RRB Group D Official Paper (Held On: 01 Dec, 2025 Shift 3) (Previous Year Paper)

RRB Group D • 2025 • 100 questions • 90 minutes • Answer key and solutions

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GENERAL SCIENCE

Q1. Which of the following life processes is NOT essential to maintain the life of an individual organism?

(a) Nutrition
(b) Excretion
(c) Respiration
(d) Reproduction

Q2. The total resistance of 10 resistors of equal resistance R arranged in series arrangement is _____.

(a) R10
(b) 10R
(c) R/10
(d) 10/R

Q3. Which of the following is/are controlled by the use of insecticides in crop protection management?

(a) Fungus
(b) Insects
(c) Virus
(d) Weeds

Q4. What is the primary cause of reverberation in a hall or room?

(a) Variation in air temperature
(b) Bending of sound waves
(c) Multiple reflections of sound from hard surfaces
(d) Absorption of sound by soft materials

Q5. Which of the following statements is correct about 'Bohr's model of an Atom'?

(a) While revolving in discrete orbits, the electrons do not exist.
(b) While revolving in discrete orbits, the electrons radiate energy.
(c) Only certain special orbits known as discrete orbits of electrons are allowed outside the atom.
(d) Only certain special orbits known as discrete orbits of electrons are allowed inside the atom.

Q6. A triangular glass prism has how many rectangular lateral surfaces?

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

Q7. From the given compounds, which is used as a fuel additive?

(a) Ethanol
(b) Ethane
(c) Ethanal

(d) Ethanoic acid

Q8. The Golgi apparatus is associated with which of the following organelles?

(a) Endoplasmic reticulum
(b) Nucleus
(c) Plastids
(d) Mitochondria

Q9. Which of the following is considered a major factor contributing to poor living standards in society?

(a) Inequality in the distribution of resources
(b) Overuse of technology in urban areas
(c) Only the level of education in society
(d) Only the rapid growth of the population

Q10. Which of the following organisms multiplies by the means of multiple fission mode of reproduction?

(a) Plasmodium
(b) Garden pea
(c) Leishmania
(d) Hibiscus

Q11. Neurons have many short, branched parts or processes attached to cell body called _____.

(a) axons
(b) dendrites
(c) nuclei
(d) nerve endings

Q12. An object moves along a straight path from point O to point A (100 m away), then immediately reverses and stops at point B, which is 30 m away from A back towards O. What is the total distance covered and the magnitude of the displacement, respectively?

(a) 100 m, 70 m
(b) 130 m, 30 m
(c) 130 m, 70 m
(d) 70 m, 70 m

Q13. Which of the following is a general physical property of nonmetals?

(a) High electrical conductivity
(b) Dull appearance (non-lustrous)
(c) High melting and boiling points
(d) Malleability and ductility

Q14. A passenger standing in a moving bus suddenly falls forward when the bus stops abruptly. This illustrates which of the following laws?

(a) Newton’s second law
(b) Law of gravitation
(c) Newton’s third law
(d) Newton’s first law

Q15. What is the chemical formula for Glucose?

(a) C11H22O11
(b) CH3COOH
(c) CH4
(d) C6H12O6

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Q16. In circuit diagrams, a zigzag line is used to represent which of the following?

(a) A switch
(b) A fuse
(c) A resistor
(d) A battery

Q17. Electrons revolve around the nucleus in fixed paths called:

(a) Quarks
(b) Elliptical paths
(c) Shells or orbitals
(d) Nucleons

Q18. A runner completes one round of a circular track of radius 175 m in 35 seconds. The average velocity after one round is _____.

(a) 5 m/s
(b) 10 m/s
(c) 0 m/s
(d) 20 m/s

Q19. Where should an object be placed in front of a convex lens to get a real image of the size of the object?

(a) At the principal focus of the lens
(b) At infinity
(c) Between infinity and the principal focus of the lens
(d) At twice the focal length

Q20. A baby pulls a toy car along the ground. If the force and displacement are in the same direction, the work done is:

(a) equal to zero
(b) negative
(c) equal to the product of force and displacement
(d) equal to the speed of the car

Q21. Which of the following nutrients is required in large quantities by plants?

(a) Phosphorus
(b) Iron
(c) Copper
(d) Zinc

Q22. Neutralisation reaction involves the combination of _____ from the acid and _____ from the base to form water molecules.

(a) OH+ ions and H- ions, respectively
(b) H+ ions and OH- ions, respectively
(c) H- ions and OH+ ions, respectively
(d) OH+ ions and OH- ions, respectively

Q23. Liquids have:

(a) no definite shape but have a fixed volume
(b) no definite shape and no fixed volume
(c) a definite shape and a fixed volume
(d) a definite shape and no fixed volume

Q24. For the life processes, the transfer of a source of energy from outside the body of the organism is called _____.

(a) nutrition
(b) digestion
(c) excretion
(d) respiration

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Q25. What is corrosion?

(a) Endothermic reaction
(b) Physical change
(c) Neutralisation reaction
(d) Chemical change

MATHEMATICS

Q26. For a trip of 600 km, a truck travels the first 300 km at a speed of 42 km/hr. At what speed (in km/hr) should it cover the remaining distance, so that the average speed for the entire journey is 63 km/hr?

(a) 106
(b) 126
(c) 141
(d) 101

Q27. A shop that sells towels has offers going on, wherein customers can buy 2 towels and get 2 free. What is the percentage discount that customers get?

(a) 45%
(b) 55%
(c) 60%
(d) 50%

Q28. A and B working together can do a piece of work in 3 days. B alone can do the same work in 21 days. How long (in days) will A alone take to do double the work?

(a) 3.5
(b) 10
(c) 8
(d) 7

Q29. A 435-metre-long train crosses a platform thrice its length in 87 seconds. What is the speed of the train (in km/hr)?

(a) 72
(b) 80
(c) 76
(d) 68

Q30. The arithmetic mean of the observations 79, 42, 47, 77, 49, 75, 56, 26 and 35 is:

(a) 45
(b) 49
(c) 64
(d) 54

Q31. The cost of 1 litre milk is equal to the selling price of 800 ml milk. The percentage of profit is ____.

(a) 25%
(b) 27.5%
(c) 22.5%
(d) 20%

Q32. A credit card payment that will settle a bill for 290 microwaves at Rs. 1,050 per microwave with successive discounts of 4% and 25%, with a further discount of 5% on card payment is:

(a) Rs. 2,08,260
(b) Rs. 2,08,292
(c) Rs. 2,08,290
(d) Rs. 2,08,278

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Q33. Diana is thrice as old as Teresa and Homi is twice as old as Diana. If Diana's age is 4 years less than the average age of all three, then Homi's age (in years) is:

(a) 78
(b) 72
(c) 68
(d) 70

Q34. A cylindrical water tank has a diameter of 2.8 m and a height of 3.5 m. It is to be painted on both its outer curved surface and two circular ends. If the cost of painting is Rs. 25/m², find the total cost of painting the tank. (Use π = 22/7)

(a) Rs. 1,220
(b) Rs. 1,160
(c) Rs. 1,290
(d) Rs. 1,078

Q35. The value of $((0.85)^3 - (0.1)^3)/((0.85)^2 + 0.085 + 0.01)$ is:

(a) 0.95
(b) 0.65
(c) 0.75
(d) 0.99

Q36. The average of 4, 12, 8, 10, 16, 14, 9, 20, 18, 22, 15 and K is 14. Find the value of K.

(a) 20
(b) 16
(c) 18
(d) 15

Q37. If $x + y + z = 0$ and $xyz = 21$, then $x^3 + y^3 + z^3$ is equal to:

(a) 42
(b) 63
(c) 21
(d) 0

Q38. Akriti earns Rs. 54,500 monthly and saves 17% of her salary. Find her monthly expenditure.

(a) Rs. 45,325
(b) Rs. 45,235
(c) Rs. 45,352
(d) Rs. 45,523

Q39. A typist takes 40 minutes to type 2 pages. How long (in minutes) will he take to type 81 pages?

(a) 1625
(b) 1620
(c) 1610
(d) 1630

Q40. In a box containing blue, yellow, and orange tokens, the ratio of blue to yellow tokens was 13 : 19, while the ratio of orange to blue tokens was 10 : 3. What was the ratio of orange to yellow tokens?

(a) 130 : 57
(b) 137 : 61
(c) 134 : 62
(d) 132 : 59

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Q41. Find the simple interest (in Rs.) on Rs. 4,000 at 6% per annum rate of interest for the period from 21 February 2024 to 22 April 2024.

(a) 41
(b) 38
(c) 39
(d) 40

Q42. The diagonals of a quadrilateral are perpendicular bisectors of each other. If the length of one diagonal is 8 cm and the area of the quadrilateral is 48 cm^2, find the length (in cm) of the other diagonal.

(a) 10
(b) 12
(c) 14
(d) 8

Q43. Simplify: $(1 - \cos 2\theta)/(\sin 2\theta)$

(a) $\text{cosec}\theta$
(b) $\sin \theta$
(c) $\cot \theta$
(d) $\tan \theta$

Q44. In a fruit basket, there are twice as many oranges as apples. If there are a total of 36 fruits, how many oranges are there?

(a) 12
(b) 18
(c) 30
(d) 24

Q45. Simplify: $((3^4 \times 9^{(-2)})/(27^{(-1)} \times 3^{(-3)}))^{1/3}$

(a) 9
(b) 3
(c) 1
(d) 27

Q46. P is any point inside the rectangle ABCD. If PA = 57 cm, PB = 9 cm, and PC = 54 cm, then the length PD (in cm) is equal to:

(a) 76
(b) 83
(c) 80
(d) 78

Q47. The price per unit of lemon candy to strawberry candy is in the ratio 4 : 14, and a family consumes them in the ratio 23 : 2 by quantity. Find the ratio of the expenditure on strawberry candy to that on lemon candy.

(a) 7 : 24
(b) 10 : 24
(c) 8 : 26
(d) 7 : 23

Q48. Three men can dig a well 39 feet deep in 4 days. How many men can dig a well 78 feet deep in 12 days?

(a) 5
(b) 3
(c) 1
(d) 2

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Q49. If 20% of a number is added to 102, then the result is the same number. 60% of the same number is:

(a) 76.5
(b) 86.5
(c) 106.5
(d) 96.5

Q50. At beginning of the poll, Rahul received 52% of the total votes and Leena received 48% of the total votes. The total voting was of 3,72,000 votes. How many votes did Leena earn above 1,00,000?

(a) 1,00,000 votes
(b) 37,20,000 votes
(c) 78,560 votes
(d) 1,78,560 votes

GENERAL INTELLIGENCE & REASONING

Q51. In a row of 50 students facing north, Neetu is 12th from the right end. If Kaden is 6th to the left of Neetu, what is Kaden's position from the left end of the line?

