• The ovary grows rapidly and ripens to form a fruit. During this transformation, the other floral parts like petals and stamens fall away to ensure the plant's energy is directed toward seed and fruit development.

• Seed Structure:

• The seed contains the future plant or embryo which develops into a seedling under appropriate conditions (germination).

• Cotyledons act as food reservoirs for the developing embryo until the young plant can perform photosynthesis on its own.

• Double Fertilisation:

• In flowering plants, a unique process called double fertilisation occurs where one male gamete fuses with the egg to form a zygote, and another fuses with two polar nuclei to form the endosperm.

• The endosperm provides nourishment to the developing embryo.

Important Points

• Exceptions to the Rule:

• In some plants, certain parts like sepals may persist even after fruit formation. This is known as a persistent calyx.

• Common examples of persistent calyx include brinjal (eggplant), tomato, chilli, and strawberry, where the green leafy structure remains attached to the fruit.

• Floral Whorls:

• A typical flower consists of four whorls: Calyx (sepals), Corolla (petals), Androecium (stamens), and Gynoecium (pistil/carpel).

• The pistil consists of the stigma, style, and ovary. While the stigma and style usually disappear post-fertilisation, the ovary is the part that remains to become the fruit.

Q7. Answer: (b) Wing-like or hairy outgrowths

The correct answer is Wing-like or hairy outgrowths.

Key Points

• Wind dispersal, also known as Anemochory, is a method where seeds are carried away from the parent plant by air currents. To facilitate this, seeds develop specific structural modifications.

• Wing-like outgrowths are found in seeds of plants like Maple and Drumstick. These wings increase the surface area, allowing the seeds to spin or glide through the air over long distances.

• Hairy outgrowths are another common modification. Examples include the hairy seeds of Madar (Calotropis) and the hairy fruit of Sunflower. These hairs act like tiny parachutes, catching the breeze to keep the seed buoyant.

• Seeds adapted for wind dispersal are typically lightweight and small. This ensures that even a gentle breeze can transport them effectively.

• The primary goal of these modifications is to prevent overcrowding and reduce competition between the parent plant and the offspring for resources like sunlight, water, and minerals. Hence, the correct answer is Wing-like or hairy outgrowths.

Additional Information

• Animal Dispersal (Zoochory):

• Plants like Xanthium and Urena produce seeds with spiny or hook-like outgrowths.

• These hooks attach to the fur of animals or clothes of humans, carrying the seeds to distant locations.

• Fleshy fruits are also eaten by animals, and the seeds are later dispersed through their droppings.

• Water Dispersal (Hydrochory):

• Seeds or fruits dispersed by water usually develop a thick and fibrous coat or a spongy outer layer.

• The Coconut is a classic example, where the fibrous husk enables the fruit to float in sea or river water for long periods.

• Aquatic plants like Lotus and Water Lily also rely on this mechanism.

• Explosive Dispersal (Autochory):

• Some plants, such as Balsam, Pea, and Castor, have fruits that burst open with a sudden jerk.

• The mechanical force of the explosion scatters the seeds away from the parent plant.

Important Points

• Impact of Seed Size: Large size seeds (Option 4) are generally not suited for wind dispersal as they are too heavy to be carried by air. They usually rely on gravity or large animals for movement.

• Pappus: In the Asteraceae family (like Dandelion), the calyx is modified into a ring of fine hairs called a pappus, which is a specialized structure for anemochory.

• Orchids: Some plants produce millions of dust-like seeds that are so light they do not need wings or hairs to be carried by the wind.

• Evolutionary Advantage: Seed dispersal allows species to colonize new habitats and increases the chances of survival against localized environmental threats or pests.

Q8. Answer: (c) It depends on direction of motion.

The correct answer is It depends on direction of motion.

Key Points

• Kinetic energy is the energy possessed by an object due to its motion. By definition, any object that is moving has kinetic energy, and if an object is at rest, its kinetic energy is zero. Hence, statement 1 is correct.

• Energy is a scalar quantity, which means it only has magnitude and no direction. Unlike velocity or force, which are vector quantities, kinetic energy does not require a directional component to be fully described. Hence, statement 2 is correct.

• The formula for kinetic energy is $1/2\ mv^2$, where v is the speed (magnitude of velocity). Since the velocity term is squared, the direction of motion (whether positive or negative, north or south) has no effect on the total energy value. Therefore, it does not depend on direction. Hence, statement 3 is incorrect.

• Kinetic energy can never be negative. This is because mass (m) is always a positive value, and any real number (velocity) squared (v^2) results in a positive value or zero. Hence, statement 4 is correct.

• Hence, the correct answer is It depends on direction of motion.

Additional Information

• Mathematical Expression:

• The standard formula for calculating kinetic energy is K.E. = $1/2\ mv^2$.

• In this formula, m represents the mass of the object in kilograms (kg) and v represents the velocity (or speed) in meters per second (m/s).

• Units of Measurement:

• The SI unit of kinetic energy is the Joule (J).

• One Joule is defined as 1 kg·m²/s². In the CGS system, the unit is the erg, where 1 Joule equals 10^7 ergs.

• Factors Affecting Kinetic Energy:

• Mass: Kinetic energy is directly proportional to the mass of the object. If the mass is doubled, the kinetic energy doubles.

• Velocity: Kinetic energy is proportional to the square of the velocity. This means if the velocity is doubled, the kinetic energy increases four times (2 squared).

• Relationship with Momentum:

• Kinetic energy can also be expressed in terms of linear momentum (p) using the formula K.E. = p^2 / 2m.

• This shows that for a constant mass, kinetic energy increases with the square of the momentum.

Important Points

• Work-Energy Theorem: This principle states that the net work done on an object is equal to the change in its kinetic energy. If work is done on an object, its speed and kinetic energy increase.

• Types of Kinetic Energy:

• Translational Kinetic Energy: Due to motion from one location to another.

• Rotational Kinetic Energy: Due to an object spinning around an axis.

• Vibrational Kinetic Energy: Due to vibrational motion, common in molecules.

• Frame of Reference: While kinetic energy is a scalar, its numerical value depends on the frame of reference of the observer. An object may have zero kinetic energy relative to a person sitting next to it, but high kinetic energy relative to an observer on the ground.

• Conservation of Energy: In an isolated system, energy can transform between potential energy and kinetic energy, but the total mechanical energy remains constant in the absence of friction or air resistance.

Q9. Answer: (c) Inertia of an object increases with its mass.

The correct answer is Inertia of an object increases with its mass.

Key Points

• Inertia is defined as the inherent property of an object by virtue of which it resists any change in its state of rest or of uniform motion in a straight line.

• The Mass of an object is a quantitative measure of its inertia. This means that mass and inertia are directly proportional to each other; the more mass an object has, the more inertia it possesses.

• A lighter body has less mass, which means it offers less resistance to change. Therefore, it is easier to move a stationary lighter object or stop a moving one compared to a heavier one. Hence, statement 1 is incorrect.

• Since mass is the fundamental property that determines how much an object will resist acceleration, it is the very scale used to measure inertia. Hence, statement 2 is incorrect.

• When the mass of an object is high, the force required to change its velocity is also high. This indicates that the inertia of an object increases with its mass. Hence, statement 3 is correct.

• A body with a larger mass possesses greater inertia because it requires a significantly larger external force to alter its state of motion. Hence, statement 4 is incorrect.

Additional Information

• Newton’s First Law of Motion: Often referred to as the Law of Inertia, it states that an object will remain at rest or in uniform motion unless acted upon by an external unbalanced force. This law was first formulated by Sir Isaac Newton in his work Principia Mathematica in 1687.

• Types of Inertia:

• Inertia of Rest: The inability of a body to change its state of rest by itself. For example, when a carpet is beaten with a stick, dust particles fall off due to inertia of rest.

• Inertia of Motion: The inability of a body to change its state of uniform motion. For instance, an athlete often runs some distance before taking a long jump to gain momentum and utilize inertia of motion.

• Inertia of Direction: The inability of a body to change its direction of motion. An example is when a car takes a sharp turn, the passengers tend to lean outwards because their bodies try to maintain the original direction.

• SI Unit of Mass: The kilogram (kg) is the standard unit used to measure mass. In scientific calculations, inertia is not measured in a separate unit but is expressed through the magnitude of the mass.

• Relationship with Force: According to Newton's Second Law, Force (F) = mass (m) × acceleration (a). This formula highlights that for a constant force, acceleration is inversely proportional to mass, further proving that higher mass (higher inertia) results in less change in motion.

Important Points

• Galileo Galilei was the first to suggest the concept of inertia before Newton formalized it. Galileo conducted experiments with

inclined planes to demonstrate that objects would move forever if friction was absent.

• It is important to distinguish between Mass and Weight. While mass is a measure of inertia and remains constant regardless of location, weight is the force of gravity acting on that mass and changes depending on the gravitational field (e.g., Earth vs. Moon).

• In a vacuum where air resistance is zero, a feather and a hammer will fall at the same acceleration due to gravity, but the hammer still possesses much higher inertia due to its greater mass.

Q10. Answer: (d) Improving crop productivity and quality

The correct answer is Improving crop productivity and quality.

Key Points

• Nutrient management refers to the efficient use of essential plant nutrients such as Nitrogen (N), Phosphorus (P), and Potassium (K) to optimize crop yield and minimize environmental impact.

• The primary objective of these practices is Improving crop productivity and quality. By ensuring plants receive the right amount of nutrients at the right stage of growth, farmers can achieve higher biological yields and better nutritional value. Hence, statement 4 is correct.

• Enhancing soil erosion is a negative process that involves the removal of the fertile topsoil layer. Nutrient management, conversely, focuses on maintaining soil health and structure to prevent such degradation. Hence, statement 1 is incorrect.

• Pouring polluted water on crops introduces heavy metals and pathogens into the food chain, which damages crop health and poses risks to human consumption. Nutrient management promotes the use of clean water and specific irrigation techniques. Hence, statement 2 is incorrect.

• Mixing plastic residues into the field leads to soil pollution and disrupts the physical properties of the soil, making it difficult for roots to penetrate and absorb water. Modern agriculture aims for sustainable waste management rather than contamination. Hence, statement 3 is incorrect.

• Effective nutrient management follows the 4R Stewardship principle: applying the Right source, at the Right rate, at the Right time, and in the Right place.

Additional Information

• Integrated Nutrient Management (INM):

• This approach combines chemical fertilizers with organic manures, bio-fertilizers, and green manures to maintain soil fertility over the long term.

• It helps in reducing the dependency on expensive chemical inputs, thereby lowering input costs for farmers while preserving the ecological balance.

• Macro and Micro Nutrients:

• Plants require 17 essential elements for growth. Macronutrients like Carbon, Hydrogen, and Oxygen are taken from air and water, while Nitrogen, Phosphorus, and Potassium are the primary minerals supplied via fertilizers.

• Micronutrients such as Zinc (Zn), Iron (Fe), and Boron (B) are needed in smaller quantities but are crucial for enzyme activities and metabolic functions in plants.

• Environmental Benefits:

• Proper management prevents nutrient leaching and surface runoff, which can lead to eutrophication (excessive algal growth) in nearby water bodies.

• It also reduces the emission of greenhouse gases like Nitrous Oxide (N_2O), which is a potent contributor to global warming.

Important Points

• Soil Health Card Scheme: Launched by the Government of India in February 2015, this scheme provides farmers with reports on the nutrient status of their soil and recommends appropriate dosages of fertilizers and amendments.

• Precision Agriculture: The use of technology like GPS and variable rate application (VRA) allows farmers to apply nutrients only where needed, significantly increasing efficiency and profitability.

• Economic Impact: By optimizing nutrient use, farmers can prevent luxury consumption (uptake of nutrients beyond what is needed) and reduce economic losses associated with over-fertilization.

Q11. Answer: (d) By transfer of electrons from metal atoms to non-metal atoms.

The correct answer is By transfer of electrons from metal atoms to non-metal atoms.

Key Points

• Ionic compounds are formed through the process of ionic bonding, which primarily occurs between metals and non-metals.

• The fundamental mechanism involves the complete transfer of one or more electrons from the valence shell of a metal atom to the valence shell of a non-metal atom.

• Metal atoms generally have 1, 2, or 3 electrons in their outermost shell and possess low ionization energy, making it easy for them to lose electrons and form positively charged ions known as cations.

• Non-metal atoms usually have 5, 6, or 7 electrons in their valence shell and have high electron affinity, allowing them to accept

electrons to form negatively charged ions known as anions.

• This transfer allows both atoms to achieve a stable noble gas electronic configuration, often referred to as the Octet Rule.

• The resulting cations and anions are held together by strong electrostatic forces of attraction, which results in the formation of an ionic bond. Hence, the correct answer is the transfer of electrons from metal atoms to non-metal atoms.

Additional Information

• Properties of Ionic Compounds:

• Physical State: They are generally hard and brittle crystalline solids at room temperature due to the strong inter-ionic attraction.

• Melting and Boiling Points: They possess high melting and boiling points because a significant amount of energy is required to break the strong electrostatic forces holding the crystal lattice together.

• Solubility: Ionic compounds are typically soluble in polar solvents like water but are insoluble in non-polar solvents such as benzene, ether, or petrol.

• Electrical Conductivity: They do not conduct electricity in the solid state because ions are fixed in the lattice. However, they are excellent conductors in molten or aqueous solutions as the ions become free to move.

• Comparison with Other Bonding Types:

• Covalent Bonding: This involves the sharing of electrons between two non-metal atoms (Option 2).

• Metallic Bonding: This is characterized by a sea of delocalized electrons surrounding positively charged metal kernels (Option 1).

• Example of Ionic Compound: Sodium Chloride (NaCl). Sodium (Na), a metal, transfers its one valence electron to Chlorine (Cl), a non-metal, forming Na+ and Cl- ions.

Important Points

• The strength of an ionic bond is directly related to the lattice energy, which is the energy released when one mole of an ionic compound is formed from its gaseous ions.

• Electronegativity Difference: An ionic bond is most likely to form when the electronegativity difference between the two atoms is greater than 1.7 on the Pauling scale.

• Crystal Lattice: Ionic compounds do not exist as individual molecules; instead, they form a three-dimensional network of ions arranged in a regular pattern.

Q12. Answer: (d) Retina

The correct answer is Retina.

Key Points

• The Retina is the innermost, light-sensitive layer of the eye that functions similarly to the film in a traditional camera or the image sensor in a digital camera.

• Its primary responsibility is to receive light that the lens has focused, convert that light into neural (electrical) signals, and send these signals to the brain for visual recognition via the optic nerve. Hence, the Retina is the correct part of the eye for this function.

• This conversion process is known as phototransduction, which occurs within specialized cells called photoreceptors.

• The retina contains millions of these photoreceptors, categorized into two main types: Rods and Cones, which detect light intensity and color respectively.

• Located at the back of the eyeball, the retina covers about 65% of its interior surface, providing a wide field of view.

Additional Information

• Cornea:

• The Cornea is the transparent, dome-shaped outer layer covering the front of the eye.

• It acts as the eye's outermost lens and functions like a window that controls and focuses the entry of light into the eye.

• It contributes approximately two-thirds of the eye's total optical power.

• Iris:

• The Iris is the colored, ring-shaped membrane behind the cornea that contains the pupil.

• Its primary function is to regulate the amount of light entering the eye by controlling the diameter and size of the pupil.

• In bright light, the iris constricts the pupil; in low light, it dilates the pupil to allow more light in.

• Lens:

• The Lens is a transparent, biconvex structure situated behind the iris.

• It functions by changing shape to change the focal distance of the eye so that it can focus on objects at various distances; this process is called accommodation.

• It works in conjunction with the cornea to refract light to be focused on the retina.

Important Points

• Photoreceptor Specifics:

• Rods: Highly sensitive to light and allow us to see in dim light (night vision), but they do not perceive color. There are

approximately 120 million rods in the human retina.

• Cones: Responsible for high-resolution vision and color perception. They function best in bright light. There are about 6 to 7 million cones, concentrated mostly in the fovea centralis.

• The Optic Disc (Blind Spot): This is the location where the optic nerve exits the eye. It contains no photoreceptors, which is why any light focused on this specific spot cannot be converted into electrical signals, resulting in a blind spot in our vision.

• Macula and Fovea: The Macula is a small, specialized area of the retina that provides sharp, central vision. The Fovea, located at the center of the macula, contains only cones and is the point of sharpest visual acuity.

• Vitreous Humor: A clear, gel-like substance that fills the space between the lens and the retina, helping the eye maintain its spherical shape and ensuring the retina remains pressed against the choroid for nourishment.

Q13. Answer: (b) Highly diminished, virtual, erect and point-sized

The correct answer is Highly diminished, virtual, erect and point-sized.

Key Points

• When an object is placed at infinity in front of a convex mirror, the incident light rays are parallel to the principal axis of the mirror.

• After reflection, these rays diverge away from the mirror's surface. To an observer, these reflected rays appear to originate from a single point behind the mirror, known as the principal focus (F).

• The image formed in this specific case is highly diminished and point-sized, meaning its size is significantly smaller than the actual object.

• Because the light rays do not actually intersect but only appear to meet behind the mirror, the nature of the image is virtual and erect (upright).

• The position of the image is always at the focus (F) behind the mirror when the object is at infinite distance. Hence, the correct answer is Highly diminished, virtual, erect and point-sized.

Additional Information

• Convex Mirror Characteristics:

• A convex mirror, also known as a diverging mirror, has a reflecting surface that bulges outward toward the light source.

• It always forms a virtual, erect, and diminished image, regardless of the distance between the object and the mirror.

• The field of view of a convex mirror is much wider than that of a plane mirror or a concave mirror, which makes it highly useful in specific applications.

• Common Applications:

• Rear-view mirrors: In vehicles like cars and trucks, convex mirrors are used to help drivers see a larger area of traffic behind them.

• Security Mirrors: These are often installed in shops, supermarkets, and automated teller machines (ATMs) to allow for wide-angle surveillance.

• Blind Curves: Large convex mirrors are placed at sharp turns or driveways to help motorists see oncoming traffic that would otherwise be hidden.

Important Points

• Mirror Formula: The relationship between the object distance (u), image distance (v), and focal length (f) is given by the formula $1/v + 1/u = 1/f$.

• Sign Convention: According to the New Cartesian Sign Convention, the focal length (f) and radius of curvature (R) of a convex mirror are always taken as positive.

• Magnification (m): For a convex mirror, the magnification is always positive and less than 1 ($m < 1$). This is because the image is always erect (positive sign) and smaller than the object (value less than 1).

• Image Formation Scenarios:

• Object at Infinity: Image is at Focus (F), virtual, erect, and point-sized.

• Object between Infinity and Pole (P): Image is formed between P and F behind the mirror, and it is virtual, erect, and diminished.

Q14. Answer: (c) 50–90%

The correct answer is 50-90%.

Key Points

• A vacuole is a membrane-bound organelle found in the cytoplasm of a cell. While they are present in both animal and plant cells, their size and function differ significantly between the two.

• In a mature plant cell, the central vacuole is a large, prominent sac that typically occupies 50% to 90% of the total cell volume. Hence, option 3 is correct.

• The primary function of this large vacuole is to store water, nutrients, and waste products, while also providing structural support to the plant.

• The vacuole contains a fluid known as cell sap, which is a dilute solution of sugars, amino acids, mineral salts, and organic

acids.

• By filling up most of the cell's interior, the vacuole exerts outward pressure (turgor pressure) against the cell wall, which helps the plant remain upright and provides rigidity to the plant tissue.

Additional Information

• Tonoplast: The single unit membrane that surrounds the vacuole in plant cells is called the tonoplast. In plant cells, the tonoplast facilitates the transport of a number of ions and other materials against concentration gradients into the vacuole, which is why their concentration is significantly higher in the vacuole than in the cytoplasm.

• Turgor Pressure: This is the hydrostatic pressure generated by the fluid inside the vacuole. When a plant cell is well-hydrated, the vacuole swells, creating turgidity. If the plant loses too much water, the vacuole shrinks, leading to plasmolysis and causing the plant to wilt.

• Difference between Plant and Animal Vacuoles:

• Plant Cells: Usually have one large, permanent central vacuole that provides structural support and occupies most of the cell.

• Animal Cells: Contain small, temporary vacuoles. These are often involved in exocytosis, endocytosis, or the storage of specific substances like lipids or water for short durations.

• Specialized Vacuoles: In some organisms like Amoeba, a contractile vacuole is present for osmoregulation and excretion. In many protists, food vacuoles are formed by engulfing food particles through phagocytosis.

• Waste Management: The vacuole acts as a storage bin for metabolic by-products. Some plant vacuoles also contain pigments (like anthocyanins) that give flowers their color, or toxic chemicals that discourage herbivores from eating the plant.

Important Points

• The high percentage (50-90%) of volume occupied by the vacuole is a defining characteristic of eukaryotic plant cells.

• The discovery of the vacuole is often attributed to Antonie van Leeuwenhoek in the 17th century, although its functional understanding evolved much later.

• The concentration of solutes inside the vacuole is maintained through active transport, ensuring the cell remains hypertonic to its surroundings to draw in water via osmosis.

Q15. Answer: (c) W = V × q

The correct answer is W = V x q.

Key Points

• The electric potential difference between two points in an electric circuit is defined as the amount of work done (W) in moving a unit charge (q) from one point to another.

• Mathematically, potential difference (V) is expressed as the ratio of work done to the charge, which gives the formula V = W / q.

• By rearranging this fundamental equation, we find that the work done is the product of the potential difference and the charge moved, represented as W = V x q.

• The SI unit of electric potential difference is the Volt (V), named in honor of Alessandro Volta, an Italian physicist. One Volt is defined as the potential difference between two points when 1 Joule of work is done to move a charge of 1 Coulomb.

• The work done is a scalar quantity, meaning it has magnitude but no specific direction, and it is measured in Joules (J) in the International System of Units.

Additional Information

• Electric Potential: While potential difference is the change in energy between two points, electric potential at a single point is the work done per unit charge to bring a positive test charge from infinity to that point.

• Nature of Charge: The charge (q) is measured in Coulombs (C). One Coulomb is equivalent to the charge of approximately 6.242 x 10^18 electrons. The work done depends linearly on both the magnitude of the charge and the voltage across which it moves.

• Energy Transformation: In a closed circuit, the work done by the battery or power source provides the electrical energy necessary to move charges through components like resistors or bulbs, where it is converted into heat or light.

• Relationship with Electric Field: For a uniform electric field (E), the potential difference (V) is also related to the distance (d) moved by the formula V = E x d. Combining this with W = V x q, we get W = F x d, consistent with the classical definition of work in mechanics.

• Electron-Volt (eV): In atomic and nuclear physics, energy is often measured in electron-volts. 1 eV is the amount of kinetic energy gained by a single electron accelerating through a potential difference of 1 Volt, which equals approximately 1.602 x 10^-19 Joules.

Important Points

• Direction of Flow: By convention, positive charges move from a point of higher potential to lower potential. The work done by the electric field is positive in this case. If a charge is moved from lower to higher potential, external work must be applied.

• Conservation of Energy: The formula W = V x q is a reflection of the law of conservation of energy. The electrical potential energy lost or gained by the charge is exactly equal to the work done on or by the system.

• Measurement Tools: A Voltmeter is the device used to measure potential difference. It is always connected in parallel across the points between which the potential difference is to be determined to ensure it measures the voltage without significantly altering the current in the circuit.

Q16. Answer: (a) Salt and water

The correct answer is Salt and water.

Key Points

• A neutralisation reaction is a fundamental chemical process where an acid and a base react with each other to cancel out their respective properties, typically resulting in a pH closer to 7.

• In this reaction, the hydrogen ions (H+) from the acid react with the hydroxide ions (OH-) from the non-carbonated base to form water (H2O). Hence, the product includes water.

• The remaining cations from the base and anions from the acid combine to form an ionic compound known as a salt. Hence, the typical products are salt and water.

• A non-carbonated base usually refers to metal hydroxides (like NaOH or KOH) or metal oxides (like MgO). Because these do not contain carbonate (CO3) or bicarbonate (HCO3) groups, no carbon dioxide (CO2) gas is released.

• The general chemical equation for this reaction is: Acid + Base → Salt + Water. A classic example is Hydrochloric Acid (HCl) reacting with Sodium Hydroxide (NaOH) to produce Sodium Chloride (NaCl) and water.

Additional Information

• Nature of Reactants:

• Acids are substances that provide H+ ions in aqueous solutions, have a pH less than 7, and turn blue litmus red.

• Bases (specifically alkalis when dissolved in water) provide OH- ions, have a pH greater than 7, and turn red litmus blue.

• Exothermic Nature: Neutralisation reactions are generally exothermic, meaning they release energy in the form of heat. This is why the reaction vessel often becomes warm to the touch during the process.

• Strong vs. Weak Neutralisation:

• The reaction between a strong acid and a strong base results in a perfectly neutral salt (pH 7).

• A strong acid reacting with a weak base produces an acidic salt (pH < 7).

• A weak acid reacting with a strong base produces a basic salt (pH > 7).

• Indicators: Scientists use indicators like Phenolphthalein (which turns pink in basic solutions and colourless in acidic ones) or Methyl Orange to identify the equivalence point of the reaction.

Important Points

• Comparison with Carbonated Bases: If the reaction involved a metal carbonate (e.g., Calcium Carbonate) or bicarbonate, the products would be salt, water, and carbon dioxide gas. This is a common point of confusion in chemistry exams.

• Daily Life Applications:

• Antacids: Common medications like Milk of Magnesia (Magnesium Hydroxide) are used to neutralise excess Hydrochloric acid in the stomach to treat acidity.

• Soil Treatment: Farmers add Quicklime (Calcium Oxide) or Slaked lime (Calcium Hydroxide) to acidic soil to neutralise it for better crop yield.

• Waste Treatment: Industrial acidic waste is often neutralised with bases before being discharged into water bodies to protect aquatic life.

• Titration: This is a quantitative laboratory technique based on neutralisation used to determine the unknown concentration of an acid or a base.

Q17. Answer: (d) Rarefaction

The correct answer is Rarefaction.

Key Points

• A rarefaction is a region in a longitudinal wave where the particles are furthest apart, resulting in a low-pressure and low-density area.

• When a vibrating object moves backward, it creates a region of low pressure in the medium (such as air) because the particles of the medium are pulled apart. Hence, the correct answer is Rarefaction.

• In contrast, when the vibrating object moves forward, it pushes and compresses the air in front of it, creating a region of high pressure known as a compression.

• Sound travels through a medium as a series of compressions and rarefactions. These fluctuations in pressure and density allow the energy of the sound to propagate from the source to the listener's ear.

• The density of the medium and the pressure are directly proportional to each other; thus, high density corresponds to high pressure (compression), and low density corresponds to low pressure (rarefaction).

Additional Information

• Wavelength:

• Wavelength is defined as the distance between two consecutive compressions or two consecutive rarefactions.

• It is commonly represented by the Greek letter lambda (λ) and its SI unit is the meter (m). Hence, statement 1 is incorrect.

• Compression:

• Compression is the part of a longitudinal wave where the particles of the medium are closest together.

• This region is characterized by high pressure and high density, occurring when the vibrating body moves forward. Hence, statement 2 is incorrect.

• Reflection:

• Reflection of sound occurs when a sound wave hits a hard surface and bounces back into the same medium.

• This phenomenon is responsible for echoes and reverberations. It follows the laws of reflection, where the angle of incidence equals the angle of reflection. Hence, statement 3 is incorrect.

• Frequency and Pitch:

• The number of oscillations (one compression and one rarefaction) per unit time is called the frequency of the sound wave.

• Frequency is measured in Hertz (Hz) and determines the pitch of the sound; higher frequency results in a higher pitch.

Important Points

• Medium for Propagation: Sound is a mechanical wave and requires a material medium (solid, liquid, or gas) to travel. It cannot travel through a vacuum because there are no particles to compress or rarefy.

• Speed of Sound: The speed of sound depends on the properties of the medium through which it travels. It is generally fastest in solids, slower in liquids, and slowest in gases.

• Amplitude and Loudness: The loudness of a sound depends on its amplitude. A larger amplitude means a louder sound, while a smaller amplitude means a feeble sound. Loudness is typically measured in decibels (dB).

• Audible Range: For human beings, the audible range of frequencies is roughly between 20 Hz and 20,000 Hz. Frequencies below 20 Hz are infrasonic, and those above 20 kHz are ultrasonic.

Q18. Answer: (b) It is valid only for metallic conductors at constant temperature.

The correct answer is It is valid only for metallic conductors at constant temperature.

Key Points

• Ohm’s Law states that the electric current (I) flowing through a conductor is directly proportional to the potential difference (V) across its ends, provided physical conditions like temperature remain constant.

• The law specifies that Resistance (R) is a constant for a given conductor at a specific temperature. It does not state that resistance decreases with voltage; rather, resistance is the ratio of V to I. Hence, statement 1 is incorrect.

• Ohm's Law is strictly valid for metallic conductors (like copper, silver, and aluminum) where the relationship between voltage and current is linear. Hence, statement 2 is correct.

• It is not applicable to non-ohmic conductors such as semiconductors (e.g., silicon, germanium), diodes, transistors, and electrolytes, as they do not maintain a constant resistance. Hence, statement 3 is incorrect.

• The law fails if temperature or other physical conditions change, because the resistance of a metal typically increases with an increase in temperature. Therefore, it is not valid for all conductors at all temperatures. Hence, statement 4 is incorrect.

Additional Information

• Origin: The law was named after the German physicist Georg Simon Ohm, who published his findings in 1827 in his work "The Galvanic Circuit Investigated Mathematically."

• Mathematical Formula: It is expressed as $V = I \times R$, where V is the Voltage in Volts, I is the Current in Amperes, and R is the Resistance in Ohms (Ω).

• Resistance Factors: The resistance of a conductor depends on its length, cross-sectional area, nature of the material, and temperature.

• Length: Resistance is directly proportional to the length of the conductor.

• Area: Resistance is inversely proportional to the area of the cross-section.

• Ohmic vs. Non-Ohmic:

• Ohmic Conductors: Conductors that obey Ohm’s Law and show a straight-line V-I graph passing through the origin.

• Non-Ohmic Conductors: Components like LEDs and vacuum tubes where the V-I graph is curved.

Important Points

• Limitations: Ohm’s Law is not a universal law of nature (like the law of gravity) but rather an empirical description of the behavior of certain materials.

• Temperature Sensitivity: When a high current passes through a wire, it produces heat (Joule heating). This rise in temperature increases the vibrations of atoms, which leads to more collisions with electrons, thereby increasing resistance and causing a deviation from Ohm's Law.

• Applications: It is used to determine the voltage, resistance, or current of an electric circuit. It also helps in choosing the correct fuses and circuit breakers for household appliances.

Q19. Answer: (a) No fixed shape but fixed volume

The correct answer is No fixed shape but fixed volume.

Key Points

• Liquids are a state of matter characterized by having a definite volume but no fixed shape. This means that if you pour 500 ml of water from a glass into a bowl, the volume remains 500 ml, but the water takes the shape of the bowl.

• The particles in a liquid are close to each other but not as tightly packed as in solids. This arrangement allows the particles to slide past one another, providing the property of fluidity.

• Because the particles have some kinetic energy and are not held in a rigid lattice, liquids can flow and change their physical form based on the container they are placed in. Hence, the statement "No fixed shape but fixed volume" is correct.

• The intermolecular forces of attraction in liquids are strong enough to keep the particles together (maintaining volume) but not strong enough to fix them in specific positions (resulting in no fixed shape).

• Compared to gases, liquids have much higher density and are relatively incompressible because there is very little empty space between the individual molecules.

Additional Information

• Solid State:

• Solids have both a fixed shape and a fixed volume. The particles are arranged in a regular, repeating pattern called a crystal lattice.

• The intermolecular forces are extremely strong, meaning the particles only vibrate around fixed positions and cannot move freely.

• Gaseous State:

• Gases have no fixed shape and no fixed volume. They expand to fill the entire space of whatever container they are in.

• The particles in a gas have high kinetic energy and are separated by large distances, making gases highly compressible.

• Diffusion:

• Liquids undergo diffusion, where particles mix with other substances. This process is faster than in solids but slower than in gases. For example, adding a drop of ink to water demonstrates the diffusion of liquid particles.

• Surface Tension and Viscosity:

• Surface Tension is a property of liquids where the surface molecules are pulled inward, causing the surface to behave like a thin elastic skin.

• Viscosity is the measure of a liquid's resistance to flow. For example, honey has a higher viscosity than water because its particles have stronger internal friction.

Important Points

• The boiling point is the temperature at which a liquid turns into a gas at a specific atmospheric pressure.

• The freezing point is the temperature at which a liquid changes into a solid as energy is removed.

• While most substances are denser in their solid state, water is a unique example where the solid (ice) is less dense than the liquid, which is why ice floats.

• The kinetic theory of matter explains that the state of a substance (solid, liquid, or gas) depends on the temperature and pressure applied to it.

Q20. Answer: (b) Statement A is correct but B is incorrect.

The correct answer is Statement A is correct but B is incorrect.

Key Points

• Sodium hydroxide, chemically represented as NaOH, is an inorganic compound commonly known as caustic soda. It is a highly versatile substance used in various industrial processes.

• Statement A mentions its use in soaps and paper. In the soap industry, it is a fundamental ingredient used in saponification, a chemical reaction where it reacts with fats and oils to produce soap.

• In the pulp and paper industry, sodium hydroxide is used to treat wood pulp. It helps in dissolving lignin, the substance that binds wood fibers together, thereby facilitating the creation of high-quality white paper. Hence, statement A is correct.

• Statement B claims it is a weak base and neutral in nature. In chemistry, a base is classified based on its degree of ionization. Sodium hydroxide is a strong base because it dissociates completely into sodium ions (Na+) and hydroxide ions (OH-) in an aqueous solution.

• The pH scale measures how acidic or basic a substance is, ranging from 0 to 14. A neutral substance has a pH of 7. However, a concentrated solution of sodium hydroxide has a pH value of approximately 14, making it extremely alkaline rather than neutral. Hence, statement B is incorrect.

• Hence, the correct answer is Statement A is correct but B is incorrect.

Additional Information

• Physical Properties of NaOH:

• It is a white solid at room temperature, usually found in the form of pellets, flakes, or sticks.

• It is deliquescent, meaning it readily absorbs moisture and carbon dioxide from the air.

• It is highly soluble in water, and the dissolution process is highly exothermic (releases a significant amount of heat).

• Other Industrial Uses:

• Textile Industry: It is used for mercerization of cotton fabrics, which increases their strength and luster.

• Petroleum Refining: It helps in removing acidic impurities from crude oil and petroleum products.

• Water Treatment: It is used to adjust the pH level of water and to assist in the removal of heavy metals from water supplies.

• Degreasing: Due to its ability to dissolve grease and fats, it is a primary component in oven cleaners and drain openers.

• Safety and Handling:

• Sodium hydroxide is highly corrosive. It can cause severe chemical burns upon contact with skin or eyes.

• It must be handled with protective gear like gloves and goggles, and any spills should be neutralized with a weak acid like vinegar (acetic acid).

Important Points

• Strong vs. Weak Bases:

• Strong Bases: Examples include NaOH and Potassium hydroxide (KOH). They fully ionize in water.

• Weak Bases: Examples include Ammonium hydroxide (NH4OH) and Magnesium hydroxide (Mg(OH)2). They do not fully ionize and maintain a lower concentration of hydroxide ions.

• Neutralization Reaction:

• When sodium hydroxide reacts with an acid (like Hydrochloric acid - HCl), it forms salt (NaCl) and water (H2O). This is a classic neutralization reaction.

• The chemical equation for this is: NaOH + HCl → NaCl + H2O.

• Historical Context:

• The Castner-Kellner process and the Chloralkali process are the primary industrial methods used to manufacture sodium hydroxide through the electrolysis of brine (sodium chloride solution).

Q21. Answer: (b) Basic

The correct answer is Basic.

Key Points

• Non-metallic oxides are generally acidic in nature because they react with water to form acidic solutions. For example, Carbon Dioxide (CO2) reacts with water to form Carbonic Acid (H2CO3).