(a) 31st
(b) 33rd
(c) 30th
(d) 32nd

Q52. 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) 6 3 1 1 2 3 2 8 5 7 6 1 3 7 2 6 9 6 9 2 4 6 2 8 6 3 1 (Right)

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

(a) 3
(b) 2
(c) 5
(d) 4

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

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

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

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

Q54. This question is based on the five, three-digit numbers given below.

(Left) 567 862 426 326 749 (Right)

(Example: 697 – First digit = 6, second digit = 9 and third digit = 7)

(NOTE: All operations to be done from left to right.)

If 2 is added to the second digit of every number, in how many numbers will the second digit be exactly divisible by the third digit?

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

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Q55. What will come in the place of '?' in the following equation, if '+' and '-' are interchanged and 'x' and '÷' are interchanged?

113 ÷ 6 + 98 × 2 - 156 = ?

(a) 785
(b) 798
(c) 779
(d) 775

Q56. 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.)

(34, 70, 1)

(21, 92, 25)

(a) (2, 31, 14)
(b) (36, 73, 1)
(c) (17, 52, 9)
(d) (19, 63, 13)

Q57. In a certain code language,

A + B means 'A is the sister of B',

A @ B means 'A is the brother of B',

A - B means 'A is the wife of B',

and A # B means 'A is the father of B'.

How is O related to V if 'O @ P + T - G # V'?

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

Q58. In the following triads, each group of letters is related to the subsequent one following a certain logic. Select from the given options, the one which follows the same logic.

WEST - EWST - WSTE

TOPS - OTPS - TPSO

(a) HIRE - HRIE - ERIH
(b) EXIT - XEIT - EITX
(c) LADS - ALDS - SADL
(d) OPEN - POEN - PENO

Q59. What should come in place of the question mark (?) in the given series?

161 165 173 185 201 ?

(a) 207
(b) 221
(c) 215
(d) 220

Q60. Each of the digits in the number 4876231 is arranged in ascending order from left to right. What will be the sum of the digits which are second from the left and third from the right in the new number thus formed?

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

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Q61. Which of the following letter-clusters will replace the question mark (?) in the given series to make it logically complete?

BBO 2 ECM -4 HDK 8 KEI -16 ?

(a) KLI 33
(b) NFG 32
(c) MKL 22
(d) MJJ 31

Q62. What should come in place of the question mark (?) in the given series based on the English alphabetical order?

VNQ UMP TLO SKN ?

(a) RIM
(b) RIN
(c) RJN
(d) RJM

Q63. Select the triad that follows the same pattern as the one followed by the two triads given below. Both triads follow the same pattern.

LF-OI-RT

NH-QK-TV

(a) PJ-SM-VY
(b) PJ-SM-VX
(c) OJ-SN-VY
(d) OJ-SM-VY

Q64. In a certain code language, ‘PEARL’ is coded as ‘18723’ and ‘PAYER’ is coded as ‘82736’. What is the code for ‘Y’ in the given code language?

(a) 8
(b) 2
(c) 3
(d) 6

Q65. A, B, C, R, S, T and U are sitting around a circular table facing the centre of the table. Only one person sits between S and T when counted from the left of T. R sits third to the right of A. U sits third to the left of C. R sits to the immediate right of U. B is not an immediate neighbour of U. How many people sit between B and T when counted from the right of B?

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

Q66. If ‘A’ stands for ‘+’, ‘B’ stands for ‘−’, ‘C’ stands for ‘÷’ and ‘D’ stands for ‘×’, what will come in place of the question mark (?) in the following equation?

75 B 4 D 20 A 40 C 8 = ?

(a) 4
(b) 3
(c) 1
(d) 0

Q67. 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 is the letter-cluster that 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) STP
(b) UWR
(c) QRN

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(d) WXT

Q68. 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 lotions are creams.

All creams are soaps.

No cream is a facewash.

Conclusions:

(I) No soap is a facewash.

(II) No lotion is a facewash.

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

Q69. What should come in place of the question mark (?) in the given series?

214 217 222 229 238 ?

(a) 249
(b) 241
(c) 247
(d) 243

Q70. Ronak starts from Point A and drives 6 km towards the south. He then takes a left turn, drives 5 km, turns left and drives 14 km. He then takes a left turn and drives 11 km. He takes a final left turn, drives 8 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) 6 km to the east
(b) 7 km to the west
(c) 6 km to the west
(d) 7 km to the east

Q71. 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 geysers are lights. No light is an oven.

Conclusion (I): No geyser is an oven.

Conclusion (II): Some ovens are lights.

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

Q72. Refer to the number series given below and answer the question that follows. Counting to be done from left to right only.

(NOTE: All numbers are single-digit numbers only.)

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

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

(a) More than two
(b) None
(c) One
(d) Two

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Q73. In a particular coding system, 'house' is represented as '35791' and 'hose' is encoded as '3751'. How is 'u' represented in this coding system?

(a) 9
(b) 1
(c) 3
(d) 7

Q74. Seven people, A, B, C, D, E, F, and G, are sitting in a row, facing the north. Only two people sit to the left of A. Only three people sit between A and G. D sits second to the right of A. Only two people sit between D and C. E sits at some place to the right of F but at some place to the left of B.

How many people sit to the right of C?

(a) 4
(b) 3
(c) 5
(d) 2

Q75. Mr. Zzz starts from Point A and drives 7 km towards the South. He then takes a left turn, drives 21 km, turns left and drives 16 km. He then takes a left turn and drives 26 km. He takes a final left turn, drives 9 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 degrees turns only unless specified).

(a) 3 km to the West
(b) 4 km to the North
(c) 2 km to the South
(d) 5 km to the East

Q76. A, B, C, E, F, P and Q are sitting around a circular table, facing the centre. F sits third to the left of C. Only one person sits between C and P when counted from the left of P. Only two people sit between B and E when counted from the right of E. A is an immediate neighbour of B. Who sits to the immediate left and right of Q, respectively?

(a) P and C
(b) P and B
(c) C and P
(d) F and A

Q77. In a row of people all facing north, Hirani is 17^(th) from the left end, and Tushar is 32^(th) from the left end. Tushar is exactly between Hirani and Kiran. If Kiran is 12^(th) from the right end of the line, how many people are there in the row?

(a) 59
(b) 60
(c) 58
(d) 57

Q78. Select the pair that follows the same pattern as that followed by the two pairs given below. Both pairs follow the same pattern.

AWY−UQS

RNP−LHJ

(a) PLN−JFH
(b) PLN−IFG
(c) PKL−IEG
(d) PKL−JFH

Q79. What should come in place of the question mark (?) in the given series?

921 923 927 933 941 ?

(a) 955
(b) 953
(c) 951

(d) 949

Q80. 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) LOI
(b) QTO
(c) HKF
(d) ILG

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. In which state did the Defence Research and Development Organisation (DRDO) successfully test its indigenous Stratospheric Airship Platform on 3 May 2025?

(a) Madhya Pradesh
(b) Rajasthan
(c) Gujarat
(d) Andhra Pradesh

Q82. Who among the following was appointed as Deputy Chief Executive Officer (CEO) of SBI General Insurance in June 2025?

(a) Rakesh Sharma
(b) Mohd. Arif Khan
(c) Ashok Mittal
(d) Manish Jain

Q83. The Lokpal of India celebrated its 1^(st) Foundation Day on which date in 2025?

(a) 15 january
(b) 16 january
(c) 31 january
(d) 30 january

Q84. Which ministry released the 'Model Rules for Felling Trees in Agricultural Lands' in 2025?

(a) Ministry of Rural Development
(b) Ministry of Agriculture
(c) Ministry of Home Affairs
(d) Ministry of Environment, Forest and Climate Change

Q85. Which film by Aamir Khan was released in June 2025?

(a) Sky Force
(b) Sitaare Zameen Par
(c) Fateh
(d) Raid 2

Q86. As per revised Reserve Bank of India guidelines in April 2025, from what minimum age can minors independently open and operate savings accounts?

(a) 10 years
(b) 15 years
(c) 12 years
(d) 8 years

Q87. Which of the following countries will be hosting the World Rowing Championships 2025?

(a) Shanghai, China
(b) London, UK
(c) Tokyo, Japan

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(d) Sydney, Australia

Q88. Which award did former cyclist Sucha Singh receive in 2025?

(a) Dronacharya Award
(b) Khel Ratna Award
(c) MAKA Trophy
(d) Arjuna Award (Lifetime)

Q89. Which of the following platforms will provide training to the new recruits inducted during the 15^(th) edition of the Rozgar Mela in April 2025, apart from formal skill programmes?

(a) e-Shram Portal
(b) National Career Service
(c) SWAYAM
(d) iGOT Karmayogi

Q90. In January 2025, the World Economic Forum annual meeting was held in _____.

(a) Wengen
(b) Geneva
(c) Zurich
(d) Davos

Q91. Which State Government inaugurated the Rajiv Gandhi Van Samvardhan Yojana on 2 June 2025?

(a) Telangana
(b) Karnataka
(c) Himachal Pradesh
(d) Uttar Pradesh

Q92. Who took over as the Chairperson of the Securities and Exchange Board of India (SEBI) in March 2025?

(a) Madhabi Puri Buch
(b) Shaktikanta Das
(c) Tuhin Kanta Pandey
(d) Arvind Panagariya

Q93. Which of the following is NOT a main feature of ‘Control of Water Pollution (Grant, Refusal or Cancellation of Consent) Guidelines', 2025?

(a) Streamlined Consent Process
(b) Stricter Location Criteria
(c) Air Pollution Prevention Penalties
(d) Clear Enforcement of Rules

Q94. Finland became the _____ European country to exit the Ottawa landmine treaty in June 2025.

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

Q95. How many total medals did India win at the 2025 World Boxing Cup?

(a) 8
(b) 10
(c) 11
(d) 9

Q96. Which athlete won the Arjuna Award for para-athletics in 2025?

(a) Navdeep Singh
(b) Sumit Antil
(c) Avani Lekhara

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(d) Yogesh Kathuniya

Q97. In which of the following months, during the 'Genomics Data Conclave', was the 'GenomeIndia Data' dedicated to the researchers by Narendra Modi, Prime Minister of India?

(a) March 2025
(b) June 2025
(c) April 2025
(d) January 2025

Q98. Which of the following Indian Constitutional Amendment Acts is also known as Nari Shakti Vandan Adhiniyam?

(a) 107th Constitutional Amendment Bill
(b) 104th Constitutional Amendment Bill
(c) 105th Constitutional Amendment Bill
(d) 106th Constitutional Amendment Bill

Q99. In which of the following months was the grand finale and prize distribution ceremony of the Defence Innovation Challenge for Excellence (DICE-2024) organised during Aero India 2025 in Bengaluru by the Marathwada Accelerator for Growth and Incubation Council (MAGIC)?