• When a non-metallic oxide reacts with a strong base, a neutralization reaction takes place, producing salt and water.

• In this specific reaction, the acidic oxide behaves like a weak acid. When a weak acid reacts with a strong base, the resulting salt is Basic in nature. Hence, the statement regarding the basic nature of the salt is correct.

• The pH of the salt solution formed in this process is greater than 7. This is because the anion of the salt (derived from the weak acid) undergoes hydrolysis in water, releasing hydroxide ions (OH-), which makes the solution alkaline.

• A classic example of this reaction is Carbon Dioxide (CO2) reacting with Sodium Hydroxide (NaOH), a strong base, to form Sodium Carbonate (Na2CO3) and water. Sodium Carbonate is a well-known basic salt.

Additional Information

• Nature of Oxides:

• Metallic Oxides: Most metals react with oxygen to form basic oxides (e.g., MgO, Na2O). These oxides react with acids to form salt and water.

• Non-Metallic Oxides: These are acidic (e.g., SO2, NO2) or neutral (e.g., CO, N2O). Acidic non-metallic oxides react with bases to form salts.

• Amphoteric Oxides: Some oxides show both acidic and basic properties, such as Aluminium Oxide (Al2O3) and Zinc Oxide (ZnO).

• The pH Scale:

• The pH scale ranges from 0 to 14. A pH of 7 is considered neutral (like pure water at 25°C).

• Solutions with a pH less than 7 are acidic, while those with a pH greater than 7 are basic or alkaline.

• The nature of a salt depends on the strength of the parent acid and base used during its formation.

• Strong Bases:

• A strong base is a compound that completely dissociates into its ions in an aqueous solution. Common examples include

Sodium Hydroxide (NaOH) and Potassium Hydroxide (KOH).

• These substances have high pH values, typically ranging from 12 to 14 in concentrated forms.

• Types of Salts:

• Neutral Salts: Formed from a strong acid and a strong base (e.g., NaCl).

• Acidic Salts: Formed from a strong acid and a weak base (e.g., NH4Cl).

• Basic Salts: Formed from a weak acid and a strong base (e.g., CH3COONa, Na2CO3).

Q22. Answer: (c) Al2O3

The correct answer is Al2O3.

Key Points

• Aluminium oxide is a chemical compound composed of aluminium and oxygen, widely known by its chemical formula Al2O3.

• The formation of the formula is based on the valency of the constituent elements. Aluminium (Al) belongs to Group 13 and has a valency of +3, while Oxygen (O) belongs to Group 16 and has a valency of -2.

• To reach a stable, neutral state, the criss-cross method is applied, where the numerical value of the charge of one ion becomes the subscript of the other. This results in two aluminium ions (total charge +6) balancing three oxide ions (total charge -6).

• It is often referred to as alumina in mining and ceramic engineering circles and is the most common oxide of aluminium.

• The chemical formula AlO, AlO3, or Al2O do not represent stable neutral compounds of aluminium and oxygen under standard conditions. Hence, the correct answer is Al2O3.

Additional Information

• Occurrence and Extraction:

• The primary ore for Aluminium oxide is Bauxite. It is extracted through the Bayer process, which involves heating the ore with sodium hydroxide.

• In nature, it exists in the form of the mineral corundum. Precious gems like Ruby and Sapphire are varieties of corundum, owing their color to trace amounts of transition metals like chromium or iron.

• Amphoteric Property:

• Aluminium oxide is amphoteric, meaning it exhibits both acidic and basic properties. It reacts with hydrochloric acid to form aluminium chloride and with sodium hydroxide to form sodium aluminate.

• Industrial Uses:

• Due to its hardness (ranking 9 on the Mohs scale), it is used extensively as an abrasive in sandpaper and cutting tools.

• Its high melting point of approximately 2,072 °C makes it an excellent refractory material for lining furnaces and kilns.

Important Points

• Protective Layer: When aluminium metal is exposed to air, it naturally forms a very thin, tough layer of Al2O3 on its surface. This layer acts as a barrier, preventing further oxidation or corrosion of the metal underneath.

• Electrical and Thermal Properties: It is an excellent electrical insulator but possesses a high thermal conductivity for a ceramic, making it useful in electronic substrates and heat sinks.

• Catalysis: In the chemical industry, activated alumina is frequently used as a catalyst or a catalyst support in processes like the Claus process for desulfurization and alcohol dehydration.

Q23. Answer: (d) all living things are made of cells

The correct answer is all living things are made of cells.

Key Points

• When observing an onion peel under a compound microscope, the basic structures look the same regardless of whether the onion bulb is small, medium, or large.

• These small, repeating rectangular structures are the fundamental building blocks of the onion bulb, and they are known as cells.

• The fact that different sizes of the same organism show the same cellular structure proves that the cell is the structural unit of life, supporting the conclusion that all living things are made of cells. Hence, statement 4 is correct.

• Individual cells in an onion do not significantly differ in their basic architecture because they belong to the same species (Allium cepa) and tissue type (epidermal tissue). Hence, statement 1 is incorrect.

• The presence of cells is a universal characteristic of all living organisms, not just large ones. Hence, statement 2 is incorrect.

• While cork cells were the first cells discovered, they are dead cells; onion peel cells observed in fresh bulbs are living cells containing protoplasm. Hence, statement 3 is incorrect.

Additional Information

• Cell Theory: This is a landmark theory in biology formulated by Matthias Schleiden (a German botanist) in 1838 and Theodor Schwann (a German zoologist) in 1839. It states that all plants and animals are composed of cells.

• Onion Cell Features: Onion cells are typical plant cells. They possess a rigid cell wall made of cellulose, a nucleus pushed to the

periphery, a large central vacuole, and cytoplasm.

• Microscopic Observation: To view these cells, a thin layer of epidermis is removed from the fleshy leaf of the onion, placed on a glass slide, and stained with Safranin or Iodine solution to highlight the nucleus and cell walls.

• Function of the Cell Wall: The distinct rectangular shape seen under the microscope is due to the cell wall, which provides mechanical strength and protection to the plant cell.

• Magnification: These structures are typically observed under low power (10x) and then high power (40x) objectives of a light microscope.

Important Points

• Discovery of Cells: Robert Hooke discovered the cell in the year 1665. He observed a thin slice of cork and noticed structures resembling a honeycomb or "little rooms."

• Living Cells: Anton van Leeuwenhoek, in 1674, used an improved microscope to discover free-living cells (like bacteria and protozoa) in pond water for the first time.

• Discovery of Nucleus: The nucleus, which acts as the control center of the cell, was discovered by Robert Brown in 1831.

• Expansion of Cell Theory: In 1855, Rudolf Virchow refined the Cell Theory by stating "Omnis cellula-e cellula," meaning all cells arise from pre-existing cells.

• Protoplasm: The term protoplasm for the fluid substance of the cell was coined by Purkinje in 1839.

Q24. Answer: (a) Plastic bag

The correct answer is Plastic bag.

Key Points

• Non-biodegradable materials are substances that cannot be broken down or decomposed by biological processes or microorganisms such as bacteria and fungi.

• Plastic bags are manufactured from synthetic polymers like high-density polyethylene (HDPE). These materials possess strong chemical bonds that are not recognized by the enzymes of decomposers, making them persist in the environment for hundreds of years. Hence, statement 1 is correct.

• Paper is primarily composed of cellulose, which is an organic compound derived from plants. It is easily digested by microbes and typically decomposes within 2 to 6 weeks under appropriate conditions of moisture and temperature. Hence, statement 2 is incorrect.

• Vegetable peels are classified as wet waste or organic matter. They are highly biodegradable and can be converted into compost or organic manure through natural decomposition within a few days or weeks. Hence, statement 3 is incorrect.

• Cotton cloth is made from natural fibers obtained from the cotton plant. Being a plant-based product, it is biodegradable and generally takes about 2 to 5 months to decompose in the soil. Hence, statement 4 is incorrect.

Additional Information

• Classification of Waste:

• Biodegradable waste: Includes food waste, agricultural residues, wood, and paper. These can be processed via vermicomposting or anaerobic digestion to produce biogas.

• Non-biodegradable waste: Includes glass, metals, plastics, and synthetic chemicals. These materials require recycling or safe disposal in landfills to prevent environmental pollution.

• Impact of Plastic Pollution:

• Plastics undergo photodegradation, where ultraviolet (UV) radiation from the sun breaks them into smaller fragments called microplastics (less than 5mm in size).

• These microplastics enter the food chain through aquatic ecosystems, leading to bioaccumulation and potential health hazards for humans and wildlife.

• Global and National Regulations:

• The Government of India notified the Plastic Waste Management Amendment Rules, 2021, which prohibited the manufacture, import, and sale of identified single-use plastic (SUP) items with effect from July 1, 2022.

• The United Nations Environment Assembly (UNEA) has also proposed a global treaty to end plastic pollution, emphasizing the circular economy.

Important Points

• Decomposition Timeframes: While organic waste like banana peels takes about 1-2 weeks, aluminum cans can take 80-200 years, and glass bottles may take 1 million years to degrade.

• The 5 R's Principle: To manage non-biodegradable waste effectively, the hierarchy followed is Refuse, Reduce, Reuse, Repurpose, and Recycle.

• Leaching: Non-biodegradable materials in landfills can cause leaching, where toxic chemicals seep into the groundwater, affecting water quality and soil fertility.

• Energy Recovery: Some non-biodegradable wastes with high calorific value are used in Waste-to-Energy (WtE) plants to

generate electricity through incineration.

Q25. Answer: (c) They are found in the nucleus of an atom.

The correct answer is They are found in the nucleus of an atom.

Key Points

• Neutrons are subatomic particles that, along with protons, are located in the nucleus of an atom. They were discovered by the British physicist James Chadwick in the year 1932.

• Statement 1 suggests that they revolve around the nucleus in fixed orbits. This is inaccurate as it describes the behavior of electrons, which occupy the space around the nucleus in shells or orbitals. Hence, statement 1 is incorrect.

• Statement 2 claims they determine chemical properties. While neutrons affect the mass and stability of an atom, the chemical properties are primarily determined by the number and arrangement of electrons in the outermost shell. Hence, statement 2 is incorrect.

• Statement 3 asserts they are found in the nucleus. Neutrons and protons are collectively known as nucleons and are held together in the central core of the atom by the strong nuclear force. Hence, statement 3 is correct.

• Statement 4 mentions they have a positive charge. In reality, protons carry a positive charge (+1), while neutrons have no electric charge (neutral). Hence, statement 4 is incorrect.

• The number of neutrons in an atom can vary, leading to different isotopes of the same element, such as Carbon-12 and Carbon-14.

Additional Information

• Mass of Neutron: The mass of a neutron is approximately 1.6749 x 10^-27 kg, which is slightly greater than the mass of a proton (1.6726 x 10^-27 kg). In atomic mass units, it is roughly 1.00866 amu.

• Role in Nuclear Fission: Neutrons play a critical role in nuclear chain reactions. In nuclear reactors, slow-moving or thermal neutrons are used to bombard heavy nuclei like Uranium-235 to trigger fission.

• Beta Decay: Outside the nucleus, a free neutron is unstable and has a mean lifetime of about 880 seconds (nearly 14 minutes and 40 seconds). It decays into a proton, an electron, and an electron antineutrino.

• Isotopes: Atoms of the same element that have the same number of protons but different numbers of neutrons are called isotopes. For example, Deuterium is a hydrogen isotope with one neutron, whereas ordinary hydrogen (Protium) has zero neutrons.

Important Points

• Discovery Context: James Chadwick was awarded the Nobel Prize in Physics in 1935 for the discovery of the neutron, which proved that the atomic nucleus contained more than just protons.

• Atomic Mass Number: The Mass Number (A) of an atom is the sum of the number of protons (Z) and the number of neutrons (N). Therefore, N = A - Z.

• Neutrality: Because neutrons are electrically neutral, they can penetrate deep into materials and atoms without being repelled by the electrostatic forces of the nucleus or electrons, making them ideal for neutron diffraction studies.

• Stability: The ratio of neutrons to protons (N/Z ratio) is a key factor in determining the nuclear stability of an element. If this ratio is too high or too low, the nucleus becomes radioactive.

Q26. Answer: (b) Rs. 4,224

Shortcut Trick

Net discount % = a + b − (a × b) ÷ 100

Net discount = 25 + 12 − (25 × 12) ÷ 100 = 37 − 3 = 34%

Selling Price = Marked Price × (100 − Net Discount%) ÷ 100

SP = 6400 × (100 − 34) ÷ 100 = 6400 × 0.66 = 4224

Therefore The correct answer is Rs. 4,224.

Alternate Method

Given: Marked Price (MP) = Rs. 6,400, First Discount (d1) = 25%, Second Discount (d2) = 12%.

Formulas: SP = MP × (100 − d1)% × (100 − d2)%

=> Price after first discount = 6400 × (1 − 25/100) = 6400 × 3/4 = Rs. 4,800

=> Price after second discount (Final SP) = 4800 × (1 − 12/100)

=> Final SP = 4800 × 88/100 = 48 × 88

=> Final SP = Rs. 4,224

Therefore The correct answer is Rs. 4,224.

Additional Information

Successive Discounts

When multiple discounts are applied one after another, the base for each subsequent discount is the value after the previous discount.

Marked Price & Selling Price

Selling Price = Marked Price − Discount. Discount is always calculated on the Marked Price unless stated otherwise.

Q27. Answer: (d) 50

Shortcut Trick

Assume an arbitrary mean (let A = 50) and calculate deviations from it.

Deviations: (+35, +23, +39, −21, −30, +2, −28, −25, +5).

Sum of deviations = (35 + 23 + 39 + 2 + 5) − (21 + 30 + 28 + 25) = 104 − 104 = 0.

Correct Mean = Assumed Mean + (Sum of Deviations ÷ Total Count) = 50 + (0 ÷ 9) = 50.

Therefore The correct answer is 50.

Alternate Method

Given: Observations = 85, 73, 89, 29, 20, 52, 22, 25, 55

Formula Used: Arithmetic Mean = (Sum of all observations) ÷ (Total number of observations)

=> Sum = 85 + 73 + 89 + 29 + 20 + 52 + 22 + 25 + 55

=> Sum = 450

=> Number of observations (n) = 9

=> Arithmetic Mean = 450 ÷ 9

=> Arithmetic Mean = 50

Therefore The correct answer is 50.

Additional Information

Properties of Arithmetic Mean

The sum of the deviations of all observations from their arithmetic mean is always zero: $\Sigma(x_i - \text{mean}) = 0$.

Effect of Change of Origin

If a constant value k is added to or subtracted from every observation, the new mean will be (original mean + k) or (original mean − k).

Empirical Relationship

For a moderately skewed distribution, the relationship between measures of central tendency is: Mode = 3 × Median − 2 × Mean.

Q28. Answer: (c) 2

Shortcut Trick

Let A = 0°.

Substitute A = 0° in the expression: $(1 / (1 - \sin 0°) + 1 / (1 + \sin 0°)) \times \cos^2 0°$

=> $(1 / (1 - 0) + 1 / (1 + 0)) \times 1^2 = (1 + 1) \times 1 = 2$

Check options with A = 0°: Option (3) is 2.

Therefore The correct answer is 2.

Alternate Method

Given:

Expression: $(1 / (1 - \sin A) + 1 / (1 + \sin A)) \times \cos^2 A$

Formula Used:

=> $(a - b)(a + b) = a^2 - b^2$

=> $1 - \sin^2 A = \cos^2 A$

Calculations:

Simplify the term inside the bracket by taking the LCM:

=> $(1 + \sin A + 1 - \sin A) / ((1 - \sin A)(1 + \sin A)) \times \cos^2 A$

=> $2 / (1 - \sin^2 A) \times \cos^2 A$

=> $2 / \cos^2 A \times \cos^2 A$

=> 2

Therefore The correct answer is 2.

Additional Information

Trigonometric Identities

The three basic Pythagorean identities are: $\sin^2 \theta + \cos^2 \theta = 1$, $1 + \tan^2 \theta = \sec^2 \theta$, and $1 + \cot^2 \theta = \text{cosec}^2 \theta$.

Reciprocal Identities

sec θ = 1 / cos θ, cosec θ = 1 / sin θ, and cot θ = 1 / tan θ.

Q29. Answer: (b) 26 years

Shortcut Trick

Age difference remains constant at 16 years.

Present sum = 56 + (6 × 2) = 68 years.

Vijay's age = (Sum − Difference) ÷ 2

Vijay's age = (68 − 16) ÷ 2 = 52 ÷ 2 = 26 years.

Therefore The correct answer is 26 years.

Alternate Method

Given:

Difference between Ajay and Vijay = 16 years.

Sum of ages 6 years ago = 56 years.

Let Vijay's present age be x years.

Therefore Ajay's present age = x + 16 years.

=> (x − 6) + (x + 16 − 6) = 56

=> 2x + 4 = 56

=> 2x = 52

=> x = 26

Therefore The correct answer is 26 years.

Additional Information

Age Difference Property

The difference between the ages of two people always remains the same regardless of the number of years passed or preceding.

Sum of Ages Calculation

To find the sum of ages ‘n’ years ago for ‘k’ people, subtract (n × k) from the present sum.

Linear Equations in Ages

Problems involving two variables are best solved by substituting one variable to form a single-variable linear equation.

Q30. Answer: (a) 52,500

Shortcut Trick

Difference in Rate of Interest = 7% − 3.5% = 3.5% p.a.

Total difference in Percentage for 3 years = 3.5% × 3 = 10.5%

Positive difference in Simple Interest = 10.5% of Rs. 5,00,000

=> (10.5/100) × 5,00,000 = 10.5 × 5,000 = Rs. 52,500

Therefore The correct answer is Rs. 52,500.

Alternate Method

Given:

Principal (P) = Rs. 5,00,000 for both banks.

Rate for Bank A (R1) = 3.5% | Rate for Bank B (R2) = 7%

Time (T) = 3 years

Formula Used: Simple Interest (SI) = (P × R × T) / 100

Calculations:

=> SI paid to Bank A = (5,00,000 × 3.5 × 3) / 100

=> SI paid to Bank A = 5,000 × 10.5 = Rs. 52,500

=> SI paid to Bank B = (5,00,000 × 7 × 3) / 100

=> SI paid to Bank B = 5,000 × 21 = Rs. 1,05,000

=> Positive Difference = Rs. 1,05,000 − Rs. 52,500

=> Positive Difference = Rs. 52,500

Therefore The correct answer is Rs. 52,500.

Additional Information

Simple Interest (SI) Properties

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The Simple Interest remains constant every year if the principal and rate are unchanged. It is calculated only on the original Principal amount.

Interest Difference Formula

When the Principal (P) and Time (T) are the same, the difference in interest is given by: Difference = P × T × (R_(high) − R_(low)) / 100.

Total Amount

The total amount (A) to be repaid at the end of the term is the sum of the Principal and the Simple Interest: A = P + SI.

Q31. Answer: (a) 2

Shortcut Trick

Factorize 30 into two consecutive integers: 30 = 5 × 6.

For the positive series x, the value is the larger factor: x = 6.

For the negative series y, the value is the smaller factor: y = 5.

Product xy = 6 × 5 = 30. When 30 is divided by 7, the remainder is 2 (since 7 × 4 = 28).

Therefore The correct answer is 2.

Alternate Method

Given: x = √(30 + √(30 + √(30 + … ∞))) and y = √(30 - √(30 - √(30 - … ∞)))

Formula Used: For √(n ± √(n ± …)), the value is (√(4n+1) ± 1)/2.

=> x = (√(4 × 30 + 1) + 1)/2 = (√121 + 1)/2 = (11+1)/2 = 6

=> y = (√(4 × 30 + 1) - 1)/2 = (√121 - 1)/2 = (11-1)/2 = 5

=> Product xy = 6 × 5 = 30

=> Remainder of (30 ÷ 7) => 30 = (7 × 4) + 2

=> Remainder = 2

Therefore The correct answer is 2.

Additional Information

Infinite Nested Radicals

If n = k(k+1), then √(n+√(n+...)) = k+1 and √(n−√(n−...)) = k.

Relation between Roots

For any number n, the difference between the positive and negative infinite series is always x − y = 1 and their product is x × y = n.

Remainder Theorem

The remainder of a product (A × B) ÷ n is equal to (Rem(A/n) × Rem(B/n)) ÷ n.

Q32. Answer: (a) 399/110

Shortcut Trick

Number = 3.6(27)

Decimal part = 0.6 + 0.0272727…

= 6/10 + 27/990

= 3/5 + 3/110 = 66/110 + 3/110 = 69/110

Total = 3 + 69/110 = (330 + 69)/110 = 399/110

Therefore Answer = 399/110

Alternate Method

Given:

x = 3.6272727… (27 repeating)

Formula used:

Multiply and subtract method

Calculation:

=> x = 3.6272727…

=> 10x = 36.272727…

=> 1000x = 3627.272727…

=> Subtract: 1000x − 10x

=> 990x = 3591

=> x = 3591/990

=> Divide by 9 => x = 399/110

Therefore The correct answer is 399/110.
Additional Information
Recurring Decimal Rule
Use powers of 10 to align repeating digits and subtract.
Shortcut Method
For mixed recurring decimals: (Full number − non-repeating part) ÷ (99…0 form)
Denominator Rule
Use 9s for repeating digits and 0s for non-repeating digits.

Q33. Answer: (b) 20.75

Shortcut Trick
Direct formula: 2 × Mean = 3 × Median − Mode
Substitute the given values: 2 × Mean = 3(23) − 27.5
2 × Mean = 69 − 27.5 = 41.5
Mean = 41.5 ÷ 2 = 20.75
Therefore The correct answer is 20.75.
Alternate Method
Given:
Mode of the data = 27.5
Median of the data = 23
Formula Used:
The Empirical relationship between Mean, Median, and Mode is:
Mode = 3 × Median − 2 × Mean
Calculations:
=> 27.5 = 3 × (23) − 2 × Mean
=> 27.5 = 69 − 2 × Mean
=> 2 × Mean = 69 − 27.5
=> 2 × Mean = 41.5
=> Mean = 41.5 ÷ 2
=> Mean = 20.75
Therefore The correct answer is 20.75.
Additional Information
Empirical Relationship
For a moderately skewed distribution, the relationship is: Mode = 3 × Median − 2 × Mean or Mean − Mode = 3(Mean − Median).
Symmetrical Distribution
In a perfectly symmetrical distribution, the values of Mean, Median, and Mode are all equal (Mean = Median = Mode).
Positively Skewed Distribution
In a positively skewed distribution, the tail on the right side is longer, and generally: Mean > Median > Mode.
Negatively Skewed Distribution
In a negatively skewed distribution, the tail on the left side is longer, and generally: Mean < Median < Mode.

Q34. Answer: (d) 3

Shortcut Trick
Combined efficiency of A, B and C = 4 + 3 + 1 = 8 units/day (taking Total Work as 12 units).
Twice the work = 12 × 2 = 24 units.
Time taken to complete twice the work together = 24 ÷ 8 = 3 days.
Therefore The correct answer is 3 days.
Alternate Method
Given:
Time taken by A = 3 days
Time taken by B = 4 days
Time taken by C = 12 days

Formula Used:

Efficiency = Total Work ÷ Time Taken

Person	Days	Total Work	Efficiency
A	3	12	4
B	4	3	
C	12	1	

Calculations:

=> Total efficiency of A, B and C = 4 + 3 + 1 = 8 units/day

=> New work to be completed = 2 × Total Work = 2 × 12 = 24 units

=> Time taken together = New work ÷ Total efficiency

=> Time taken together = 24 ÷ 8 = 3 days

Therefore The correct answer is 3 days.

Additional Information

LCM Method for Time and Work

Taking the LCM of individual days as the total work simplifies calculations by avoiding fractions, making the determination of individual efficiencies straightforward.

Work and Efficiency Relation

Efficiency is inversely proportional to the time taken to complete a task. If the amount of work changes, the time taken changes proportionally for a constant efficiency.

Q35. Answer: (d) Decreases by 63.28%

Shortcut Trick

Using the Multiplying Factor method for successive changes.

Net Factor = (1 − 0.55) × (1 − 0.40) × (1 − 0.15) × (1 + 0.60)

Net Factor = 0.45 × 0.60 × 0.85 × 1.60 = 0.3672

Percentage Change = (0.3672 − 1) × 100 = −63.28%

Therefore The correct answer is Decreases by 63.28%.

Alternate Method

Given: Initial price decreases by 55%, 40%, 15% and then increases by 60%.

=> Let the Original Price be 100.

=> Price after 1^(st) month = 100 − 55% of 100 = 45

=> Price after 2^(nd) month = 45 − 40% of 45 = 45 − 18 = 27

=> Price after 3^(rd) month = 27 − 15% of 27 = 27 − 4.05 = 22.95

=> Price after 4^(th) month = 22.95 + 60% of 22.95 = 22.95 + 13.77 = 36.72

=> Total Decrease = 100 − 36.72 = 63.28

=> Percentage Decrease = (63.28 ÷ 100) × 100 = 63.28%

Therefore The correct answer is Decreases by 63.28%.

Additional Information

Successive Percentage Change Formula

For two changes a% and b%, the effective change is [a + b + (a×b)/100]%.

Successive Discount/Decrease

If values are decreasing, use negative signs in the formula or multiplying factors less than 1.

Net Multiplying Factor

The final value is found by multiplying the initial value by (1 ± r1/100)(1 ± r2/100)...

Q36. Answer: (b) Rs. 1,350

Shortcut Trick

Initial profit = 14%, so initial SP = 114% of CP = Rs. 1,425.

Required profit = 8%, so required SP = 108% of CP.

Using unitary method: SP = (1,425 ÷ 114) × 108.

SP = 12.5 × 108 = Rs. 1,350.

Therefore The correct answer is Rs. 1,350.

Alternate Method

Given: Selling Price1 = Rs. 1,425, Profit1 = 14%, Profit2 = 8%.

Formulas: CP = SP × 100 ÷ (100 + Profit%), SP = CP × (100 + Profit%) ÷ 100.

=> First, find the Cost Price (CP): CP = 1,425 × 100 ÷ 114 = Rs. 1,250.

=> Now, calculate the new Selling Price (SP) for 8% profit: SP = 1,250 × (100 + 8) ÷ 100.

=> SP = 1,250 × 108 ÷ 100 = 12.5 × 108 = Rs. 1,350.

Therefore The correct answer is Rs. 1,350.

Additional Information

Relationship between CP and SP

If there is a profit, SP is always greater than CP. SP = CP + Profit. If there is a loss, CP is greater than SP. SP = CP − Loss.

Constant CP Method

Since the article is the same, CP remains constant. We can directly compare the percentage values: (SP1 ÷ (100 + P1%)) = (SP2 ÷ (100 + P2%)).

Q37. Answer: (d) 16 seconds

Shortcut Trick

Total distance to cover = Sum of lengths of both trains = 402 + 286 = 688 m.

Relative speed (opposite direction) = Sum of speeds = 6 + 37 = 43 m/s.

Time taken = Total distance ÷ Relative speed = 688 ÷ 43 = 16 sec.

Therefore The correct answer is 16 sec.

Alternate Method

Given:

Length of Train A (L1) = 402 m

Length of Train B (L2) = 286 m

Speed of Train A (S1) = 6 m/s

Speed of Train B (S2) = 37 m/s

Formula Used:

Time = (L1 + L2) ÷ (S1 + S2) [When moving in opposite directions]

Calculations:

=> Total Distance = 402 + 286 = 688 m

=> Relative Speed = 6 + 37 = 43 m/s

=> Time = 688 ÷ 43

=> Time = 16 sec

Therefore The correct answer is 16 sec.

Additional Information

Relative Speed in Same Direction

When two objects move in the same direction, the relative speed is the difference of their speeds: |S1 − S2|.

Speed Conversion

To convert km/hr to m/s, multiply by 5/18. To convert m/s to km/hr, multiply by 18/5.

Crossing a Point Object

When a train crosses a pole or a standing man, the distance covered is equal to the length of the train itself.

Q38. Answer: (a) 80

Shortcut Trick

Total heads = 180. If all animals were Parrots (2 legs), total legs = 180 × 2 = 360.

Actual legs = 520. Extra legs = 520 − 360 = 160.

Difference in legs between a Rabbit and a Parrot = 4 − 2 = 2.

Number of Rabbits = Extra legs ÷ Difference = 160 ÷ 2 = 80.

Therefore The correct answer is 80 rabbits.

Alternate Method

Given: Total animal heads = 180, Total animal legs = 520.

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Formula: Let number of Rabbits be R and Parrots be P.

Let the number of Rabbits be R and Parrots be P.

=> R + P = 180 — (Eq. 1)

=> 4R + 2P = 520 — (Eq. 2)

=> Divide (Eq. 2) by 2: 2R + P = 260 — (Eq. 3)

=> Subtract (Eq. 1) from (Eq. 3): (2R + P) − (R + P) = 260 − 180

=> R = 80

=> Number of Rabbits = 80

Therefore The correct answer is 80 rabbits.

Additional Information

Direct Formula for 4-legged animals

Number of 4-legged animals = (Total Legs − 2 × Total Heads) ÷ 2. This accounts for the 2 extra legs each animal has over the base of 2 legs.

Direct Formula for 2-legged animals

Number of 2-legged animals = (4 × Total Heads − Total Legs) ÷ 2. This assumes all are 4-legged and subtracts the deficiency.

Alligation Application

Ratio of 2-legged to 4-legged animals = (Legs of 4-legged − Avg Legs) : (Avg Legs − Legs of 2-legged).

Q39. Answer: (c) Two successive discounts of 38% and 46%

Shortcut Trick

To gain the maximum advantage, Rohit must choose the option with the highest total discount percentage.

Compare total values: Option 1 = 14%; Option 2 = 14 + 14 − (14 × 14 ÷ 100) ≈ 26.04%; Option 4 = 14 + 8 − (14 × 8 ÷ 100) ≈ 20.88%.

Option 3 = 38 + 46 − (38 × 46 ÷ 100) = 84 − 17.48 = 66.52%.

Clearly, 66.52% is the largest discount among all available choices.

Therefore The correct answer is Two successive discounts of 38% and 46%.

Alternate Method

Given → Marked Price (MP) = Rs. 6,900.

Formulas: Successive Discount = a + b − (a × b ÷ 100).

→ Option 1: 14%.

→ Option 2: 14 + 14 − (196 ÷ 100) = 28 − 1.96 = 26.04%.

→ Option 3: 38 + 46 − (38 × 46 ÷ 100) = 84 − 17.48 = 66.52%.

→ Option 4: 14 + 8 − (14 × 8 ÷ 100) = 22 − 1.12 = 20.88%.

→ Maximum advantage is gained when the Equivalent Discount is the highest.

Therefore The correct answer is Two successive discounts of 38% and 46%.

Additional Information

Successive Discounts

When two or more discounts are applied one after another, the net discount is calculated on the diminishing balance. Formula: Total = a + b − (ab/100).

Maximum Advantage

For a buyer, the best offer is the one that results in the highest effective discount rate, regardless of the initial base price.

Q40. Answer: (a) 16 minutes

Shortcut Trick

Pipe A works for the entire 23 minutes.

Work done by Pipe A in 23 minutes = 23 ÷ 46 = 1/2 of the tank.

Remaining 1/2 of the tank is filled by Pipe B.

Time taken by Pipe B = (1/2) × 32 = 16 minutes.

Therefore The correct answer is 16 min.

Alternate Method

Given: Filling time for Pipe A = 46 min, Pipe B = 32 min. Total time to fill = 23 min.

Person	Days	Total Work	Efficiency

Pipe A	46 min	736 units	16
Pipe B	32 min	23	

=> Total capacity (LCM of 46 and 32) = 736 units.

=> Efficiency of Pipe A = 736 ÷ 46 = 16 units/min.

=> Efficiency of Pipe B = 736 ÷ 32 = 23 units/min.

=> Pipe A runs for the full 23 minutes: Work by A = 16 × 23 = 368 units.

=> Remaining work for Pipe B = 736 − 368 = 368 units.

=> Time for which Pipe B was open = 368 ÷ 23 = 16 minutes.

Therefore The correct answer is 16 min.

Additional Information

Pipes and Cisterns Efficiency

Efficiency is inversely proportional to time. If a pipe fills a tank in 'x' hours, its 1-hour work is 1/x.

Total Work Concept

Total Work = Efficiency × Time. In problems where one pipe is closed early, the pipe that remains open throughout completes its share based on the total duration.

Q41. Answer: (d) 1728

Shortcut Trick

Floor Area = 3888 ÷ 18 = 216 m²

Ratio of Length (L) to Width (W) = 1.5 : 1 = 3 : 2 => 3x × 2x = 216 => 6x² = 216 => x = 6

Dimensions: L = 18 m, W = 12 m

Wall Area = 4320 ÷ 9 = 480 m² => Height (H) = 480 ÷ [2 × (18 + 12)] = 8 m

Volume = Floor Area × Height = 216 × 8 = 1728 m³

Therefore The correct answer is 1728 m³.

Alternate Method

Given: Cost of carpeting = Rs. 18/m², Total carpeting cost = Rs. 3,888, Cost of whitewashing walls = Rs. 9/m², Total whitewashing cost = Rs. 4,320, Length (L) = 1.5 × Width (W).

Formula Used: Area of floor = L × W | Area of 4 walls = 2H(L + W) | Volume = L × W × H

=> Area of the floor = 3888 ÷ 18 = 216 m²

=> L × W = 216 => (1.5W) × W = 216

=> 1.5W² = 216 => W² = 144 => Width (W) = 12 m

=> Length (L) = 1.5 × 12 = 18 m

=> Area of 4 walls = 4320 ÷ 9 = 480 m²

=> 2H(L + W) = 480 => 2 × H × (18 + 12) = 480

=> 2 × H × 30 = 480 => 60H = 480 => Height (H) = 8 m

=> Volume of the room = L × W × H = 18 × 12 × 8

=> Volume = 216 × 8 = 1728 m³

Therefore The correct answer is 1728 m³.

Additional Information

Area of Four Walls (Lateral Surface Area)

The lateral surface area of a cuboid (room) is the area of the 4 vertical faces, calculated as 2 × Height × (Length + Width).

Total Surface Area of a Cuboid

It includes the floor and ceiling area along with the four walls: TSA = 2(LW + WH + LH).

Longest Rod in a Room (Diagonal)

The length of the longest rod that can be placed in a room is given by √(L² + W² + H²).

Q42. Answer: (d) 90

Shortcut Trick

Number of sides (n) = 360° ÷ Exterior angle

=> n = 360 ÷ 24 = 15

Number of diagonals = [n × (n − 3)] ÷ 2

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=> Diagonals = [15 × (15 − 3)] ÷ 2
=> Diagonals = [15 × 12] ÷ 2 = 90
Therefore The correct answer is 90.
Alternate Method
Given:
Each exterior angle of a regular polygon = 24°
Formula Used:
1. Number of sides (n) = 360° ÷ Exterior angle
2. Number of diagonals = [n × (n − 3)] ÷ 2

Q43. Answer: (a) 66

Shortcut Trick
Let number = x
Given: x = 66 + 20% of x
=> 80% of x = 66
=> x = 66 ÷ 0.8 = 82.5
80% of x = 66
Therefore Answer = 66
Alternate Method
Given:
20% of a number + 66 = the number
Formula used:
Percentage = (part ÷ whole) × 100
Calculation:
=> Let the number be x
=> x = 66 + 20% of x
=> x = 66 + 0.2x
=> x − 0.2x = 66
=> 0.8x = 66
=> 80% of x = 66
Therefore The correct answer is 66.
Additional Information
Percentage Concept
x% = x/100
Equation Formation
Translate word statement into equation.
Shortcut Idea
Bring like terms together to isolate variable.

Q44. Answer: (c) 18

Shortcut Trick
For fourth proportional: 12 ÷ a = 2a ÷ 54
Product of extremes = Product of means
12 × 54 = a × 2a
$2a^2 = 648 \Rightarrow a^2 = 324$
$a = \sqrt{324} = 18$
Therefore The correct answer is 18.
Alternate Method
Given: First term = 12, Second term = a, Third term = 2a, Fourth term = 54
Formula: If x, y, z, w are in proportion, then x/y = z/w
=> 12 / a = 2a / 54
=> 12 × 54 = a × 2a

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=> 648 = 2a²

=> a² = 648 ÷ 2

=> a² = 324

=> a = √324

=> a = 18

Therefore The correct answer is 18.