(a) April 2025
(b) June 2025
(c) February 2025
(d) March 2025

Q100. Approximately how many hectares are targeted for increased forest and tree cover by 2030 as per the Revised Green India Mission (GIM) Plan released in 2025?

(a) 10 million
(b) 24.7 million
(c) 20 million
(d) 15.5 million

ANSWER KEY

1	d	2	b	3	b	4	c	5	d	6	d	7	a	8	a	9	a	10	a
11	b	12	c	13	b	14	d	15	d	16	c	17	c	18	c	19	d	20	c
21	a	22	b	23	a	24	a	25	d	26	b	27	d	28	d	29	a	30	d
31	a	32	d	33	b	34	d	35	c	36	a	37	b	38	b	39	b	40	a
41	d	42	b	43	d	44	d	45	a	46	d	47	d	48	d	49	a	50	c
51	b	52	a	53	d	54	a	55	a	56	c	57	d	58	b	59	b	60	b
61	b	62	d	63	b	64	d	65	b	66	d	67	b	68	a	69	a	70	a
71	a	72	c	73	a	74	c	75	d	76	c	77	c	78	a	79	c	80	a
81	a	82	b	83	b	84	d	85	b	86	a	87	a	88	d	89	d	90	d
91	c	92	c	93	c	94	a	95	c	96	a	97	d	98	d	99	c	100	b

SOLUTIONS

Q1. Answer: (d) Reproduction

The correct answer is Reproduction.

Key Points

• Reproduction is the biological process by which organisms produce offspring to ensure the continuation of their species. However, it is not essential for maintaining the life of an individual organism. An organism can survive without reproducing.

• Nutrition is crucial for organisms as it provides the necessary energy and nutrients to carry out all life processes, such as growth, repair, and maintaining homeostasis. Without nutrition, an organism cannot survive. Hence, this is essential.

• Excretion is vital for removing metabolic waste products from the body, such as urea, carbon dioxide, and other toxins, ensuring that the organism's internal environment remains stable. Hence, this is essential.

• Respiration is the process of converting glucose into energy (ATP) in the presence or absence of oxygen. Energy is required for all cellular activities and functions. Hence, this is essential.

• While reproduction is critical for the survival of the species, it is not directly linked to the survival of the individual organism. Many organisms, such as sterile animals or humans who choose not to reproduce, can live a healthy life. Hence, reproduction is not essential to maintain life.

Additional Information

• Nutrition:

• It involves the intake of food and its conversion into energy and raw materials required for growth, repair, and maintenance of the body.

• Organisms obtain nutrition through various modes, such as autotrophic (plants) or heterotrophic (animals and fungi).

• Examples include photosynthesis in plants, where sunlight is converted into chemical energy, and digestion in animals, where food is broken down into simpler molecules.

• Excretion:

• It is the process of eliminating waste products formed during metabolic activities.

• Examples of excretory organs include the kidneys in humans (which excrete urea and water) and stomata in plants (which release oxygen as a byproduct of photosynthesis).

• Without excretion, toxic substances can accumulate in the body and disrupt vital processes.

• Respiration:

• It is the biochemical process of breaking down glucose to release energy in the form of ATP.

• Respiration can be aerobic (requiring oxygen) or anaerobic (occurs in the absence of oxygen).

• Examples include cellular respiration in animals and fermentation in microorganisms.

• The energy released is used for various life processes, such as movement, reproduction, and repair.

• Reproduction:

• It ensures the continuation of the species by producing offspring.

• Reproduction can be sexual (involving the fusion of gametes) or asexual (without gamete fusion).

• Examples include budding in Hydra and binary fission in bacteria.

• While reproduction is important for the survival of the species, it is not essential for the survival of an individual organism.

Important Points

• Life Processes:

• Life processes are essential biological functions that maintain the life of an organism.

• Examples include nutrition, respiration, excretion, growth, movement, and reproduction.

• Characteristics of Living Organisms:

• Living organisms exhibit characteristics such as growth, metabolism, responsiveness, reproduction, and adaptability.

• While reproduction is a characteristic of living organisms, it is not essential for an individual's survival.

• Energy and Survival:

• Energy obtained through nutrition and respiration is critical for maintaining all other life processes.

• Without energy, life processes such as movement, growth, and repair would cease.

Q2. Answer: (b) 10R

The correct answer is 10R.

Key Points

• When resistors are arranged in a series connection, the total resistance is the sum of the individual resistances. This means all resistances are added together without any modification.

• The formula for total resistance in a series connection is R_(total) = R1 + R2 + ... + R_n, where R_n is the resistance of each resistor.

• In the given problem, there are 10 resistors of equal resistance, each having a resistance value of R.

• Applying the series formula: R_(total) = R + R + R + ... (10 times). Therefore, R_(total) = 10R.

• Option 2 is the correct answer because the total resistance of 10 resistors in series is 10R, as derived from the above calculation.

Additional Information

• Series Combination of Resistors:

• In a series connection, the current flowing through all the resistors remains the same, but the voltage across each resistor may

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vary depending on its resistance.

• The total resistance in series is always greater than the largest individual resistance in the circuit.

• Example: If three resistors of 2Ω, 4Ω, and 6Ω are connected in series, the total resistance will be 2 + 4 + 6 = 12Ω.

• Parallel Combination of Resistors:

• In a parallel connection, the total resistance is calculated using the formula: 1/R_(total) = 1/R1 + 1/R2 + ... + 1/R_n.

• The total resistance in a parallel circuit is always less than the smallest individual resistance.

• Example: If two resistors of 4Ω and 6Ω are connected in parallel, the total resistance is calculated as 1/R_(total) = 1/4 + 1/6 = 5/12; R_(total) = 12/5 = 2.4Ω.

• Applications of Series and Parallel Circuits:

• Series circuits are commonly used in devices like string lights or older Christmas lights, where all lights will go off if one fails.

• Parallel circuits are widely used in household wiring to ensure that the failure of one appliance does not affect others.

• Key Differences Between Series and Parallel Circuits:

• In a series circuit, the current is the same across all components, while in a parallel circuit, the voltage is the same across all components.

• Series circuits are not suitable for high-power applications due to high resistance, whereas parallel circuits are more efficient for such cases.

Q3. Answer: (b) Insects

The correct answer is Insects.

Key Points

• Insecticides are chemical substances specifically designed to target and control insect pests that damage crops. They are a major category of pesticides used in agricultural practices.

• The primary function of insecticides is to kill or disrupt the life cycle of insects, thereby preventing them from harming crops. Common examples include aphids, caterpillars, whiteflies, and beetles.

• Insecticides act in various ways, such as contact action (killing insects upon direct contact), stomach action (ingestion by the insect), and systemic action (absorbed by the plant and affecting insects that feed on it).

• Fungicides, on the other hand, are used for controlling fungal diseases in plants, and herbicides are used to control weeds. Hence, options like fungus and weeds are incorrect.

• Insecticides are not effective against viruses and bacterial infections in plants. These require other specialized treatments or preventive measures, such as the use of resistant crop varieties or biological controls.

• Therefore, insecticides specifically target insects, making option Insects the correct answer.

Additional Information

• Types of Insecticides:

• Organophosphates: These are widely used insecticides that act on the nervous system of insects. Examples include malathion and chlorpyrifos.

• Pyrethroids: Synthetic chemicals modeled after natural pyrethrins found in chrysanthemum flowers. They are effective against a wide range of insects.

• Neonicotinoids: These are systemic insecticides that target the central nervous system of insects. Examples include imidacloprid and clothianidin.

• Carbamates: These act similarly to organophosphates and include chemicals like carbaryl.

• Impact of Insecticides:

• Insecticides significantly improve crop yield and quality by reducing pest infestations.

• However, overuse or improper use can lead to environmental damage, such as water contamination, and harm to beneficial insects like bees.

• Integrated Pest Management (IPM) practices are encouraged to minimize the adverse effects of insecticides.

• Alternatives to Insecticides:

• Biological control methods like the use of natural predators (e.g., ladybugs for aphid control).

• Crop rotation and companion planting to reduce pest populations naturally.

• Use of genetically modified (GM) crops that are resistant to specific pests.

• Regulation and Safety:

• Insecticides are regulated by government authorities such as the Environmental Protection Agency (EPA) in the USA and the Central Insecticides Board and Registration Committee (CIBRC) in India.

• Farmers are advised to use personal protective equipment (PPE) while handling insecticides to avoid health risks.

Q4. Answer: (c) Multiple reflections of sound from hard surfaces

The correct answer is Multiple reflections of sound from hard surfaces.

Key Points

• Reverberation is the persistence of sound in a space after the original sound source has stopped. It is primarily caused by the multiple reflections of sound waves from hard surfaces, such as walls, floors, and ceilings.

• When sound waves strike hard surfaces, they are reflected back instead of being absorbed. This repeated reflection leads to a blending of sound waves, creating a prolonged sound effect.

• Hard surfaces like concrete, glass, and tiles reflect most of the sound energy, amplifying the reverberation effect, while soft materials like carpets and curtains absorb sound, reducing reverberation.

• The time duration for which the sound persists due to reflection is called the reverberation time. It depends on the size of the room and the type of materials used in its construction.

• Excessive reverberation can distort speech or music, making it difficult to understand sounds clearly. This is why acoustical treatments are crucial in spaces like auditoriums and recording studios.

Additional Information

• Variation in air temperature:

• Sound waves can bend due to differences in air temperature, a phenomenon called refraction. However, this does not cause reverberation, as it merely changes the direction of sound propagation.

• This effect is more noticeable in outdoor environments where temperature gradients exist, such as during the early morning or late evening.

• Bending of sound waves:

• Sound waves bend due to refraction or diffraction when they pass through mediums with varying densities or around obstacles. While this can affect sound quality, it is not the cause of reverberation.

• For example, sound bending is commonly observed near water bodies or in hilly terrains.

• Absorption of sound by soft materials:

• Soft materials like carpets, curtains, and acoustic panels absorb sound waves, reducing the intensity of reflections. This helps in minimizing reverberation in enclosed spaces.

• Such materials are commonly used in theaters, classrooms, and conference halls to improve sound clarity.

• Importance of reverberation control:

• In spaces like lecture halls, low reverberation is preferred to ensure clear speech delivery. However, in concert halls, a controlled amount of reverberation enhances musical performance.

• Acoustic engineers use materials like fiberglass panels, foam, or perforated wood to design spaces with optimal reverberation times.

• Examples of reverberation:

• Reverberation is commonly experienced in large, empty rooms with hard surfaces, such as gymnasiums or empty halls.

• In contrast, sound is less persistent in spaces with soft furnishings, such as bedrooms or living rooms.

Q5. Answer: (d) Only certain special orbits known as discrete orbits of electrons are allowed inside the atom.

The correct answer is Only certain special orbits known as discrete orbits of electrons are allowed inside the atom..