Additional Information

Fourth Proportional

For three numbers x, y, and z, the fourth proportional d is defined such that x/y = z/d, implying d = (y × z) / x.

Third Proportional

For two numbers x and y, the third proportional c is such that x/y = y/c, which gives c = y² / x.

Mean Proportional

The mean proportional between two numbers x and y is given by √(x × y).

Q45. Answer: (b) 12,363

Shortcut Trick

Spending = 60%, so Savings = 40%.

Ratio of Spending : Savings = 60 : 40 = 3 : 2.

Given 2 units = Rs. 8,242.

Then 3 units (Expenses) = (8,242 ÷ 2) × 3 = 4,121 × 3 = Rs. 12,363.

Therefore The correct answer is Rs. 12,363.

Alternate Method

Given:

Spending Percentage = 60%

Monthly Savings = Rs. 8,242

Formula Used:

Income = Expenditure + Savings

Expenditure = Income × Spending %

Calculations:

=> Let Total Income be x.

=> Savings Percentage = 100% − 60% = 40%

=> 40% of x = 8,242

=> (40/100) × x = 8,242

=> x = (8,242 × 100) ÷ 40

=> x = 20,605

=> Monthly Expenses = 60% of 20,605

=> Monthly Expenses = (60/100) × 20,605

=> Monthly Expenses = 0.6 × 20,605 = 12,363

Therefore The correct answer is Rs. 12,363.

Additional Information

Percentage Change

If income increases by a% and expenses increase by b%, the new savings can be calculated using the Income = Expenditure + Savings balance.

Base Value concept

Always ensure the Percentage is calculated on the correct base. Here, both spending and savings percentages are based on the Total Monthly Income.

Ratio Application

For quick calculations, convert percentages to fractions: 60% = 3/5 (Expenses) and 40% = 2/5 (Savings).

Q46. Answer: (a) 37:32:9

Shortcut Trick

Multiply each ratio part by its respective growth multiplier (1 + increment%).

New Ratio = (10 × 1.11) : (8 × 1.20) : (2 × 1.35)

=> 11.1 : 9.6 : 2.7
=> 111 : 96 : 27 (dividing by 3) → 37 : 32 : 9
Therefore The correct answer is 37:32:9.
Alternate Method
Given: Ratio of salaries P : Q : R = 10 : 8 : 2. Increments are 11%, 20% and 35%.
Let the initial salaries be 1000, 800, and 200 for easier calculation.
=> New Salary of P = 1000 + (11% of 1000) = 1110
=> New Salary of Q = 800 + (20% of 800) = 800 + 160 = 960
=> New Salary of R = 200 + (35% of 200) = 200 + 70 = 270
=> New Ratio = 1110 : 960 : 270
=> Simplify by dividing by 30: 37 : 32 : 9
Therefore The correct answer is 37:32:9.
Additional Information
Successive Percentage Change
When a value changes by a% and then by b%, the net effective change is (a + b + ab/100)%.
Ratio Scaling
If a ratio a:b is increased by x% and y% respectively, the new ratio becomes a(1 + x/100) : b(1 + y/100).
Compounded Ratio
The compounded ratio of (a : b) and (c : d) is (ac : bd).

Q47. Answer: (b) $49a^2 - 16b^2$

Shortcut Trick
Use the Difference of Two Squares algebraic identity: $(x + y)(x - y) = x^2 - y^2$.
Substituting the values x = 7a and y = 4b into the identity:
$(7a)^2 - (4b)^2 = 49a^2 - 16b^2$
Therefore The correct answer is $49a^2 - 16b^2$.
Alternate Method
Given Expression: (7a + 4b)(7a − 4b)
Formula Used: Distributive Property (FOIL Method)
=> $(7a \times 7a) + (7a \times (-4b)) + (4b \times 7a) + (4b \times (-4b))$ => $49a^2 - 28ab + 28ab - 16b^2$ => $49a^2 + 0 - 16b^2$ => $49a^2 - 16b^2$
Therefore The correct answer is $49a^2 - 16b^2$.
Additional Information
Difference of Two Squares
The identity $(a + b)(a - b) = a^2 - b^2$ is used to multiply the sum and difference of the same two terms quickly.
Square of a Binomial (Sum)
The identity for the square of a sum is $(a + b)^2 = a^2 + 2ab + b^2$.
Square of a Binomial (Difference)
The identity for the square of a difference is $(a - b)^2 = a^2 - 2ab + b^2$.

Q48. Answer: (b) $54\sqrt{3} - 3\pi$

Shortcut Trick
Total area of Regular Hexagon = $3\sqrt{3}/2 \times side^2 = 3\sqrt{3}/2 \times 36 = 54\sqrt{3}$ cm².
Interior angle of a Regular Hexagon is 120°.
Area of Overlapping Sector = $(120/360) \times \pi \times radius^2 = (1/3) \times \pi \times 3^2 = 3\pi$ cm².
Required non-overlapping area = Total Hexagon Area − Overlapping Sector Area = $54\sqrt{3} - 3\pi$ cm².
Therefore The correct answer is $54\sqrt{3} - 3\pi$ cm².
Alternate Method
Given:
Side of Regular Hexagon (a) = 6 cm
Radius of Circle (r) = 3 cm
Formula Used:
Area of Regular Hexagon = $(3\sqrt{3} / 2) \times a^2$

Interior angle of a regular polygon (θ) = ((n − 2) × 180) / n

Area of Circular Sector = (θ / 360) × πr²

Calculations:

=> Area of Regular Hexagon = (3√3 / 2) × 6²

=> Area of Regular Hexagon = (3√3 / 2) × 36 = 54√3 cm²

=> Interior angle (θ) = ((6 − 2) × 180) / 6 = 120°

=> Area of the overlapping Circular Sector = (120 / 360) × π × 3²

=> Sector Area = (1/3) × 9π = 3π cm²

=> Non-overlapping area = Total Area − Sector Area

=> Non-overlapping area = 54√3 − 3π cm²

Therefore The correct answer is 54√3 − 3π cm².

Additional Information

Regular Hexagon Properties

A Regular Hexagon can be divided into 6 equilateral triangles. Each interior angle is 120° and each exterior angle is 60°.

Area of a Sector

The area of a sector of a circle with radius 'r' and central angle 'θ' is given by A = (θ/360) × πr².

Sum of Interior Angles

The sum of all interior angles of a polygon with 'n' sides is (n − 2) × 180°.

Q49. Answer: (d) 84 hm/hr

Shortcut Trick

Total Distance = 100 + 150 + 50 + (60 × 2) = 420 km

Total Time = 1 + 1 + 1 + 2 = 5 hours

Average Speed = 420 ÷ 5 = 84 km/hr

Therefore The correct answer is 84 km/hr.

Alternate Method

Given:

Distance1 = 100 km, Time1 = 1 hr

Distance2 = 150 km, Time2 = 1 hr

Distance3 = 50 km, Time3 = 1 hr

Speed4 = 60 km/hr, Time4 = 2 hr

Formula Used:

Average Speed = Total Distance ÷ Total Time

Calculations:

=> Distance in last 2 hours = 60 × 2 = 120 km

=> Total Distance = 100 + 150 + 50 + 120 = 420 km

=> Total Time = 1 + 1 + 1 + 2 = 5 hours

=> Average Speed = 420 ÷ 5 = 84 km/hr

Therefore The correct answer is 84 km/hr.

Additional Information

Average Speed (Equal Distances)

When two equal distances are covered at speeds u and v, Average Speed = 2uv ÷ (u + v).

Relative Speed

Same direction = S1 − S2 | Opposite direction = S1 + S2.

Unit Conversion

To convert km/hr to m/s, multiply by 5/18. To convert m/s to km/hr, multiply by 18/5.

Q50. Answer: (c) 25

Shortcut Trick

For a number to be divisible by 7, the difference between twice the unit digit and the remaining part of the number must be divisible by 7.

Number: 34X1 → Calculation: 34X − (2 × 1) = 34X − 2.

Trying options for X: If X = 5, then 345 − 2 = 343.

Since 343 is 7^3, it is divisible by 7, so X = 5.

Value of $X^2 = 5^2 = 25$.

Therefore The correct answer is 25.

Alternate Method

Given: Four-digit number 34X1 is divisible by 7.

Formula Used: Standard division method or place value expansion.

=> 3401 + 10X must be a multiple of 7.

=> Dividing 3401 by 7: 3401 = 485 × 7 + 6.

=> Remainder is 6. So, (6 + 10X) must be divisible by 7.

=> For X = 1: 6 + 10 = 16 (No)

=> For X = 5: 6 + 50 = 56 (Yes, 56 = 8 × 7)

=> X = 5

=> $X^2 = 5^2 = 25$.

Therefore The correct answer is 25.

Additional Information

Divisibility Rule of 7

Subtract twice the last digit from the number formed by the remaining digits. If the result is 0 or a multiple of 7, the original number is divisible by 7.

Divisibility Rule of 11

The difference between the sum of digits at odd places and the sum of digits at even places must be 0 or a multiple of 11.

Divisibility Rule of 13

Add four times the last digit to the remaining number. If the sum is divisible by 13, the number is divisible by 13.

Q51. Answer: (a) 2

Given: Seven boxes C, F, J, N, Q, S and V are kept one over the other but not necessarily in the same order.

Only three boxes are kept above G.

Only one box is kept between B and G.

Only three boxes are kept between B and C.

C is kept at some place above G.

F is kept immediately below C.

E is kept at one of the places above D.

A is not kept immediately above or below B.

Position	Box
1	Q
2	F
3	C
4	S
5	V
6	J
7	N

Now, Boxes between C and N = 2 boxes

Hence, the correct answer is "Option 1".

Q52. Answer: (b) 19 km to the east

Given:

Nayan drives 45 km North.

He turns right → 37 km East.

He turns right → 60 km South.

He turns right → 56 km West.

He turns right → 15 km North and reaches point P.

Therefore, to reach Point A again, Nayan must drive 19 km towards the East.

Hence, the correct answer is "Option 2".

Q53. Answer: (c) Three

Given: (Left) 2 4 8 4 7 1 5 7 4 3 4 2 8 7 4 3 6 8 5 4 9 1 6 9 3 5 2 4 8 (Right)

Now,

We need to identify odd numbers which are immediately preceded by an odd number and also immediately followed by an even number.

So, needed pattern is: Odd - Odd - Even

(Left) 2 4 8 4 7 1 5 7 4 3 4 2 8 7 4 3 6 8 5 4 9 1 6 9 3 5 2 4 8 (Right)

So, total valid numbers = 3

Hence, the correct answer is Option 3.

Q54. Answer: (d) Wife's brother

Family Chart:

Decoding the Symbols:

Symbol	•	•	x	&
Meaning	Son of	Brother of	Wife of	Father of

Given: K - T + R & Z x V

It means: K is the brother of T, T is the son of R, R is the father of Z, and Z is the wife of V.

Therefore, K is V's wife's brother.

Hence, the correct answer is Option 4.

Q55. Answer: (b) BA

Given: Six people A, B, C, D, E and F are sitting in a row facing north.

B sits fourth to the left of E.

A sits to the immediate right of E.

Only one person sits between B and F.

C sits to the immediate left of F.

D sits second to the left of A.

Now, check the pairs:

Option 1) FD → D is to the immediate right of F

Option 2) BA → A is not to the immediate right of B

Option 3) DE → E is to the immediate right of D

Option 4) CF → F is to the immediate right of C

Thus, three pairs follow the pattern "second person is immediate right of first person", except BA.

Hence, the correct answer is "Option 2".

Q56. Answer: (a) None

Given: (Left) 1 8 9 1 3 8 3 8 9 9 5 9 6 5 5 1 7 7 4 2 3 1 6 (Right)

Now,

We need to find even digits which are immediately preceded by an even digit and also immediately followed by an even digit.

So, needed pattern is: Even - Even - Even

(Left) 1 8 9 1 3 8 3 8 9 9 5 9 6 5 5 1 7 7 4 2 3 1 6 (Right)

So, no digit satisfies Even - Even - Even condition.

So, total valid numbers = 0

Hence, the correct answer is Option 1.

Q57. Answer: (c) 214

The logic followed here is:

thus, "214" will replace the question mark in the given series.

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Hence, the correct option is "Option 3"

Q58. Answer: (b) (7, 22, 15)

The logic followed here is:

Logic:

=> First Number × 2 + 8 = Second Number

=> First Number × 2 + 1 = Third Number

For, (5, 18, 11)

=> 5 × 2 + 8 = 18

=> 5 × 2 + 1 = 11

For, (9, 26, 19)

=> 9 × 2 + 8 = 26

=> 9 × 2 + 1 = 19

Now, checking the options using the same pattern:

Option 1) (10, 12, 5)

=> 10 × 2 + 8 = 28 ≠ 12

=> 10 × 2 + 1 = 21 ≠ 5

Option 2) (7, 22, 15)

=> 7 × 2 + 8 = 22

=> 7 × 2 + 1 = 15

Option 3) (8, 24, 31)

=> 8 × 2 + 8 = 24

=> 8 × 2 + 1 = 17 ≠ 31

Option 4) (25, 58, 50)

=> 25 × 2 + 8 = 58

=> 25 × 2 + 1 = 51 ≠ 50

Hence, the correct answer is Option 2.

Q59. Answer: (c) 685

BODMAS Table:

Given equation: 89 ÷ 8 + 684 × 6 − 87 = ?

Now, replacing the symbols as:

Symbol	•	−	×	÷
Replaced by	−	•	÷	×

=> 89 × 8 − 684 ÷ 6 + 87 = ?

=> 712 − 684 ÷ 6 + 87 = ?

=> 712 − 114 + 87 = ?

=> 598 + 87 = ?

=> 685

Hence, the correct answer is Option 3.

Q60. Answer: (b) 9

Given:

‘LEMA’ is coded as ‘4753’

‘MALT’ is coded as ‘3479’

So, T = 9

Hence, the correct answer is "Option 2".

Q61. Answer: (b) 24

The logic followed here is:

thus, "24" will replace the question mark in the given series.

Hence, the correct option is "Option 2"

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Q62. Answer: (b) Neither conclusion (I) nor (II) follows

Given Statements:

All tables are golds.

No table is a helmet.

The least possible Venn diagram for the given statement is:

Conclusions:

I. Some helmets are golds – Does not follow (No definite relation is given).

II. All golds are helmets – Does not follow (Tables are golds, but no table is a helmet).

So, neither conclusion I nor II follows.

Hence, the correct answer is Option 2.

Q63. Answer: (a) OFX

The logic followed here is:

So, 'OFX' will replace the question mark in the given series.

Hence, the correct answer is "Option 1".

Q64. Answer: (a) MAT 162

The logic followed here is:

So, 'MAT 162' will replace the question mark in the given series.

Hence, the correct answer is "Option 1".

Q65. Answer: (c) Three

Given: Seven boxes U, E, D, V, W, F and X are kept one over the other but not necessarily in the same order.

D is kept immediately above V.

W is kept immediately above F.

Only U is kept above E.

Only one box is kept between U and D.

W is not kept at the third position from the bottom.

Position	Box
7 (Top)	U
6	E
5	D
4	V
3	X
2	W
1	F

So, total boxes between X and U = 3 boxes

Hence, the correct answer is "Option 3".

Q66. Answer: (c) Neither conclusion (I) nor (II) follows

Given Statements:

All soaps are oils.

All oils are dispensers.

Some dispensers are towels.

The least possible Venn diagram for the given statement is:

Conclusions:

I. Some soaps are towels – Does not follow (No definite relation is given).

II. Some oils are towels – Does not follow (No definite relation is given).

So, neither conclusion I nor II follows.

Hence, the correct answer is Option 3.

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Q67. Answer: (c) 7

Given:

'SKATE' is coded as '51324'

'ASKEW' is coded as '47315'

So, W = 7

Hence, the correct answer is "Option 3".

Q68. Answer: (c) UT−RT

The logic followed here is based on the alphabetical position pattern:

Option 1: YX−WV

Option 2: FE−DC

Option 3: UT−RT

Option 4: BA−ZY

Thus, UT−RT does not follow the pattern.

Hence, the odd one out is Option 3.

Q69. Answer: (c) None

The logic followed here is:

Given number: 5 4 2 8 1 6 3 7 9

Logic: Each even digit is increased by 1 and each odd digit is decreased by 1.

Original number: 5 4 2 8 1 6 3 7 9

Digit	Type	Operation	New Digit
5	Odd	5 − 1 = 4	4
4	Even	4 + 1 = 5	5
2	Even	2 + 1 = 3	3
8	Even	8 + 1 = 9	9
1	Odd	1 − 1 = 0	0
6	Even	6 + 1 = 7	7
3	Odd	3 − 1 = 2	2
7	Odd	7 − 1 = 6	6
9	Odd	9 − 1 = 8	8

New number formed: 4 5 3 9 0 7 2 6 8

Now, checking frequency: All digits appear exactly once

So, number of digits appearing more than once = 0

Hence, the correct answer is Option 3.

Q70. Answer: (b) 9

The logic followed here is:

Given number: 321854

Logic: Add 1 to each even digit and add 1 to each odd digit.

Original number: 3 2 1 8 5 4

Digit	Type	Operation	New Digit
3	Odd	3 + 1 = 4	4
2	Even	2 + 1 = 3	3
1	Odd	1 + 1 = 2	2
8	Even	8 + 1 = 9	9
5	Odd	5 + 1 = 6	6

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4	Even	4 + 1 = 5	5

New number formed: 4 3 2 9 6 5

Now:

First digit = 4

Last digit = 5

Sum = 4 + 5 = 9

Hence, the correct answer is Option 2.

Q71. Answer: (a) AQWF

The logic followed here is:

For, GWCL → PFLU

Now, for QGMV → ZPVE

Now, applying the same logic for RHNW:

So, RHNW → AQWF

Hence, the correct answer is "Option 1".