Key Points

• Bohr's Model of an Atom: According to Niels Bohr's atomic model, electrons revolve around the nucleus in fixed paths called discrete orbits or energy levels. These energy levels are denoted by quantum numbers such as n = 1, 2, 3, etc.

• Discrete Orbits: Only certain orbits are permitted for electrons, and these orbits are associated with fixed amounts of energy. These are referred to as stationary states, where electrons do not radiate energy.

• Energy Conservation: Electrons do not lose energy while revolving in these discrete orbits, ensuring the atom's stability. This is contrary to classical physics predictions.

• Statement Analysis: The statement "Only certain special orbits known as discrete orbits of electrons are allowed inside the atom" is correct as it aligns with Bohr's postulates.

• Incorrect Statements: The statements such as "While revolving in discrete orbits, the electrons radiate energy" and "While revolving in discrete orbits, the electrons do not exist" are incorrect because electrons neither radiate energy in stationary states nor cease to exist while revolving in discrete orbits.

Additional Information

• Key Postulates of Bohr's Model:

• Stationary Orbits: Electrons revolve around the nucleus in fixed orbits without radiating energy.

• Energy Quantization: The energy of electrons in discrete orbits is quantized and remains constant as long as the electron stays in a particular orbit.

• Energy Transition: Electrons can jump between energy levels by absorbing or emitting energy equal to the difference between the energy levels.

• Limitations of Bohr's Model:

• It could not explain the spectra of larger atoms with multiple electrons.

• It failed to account for the Zeeman effect (splitting of spectral lines in a magnetic field) and Stark effect (splitting in an electric field).

• The model does not align with the principles of quantum mechanics introduced later.

• Applications of Bohr's Model:

• Explains the hydrogen spectrum and the Rydberg formula for spectral line wavelengths.

• Helps in understanding atomic structure and energy transitions in simple atoms.

• Quantum Mechanical Model: The shortcomings of Bohr's model were later addressed by the quantum mechanical model of the atom, which describes electrons as wave-particles and uses orbitals instead of fixed orbits to describe their probable locations.

Important Points

• Historical Context: Bohr proposed his model of the atom in 1913, building upon Rutherford's nuclear model but addressing its limitations.

• Energy Levels: The discrete orbits are also referred to as shells, and their energy is proportional to the square of the quantum number (n).

• Hydrogen Atom Spectrum: Bohr's model accurately explains the emission spectrum of the hydrogen atom, including the Lyman, Balmer, and Paschen series.

• Bohr Radius: The radius of the smallest orbit (n = 1) is known as the Bohr radius, approximately 0.529 Å.

Q6. Answer: (d) Three

The correct answer is Three.

Key Points

• A triangular glass prism is a three-dimensional solid object with a triangular base and triangular top.

• The prism has a total of five faces – three rectangular lateral surfaces and two triangular bases.

• The three rectangular lateral surfaces connect the corresponding edges of the triangular bases of the prism.

• The rectangular lateral faces are responsible for light refraction and dispersion when light passes through the prism.

• Hence, the correct answer is that a triangular glass prism has three rectangular lateral surfaces.

Additional Information

• Structure of a Triangular Glass Prism:

• A triangular prism is a type of polyhedron with two identical triangular bases and three rectangular faces connecting them.

• It is commonly used in optics due to its ability to refract and disperse light.

• Applications of Glass Prisms:

• Glass prisms are widely used in spectrometers and scientific experiments to study the dispersion of light.

• They are also used in optical instruments like cameras, binoculars, and telescopes.

• Refraction and Dispersion:

• When light enters a prism, it bends (refraction) due to the change in medium from air to glass.

• The prism separates white light into its constituent colors (dispersion) due to different wavelengths bending differently.

• Common Types of Prisms:

• Triangular Prism: Used for light dispersion and refraction.

• Rectangular Prism: Commonly seen in everyday objects like cuboid-shaped glass slabs.

• Pentagonal Prism: Used for specialized optical applications.

Important Points

• History of Prism Studies:

• The study of prisms and their optical properties dates back to Sir Isaac Newton, who demonstrated the dispersion of light using a triangular glass prism in the 17th century.

• Newton’s experiments laid the foundation for modern optics and the understanding of the spectrum of light.

• Key Terms:

• Refraction: The bending of light as it passes from one medium to another.

• Dispersion: The separation of light into its component colors due to varying wavelengths.

• Polyhedron: A solid figure with flat faces, straight edges, and vertices.

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Q7. Answer: (a) Ethanol

The correct answer is Ethanol.

Key Points

• Ethanol, also known as ethyl alcohol, is widely used as a fuel additive to enhance the efficiency and reduce emissions of gasoline engines.

• It is a renewable and environmentally friendly fuel derived primarily from fermentation of plant materials, including corn, sugarcane, and other biomass.

• Blending ethanol with gasoline creates formulations such as E10 (10% ethanol and 90% gasoline) and E85 (85% ethanol), which help reduce dependency on fossil fuels.

• Ethanol helps improve the combustion efficiency of gasoline by increasing the octane rating, leading to better engine performance.

• Its use as a fuel additive also contributes to reducing air pollution by lowering carbon monoxide emissions and other harmful pollutants from vehicle exhausts.

Additional Information

• Ethanol:

• Ethanol is classified as a biofuel due to its production from organic sources such as crops and agricultural waste.

• It has been adopted in several countries, including India, the USA, and Brazil, as part of their energy policies to promote sustainable and renewable fuels.

• In India, the National Bio-Energy Policy encourages the blending of ethanol with petrol to reduce reliance on imported petroleum and lower greenhouse gas emissions.

• Ethanol has a high affinity for water, which requires careful storage and handling to avoid contamination.

• Ethane:

• Ethane is a hydrocarbon primarily used as a feedstock in the petrochemical industry for producing ethylene, which is used to make plastics.

• It is not used as a fuel additive due to its limited application in enhancing combustion efficiency.

• Ethanal (Acetaldehyde):

• Ethanal is an intermediate compound in the production of ethanol but is not directly used as a fuel additive.

• It is primarily utilized in the chemical industry for manufacturing acetic acid, perfumes, and drugs.

• Ethanoic Acid (Acetic Acid):

• Ethanoic acid is a weak organic acid widely used in the food industry as vinegar, in the chemical industry, and in medical applications.

• It is not suitable for use as a fuel additive due to its acidic nature, which could corrode engine components.

Important Points

• Global Adoption of Ethanol:

• The United States is the largest producer and consumer of ethanol as a fuel additive, with most of its ethanol produced from corn.

• Brazil extensively uses ethanol derived from sugarcane as part of its Proálcool Program.

• India has recently launched the E20 fuel program (20% ethanol blend) to promote sustainable energy solutions and reduce import dependency.

• Environmental Benefits:

• Ethanol blends help reduce greenhouse gas emissions, contributing to global efforts to combat climate change.

• It reduces emissions of volatile organic compounds (VOCs), which are precursors to smog formation.

• Economic Impact:

• Promoting ethanol production supports rural economies by generating demand for crops like sugarcane and corn.

• It creates employment opportunities in bio-refineries and associated industries.

Q8. Answer: (a) Endoplasmic reticulum

The correct answer is Endoplasmic Reticulum.

Key Points

• The Golgi apparatus works closely with the Endoplasmic Reticulum (ER) to process, modify, and transport proteins and lipids produced by the ER.

• The rough ER is responsible for synthesizing proteins, which are then transferred to the Golgi apparatus for further modification, sorting, and packaging.

• The smooth ER synthesizes lipids and steroids, which may also be processed by the Golgi apparatus.

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• The Golgi apparatus is involved in the formation of lysosomes, which contain enzymes synthesized in the ER.

• Transport between the ER and Golgi occurs via vesicles, ensuring the delivery of molecules to their final destinations within or outside the cell.

Additional Information

• Golgi Apparatus:

• Also known as the Golgi complex, it is a membrane-bound organelle present in eukaryotic cells.

• It was discovered by Camillo Golgi in 1898.

• Its primary function is to modify, sort, and package proteins and lipids for secretion or use within the cell.

• The Golgi apparatus is made up of flattened, stacked pouches called cisternae.

• Endoplasmic Reticulum (ER):

• The ER is a network of tubular membranes located in the cytoplasm of eukaryotic cells.

• It is divided into two types: rough ER (with ribosomes attached) and smooth ER (without ribosomes).

• Rough ER is involved in protein synthesis, while smooth ER is responsible for lipid synthesis and detoxification.

• The ER provides structural support and functions as a pathway for the transport of materials within the cell.

• Other Organelles:

• Nucleus: Contains genetic material and regulates cellular activities; however, it does not directly interact with the Golgi apparatus.

• Plastids: Found in plant cells; they are involved in photosynthesis and storage, but are not closely associated with the Golgi apparatus.

• Mitochondria: Known as the powerhouse of the cell, mitochondria produce energy (ATP); they function independently of the Golgi apparatus.

Important Points

• Vesicle Transport:

• Materials synthesized in the ER are transported to the Golgi apparatus via vesicles.

• These vesicles merge with the cis face of the Golgi apparatus, where the initial processing occurs.

• After modification, the substances are sorted and packed into vesicles at the trans face of the Golgi for distribution.

• Golgi and Lysosomes:

• The Golgi apparatus produces lysosomes, which contain digestive enzymes for breaking down cellular waste and macromolecules.

• These enzymes are initially synthesized in the ER and then processed by the Golgi.

• Cellular Communication:

• The Golgi apparatus plays a critical role in secreting proteins and lipids outside the cell, aiding in cellular communication and signaling.

• It is especially prominent in cells involved in secretion, such as glandular cells.

Q9. Answer: (a) Inequality in the distribution of resources

The correct answer is Inequality in the distribution of resources.

Key Points

• Inequality in the distribution of resources is one of the primary reasons for poor living standards in society as it creates a significant gap between the rich and the poor.

• Unequal access to land, wealth, education, healthcare, and employment opportunities often leads to social stratification, poverty, and limited upward mobility for disadvantaged groups.

• This disparity hinders the equitable development of society, leaving large sections of the population unable to afford basic necessities like food, shelter, and education.

• The Gini Index, a measurement of income inequality, highlights how uneven resource distribution directly impacts economic growth and the overall quality of life in a country.

• Addressing inequality through progressive taxation, social welfare programs, and equitable policies can help in improving living standards and reducing poverty.

Additional Information

• Overuse of technology in urban areas:

• While technology has improved efficiency and lifestyle, its overuse in urban areas has led to issues like digital addiction, reduced human interaction, and mental health challenges.

• However, this is not a primary factor contributing to poor living standards, as technology also helps improve access to education, healthcare, and services.

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• Thus, it is not directly linked to widespread poverty or inequality.

• Level of education in society:

• Education plays a pivotal role in economic development and individual empowerment, but it is not the sole factor behind poor living standards.

• Unequal access to education is a consequence of resource disparity, making inequality a more fundamental cause.

• Rapid growth of the population:

• Population growth can strain resources, infrastructure, and services, impacting living standards.

• However, with efficient resource allocation and population management strategies, the negative effects of population growth can be mitigated.

• The underlying issue remains the inequitable distribution of resources.

• Inequality in global context:

• According to the World Inequality Report 2022, the top 10% of the global population controls 76% of the wealth, while the bottom 50% owns just 2%.

• This imbalance is a significant contributor to global poverty and inadequate living standards, highlighting the need for systemic reforms.

Important Points

• Government Initiatives:

• To tackle inequality, governments across the globe implement measures like minimum wage laws, social security programs, and universal healthcare.

• In India, schemes like MGNREGA (Mahatma Gandhi National Rural Employment Guarantee Act) aim to provide employment and reduce poverty.

• Role of Education:

• Education can serve as a great equalizer by providing individuals with skills and knowledge to improve their socio-economic status.

• However, in countries with significant inequality, access to quality education remains limited for marginalized communities.

• Examples of Nations:

• Countries with lower levels of income inequality, such as Norway and Sweden, tend to have higher living standards and better social welfare systems.

• In contrast, countries with high inequality, like South Africa and Brazil, often face higher rates of poverty and social unrest.

Q10. Answer: (a) Plasmodium

The correct answer is Plasmodium.

Key Points

• Plasmodium, a parasitic protozoan, reproduces by the process of multiple fission, a form of asexual reproduction where the nucleus divides repeatedly before the cytoplasm divides, producing several daughter cells.

• During multiple fission, Plasmodium undergoes a stage called schizogony in its life cycle, particularly in the human host. The nucleus of the parasite divides multiple times, and the cytoplasm then segregates around each nucleus, forming numerous merozoites.

• This process occurs in the liver cells and red blood cells of the human body during the parasite's life cycle, leading to the release of merozoites into the bloodstream, which further infect more red blood cells.

• Plasmodium is responsible for causing malaria in humans. The disease is transmitted through the bite of an infected female Anopheles mosquito.

• Other organisms mentioned in the options, such as Garden pea, Leishmania, and Hibiscus, do not reproduce by multiple fission. Hence, these options are incorrect.

Additional Information

• Plasmodium Life Cycle:

• The life cycle of Plasmodium alternates between a human host and a mosquito vector. In humans, it includes both the liver stage (exo-erythrocytic schizogony) and the blood stage (erythrocytic schizogony), where multiple fission occurs.

• The mosquito stage involves the sexual reproduction of Plasmodium in the gut of the mosquito.

• What is Multiple Fission?

• Multiple fission is a type of asexual reproduction in which a single organism divides its nucleus multiple times to form several nuclei, and then the cytoplasm divides to form individual daughter cells.

• It is common in protozoans such as Plasmodium and Amoeba.

• Comparison with Other Modes of Reproduction:

• Garden pea (Pisum sativum) reproduces through sexual reproduction, involving the formation of seeds through pollination and

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fertilization.

• Leishmania, a protozoan parasite, reproduces by binary fission, where the organism splits into two identical daughter cells.

• Hibiscus, a flowering plant, reproduces sexually through the formation of seeds and fruits after pollination.

• Diseases Caused by Plasmodium:

• Plasmodium species such as P. falciparum, P. vivax, P. ovale, and P. malariae cause malaria in humans.

• P. falciparum is the most severe and deadly species, often associated with cerebral malaria.

Important Points

• Multiple Fission vs Binary Fission: Binary fission results in two daughter cells, while multiple fission results in several daughter cells from a single parent organism.

• Control of Malaria: Preventive measures include mosquito control through insecticide-treated nets, indoor spraying, and antimalarial drugs such as artemisinin-based combination therapies (ACTs).

• Malaria Statistics: According to the World Health Organization (WHO), malaria affects millions of people annually, with a significant number of cases reported from sub-Saharan Africa.

Q11. Answer: (b) dendrites

The correct answer is dendrites.

Key Points

• Dendrites are the short, branched projections of a neuron that extend from the cell body (soma). These structures are primarily responsible for receiving signals from other neurons or sensory inputs.

• They play a critical role in transmitting electrical impulses toward the neuron’s cell body, allowing the neuron to process incoming information.

• Each neuron may have multiple dendrites, which increase the surface area for receiving synaptic connections, thus enhancing the neuron's ability to communicate with multiple other neurons.

• Dendrites contain specialized receptors that bind neurotransmitters released by other neurons at synapses, facilitating the transfer of information.

• The structure of dendrites can vary among different types of neurons, but their primary function remains the same – to receive and integrate information.

Additional Information

• Axons:

• An axon is a long, slender projection of a neuron that conducts electrical impulses away from the neuron’s cell body to other neurons, muscles, or glands.

• Unlike dendrites, axons are usually singular and unbranched, although they may have collateral branches.

• The axon is often covered by a myelin sheath, which increases the speed of impulse transmission.

• Axons end in axon terminals, which form synapses with other neurons or target cells.

• Nuclei:

• In the context of neurons, "nuclei" refer to clusters of neuron cell bodies within the central nervous system, not a part of individual neurons.

• The nucleus of a neuron (located within the cell body) contains genetic material (DNA) and is essential for the cell’s functioning and survival.

• Nerve Endings:

• Nerve endings are the terminal parts of neurons where they connect with target tissues (like muscles, glands, or other neurons).

• These endings are involved in transmitting signals via neurotransmitters or directly stimulating target cells.

• Neurons:

• Neurons are the fundamental structural and functional units of the nervous system, specialized for transmitting electrical and chemical signals.

• They consist of three main parts: the cell body (soma), dendrites, and axon.

• Neurons are classified into various types based on their structure (e.g., unipolar, bipolar, multipolar) and function (e.g., sensory, motor, interneurons).

Important Points

• Synaptic Connections: Dendrites form synapses with axon terminals of other neurons to receive neurotransmitters, which generate electrical signals called postsynaptic potentials.

• Plasticity: Dendrites exhibit plasticity, meaning they can change their structure and strength of connections in response to learning and experience. This phenomenon is known as synaptic plasticity.

• Dendritic Spines: Many dendrites have small, bulbous protrusions called dendritic spines, which further increase the surface area for synaptic connections and play a role in learning and memory.

• Role in Neural Networks: Dendrites are vital for integrating signals from thousands of synapses, enabling the neuron to generate an appropriate output signal.

Q12. Answer: (c) 130 m, 70 m

The correct answer is Option 3.

Key Points

• The total distance covered by the object is calculated as the sum of all the distances traveled by it. The object first moves from point O to A, covering 100 m, and then reverses direction to travel back 30 m from A to B. Thus, the total distance covered is 100 m + 30 m = 130 m.

• The displacement is the straight-line distance between the initial position (O) and the final position (B), along with its direction. Since the object starts at O and ends at B, which is 70 m away from O, the magnitude of displacement is 70 m.

• Displacement is a vector quantity and is always the shortest distance between two points. In this case, it is the direct distance from O to B, disregarding the path taken.

• Total distance covered is a scalar quantity, which takes into account the entire path traveled by the object, irrespective of direction.

• Hence, the total distance covered is 130 m, and the magnitude of displacement is 70 m. This matches Option 3.

Additional Information

• Distance:

• Distance is a scalar quantity that refers to the total path covered by an object, regardless of direction.

• It is always positive and is measured in meters (m) in the SI system.

• For example, if an object moves 5 m forward and then 2 m backward, the total distance covered is 7 m.

• Displacement:

• Displacement is a vector quantity, which measures the shortest distance between the starting and ending points of an object, along with direction.

• It can be positive, negative, or zero, depending on the relative positions of the starting and ending points.

• For instance, if an object moves 5 m forward and then 2 m backward, the displacement is 3 m in the forward direction.

• Key Differences Between Distance and Displacement:

• Distance: Scalar, depends on the path taken, always positive.

• Displacement: Vector, depends only on initial and final positions, can be positive, negative, or zero.

• Applications of Distance and Displacement:

• These concepts are widely used in physics to describe motion in one, two, or three dimensions.

• Displacement is used in calculations for velocity and acceleration, while distance is used to measure the total travel length.

• Real-Life Example:

• If a person walks 3 km east and then 4 km west, the total distance covered is 7 km, but the displacement is 1 km west.

Important Points

• SI Units: Both distance and displacement are measured in meters (m) in the International System of Units.

• Direction in Displacement: Always specified in relation to a reference point or direction (e.g., 70 m towards west).

• Zero Displacement: If an object returns to its starting point, the displacement is zero, even if a significant distance has been covered.

• Example of Zero Displacement: A person walking 5 m forward and then 5 m back to the starting point has zero displacement.

• Understanding these concepts is essential in fields like physics, engineering, and navigation.

Q13. Answer: (b) Dull appearance (non-lustrous)

The correct answer is Dull appearance (non-lustrous).

Key Points

• Nonmetals are generally characterized by their dull appearance rather than having a shiny or lustrous surface like metals. This is due to their atomic structure, which doesn't allow free electrons to reflect light effectively.

• They are poor conductors of electricity and heat because they lack free-moving electrons, making them insulators. Hence, the statement "high electrical conductivity" is incorrect.

• Most nonmetals have low melting and boiling points, unlike metals, which generally exhibit high melting and boiling points. Therefore, the statement "high melting and boiling points" is not a general property of nonmetals.

• Nonmetals are not malleable or ductile; instead, they are brittle and break easily when subjected to stress. This makes the statement "malleability and ductility" incorrect.

• Examples of nonmetals include oxygen, carbon, sulfur, and nitrogen, which exhibit dull appearances and other typical nonmetallic properties.

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Additional Information

• Physical Properties of Nonmetals:

• Nonmetals are usually found in solid or gaseous states at room temperature, with the exception of bromine, which is liquid.

• They exhibit low density compared to metals and are often lightweight.

• Nonmetals generally have low thermal and electrical conductivity because their electrons are tightly bound and don't move freely.

• They are brittle in solid form, meaning they break or shatter rather than deform when subjected to force.

• Nonmetals have a wide range of chemical properties and can form acidic oxides when combined with oxygen.

• Chemical Properties of Nonmetals:

• Nonmetals tend to gain electrons in chemical reactions, forming negative ions or anions.

• They often react with metals to form ionic compounds, such as sodium chloride (NaCl).

• Nonmetals can also form covalent bonds with other nonmetals, creating molecules like water (H2O) and carbon dioxide (CO2).

• Examples of reactive nonmetals include fluorine, which is highly electronegative and reacts with almost all elements.

• Examples of Nonmetals:

• Carbon: Found in various allotropes like diamond, graphite, and amorphous carbon.

• Oxygen: Essential for respiration and combustion processes.

• Nitrogen: Major component of Earth's atmosphere and used in fertilizers.

• Sulfur: Commonly used in the manufacturing of sulfuric acid and vulcanization of rubber.