Q72. Answer: (c) AWN:CZP

The logic followed here is based on the alphabetical position shift pattern between corresponding letters:

For, DHL → FKN

For, QJM → SMO

Now check options:

Option 1: VTS → SDR

Option 2: MPS → ASY

Option 3: AWN → CZP

Option 4: SDK → LGI

Hence, the correct answer is Option 3.

Q73. Answer: (a) ALRW

The logic followed here is:

For, MKBZ → SQHF

Now, for PDRW → VJXC

Now, applying the same logic for UFLQ:

So, UFLQ → ALRW

Hence, the correct answer is "Option 1".

Q74. Answer: (a) Three

Given: Seven people A, B, C, D, E, F and G are sitting in a straight line facing north.

A sits third from the left end.

Only one person sits between A and B.

Only three people sit between C and B.

E sits to the immediate right of C.

D sits to the immediate right of G.

People to the right of F are: 3 people.

Hence, the correct answer is "Option 1".

Q75. Answer: (b) B

Given: Six people A, B, C, D, E and F are sitting in a row facing north.

D sits to the immediate left of F.

C sits third to the left of B.

F is an immediate neighbour of C.

E sits second to the right of C.

A sits to the immediate left of E.

Now, the person at the extreme right end is B.

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Hence, the correct answer is "Option 2".

Q76. Answer: (a) 128

The logic followed here is:

thus, "128" will replace the question mark in the given series.

Hence, the correct option is "Option 1"

Q77. Answer: (b) 4

Given: (Left) 9 9 3 9 2 4 4 1 9 1 6 9 4 9 9 6 3 2 6 1 7 9 8 3 9 8 7 (Right)

Now,

We need to find odd numbers which are immediately preceded by an odd number and also immediately followed by an odd number.

So, needed pattern is: Odd - Odd - Odd

(Left) 9 9 3 9 2 4 4 1 9 1 6 9 4 9 9 6 3 2 6 1 7 9 8 3 9 8 7 (Right)

So, total valid numbers = 4

Hence, the correct answer is Option 2.

Q78. Answer: (c) PTWZ

The logic followed here is based on the alphabetical position pattern:

Option 1: NRTX

Option 2: HLNR

Option 3: PTWZ

Option 4: QUWA

Thus, PTWZ does not follow the pattern.

Hence, the odd one out is Option 3.

Q79. Answer: (c) 3 km to the south

Given:

Rohit drives 15 km West.

He turns left → 11 km South.

He turns left → 18 km East.

He turns left → 14 km North.

He turns left → 3 km West and reaches point P.

Therefore, to reach Point A again, Rohit must drive 3 km towards the South.

Hence, the correct answer is "Option 3".

Q80. Answer: (c) 5

Given: (Left) 5 5 7 8 2 3 3 2 3 3 9 5 5 7 9 8 5 6 3 5 3 8 3 5 5 8 9 (Right)

Now,

We need to find odd numbers which are immediately preceded by an odd number and also immediately followed by an even number.

So, needed pattern is: Odd - Odd - Even

(Left) 5 5 7 8 2 3 3 2 3 3 9 5 5 7 9 8 5 6 3 5 3 8 3 5 5 8 9 (Right)

So, total valid occurrences = 5

Hence, the correct answer is Option 3.

Q81. Answer: (c) Hnahthial

The correct answer is Hnahthial.

Key Points

• The second edition of the North Eastern Region (NER) District SDG Index (2023-24) was officially released in July 2025. It serves as a comprehensive tool to measure the progress of districts across the eight North Eastern states in achieving the Sustainable Development Goals.

• In this edition, the Hnahthial district, located in the state of Mizoram, emerged as the top-performing district in the entire region with an impressive score of 81.43. This highlights the district's significant strides in sectors like health, education, and clean energy.

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• The index is a collaborative effort between NITI Aayog and the Ministry of Development of North Eastern Region (MDoNER), with technical support provided by the United Nations Development Programme (UNDP).

• Following Hnahthial, other high-performing districts in the 2023-24 index included Aizawl (also in Mizoram) and East Sikkim (in Sikkim), both of which maintained scores above 78, showcasing the strong performance of Mizoram and Sikkim in the regional rankings.

• The report evaluates 103 districts across the region based on 84 indicators that cover 15 global goals out of the 17 SDGs, excluding goals 14 (Life Below Water) and 17 (Partnerships for the Goals) as they are less applicable at the district level in this landlocked region.

Additional Information

• Sustainable Development Goals (SDGs): These are a set of 17 global goals established by the United Nations in 2015 as a universal call to action to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity.

• NER District SDG Index Framework: This index is the first of its kind in India that focuses specifically on a geographical region. It categorizes districts into four categories based on their scores: Aspirant (0–49), Performer (50–64), Front Runner (65–99), and Achiever (100).

• State Performance: In the 2023-24 report, Mizoram and Sikkim dominated the list of top districts. Hnahthial, a relatively new district carved out of Lunglei in 2019, showed exceptional growth in environmental sustainability and poverty reduction.

• Regional Coverage: The index covers all eight states of the North Eastern Region, which include Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura.

• Monitoring and Evaluation: The index allows state and district administrations to identify gaps in socio-economic development and helps the Central Government in better resource allocation and policy framing under the Act East Policy.

Important Points

• Comparison with First Edition: The first edition of the NER District SDG Index was launched in 2021 (for the period 2021-22), where East Sikkim topped the list. The shift in 2023-24 to Hnahthial indicates a dynamic change in local governance and development speed in Mizoram.

• NITI Aayog's Role: As the premier policy think tank of the Government of India, NITI Aayog (established in 2015) uses these indices to foster competitive federalism among states and districts.

• Indicators Used: The 84 indicators used in the 2023-24 index were refined to include latest data from the National Family Health Survey (NFHS-5), Unified District Information System for Education (UDISE+), and Periodic Labour Force Survey (PLFS).

• Goal 1 (No Poverty) and Goal 3 (Good Health and Well-being): These two goals saw the highest improvement across most districts in the North East, largely due to schemes like PM-JAY and MGNREGA.

Q82. Answer: (c) Smriti Mandhana

The correct answer is Smriti Mandhana.

Key Points

• The Wisden Cricketers' Almanack 2025 has named Indian pace spearhead Jasprit Bumrah and star batter Smriti Mandhana as the Leading Cricketers in the World for their exceptional performances in the year 2024.

• Jasprit Bumrah has achieved the distinction of being the first Indian fast bowler to be honored as the Leading Men's Cricketer in the World by Wisden. This recognizes his vital role in India's success, particularly during the ICC Men’s T20 World Cup 2024.

• Smriti Mandhana has been recognized as the Leading Women's Cricketer in the World. She was instrumental in the Indian Women's Team's success across formats and famously led the Royal Challengers Bangalore (RCB) to their maiden Women's Premier League (WPL) title in March 2024.

• This marks a historic "Indian double," where both the Men's and Women's top global honors from the Wisden Almanack have been awarded to Indian cricketers in the same year.

• The Wisden Cricketers' Almanack, often referred to as the "Bible of Cricket," is an annual publication that has been documenting the sport since the 19th century.

Additional Information

• Wisden Cricketers' Almanack:

• It was founded in 1864 by the English cricketer John Wisden. It is the world's most famous sports reference book and is published annually in the United Kingdom.

• The "Leading Cricketer in the World" title was introduced in the 2004 edition to recognize the single best player in the world for the previous calendar year.

• Smriti Mandhana:

• Born on July 18, 1996, in Mumbai, she is a prolific left-handed opening batter. She has previously won the Rachael Heyhoe Flint Award for the ICC Women's Cricketer of the Year twice (in 2018 and 2021).

• In 2024, she showcased remarkable consistency in One Day Internationals (ODIs) and Test matches, further cementing her status as a global icon in women's cricket.

• Jasprit Bumrah:

• Known for his unique slingshot action, Bumrah was born on December 6, 1993. He is currently regarded as one of the best all-format bowlers in history.

• He played a decisive role in India winning the ICC T20 World Cup 2024, where he was named the Player of the Tournament for taking 15 wickets at an incredible economy rate of 4.17.

Important Points

• Cricketers of the Year: Apart from the "Leading Cricketer" title, Wisden also selects "Five Cricketers of the Year," an honor that can only be won once in a player's career and is primarily based on their influence on the English cricket season.

• Previous Indian Winners: Other Indian legends who have been named the Leading Cricketer in the World include Virender Sehwag (twice), Sachin Tendulkar, and Virat Kohli (three consecutive times between 2016-2018).

• Leading T20 Cricketer: The 2025 edition also highlights the Leading T20 Cricketer in the World, a category introduced more recently to reflect the growing popularity of the shortest format of the game.

Q83. Answer: (c) Jagdish Singh Khehar

The correct answer is Jagdish Singh Khehar.

Key Points

• The Government of India announced the Padma Awards for the year 2025, where retired Chief Justice of India (CJI) Jagdish Singh Khehar was honored with the Padma Vibhushan.

• He received this prestigious award in the field of Public Affairs for his exceptional contribution to the Indian judiciary and the legal system. Hence, the correct answer is Jagdish Singh Khehar.

• Jagdish Singh Khehar served as the 44th Chief Justice of India from January 4, 2017, to August 27, 2017.

• During his tenure, he headed various landmark benches, including the one that struck down the National Judicial Appointments Commission (NJAC) Act, thereby upholding the collegium system of judicial appointments.

• He was also the presiding CJI during the historic Triple Talaq case, where a five-judge bench declared the practice of 'Talaq-e-Biddat' unconstitutional by a 3:2 majority.

• He played a crucial role in constituting the nine-judge bench for the Right to Privacy case (Justice K.S. Puttaswamy v. Union of India), which established privacy as a Fundamental Right under Article 21 of the Constitution.

Additional Information

• Padma Vibhushan:

• It is the second-highest civilian award of the Republic of India, instituted on January 2, 1954.

• The award is given for "exceptional and distinguished service" without distinction of race, occupation, position, or sex.

• In the hierarchy of civilian honors, it ranks below the Bharat Ratna and above the Padma Bhushan.

• Career of Justice Khehar:

• Born in 1952, he was the first Chief Justice of India from the Sikh community.

• Before being elevated to the Supreme Court in 2011, he served as the Chief Justice of the Uttarakhand High Court and the Karnataka High Court.

• He also served as the Acting Chief Justice of the Punjab and Haryana High Court.

• Other Options in Context:

• Justice Dipak Misra served as the 45th CJI and is known for judgments on Section 377 and Aadhaar.

• Justice Ranjan Gogoi served as the 46th CJI and was later nominated to the Rajya Sabha; he was awarded the Padma Bhushan in 2024.

• Justice H.L. Dattu served as the 42nd CJI and later as the Chairperson of the National Human Rights Commission (NHRC).

Important Points

• The Padma Awards are announced every year on the occasion of Republic Day (January 26th).

• The awards are conferred by the President of India at ceremonial functions held at Rashtrapati Bhawan usually around March or April.

• The recommendations for the awards are made by the Padma Awards Committee, which is constituted by the Prime Minister every year.

• The total number of awards given in a year (excluding posthumous awards and those to NRI/foreigners/OCIs) should not exceed 120.

• The 2025 list included several luminaries across fields like Art, Social Work, Public Affairs, Science and Engineering, Trade and Industry, Medicine, Literature and Education, Sports, and Civil Service.

Q84. Answer: (c) Vinícius Jr.

The correct answer is Vinícius Jr..

Key Points

• The Brazilian forward Vinícius Jr. was honored as the Best FIFA Men's Player for the 2024 season during the prestigious The Best FIFA Football Awards held in December 2024.

• His victory was largely attributed to his exceptional performance during the 2023-2024 club season, where he acted as the spearhead for Real Madrid in both domestic and international competitions.

• Vinícius Jr. played a decisive role in securing Real Madrid's 15th UEFA Champions League title, notably scoring in the final, and helping the club clinch their 36th La Liga trophy.

• He emerged as the winner after a global voting process that included national team coaches, national team captains, specialist journalists, and fans from around the world.

• The consideration period for the 2024 award spanned from August 2023 to August 2024, during which the player demonstrated remarkable consistency, scoring 24 goals and providing 11 assists for his club.

Additional Information

• The Best FIFA Football Awards:

• These awards were established by FIFA in 2016 following the conclusion of their partnership with France Football for the FIFA Ballon d'Or.

• The ceremony aims to recognize the most outstanding performers in association football based on their achievements over a specific sporting calendar or season.

• Other Finalists in 2024:

• Rodri: The Manchester City and Spain midfielder was a top contender after winning the Premier League and UEFA Euro 2024, where he was named the Player of the Tournament.

• Jude Bellingham: The young English midfielder was recognized for his phenomenal debut season at Real Madrid, winning the La Liga Player of the Season award.

• Erling Haaland: The Norwegian striker remained in the spotlight due to his prolific goal-scoring record in the English Premier League.

• Award Categories:

• Apart from the Best Men's Player, the event also presents awards for the Best FIFA Women's Player, Best Men's Coach, Best Women's Coach, and the FIFA Puskás Award for the best goal scored during the year.

• The FIFA FIFPRO Men's World 11 is also revealed during the ceremony, representing the best team of the year as voted by the players themselves.

Important Points

• Vinícius Jr. became the first Brazilian player to win the Best FIFA Men's Player award since its rebranding in 2016, ending a long wait for the football-rich nation.

• His triumph highlights the shift in global football dominance toward a new generation of stars following the long-standing era of Lionel Messi and Cristiano Ronaldo.

• The FIFA voting system ensures a diverse range of perspectives by giving equal weight (25% each) to the four distinct voting groups, making it one of the most comprehensive individual honors in sports.

• The 2024 awards were particularly significant as they reflected performances in major continental tournaments like the Copa América and the UEFA European Championship.

Q85. Answer: (b) National Disaster Management Authority

The correct answer is National Disaster Management Authority.

Key Points

• The National Disaster Management Authority (NDMA), which is the apex body for disaster management in India, promoted and launched the Sachet App to provide real-time disaster alerts to citizens.

• The Sachet App is a crucial part of the Integrated Alert System (IAS), designed to disseminate early warnings and alerts for various natural hazards like cyclones, floods, heatwaves, and earthquakes.

• As of April 2025, the promotion of this app has been intensified to ensure that every citizen has access to geo-targeted alerts based on their current location, facilitating timely evacuation and safety measures.

• The application was developed in collaboration with the Centre for Development of Telematics (C-DOT), under the Department of Telecommunications, utilizing the Common Alerting Protocol (CAP) standards.

• The Sachet App acts as a single point of information, aggregating data from various disaster-monitoring agencies such as the Indian Meteorological Department (IMD) and the Central Water Commission (CWC).

• A key feature of the app is its multilingual support, which allows users across different states and Union Territories of India to receive information in their local languages, enhancing the reach of disaster mitigation efforts.

Additional Information

• National Disaster Management Authority (NDMA):

• Established under the Disaster Management Act, 2005, the NDMA is chaired by the Prime Minister of India.

• Its primary role is to lay down policies, plans, and guidelines for disaster management to ensure a timely and effective response to disasters.

• The NDMA coordinates with the State Disaster Management Authorities (SDMAs) to implement safety protocols across the country.

• Indian Meteorological Department (IMD):

• The IMD is the principal agency responsible for meteorological observations, weather forecasting, and seismology.

• While it provides the raw data and weather warnings used by the Sachet App, it is not the promoting authority of the app itself.

• Ministry of Electronics and Information Technology (MeitY):

• MeitY focuses on IT policy, e-governance, and the promotion of the electronics industry in India.

• Though it supports digital initiatives, the specialized disaster-alerting platform falls under the functional domain of NDMA.

• NITI Aayog:

• The National Institution for Transforming India (NITI Aayog) is the premier policy think tank of the Government of India.

• It provides strategic and technical advice but does not typically launch operational public safety applications like Sachet.

Important Points

• Common Alerting Protocol (CAP): This is an international standard format for emergency alerting and public warning, which the Sachet App uses to ensure consistency across various communication platforms like SMS, radio, and television.

• Cell Broadcast Alert System (CBAS): Alongside the app, the NDMA has been testing Cell Broadcast technology to send loud, intrusive alerts to mobile phones even without active internet connections.

• Geofencing: The Sachet App utilizes GPS technology and geofencing to ensure that alerts are only sent to people residing in or traveling through the specific danger zone, preventing unnecessary panic in safe areas.

• Citizen Safety Features: The app also includes educational resources, "Do’s and Don’ts" for different disasters, and contact details for emergency services in various locations.

Q86. Answer: (a) India-EFTA Trade and Economic Partnership Agreement

The correct answer is India-EFTA Trade and Economic Partnership Agreement.

Key Points

• The India-EFTA Trade and Economic Partnership Agreement (TEPA) was officially signed on March 10, 2024, marking a historic milestone in India’s trade relations with European nations outside the European Union.

• The agreement involves the European Free Trade Association (EFTA), which consists of four member countries: Iceland, Liechtenstein, Norway, and Switzerland.

• A landmark feature of this agreement is the legally binding commitment by EFTA countries to invest US $100 billion in India over a period of 15 years.

• This investment is projected to facilitate the creation of 1 million direct jobs in India across various sectors, including manufacturing, services, and infrastructure.

• The TEPA is the first-ever Free Trade Agreement (FTA) signed by India that includes a specific, quantifiable commitment toward Foreign Direct Investment (FDI) and employment generation.

• Negotiations for this pact spanned over 15 years, having initially commenced in 2008, before seeing a final push for conclusion in 2023-2024.

Additional Information

• Trade in Goods and Services:

• Under TEPA, EFTA countries will provide market access to 99.6% of India’s exports. In return, India will offer tariff concessions on 92.2% of its tariff lines, covering products like machinery, watches, chocolates, and wine.

• In the services sector, India has secured better access for its professionals in areas such as IT, auditing, healthcare, and engineering through specialized provisions for Mode 1 and Mode 4 service delivery.

• Intellectual Property Rights (IPR):

• The agreement includes robust provisions for the protection of Intellectual Property Rights, balancing the interests of innovators with India's need to maintain affordable healthcare and generic medicine production.