• Important Points:

• Nonmetals play a crucial role in biological systems. For example, carbon is the backbone of organic compounds, and oxygen is vital for respiration.

• They are used in industries such as semiconductors (e.g., silicon) and pharmaceuticals (e.g., nitrogen and sulfur compounds).

• The periodic table groups nonmetals primarily on the right-hand side, including elements from groups 14-18.

• Nonmetals are critical for environmental processes, such as the formation of the ozone layer and the carbon cycle.

Q14. Answer: (d) Newton’s first law

The correct answer is Newton’s First Law.

Key Points

• Newton’s First Law, also known as the Law of Inertia, states that an object will remain at rest or in uniform motion in a straight line unless acted upon by an external force.

• In the given scenario, the passenger standing in the moving bus continues to move forward when the bus stops abruptly. This happens because the passenger’s body, due to inertia, resists the change in its state of motion.

• The bus comes to a stop due to the external force of brakes, but the passenger’s body does not stop immediately as no direct force is applied to it, illustrating the principle of inertia.

• Inertia is a property of matter by which it maintains its state of rest or uniform motion unless acted upon by an external force. This is why the passenger falls forward.

• Hence, the abrupt stopping of the bus leading to the forward fall of the passenger is a direct application of Newton’s First Law.

Additional Information

• Newton’s Laws of Motion:

• First Law (Law of Inertia): An object remains at rest or moves in a straight line at constant speed unless acted upon by an external force.

• Second Law: The force acting on an object is equal to the mass of the object multiplied by its acceleration (F = ma).

• Third Law: For every action, there is an equal and opposite reaction.

• Examples of Inertia:

• When a car suddenly stops, passengers lurch forward due to their body's tendency to continue moving.

• A book lying on a table will remain at rest unless someone moves it.

• A ball rolling on the ground eventually stops due to external forces like friction and air resistance.

• Difference Between Mass and Inertia:

• Mass: A measure of the amount of matter in an object, measured in kilograms.

• Inertia: The tendency of an object to resist changes in its state of motion, directly proportional to its mass.

• Applications of Newton’s First Law:

• Seat belts in cars are designed to counteract inertia, preventing passengers from moving forward during sudden stops.

• Spacecraft continue moving in space without propulsion due to the absence of external forces.

Important Points

• Practical Implications of Inertia:
• Inertia is the reason why heavy vehicles require more force to stop compared to lighter vehicles.
• It explains why athletes lean forward while running to overcome inertia and gain momentum quickly.
• Real-Life Safety Measures:
• Helmets and seat belts are designed to protect against inertia-related accidents during abrupt motion changes.
• Heavy machinery employs brakes and clutches to effectively manage inertia during operations.
• Historical Context:
• Newton formulated his laws of motion in 1687, published in his famous work "Philosophiæ Naturalis Principia Mathematica".
• These laws are fundamental to classical mechanics and have wide-ranging applications in science and engineering.

Q15. Answer: (d) C6H12O6

The correct answer is C6H12O6.

Key Points

• Glucose is a simple sugar and an essential carbohydrate in biological systems. Its molecular formula is C6H12O6, which indicates it contains six carbon atoms, twelve hydrogen atoms, and six oxygen atoms.
• Glucose is a monosaccharide and is classified as an aldose sugar due to the presence of an aldehyde group (-CHO) in its structure.
• It is a primary source of energy for cells and is involved in several vital metabolic processes, including cellular respiration.
• The molecular structure of glucose can exist in two forms: a straight-chain structure and a cyclic structure (pyranose form), with the cyclic form being the most stable and commonly found in nature.
• Glucose is produced naturally through the process of photosynthesis in plants and serves as a major energy substrate for organisms across all kingdoms of life.

Additional Information

• Option 1 (C11H22O11):
• This is the molecular formula for sucrose, a disaccharide composed of glucose and fructose.
• Sucrose is commonly found in table sugar and is used as a sweetener in foods and beverages.
• Option 2 (CH3COOH):
• This represents the molecular formula for acetic acid, an organic acid commonly used in vinegar.
• It is not related to glucose or carbohydrates, as it is primarily involved in acidic reactions and metabolic pathways like the Krebs cycle.
• Option 3 (CH4):
• This is the chemical formula for methane, the simplest alkane and a greenhouse gas.
• Methane is unrelated to glucose and is primarily a hydrocarbon used as a fuel source.
• Biological Importance of Glucose:
• Glucose serves as the main energy source for cellular respiration, a process occurring in the mitochondria of cells to produce ATP (adenosine triphosphate).
• It is a crucial intermediate in metabolic pathways such as glycolysis, gluconeogenesis, and the pentose phosphate pathway.
• In plants, glucose is stored as starch, while in animals, it is stored as glycogen.
• Imbalances in glucose levels can lead to conditions such as diabetes mellitus, which requires monitoring and management of blood sugar levels.
• Photosynthesis:
• In plants, glucose is synthesized during photosynthesis, where carbon dioxide and water react in the presence of sunlight and chlorophyll to form glucose and oxygen.
• The chemical equation for photosynthesis is: 6CO2 + 6H2O + light energy → C6H12O6 + 6O2.

Important Points

• Glucose is classified as a reducing sugar due to its ability to donate electrons in chemical reactions, which is often tested using Benedict's or Fehling's solution.
• The concentration of glucose in human blood is tightly regulated, with normal fasting blood glucose levels ranging between 70-100 mg/dL.
• Glucose polymers like cellulose and starch play structural and storage roles in plants.
• Insulin and glucagon are two hormones secreted by the pancreas that regulate glucose levels in the bloodstream.
• Artificial sweeteners like sorbitol and fructose are often used as substitutes for glucose in diabetic diets.

Q16. Answer: (c) A resistor

The correct answer is A resistor.

Key Points

• A zigzag line is used in circuit diagrams to represent a resistor, which is a passive electrical component.

• Resistors are designed to oppose the flow of electric current and are widely used to control voltage and current levels within an electrical circuit.

• The zigzag symbol is standardized by the International Electrotechnical Commission (IEC) and is universally recognized in electronic schematics.

• Resistors are typically represented in ohms (Ω), the unit of electrical resistance, which quantifies how much the resistor limits the current.

• Resistors are crucial for applications like dividing voltage, limiting current flow, and protecting sensitive components in a circuit.

Additional Information

• Resistor Function:

• A resistor ensures the safe functioning of circuits by controlling the amount of current that flows through them.

• It dissipates energy in the form of heat, and its resistance value determines the extent of current regulation.

• Resistor Types:

• Fixed Resistors: Have a constant resistance value (e.g., carbon film, metal film).

• Variable Resistors: Allow adjustment of resistance (e.g., potentiometers, rheostats).

• Resistor Applications:

• Used in voltage divider circuits to split voltage into proportional values.

• Protect components like LEDs by limiting current flow.

• Utilized in timing circuits and oscillators with capacitors.

• Resistor Color Code:

• Resistors are often marked with color bands to indicate their resistance values.

• For example, the colors brown, black, and red represent a resistor value of 1 kΩ.

• Other Circuit Symbols:

• Battery: Represented as a series of long and short parallel lines.

• Switch: Represented by a break in a line with an angled segment.

• Fuse: Represented by a rectangle with a diagonal line through it.

Important Points

• The unit of resistance is the ohm (Ω), named after Georg Simon Ohm, who discovered the relationship between voltage, current, and resistance.

• The mathematical formula for resistance is derived from Ohm's Law: R = V/I, where R is resistance, V is voltage, and I is current.

• Resistors are available in various ratings such as power (in watts), which indicates their ability to dissipate heat without damage.

• Common resistor values follow the E-series standard, such as E12, E24, which denote preferred numbers for resistance values.

• Modern resistors can be found in surface-mount technology (SMT) and are used in compact electronic devices like smartphones and laptops.

Q17. Answer: (c) Shells or orbitals

The correct answer is Shells or orbitals.

Key Points

• Electrons revolve around the nucleus in fixed paths called shells or orbitals. These paths are defined by specific energy levels.

• The concept of shells was introduced by Niels Bohr in his atomic model, where he explained that electrons occupy discrete orbits or energy levels.

• Each shell is associated with a specific energy level, and the shells are represented by letters such as K, L, M, N, or by principal quantum numbers n = 1, 2, 3, 4, respectively.

• The movement of electrons in these shells prevents them from spiraling into the nucleus due to attractive forces, as their energy is quantized and stable in these fixed orbits.

• Shells or orbitals also determine the chemical behavior of atoms, as the outermost shell (valence shell) plays a significant role in bonding and reactivity.

Additional Information

• Structure of an Atom:

• An atom consists of a nucleus at its center, which contains protons (positively charged particles) and neutrons (neutral particles).

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• Electrons (negatively charged particles) revolve around the nucleus in specific orbits or shells.
• The nucleus is much smaller in size compared to the overall size of the atom but contains almost all the atom's mass.
• Quantum Mechanical Model:
• The modern understanding of electron movement is based on the quantum mechanical model, which describes electrons as existing in regions of space called orbitals, rather than fixed paths.
• Orbitals are categorized into different shapes: s, p, d, and f, and each can hold a specific number of electrons.
• This model also incorporates the concept of electron probability density, instead of a precise location for electrons.
• Characteristics of Other Options:
• Quarks: These are fundamental particles that combine to form protons and neutrons, but they do not define the motion of electrons.
• Elliptical paths: While some historical atomic models suggested electrons moved in elliptical orbits, this idea is outdated and replaced by quantum mechanical principles.
• Nucleons: This term refers to protons and neutrons within the nucleus and is unrelated to the paths of electrons.
• Important Points:
• The Bohr Model, though simplistic, introduced the idea of quantized orbits, which was a breakthrough in atomic theory.
• Each shell can hold a maximum number of electrons, given by the formula $2n^2$, where n is the principal quantum number.
• The modern quantum mechanical model refined Bohr's ideas by introducing electron clouds and probability distributions instead of fixed orbits.

Q18. Answer: (c) 0 m/s

The correct answer is 0 m/s.

Key Points

• Average velocity is defined as the total displacement divided by the total time taken.
• Displacement refers to the shortest straight-line distance between the starting and ending points.
• In the case of a circular track, after completing one full round, the runner's starting and ending points are the same.
• Since the displacement is zero (starting and ending points coincide), the average velocity is also zero.
• The time taken for one round is 35 seconds, but this does not affect the displacement being zero, thereby making the average velocity 0 m/s.

Additional Information

• Concept of Velocity:
• Velocity is a vector quantity that includes both magnitude and direction.
• It is calculated as the rate of change of displacement over time.
• Formula: Velocity = Displacement / Time.
• In cases where displacement is zero, velocity automatically becomes zero irrespective of the time taken.
• Circular Motion:
• In circular motion, after completing one round, the displacement is zero because the object returns to its starting position.
• Examples include motion on a circular track, a Ferris wheel, or planetary orbits.
• While the distance traveled is significant, the displacement after completing one full rotation is always zero.
• Difference Between Speed and Velocity:
• Speed is a scalar quantity that measures the distance traveled per unit of time, without considering direction.
• Velocity, on the other hand, is a vector quantity that considers both magnitude and direction.
• In this scenario, the runner's speed can be calculated as distance / time, but the average velocity remains zero due to zero displacement.
• Practical Implications:
• Understanding average velocity is crucial in physics, engineering, and sports science to analyze motion accurately.
• For circular tracks, average velocity is often zero for complete rounds, but instantaneous velocity varies throughout the motion.

Important Points

• Displacement: It is the vector quantity representing the shortest path between the starting and ending points.
• Time: While time is essential in calculating velocity, it does not impact the average velocity if displacement is zero.
• Speed vs. Velocity: Speed is always positive and considers the entire distance traveled, while velocity can be zero or negative depending on displacement and direction.
• Practical Example: If a runner completes multiple laps on a circular track, the average velocity for each lap would still be zero due to zero displacement.

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Q19. Answer: (d) At twice the focal length

----------The correct answer is At twice the focal length.

Key Points

• A convex lens forms a real and same-sized image of an object when the object is placed at a distance equal to twice the focal length (2F) from the lens. This is because the lens equation and magnification conditions are satisfied at this position.

• When an object is placed at 2F in front of a convex lens, its image is formed at the other side of the lens, also at 2F, and the size of the image is equal to the size of the object.

• The nature of the image at this position is real, inverted, and of the same size as the object.

• The focal length of a convex lens is the distance from the lens to the principal focus, and twice the focal length is the position where the object and its image are equidistant from the lens.

• Other object positions, such as at the principal focus or at infinity, produce images of different sizes and characteristics, which do not satisfy the condition of the image being the same size as the object.

Additional Information

• Lens Equation: The lens formula is given as 1/f = 1/v - 1/u, where f is the focal length, v is the image distance, and u is the object distance. For an object placed at 2F, substituting u = -2f results in v = 2f, confirming the image forms at 2F on the other side of the lens.

• Magnification: The magnification (M) of a lens is given as M = -v/u. When u = -2f and v = 2f, the magnification becomes M = 1, indicating that the image is the same size as the object.

• Other Object Positions:

• At the principal focus (F): The image is formed at infinity, and it is real, inverted, and highly magnified.

• At infinity: The image is formed at the focal point (F) and is real, inverted, and highly diminished.

• Between F and the lens: The image is virtual, upright, and magnified.

• Applications of Convex Lenses: Convex lenses are used in devices such as cameras, magnifying glasses, microscopes, and telescopes due to their ability to form real and magnified images.

• Key Characteristics of Real Images: A real image is one that can be projected on a screen, as the light rays actually meet at the image position. It is always inverted in the case of convex lenses.

Important Points

• Focal Length: It is the distance from the lens to its principal focus, where parallel rays of light converge or appear to diverge after passing through the lens.

• Principal Focus: The point at which light rays parallel to the principal axis converge (in a convex lens) or appear to diverge (in a concave lens).

• Ray Diagrams: Ray diagrams help visualize the image formation by lenses. For a convex lens, drawing rays for objects placed at different distances (e.g., 2F, F) helps understand the size, position, and nature of the image.

• Lens Applications in Daily Life: Convex lenses are used in eyeglasses for correcting farsightedness (hypermetropia) and are also integral components in optical instruments.

• Experimental Validation: The relationship between object distance, image distance, and focal length can be experimentally verified using a convex lens, an object, and a screen.

Q20. Answer: (c) equal to the product of force and displacement

The correct answer is equal to the product of force and displacement.

Key Points

• Work Done: Work is defined as the product of the force applied to an object and the displacement of the object in the direction of the force. The formula for work is: Work (W) = Force (F) × Displacement (d) × cos(θ), where θ is the angle between force and displacement.

• Same Direction: When the force and displacement are in the same direction, the angle θ between them is 0 degrees. Hence, cos(0) = 1, and the work done simplifies to W = F × d.

• Positive Work: Since the force and displacement are aligned (same direction), the work done is positive. This means energy is being transferred to the object.

• Real-Life Example: In the given scenario, when a baby pulls a toy car along the ground with force and the car moves in the same direction, the work done is equal to the product of the force exerted and the displacement of the car.

• Incorrect Options: Option 1 (equal to zero) is incorrect because work done is zero only when there is no displacement or the force is perpendicular to the displacement. Option 2 (negative) is incorrect because work is negative when force and displacement are in opposite directions. Option 4 (equal to the speed of the car) is irrelevant, as speed is not related to work. Option 5 is not applicable in this case.

Additional Information

• Factors Affecting Work Done:

• Force: Work increases with the magnitude of the force applied.

• Displacement: The greater the displacement, the higher the work done.

• Angle (θ): The angle between force and displacement determines the effectiveness of the force. When θ = 90°, cos(90) = 0, and no work is done.

• Units of Work:

• The SI unit of work is the joule (J), where 1 joule = 1 newton × 1 meter.

• Other units include the erg (in CGS system) and foot-pound (in FPS system).

• Types of Work:

• Positive Work: Occurs when force and displacement are in the same direction, transferring energy to the object.

• Negative Work: Occurs when force and displacement are in opposite directions, reducing the object's energy.

• Zero Work: Happens when there is no displacement, or the force is perpendicular to displacement.

• Applications of Work:

• In daily life, examples of work include lifting objects, pulling carts, and pushing furniture.

• In science, work is used to calculate energy transfer, such as in engines, machinery, and physical systems.

Important Points

• Historical Development: The concept of work in physics was introduced by Gaspard-Gustave Coriolis in the early 19th century.

• Conservation of Energy: Work is closely related to energy transfer, and the principle of energy conservation states that energy cannot be created or destroyed, only transferred.

• Work and Power: Power is the rate at which work is done, and its formula is Power = Work/Time. The SI unit of power is the watt (W).

• Work and Kinetic Energy: The work-energy theorem states that the net work done on an object is equal to its change in kinetic energy.

Q21. Answer: (a) Phosphorus

The correct answer is Phosphorus.

Key Points

• Phosphorus is classified as a macronutrient, meaning it is required in large quantities by plants for their growth and development.

• It plays a vital role in energy transfer within the plant, as it is a major component of ATP (adenosine triphosphate), the energy currency of cells.

• Phosphorus is crucial for photosynthesis, respiration, and cell division, all of which are essential processes in plants.

• This nutrient is also indispensable for the formation of DNA and RNA, which are the genetic blueprints of plants.

• Phosphorus is mostly absorbed by plants in the form of phosphate ions ($H_2PO_4^-$ and HPO_4^{2-}) from the soil, and it promotes root development, flowering, and seed production.

Additional Information

• Phosphorus Deficiency in Plants:

• When phosphorus is deficient, plants exhibit symptoms such as stunted growth, delayed maturity, and dark green or purplish leaves.

• Deficiency is more common in soils with low pH (acidic soils), as phosphorus becomes less available in such conditions.

• Other Macronutrients Required by Plants:

• Nitrogen (N): Essential for protein synthesis, chlorophyll production, and overall vegetative growth.

• Potassium (K): Important for enzyme activation, water regulation, and resistance to diseases.

• Calcium (Ca): Plays a key role in cell wall structure and membrane stability.

• Micronutrients:

• Elements like iron, copper, zinc, and manganese are required in smaller quantities but are still critical for plant health.

• For instance, iron is crucial for chlorophyll synthesis, while zinc is involved in enzyme systems and growth regulation.

• Importance of Balanced Fertilization:

• Plants require a balance of macronutrients and micronutrients for optimal growth and productivity.

• Excessive application of one nutrient can lead to deficiencies of others due to nutrient interactions in the soil.

Q22. Answer: (b) H+ ions and OH- ions, respectively

The correct answer is H+ ions and OH- ions, respectively.

Key Points

• Neutralization Reaction: It is a chemical reaction where an acid and a base react to form water and a salt.

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• In a neutralization reaction, the H+ ions from the acid combine with the OH- ions from the base to form water (H2O).
• Acids are substances that donate hydrogen ions (H+), while bases are substances that donate hydroxide ions (OH-).
• The general equation for a neutralization reaction is: Acid + Base → Salt + Water.
• Example: Reaction between HCl (Hydrochloric acid) and NaOH (Sodium hydroxide):
• HCl + NaOH → NaCl + H2O
• Here, H+ ions from HCl react with OH- ions from NaOH to form water.

Additional Information

• Characteristics of Acids:
• Acids have a sour taste.
• They turn blue litmus red.
• They release H+ ions when dissolved in water, making the solution acidic.
• Examples: Hydrochloric acid (HCl), Sulfuric acid (H2SO4), Acetic acid (CH3COOH).
• Characteristics of Bases:
• Bases have a bitter taste and a slippery feel.
• They turn red litmus blue.
• Bases release OH- ions when dissolved in water, making the solution basic.
• Examples: Sodium hydroxide (NaOH), Potassium hydroxide (KOH), Ammonium hydroxide (NH4OH).
• Importance of Neutralization:
• Neutralization reactions are widely used in industries, such as the production of fertilizers, medicines, and soaps.
• It is useful in everyday life, such as treating acid reflux with antacids (bases).
• Neutralization plays a role in maintaining the pH balance in soil for agriculture.
• pH Scale:
• The pH scale measures the acidity or basicity of a solution.
• Acidic solutions have a pH less than 7, while basic solutions have a pH greater than 7. A pH of 7 indicates neutrality.

Important Points

• Indicators: Indicators like litmus paper, phenolphthalein, and methyl orange are used to identify whether a substance is acidic or basic.
• Neutralization reactions are involved in the functioning of buffer solutions, which help maintain the pH of biological systems.
• In environmental science, neutralization is used in acid rain treatment to reduce its harmful effects on soil and water bodies.

Q23. Answer: (a) no definite shape but have a fixed volume

The correct answer is Liquids have no definite shape but have a fixed volume.

Key Points

• Liquids do not have a definite shape: Liquids take the shape of the container they are poured into. This is because the particles in a liquid are not rigidly fixed in place and can move past one another. Hence, this part of the statement is correct.
• Liquids have a fixed volume: Unlike gases, the volume of a liquid does not change significantly with changes in the shape of the container. The particles in a liquid are closely packed but not as tightly as in solids, allowing them to maintain a constant volume. This part of the statement is also correct.
• Intermolecular forces in liquids: The particles in a liquid experience moderate intermolecular forces, which are weaker than those in solids but stronger than those in gases. This allows for fluidity while maintaining a fixed volume.
• Examples of liquids: Common examples include water, oil, and milk. These substances clearly demonstrate the property of taking the shape of their container while maintaining a consistent volume.
• Incorrect options: Options stating that liquids have a definite shape or no fixed volume are incorrect because they contradict the fundamental properties of the liquid state of matter.