• Economic Profile of EFTA:

• The EFTA was established in 1960 by the Stockholm Convention. While its members are not part of the European Union (EU), they are highly developed economies with a combined GDP of over US $1 trillion.

• Switzerland is India’s largest trading partner within the EFTA bloc, primarily due to the import of gold and precious metals, which constitute a significant portion of bilateral trade.

• Significance for India:

• This agreement aligns with the "Make in India" and "Atmanirbhar Bharat" initiatives by encouraging European companies to establish manufacturing bases in India to serve both domestic and global markets.

• It provides India with a strategic gateway to the European market, bypassing some of the complexities associated with broader EU trade negotiations.

Important Points

• Legal Nature of Investment: The US $100 billion commitment is unique because it includes a "rebalancing" mechanism. If the investment targets are not met within the stipulated 15-year timeframe, India reserves the right to withdraw or adjust certain tariff concessions provided under the deal.

• Sectoral Focus: The investment is expected to flow into high-growth areas such as chemicals, pharmaceuticals, food processing, and renewable energy.

• Rules of Origin: The pact includes strict Rules of Origin (RoO) to ensure that the benefits of the agreement are enjoyed primarily by the signatory nations and to prevent the re-routing of goods from third-party countries.

Q87. Answer: (d) Jawaharlal Nehru Indoor Stadium, Cuttack

The correct answer is Jawaharlal Nehru Indoor Stadium, Cuttack.

Key Points

• The 71st Senior National Men's Kabaddi Championship was held at the Jawaharlal Nehru Indoor Stadium located in Cuttack, Odisha.

• The prestigious tournament was scheduled for the year 2025, continuing the long-standing tradition of India's premier domestic kabaddi competition.

• The event was organized by the Odisha Kabaddi Association under the aegis of the Amateur Kabaddi Federation of India (AKFI), showcasing the state's capability to host major sporting events.

• This championship serves as a critical platform for players to demonstrate their skills for selection into the Indian National Kabaddi Team for upcoming international fixtures.

• The 71st edition saw intense competition among various states, union territories, and departmental teams such as Services and Railways, featuring top international stars.

Additional Information

• Jawaharlal Nehru Indoor Stadium:

• Located in Cuttack, it is one of the oldest and most iconic indoor sports arenas in Odisha, with a seating capacity of approximately 6,000 spectators.

• Apart from kabaddi, the venue frequently hosts national and international tournaments for Table Tennis, Gymnastics, and Badminton.

• Senior National Kabaddi Championship:

• It is the highest level of domestic kabaddi in India, held annually to determine the best state or departmental team in the country.

• The 70th edition of the championship was previously held in Maharashtra in 2024, where the Indian Railways team clinched the title.

• Odisha as a Sports Hub:

• The state of Odisha has been aggressively promoting sports under its "Sports for Youth, Youth for Sports" initiative, hosting global events like the FIH Men's Hockey World Cup in 2018 and 2023.

• The city of Bhubaneswar is often called the Sports Capital of India, but Cuttack remains a vital center for indoor sports development.

• Amateur Kabaddi Federation of India (AKFI):

• Founded in 1972, the AKFI is the national governing body for the sport of kabaddi in India.

• It is affiliated with the International Kabaddi Federation (IKF) and is responsible for organizing national championships across various age groups, including Junior and Sub-Junior levels.

Important Points

• Player Recruitment: Performance in the Senior Nationals is a major criterion for players to be scouted by franchises in the Pro Kabaddi League (PKL), which has significantly increased the commercial value of the sport since 2014.

• Format: The tournament typically follows a League-cum-Knockout format, where teams are divided into groups (pools) before progressing to the quarter-finals, semi-finals, and the final.

• Dates of Event: The 71st edition in 2025 highlights the continued growth of the sport post-pandemic, ensuring a steady pipeline of talent for India's dominance in the Asian Games and World Cups.

Q88. Answer: (a) Urjit Patel

The correct answer is Urjit Patel.

Key Points

• In August 2025, the Government of India appointed former Reserve Bank of India (RBI) Governor Urjit Patel as the Executive Director for India at the International Monetary Fund (IMF).

• The appointment is for a fixed tenure of three years, during which he will represent the Indian constituency at the IMF Executive Board in Washington, D.C.

• The Executive Director (ED) at the IMF represents a constituency of countries; for India, this typically includes Bangladesh, Bhutan, and Sri Lanka, in addition to the home nation.

• The Appointments Committee of the Cabinet (ACC) approved this high-profile selection to ensure India's economic interests and perspectives are robustly presented at the global lender's highest decision-making level.

• Urjit Patel succeeds Krishnamurthy Subramanian, whose term concluded in 2025, marking a continuation of appointing top-tier economists to this strategic international post.

Additional Information

• Urjit Patel:

• He served as the 24th Governor of the Reserve Bank of India from September 2016 to December 2018.

• During his tenure, the historic demonetization of November 2016 took place, and the Monetary Policy Committee (MPC) was formally established to target inflation.

• Before his IMF role, he also served as the Vice President of the Asian Infrastructure Investment Bank (AIIB) based in Beijing, focusing on investment operations.

• He holds a Ph.D. in Economics from Yale University and has previously worked with the IMF in the early 1990s.

• International Monetary Fund (IMF):

• Established in 1944 at the Bretton Woods Conference, the IMF works to foster global monetary cooperation and secure financial stability.

• The Executive Board consists of 24 Directors who are responsible for conducting the day-to-day business of the IMF.

• The Managing Director of the IMF (currently Kristalina Georgieva as of recent years) serves as the head of the organization and Chair of the Executive Board.

• Other Notable Personalities:

• Krishnamurthy Subramanian: A former Chief Economic Adviser (CEA) to the Government of India (2018–2021) who served as Executive Director at the IMF starting in November 2022.

• Raghuram Rajan: The 23rd Governor of the RBI and the first Indian to serve as the Chief Economist of the IMF (2003–2006).

• Shaktikanta Das: The 25th Governor of the RBI (appointed in 2018), recognized globally for steering the Indian economy through the COVID-19 pandemic and global inflationary cycles.

Important Points

• The role of the Executive Director is pivotal because they participate in the formulation of IMF policies, Article IV consultations, and the approval of financial assistance packages to member countries.

• India is one of the fastest-growing large economies, and its representation at the IMF is crucial for advocating for the needs of the Global South and emerging markets.

• The appointment reflects the government's strategy of deploying experienced central bankers and policy experts to international financial institutions to enhance diplomatic and economic leverage.

Q89. Answer: (a) Mumbai

The correct answer is Mumbai.

Key Points

• The annual banking conference, FIBAC, is a premier event co-hosted by the Federation of Indian Chambers of Commerce and Industry (FICCI) and the Indian Banks' Association (IBA).

• For the year 2025, the conference is scheduled to be held on 25 and 26 August 2025 in the city of Mumbai.

• The central theme for this two-day event is 'Charting New Frontiers', which aims to explore the future of the Indian financial ecosystem in a rapidly changing global environment.

• The venue, Mumbai, is strategically chosen as it is the Financial Capital of India and serves as the primary hub for major banking and financial institutions.

• The conference serves as a critical platform for Bank CEOs, Policymakers, and Fintech innovators to deliberate on strategies for the Indian banking industry to support the nation's goal of becoming a USD 5 trillion economy.

Additional Information

• FICCI (Federation of Indian Chambers of Commerce and Industry):

• Established in 1927, it is the largest and oldest apex business organization in India.

• It was founded on the advice of Mahatma Gandhi by legendary industrialists G.D. Birla and Purshottamdas Thakurdas.

• Its headquarters is located in New Delhi, and it plays a vital role in policy advocacy and networking for the Indian industry.

• IBA (Indian Banks' Association):

• Formed on 26 September 1946, it is a representative body of management of banking in India operating in India.

• It is based in Mumbai and currently represents over 240+ banking companies operating in the country.

• The association helps in strengthening the Indian banking system and facilitates coordination between various banks and the Government of India.

• Significance of Mumbai:

• Mumbai houses the headquarters of the Reserve Bank of India (RBI), the Securities and Exchange Board of India (SEBI), and the National Stock Exchange (NSE).

• It is home to the corporate headquarters of almost all major public and private sector banks, making it the most suitable location for FIBAC.

Important Points

• Key Participants: The conference typically features a keynote address by the Governor of the Reserve Bank of India (RBI) and participation from high-ranking officials of the Ministry of Finance.

• Technological Focus: Discussions at FIBAC 2025 are expected to focus heavily on Artificial Intelligence (AI), Digital Public Infrastructure (DPI), and the implementation of Central Bank Digital Currency (CBDC).

• Economic Impact: The insights derived from the FIBAC conference often influence the regulatory roadmap and operational strategies of commercial banks for the upcoming financial year.

• Previous Editions: Past editions of the conference, such as FIBAC 2024, were also hosted in Mumbai at venues like the Hotel Trident, reinforcing the city's status as the permanent heartbeat of Indian finance.

Q90. Answer: (d) Enforcement Directorate

The correct answer is Enforcement Directorate.

Key Points

• The Enforcement Directorate (ED) is the central agency responsible for investigating the Mithi River Desilting Scam under the provisions of the Prevention of Money Laundering Act (PMLA), 2002.

• The investigation focuses on the financial irregularities and money laundering aspects of contracts awarded by the Brihanmumbai Municipal Corporation (BMC) for the desilting of the Mithi River and various major drains in Mumbai.

• The scam came to light following the heavy monsoon rains in 2015, which led to severe flooding in Mumbai, raising doubts about the actual work performed by contractors despite massive payments.

• The ED stepped in after the Economic Offences Wing (EOW) and the Anti-Corruption Bureau (ACB) of the Mumbai Police registered FIRs against several contractors and civic officials for cheating and forgery.

• Investigations by the ED involve tracing the "proceeds of crime," where public funds meant for disaster management were allegedly diverted to private accounts through shell companies. Hence, the correct answer is the Enforcement Directorate.

Additional Information

• Geographical Context of Mithi River:

• The Mithi River is a major river in the island city of Mumbai, Maharashtra, flowing approximately 17.8 kilometers.

• It originates from the overflow of the Vihar Lake and also receives discharge from the Powai Lake before meeting the Arabian Sea at Mahim Bay.

• It serves as a critical natural drainage system for Mumbai; however, heavy encroachment and industrial pollution have severely reduced its width and depth over the decades.

• The Role of the Brihanmumbai Municipal Corporation (BMC):

• The BMC is the richest municipal corporation in India and is responsible for the maintenance of the city's infrastructure, including the storm-water drain (SWD) network.

• Every year, before the monsoon, the BMC awards contracts worth hundreds of crores of Indian Rupees (INR) for removing silt (desilting) to ensure the city does not flood.

• Agency Roles:

• The Central Bureau of Investigation (CBI) typically handles cases of corruption involving central government officials or cases referred by the Supreme Court or High Courts.

• The Mumbai Police handle the initial criminal investigation (cheating/forgery), while the Enforcement Directorate (ED) specifically targets the illegal wealth and money laundering generated from such crimes.

Important Points

• Modus Operandi of the Scam:

• Contractors allegedly submitted fake bills and used forged vehicle registration numbers in their logs to claim they had transported thousands of tonnes of silt to dump sites.

• Audits revealed that many registration numbers provided for "trucks" used in desilting actually belonged to two-wheelers, scooters, or auto-rickshaws, proving the work was not done as claimed.

• The scam is estimated to be worth over Rs. 150 crore, involving a nexus between contractors, third-party auditors, and civic engineers.

• Legal Actions:

• Under the PMLA, the Enforcement Directorate has the power to attach properties of the accused that are suspected to be bought using the embezzled money.

• Several prominent contractors were blacklisted by the BMC following the investigation, and charge sheets have been filed against multiple individuals for their involvement in the scam.

Q91. Answer: (d) 5.6%

The correct answer is 5.6%.

Key Points

• According to the Periodic Labour Force Survey (PLFS), India's unemployment rate was recorded at 5.6% in May 2025.

• The PLFS is a regular survey conducted by the National Statistical Office (NSO), which operates under the Ministry of Statistics and Programme Implementation (MoSPI).

• The data specifically focuses on the unemployment rate for persons aged 15 years and above, providing a clear picture of the job market's health for the working-age population.

• The survey utilizes the Current Weekly Status (CWS) approach for its quarterly and short-term updates, where a person is considered unemployed if they did not work even for one hour during the reference period of the last 7 days but were available for work.

• This 5.6% figure is a critical indicator used by policymakers to evaluate the impact of economic schemes and the pace of job creation in both urban and rural sectors. Hence, the correct answer is 5.6%.

Additional Information

• Unemployment Rate (UR):

• The Unemployment Rate is defined as the percentage of persons unemployed among the total persons in the Labour Force.

• It is calculated as: UR = (Unemployed Persons / Labour Force) x 100.

• Labour Force Participation Rate (LFPR):

• LFPR represents the percentage of the total population that is either employed or seeking/available for work (unemployed).

• In recent years, India has seen a steady increase in the LFPR, particularly among women in rural areas.

• Worker Population Ratio (WPR):

• The WPR is the percentage of employed persons in the total population.

• This ratio helps in understanding the proportion of the population that is actively contributing to the production of goods and services in the economy.

• National Statistical Office (NSO):

• The NSO was formed through the merger of the National Sample Survey Office (NSSO) and the Central Statistics Office (CSO) on May 23, 2019.

• It is the nodal agency in India for the planned development of the statistical system and for maintaining norms and standards in the field of statistics.

Important Points

• Objectives of PLFS:

• The PLFS was launched in April 2017 with two primary objectives.

• First, to estimate the key employment and unemployment indicators (viz. WPR, LFPR, UR) in the short time interval of three months for urban areas only in the Current Weekly Status (CWS).

• Second, to estimate employment and unemployment indicators in both Usual Status (ps+ss) and CWS in both rural and urban areas annually.

• Key Methodologies:

• Usual Status: The activity status is determined based on a reference period of 365 days preceding the date of the survey.

• Current Weekly Status (CWS): The activity status is determined based on a reference period of 7 days preceding the date of the survey.

• The May 2025 data point is part of the ongoing effort to provide real-time or high-frequency labor market data to assist in evidence-based policymaking.

Q92. Answer: (b) Indian Space Research Organisation (ISRO)

The correct answer is Indian Space Research Organisation (ISRO).

Key Points

• The Satish Dhawan Space Centre (SDSC), also known as Sriharikota Range (SHAR), is the primary spaceport of the Indian Space Research Organisation (ISRO).

• Located in Sriharikota, Andhra Pradesh, it provides the essential infrastructure for India's orbital launches, featuring two active

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launch pads and advanced tracking facilities.

• The NASA-ISRO Synthetic Aperture Radar (NISAR) mission is a landmark collaboration between NASA (United States) and ISRO (India). It is designed to map the entire globe every 12 days to study changes in Earth's ecosystems and ice mass.

• ISRO is responsible for the launch of the NISAR mission, utilizing the Geosynchronous Satellite Launch Vehicle (GSLV) Mark II or LVM3 from the SDSC facility.

• Established as the Indian National Committee for Space Research (INCOSPAR) in 1962 and later reconstituted as ISRO in 1969, the agency has grown to become one of the top six space agencies in the world.

Additional Information

• Indian Space Research Organisation (ISRO):

• Headquarters: Located in Bengaluru, Karnataka.

• Founding: Established on 15 August 1969 by Dr. Vikram Sarabhai, who is considered the father of the Indian space program.

• Functions: It manages the Indian space program, including satellite communication, earth observation, and planetary exploration.

• National Remote Sensing Centre (NRSC):

• Location: Headquartered in Hyderabad, Telangana.

• Role: A key wing of ISRO, it is responsible for remote sensing data acquisition, processing, and dissemination. It plays a vital role in managing natural resources and monitoring disasters.

• Defence Research and Development Organisation (DRDO):

• Establishment: Formed in 1958 under the Ministry of Defence.

• Focus: It works on developing world-class weapon systems and equipment for the Indian Armed Forces, including missiles like the Agni and Prithvi series.

• North-Eastern Space Applications Centre (NESAC):

• Location: Situated in Umiam, Shillong, Meghalaya.

• Objective: A joint initiative of the Department of Space (DoS) and the North Eastern Council (NEC), established in 2000 to provide space technology support for the development of North Eastern India.

Important Points

• NISAR Technical Features: It is the first satellite mission to use two different radar frequencies (L-band and S-band) to measure changes in our planet's surface less than a centimeter across.

• SDSC Location Advantage: Sriharikota was chosen for its proximity to the equator and the advantage of being on the East Coast, which allows satellites to gain a velocity boost from Earth's rotation during eastward launches.

• Key Milestone: The mission scheduled for July 2025 represents a significant step in Indo-US strategic partnership in the field of space and environmental science.

• Launch Vehicles: SDSC handles various vehicles including the Polar Satellite Launch Vehicle (PSLV), which is known as the "workhorse" of ISRO, and the Launch Vehicle Mark-3 (LVM3) used for heavy missions like Chandrayaan-3.

Q93. Answer: (b) Leander Paes

The correct answer is Leander Paes.

Key Points

• The legendary Indian tennis player Leander Paes was honored with the prestigious P C Chandra Puraskaar 2025 for his exceptional contribution to the world of sports.

• The award ceremony was held in Kolkata, where the P.C. Chandra Group recognized his lifelong dedication and the glory he brought to India on the international tennis circuit.

• Leander Paes is widely celebrated as one of the greatest doubles and mixed doubles players in the history of tennis, having achieved a Career Grand Slam in both categories.

• The P C Chandra Puraskaar is an annual award presented to eminent personalities who have achieved excellence in fields such as sports, culture, science, and social service. Hence, the correct answer is Leander Paes.

Additional Information

• Leander Paes:

• He won the Bronze Medal in the men's singles category at the 1996 Atlanta Olympic Games, ending a long medal drought for India in individual sports.

• He has won a total of 18 Grand Slam titles, comprising 8 men's doubles and 10 mixed doubles titles.

• In 2024, he became the first Asian man to be inducted into the International Tennis Hall of Fame in the player category.

• He has been honored with India's highest sporting honor, the Major Dhyan Chand Khel Ratna (1996-97), as well as the Padma Shri (2001) and Padma Bhushan (2014) for his services to tennis.

• Other Notable Personalities mentioned:

• Mary Kom: An Indian amateur boxer and the only woman to win the World Amateur Boxing Championship six times. She won a

bronze medal at the 2012 Summer Olympics.

• Amjad Ali Khan: A distinguished Indian classical musician who plays the Sarod. He was awarded the Padma Vibhushan in 2001.

• Kapil Dev: The former Indian cricketer who captained the national team to its first Cricket World Cup title in 1983.

Important Points

• P C Chandra Puraskaar:

• This award was instituted in the year 1993 in memory of the late Purna Chandra Chandra, the founder of the P.C. Chandra Group.

• The award typically includes a citation, a trophy, and a significant monetary prize.

• Previous recipients of this prestigious award include luminaries like Mother Teresa, Sunil Gavaskar, P.T. Usha, Sourav Ganguly, and Mithali Raj.

• Historical Context:

• The group has consistently promoted excellence and cultural heritage through this recognition for over three decades.

• The selection process involves a committee that identifies individuals whose work has had a profound impact on society or their respective professions.

Q94. Answer: (c) 130

The correct answer is 130.

Key Points

• According to the Human Development Report (HDR), India is ranked 130 among 193 countries and territories.

• The Human Development Index (HDI) is a statistical tool used to measure a country's overall achievement in its social and economic dimensions.

• The report is published annually by the United Nations Development Programme (UNDP). Hence, the correct answer is 130.

• India's HDI value is approximately 0.644, which places the country in the Medium Human Development category.

• The index evaluates three basic dimensions: long and healthy life, access to knowledge, and a decent standard of living.

Additional Information

• Dimensions and Indicators of HDI:

• Health: Measured by Life expectancy at birth. This indicates the number of years a newborn is expected to live if prevailing patterns of mortality at the time of birth stay the same throughout its life.

• Education: Measured by a combination of Mean years of schooling (for adults aged 25 years and older) and Expected years of schooling (for children of school entering age).

• Standard of Living: Measured by Gross National Income (GNI) per capita adjusted for Purchasing Power Parity (PPP) in US Dollars.

• Historical Context:

• The HDI was created by Pakistani economist Mahbub ul Haq and Indian economist Amartya Sen in 1990.

• It was launched with the goal of shifting the focus of development economics from national income statistics to people-centered policies.

• HDI Categories:

• Countries are grouped into four tiers of human development: Very High (0.800 and above), High (0.700–0.799), Medium (0.550–0.699), and Low (below 0.550).

Important Points

• India's Performance:

• In the latest data cycles, India has shown significant improvement in life expectancy, which has risen to about 67.7 years.

• The Expected years of schooling in India stands at 12.6 years, reflecting the impact of government initiatives like Sarva Shiksha Abhiyan.

• India's GNI per capita (PPP) has seen a steady increase, reaching approximately $6,951 in recent years.

• Global Rankings:

• Countries like Switzerland, Norway, and Iceland consistently top the HDI rankings due to their superior healthcare and educational infrastructure.

• Among India's neighbors, Sri Lanka (rank 78) and China (rank 75) usually feature in the High Human Development category.

• Other UNDP Indices:

• Apart from HDI, the UNDP also releases the Inequality-adjusted HDI (IHDI), Gender Development Index (GDI), and Multidimensional Poverty Index (MPI) to provide a broader view of developmental challenges.

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Q95. Answer: (c) National Payments Corporation of India (NPCI)

The correct answer is National Payments Corporation of India (NPCI).

Key Points

• The National Payments Corporation of India (NPCI) officially launched NACH 3.0 in June 2025 to revolutionize the bulk payment ecosystem in the country.

• NACH stands for National Automated Clearing House, which is a centralized system used by banks and financial institutions for interbank, high-volume, electronic transactions which are repetitive and periodic in nature.

• The primary objective of NACH 3.0 is to enable faster salary and EMI processing by streamlining the mandate management system and reducing the settlement cycle.

• This upgraded version introduces real-time mandate verification and enhanced API-driven integration, which significantly reduces the turnaround time (TAT) for recurring payments like insurance premiums, utility bills, and loan repayments.

• The system is designed to provide a seamless experience for both corporates and retail customers, ensuring higher success rates for automated debits and credits compared to previous versions.

Additional Information

• National Payments Corporation of India (NPCI):

• It is an umbrella organisation for operating retail payments and settlement systems in India, established in 2008.

• It is an initiative of the Reserve Bank of India (RBI) and the Indian Banks' Association (IBA) under the provisions of the Payment and Settlement Systems Act, 2007.

• NPCI is responsible for managing several key financial products including UPI (Unified Payments Interface), RuPay, IMPS, and Bharat BillPay.

• Reserve Bank of India (RBI):

• Established on April 1, 1935, following the recommendations of the Hilton Young Commission.

• It acts as the central bank of India and regulates the entire banking sector and monetary policy.

• Headquartered in Mumbai, it oversees the NPCI to ensure financial stability and security in the digital payment landscape.

• State Bank of India (SBI):

• The largest public sector bank in India, which was formed on July 1, 1955, after the nationalization of the Imperial Bank of India.

• While it is a major participant in the NACH system, it is a user (member bank) rather than the governing body that launches the core infrastructure updates.

• Securities and Exchange Board of India (SEBI):

• Established in 1988 and given statutory powers on January 30, 1992, through the SEBI Act, 1992.

• Its primary function is to protect the interests of investors in securities and to promote the development of the stock market. It does not handle retail payment clearing houses like NACH.

Important Points

• Technological Advancements: NACH 3.0 leverages cloud-native technologies and advanced AI-based fraud detection systems to ensure that bulk transactions are not only fast but also secure.

• Economic Impact: By ensuring that salaries are credited on time and EMI defaults due to technical lags are minimized, this system supports the Ease of Living and Digital India initiatives.

• Mandate Process: The transition to NACH 3.0 allows for the e-Mandate process to be completed in near real-time, removing the traditional delay of 2-3 business days associated with paper-based or older electronic systems.

• Direct Benefit Transfer (DBT): This platform also plays a crucial role in the Direct Benefit Transfer mechanism, allowing the government to transfer subsidies directly to the bank accounts of millions of beneficiaries with higher efficiency.

Q96. Answer: (b) Arunachal Pradesh

The correct answer is Arunachal Pradesh.

Key Points

• In May 2025, the Union Minister for Youth Affairs and Sports, Dr. Mansukh Mandaviya, officially inaugurated a new multi-purpose Khelo India Hall in the Kamle district of Arunachal Pradesh.

• The infrastructure project was established at Raga, which serves as the administrative headquarters of the Kamle district, aimed at boosting sports facilities in the remote North Eastern Region.

• The hall has been constructed under the flagship Khelo India Scheme, a national initiative by the Government of India to strengthen grass-root level sports infrastructure across the country.

• The facility is designed to accommodate various indoor sports disciplines such as badminton, table tennis, wrestling, and volleyball, providing a platform for local athletes to train under professional conditions.

• The inauguration underscores the government's focus on the "Act East Policy" and its commitment to identifying and nurturing sporting talent from Arunachal Pradesh and other tribal-dominated areas.

• Hence, the correct answer is Arunachal Pradesh.

Additional Information

• Kamle District:

• It is one of the newer districts in Arunachal Pradesh, created in December 2017.

• The district was formed by bifurcating territories from the Lower Subansiri and Upper Subansiri districts to improve administrative efficiency in the region.

• Khelo India Program:

• Launched in 2018, the Khelo India (Play India) program was introduced to revive the sports culture in India by building a strong framework for all sports played in the country.

• It operates under the Ministry of Youth Affairs and Sports and includes components like Talent Identification, Infrastructure Development, and the Khelo India State Centres of Excellence (KISCE).

• Sports in Arunachal Pradesh:

• The state has become a hub for combat sports and weightlifting. The National Center of Excellence (NCOE) in Itanagar is a key facility for training elite athletes.

• The state government frequently implements the "Catch 'Em Young" policy to scout talent at a very early age from various districts.

• Dr. Mansukh Mandaviya:

• He is a prominent political leader serving as the Union Minister of Youth Affairs and Sports and the Minister of Labour and Employment in the Indian Cabinet.

• Before this, he held the portfolio of the Union Health Minister, playing a crucial role during the national vaccination drives.

Q97. Answer: (c) Leh, Ladakh

p data-end="57" data-start="0">The correct answer is Leh, Ladakh.

Key Points

• India's first-ever Astro Tourism Festival, focused on celestial observation and the wonders of the night sky, was successfully held in Leh, Ladakh in 2025.

• The festival was designed to position Ladakh as a global hub for Astro-Tourism, capitalizing on its high altitude, low humidity, and minimal light pollution.

• The event featured diverse activities such as stargazing sessions, astrophotography workshops, and cultural performances, drawing enthusiasts from across the country.

• The initiative is part of a broader strategy to boost sustainable tourism in the Union Territory, encouraging visitors to explore the unique geographical and astronomical heritage of the region.

• It highlights the successful integration of scientific outreach with the tourism industry, fostering local entrepreneurship through the training of "Astropreneurs" or village-level astronomy guides. Hence, the correct answer is Leh, Ladakh.

Additional Information

• Dark Sky Reserve in Hanle:

• Hanle, located in the Changthang Wildlife Sanctuary in Ladakh, is home to India's first Dark Sky Reserve. This area is strictly regulated to minimize artificial light, preserving the darkness required for high-end astronomical research.

• At an elevation of approximately 4,500 meters, it hosts the Himalayan Chandra Telescope (HCT), operated by the Indian Institute of Astrophysics (IIA).

• Concept of Astro-Tourism:

• Astro-Tourism is a niche form of nature-based tourism that focuses on observing celestial events, planets, and stars in areas with clear, unpolluted skies.

• It promotes eco-friendly travel and provides a platform for educational science communication, often involving the use of telescopes and sky maps.

• Nakshatra Sabha:

• Nakshatra Sabha is a prominent series of events launched in India (often associated with Uttarakhand and Ladakh) to popularize Dark Sky Tourism.

• These campaigns are usually supported by the Ministry of Tourism and state departments to diversify the tourism portfolio beyond traditional sightseeing.

• Geography of Ladakh:

• Ladakh is often referred to as the "Land of High Passes". Its unique cold desert climate and high altitude make it one of the few places in the world with an atmosphere transparent enough for deep-space observation.

Important Points

• Light Pollution: This refers to the excessive or misdirected artificial light produced by human activities, which obscures the view

of the stars. Ladakh maintains a low Bortle scale rating, indicating exceptionally dark skies.

• Economic Impact: By 2025, the focus on astro-tourism has significantly increased the income of homestays in remote villages like Hanle and Pangong, as tourists seek authentic, off-beat experiences.

• Cultural Connection: The festival also integrates local Ladakhi folklore related to the stars, connecting ancient indigenous knowledge with modern astronomical science.

Q98. Answer: (b) They are part of “Organised Services”.

The correct answer is They are part of “Organised Services”.

Key Points

• The Supreme Court of India, in a significant observation reaffirmed in May 2025, maintained that the Group A officers of the Central Armed Police Forces (CAPF) are to be treated as Organised Group A Services (OGAS).

• This classification as an Organised Service is crucial because it grants these officers the benefit of Non-Functional Upgradation (NFU), which helps mitigate the financial loss caused by acute career stagnation. Hence, option 2 is correct.

• By being part of Organised Services, officers from forces like CRPF, BSF, CISF, ITBP, and SSB are entitled to higher pay scales and better promotional avenues, bringing them to parity with other All India Services like the IAS and IPS.

• The court dismissed the notion that these forces are "unorganised," highlighting that their recruitment, training, and cadre management follow the strict protocols of Organised Group A Services as defined by the Department of Personnel and Training (DoPT). Hence, option 4 is incorrect.

• The Supreme Court emphasized that the nature of duties performed by CAPF officers is vital for Internal Security and Border Management, and denying them OGAS status would be detrimental to their morale.

Additional Information

• Central Armed Police Forces (CAPF):

• The CAPF refers to the uniform nomenclature of five security forces in India under the authority of the Ministry of Home Affairs (MHA).

• These forces include the Border Security Force (BSF), Central Reserve Police Force (CRPF), Central Industrial Security Force (CISF), Indo-Tibetan Border Police (ITBP), and Sashastra Seema Bal (SSB).

• Recruitment for Group A officers in these forces is conducted annually by the Union Public Service Commission (UPSC) through the Central Armed Police Forces (Assistant Commandants) Examination.

• Non-Functional Upgradation (NFU):

• NFU is a scheme introduced during the 6th Central Pay Commission in 2008 to address stagnation in various Organised Group A Services.

• Under this, if an officer of an Organised Service is not promoted due to a lack of vacancies, they are granted the pay scale of the higher grade when their batchmate from the IAS is promoted to that grade.

• The implementation of NFU for CAPF was a long-standing demand that the Supreme Court finally settled in favor of the officers.

Important Points

• Cadre Review: The Organised Service status mandates a periodic Cadre Review (usually every 5 years), which ensures that the promotional structure remains dynamic and functional.

• Legal Precedent: The initial landmark judgment for OGAS status was delivered in February 2019, and subsequent clarifications, including those in 2025, have ensured that the Government of India follows the court's directions without ambiguity.

• Administrative Control: Despite being Organised Services, the CAPF remains under the administrative control of the Ministry of Home Affairs rather than the Ministry of Defence, distinguishing them from the Indian Armed Forces.

Q99. Answer: (d) The Hague, Netherlands

The correct answer is The Hague, Netherlands.

Key Points

• The 2025 NATO Summit was held on 24–25 June 2025 in The Hague, the Netherlands.

• This was a significant diplomatic event as it was the first time the Netherlands hosted a NATO Summit since 1949, marking a return to one of the founding member nations for a major high-level meeting.

• The summit brought together leaders from the 32 member states of the North Atlantic Treaty Organization to discuss the evolving security landscape in Europe and the North Atlantic region.

• The primary venue for the summit was the World Forum in The Hague, a city globally recognized as the "International City of Peace and Justice."

• The choice of The Hague emphasized the alliance's commitment to the international rule of law and collective security.

Additional Information

• NATO (North Atlantic Treaty Organization):

• Established on April 4, 1949, with the signing of the Washington Treaty.

• It is an intergovernmental military alliance between 30 European countries and 2 North American countries.

• The fundamental role of NATO is to guarantee the freedom and security of its members through political and military means.

• Recent Accessions:

• Finland officially became the 31st member on April 4, 2023.

• Sweden joined as the 32nd member on March 7, 2024, significantly altering the security dynamics of the Baltic Sea region.

• Leadership:

• The 2025 Summit was one of the first major summits presided over by Secretary General Mark Rutte, who took office in October 2024.

• Mark Rutte previously served as the Prime Minister of the Netherlands for over 13 years, making the Dutch hosting of the summit particularly symbolic.

• Strategic Objectives:

• The summit focused on the implementation of the 2022 Strategic Concept, which defines Russia as the most significant and direct threat to allies' security.

• Discussions included the long-term support package for Ukraine and the strengthening of the Eastern Flank defense posture.

Important Points

• Host City Features: The Hague is not the capital of the Netherlands (which is Amsterdam), but it is the seat of the Dutch government and parliament, and it houses the International Court of Justice (ICJ).

• Defense Spending: A major theme of the 2025 deliberations was the Defense Investment Pledge, urging all members to spend at least 2% of their GDP on defense to ensure alliance readiness.

• Future Summits: It was confirmed during the meeting that the 2026 NATO Summit would be hosted by Turkey (Türkiye) in the city of Antalya.

• Article 5: The summit reaffirmed the principle of collective defense, where an attack against one ally is considered an attack against all allies, a cornerstone of the NATO alliance.

Q100. Answer: (a) Shiv Nadar University, Delhi NCR

The correct answer is Shiv Nadar University, Delhi NCR.

Key Points

• In January 2025, Shiv Nadar University (SNU), located in Greater Noida, Delhi NCR, was selected as the Co-Chair for SDG Hub 6, which focuses on Clean Water and Sanitation.

• The appointment is for a three-year term spanning from 2025 to 2027, placing the institution at the forefront of global academic efforts to achieve sustainable water goals.

• This designation is part of the United Nations Academic Impact (UNAI) initiative, which selects institutions of higher education to serve as SDG Hubs based on their research, innovation, and community engagement.

• As a Co-Chair for SDG 6, Shiv Nadar University is tasked with leading international collaborations, sharing best practices, and developing academic solutions to tackle water scarcity and sanitation challenges globally.

• The selection highlights the university's dedicated research through its Center for Public Affairs and Critical Theory (CPACT) and various engineering departments toward water sustainability and wastewater management.

Additional Information

• Sustainable Development Goal 6 (SDG 6):

• SDG 6 is one of the 17 Sustainable Development Goals established by the United Nations in 2015.

• Its primary objective is to "ensure availability and sustainable management of water and sanitation for all" by the year 2030.

• Key targets include achieving universal and equitable access to safe and affordable drinking water, improving water quality by reducing pollution, and increasing water-use efficiency.

• United Nations Academic Impact (UNAI):

• Launched in 2010 by the United Nations, UNAI is an initiative that aligns institutions of higher education with the UN to support and contribute to the realization of UN goals and mandates.

• It currently comprises over 1,600 institutions in more than 150 countries working with the United Nations to promote global priorities.

• UNAI SDG Hubs:

• The UNAI designates specific universities as Hubs for each of the 17 SDGs. These hubs serve as centers of excellence and resources for other member institutions.

• Hubs are chosen for their demonstrated capacity to educate students and conduct research that directly impacts the specific Sustainable Development Goal they represent.

Important Points

• Shiv Nadar University was established in 2011 by the Shiv Nadar Foundation and was one of the first private universities in India

to be awarded the Institution of Eminence (IoE) status by the Government of India.

• The role of Co-Chair involves mobilizing students and faculty to engage in advocacy and policy-making related to SDG 6, ensuring that academic research translates into real-world sustainability solutions.

• The 2025–2027 term represents a critical period for the 2030 Agenda, as the world moves into the final five years of the deadline for the Sustainable Development Goals.

• The inclusion of an Indian university as a lead for SDG 6 is significant given India's diverse hydrological challenges and its massive Jal Jeevan Mission, which aligns with SDG 6 targets.

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