Additional Information

• States of Matter: Matter exists in three primary states: solid, liquid, and gas. Liquids are an intermediate state between solids (with fixed shape and volume) and gases (with no fixed shape or volume).
• Kinetic Molecular Theory: The particles in a liquid have more energy than those in a solid but less than those in a gas. This energy allows the particles to overcome some of the intermolecular forces, enabling fluidity.
• Surface Tension: Liquids exhibit surface tension due to cohesive forces between particles. This property allows phenomena like the formation of droplets and the ability of insects to walk on water.
• Viscosity: Viscosity is a measure of a liquid's resistance to flow. Liquids like honey have high viscosity, while water has low viscosity.
• Compressibility: Liquids are nearly incompressible due to the close packing of their particles. This distinguishes them from

gases, which are highly compressible.

Important Points

• Comparison with Solids: While solids have both a definite shape and volume, liquids only have a definite volume and adapt to the shape of their container.

• Comparison with Gases: Gases have neither a definite shape nor a definite volume. They expand to fill their container, unlike liquids which maintain a consistent volume.

• Phase Changes: Liquids can transition to other states of matter through processes like freezing (to solid), evaporation (to gas), and condensation (from gas).

• Applications: Liquids are widely used in industries, households, and laboratories due to their ability to flow and fill containers of various shapes. Examples include their use as solvents, coolants, and in transportation systems like pipelines.

Q24. Answer: (a) nutrition

The correct answer is nutrition.

Key Points

• Nutrition is the biological process by which organisms obtain energy and nutrients from external sources to maintain life processes.

• It involves the intake of food, its digestion, absorption, assimilation, and utilization for growth, repair, and energy production.

• The energy obtained from nutrition is crucial for various metabolic activities such as respiration, movement, reproduction, and maintaining homeostasis.

• Organisms are classified based on their mode of nutrition: autotrophs (self-nourishing, like plants) and heterotrophs (dependent on other organisms, like animals).

• This transfer of energy is essential for survival, as it ensures the organism can perform all vital functions.

Additional Information

• Digestion:

• Digestion is the process of breaking down complex food substances into simpler forms that can be absorbed by the body.

• It primarily takes place in the digestive system, including the stomach and intestines.

• While it is a part of nutrition, digestion alone does not account for the transfer of energy; it is only a preparatory step in the process.

• Respiration:

• Respiration is the metabolic process where organisms convert glucose and oxygen into energy (ATP), carbon dioxide, and water.

• Though respiration is crucial for energy release, it depends on the nutrients obtained through nutrition.

• It highlights the interdependence of nutrition and respiration in life processes.

• Excretion:

• Excretion involves the elimination of metabolic waste products, such as urea or carbon dioxide, from the body.

• While it is essential for maintaining internal balance, it does not contribute to the energy transfer from external sources.

• Autotrophic vs. Heterotrophic Nutrition:

• Autotrophic nutrition involves organisms like plants producing their food through photosynthesis, using sunlight, water, and carbon dioxide.

• Heterotrophic nutrition involves organisms like animals relying on other organisms (plants or animals) for their energy and nutrient requirements.

• Energy Transfer in Ecosystems:

• Energy flows in ecosystems primarily through the food chain, starting with primary producers (plants) and moving to herbivores, carnivores, and decomposers.

• Each level relies on nutrition to harness energy from external sources for survival and reproduction.

Important Points

• The energy obtained from nutrition is measured in calories or joules, which quantify the energy value of food.

• Nutrition is a fundamental characteristic of all living organisms and is one of the key criteria for defining life.

• Deficiency in proper nutrition can lead to malnutrition, impacting overall health and the ability to perform life processes efficiently.

• In humans, a balanced diet is essential to ensure the adequate intake of macronutrients (carbohydrates, proteins, fats) and micronutrients (vitamins, minerals).

• Advancements in nutritional science have led to the development of dietary guidelines and programs to combat malnutrition globally.

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Q25. Answer: (d) Chemical change

The correct answer is Chemical change.

Key Points

• Corrosion is defined as the gradual destruction or deterioration of materials, usually metals, due to a chemical reaction with their environment.

• The most common example of corrosion is the rusting of iron when it reacts with oxygen and moisture in the air to form iron oxide (rust), which is a new chemical compound. This confirms that it is a chemical change.

• During corrosion, there is a transformation of the material's surface into oxides, hydroxides, or other compounds, indicating a change in chemical composition.

• Unlike physical changes, which are reversible and do not involve new substances, corrosion results in the formation of entirely new substances, making it a chemical change.

• Corrosion is often an irreversible process, especially when it leads to significant damage to the material.

Additional Information

• Types of Corrosion:

• Uniform Corrosion: Occurs evenly over the surface, such as the rusting of iron.

• Pitting Corrosion: Formation of small pits or holes on the surface of the metal, often leading to localized damage.

• Galvanic Corrosion: Occurs when two dissimilar metals are in electrical contact in a corrosive environment.

• Stress Corrosion Cracking: Caused by the combined effect of tensile stress and a corrosive environment.

• Prevention Methods:

• Coating: Applying paint, oil, or other protective layers to prevent exposure to moisture and air.

• Galvanization: Coating iron or steel with a layer of zinc to prevent rusting.

• Cathodic Protection: Using a sacrificial anode to prevent corrosion of the main metal.

• Alloying: Mixing metals to improve corrosion resistance, such as stainless steel (iron mixed with chromium and nickel).

• Examples of Corrosion:

• Rusting of iron and steel in the presence of oxygen and water.

• Greenish patina formation on copper due to reaction with carbon dioxide and moisture.

• White powder formation on aluminum due to oxidation.

• Impact of Corrosion:

• Reduces the strength and durability of structures such as bridges, pipelines, and buildings.

• Increases maintenance and replacement costs.

• Can lead to catastrophic failures in industrial equipment and transport systems.

Important Points

• Difference Between Physical and Chemical Changes:

• Physical Change: No new substances are formed; the change is usually reversible (e.g., melting of ice).

• Chemical Change: New substances are formed with different properties, and the change is usually irreversible (e.g., rusting of iron).

• Examples of Chemical Changes:

• Burning of paper or wood (combustion).

• Cooking of food (formation of new compounds).

• Souring of milk (lactic acid formation).

• Digestion of food (chemical breakdown).

Q26. Answer: (b) 126

Shortcut Trick

Since the distance is divided into two equal halves (300 km each), we use the Harmonic Mean formula for Average Speed.

Average Speed = (2 × S1 × S2) ÷ (S1 + S2)

63 = (2 × 42 × S2) ÷ (42 + S2)

63 × (42 + S2) = 84 × S2 => 3 × (42 + S2) = 4 × S2

126 + 3S2 = 4S2 => S2 = 126 km/hr.

Therefore The correct answer is 126 km/hr.

Alternate Method

Given: Total Distance = 600 km, First half (D1) = 300 km, Second half (D2) = 300 km, S1 = 42 km/hr, Average Speed = 63 km/hr.

Formula Used: Total Time = Total Distance ÷ Average Speed | Time = Distance ÷ Speed

=> Total Time (T) = 600 ÷ 63 = 200/21 hours
=> Time for first half (T1) = 300 ÷ 42 = 50/7 hours
=> Time for second half (T2) = T − T1 = (200/21) − (50/7)
=> T2 = (200 − 150) ÷ 21 = 50/21 hours
=> Required Speed (S2) = D2 ÷ T2 = 300 ÷ (50/21)
=> S2 = 300 × (21/50) = 6 × 21 = 126 km/hr
Therefore The correct answer is 126 km/hr.
Additional Information
Average Speed Formula
When distances are equal, Average Speed = (2 × x × y) ÷ (x + y). If distances are different, use Total Distance ÷ Total Time.
Relative Speed
For objects moving in the same direction, relative speed is (S1 − S2). In opposite directions, it is (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.

Q27. Answer: (d) 50%

Shortcut Trick
Discount Percentage = [Free Items ÷ Total Items (Paid + Free)] × 100
Free Items = 2, Total Items = 2 + 2 = 4
Discount % = (2 ÷ 4) × 100 = 50%
Therefore The correct answer is 50%.
Alternate Method
Given: Buy 2 Get 2 Free offer.
Formula Used: Discount % = (Discount ÷ Marked Price) × 100
=> Let the Marked Price (MP) of 1 towel be Rs. 100.
=> Total Marked Price for 4 towels = 4 × 100 = Rs. 400.
=> Customer pays for only 2 towels, so Selling Price (SP) = 2 × 100 = Rs. 200.
=> Total Discount = MP − SP = 400 − 200 = Rs. 200.
=> Discount Percentage = (200 ÷ 400) × 100 = 50%.
Therefore The correct answer is 50%.
Additional Information
Successive Discounts
If two discounts x% and y% are given, total discount = x + y − (xy/100)%.
Marked Price (MP)
The price listed on the label. Discount is always calculated on the Marked Price unless stated otherwise.
Buy X Get Y Free logic
Always remember the denominator in the discount fraction is the total number of items the customer takes home (X + Y).

Q28. Answer: (d) 7

Shortcut Trick
Combined efficiency of A + B = 1/3 and B = 1/21.
Efficiency of A = 1/3 − 1/21 = (7 − 1)/21 = 6/21 = 2/7.
Time taken by A for single work = 7/2 = 3.5 days.
Time taken by A for double work = 3.5 × 2 = 7 days.
Therefore The correct answer is 7 days.
Alternate Method
Given:
Time taken by (A + B) = 3 days
Time taken by B = 21 days
Formula Used:
Total Work = LCM of time taken
Efficiency = Total Work ÷ Time

Person	Days	Total Work	Efficiency
A + B	3	21	7
B	21	1	

Calculations:
=> Efficiency of A = (Efficiency of A + B) − (Efficiency of B)
=> Efficiency of A = 7 − 1 = 6
=> New Total Work (Double) = 21 × 2 = 42 units
=> Time taken by A = New Total Work ÷ Efficiency of A
=> Time taken by A = 42 ÷ 6 = 7 days
Therefore The correct answer is 7 days.
Additional Information
Combined Work Formula
If A takes 'x' days and B takes 'y' days, together they take (x × y) ÷ (x + y) days.
Work and Efficiency Relationship
Efficiency is inversely proportional to the time taken to complete a task. E1 × T1 = E2 × T2.
Work & Wages
Wages are distributed in the ratio of the work done or the ratio of efficiencies when time is constant.

Q29. Answer: (a) 72

Shortcut Trick
Total distance = Train length + Platform length = L + 3L = 4L.
Total distance = 4 × 435 = 1740 m.
Speed (m/s) = 1740 ÷ 87 = 20 m/s.
Speed (km/hr) = 20 × (18/5) = 72 km/hr.
Therefore The correct answer is 72 km/hr.
Alternate Method
Given: Length of train = 435 m, Time taken = 87 seconds.
Formula: Speed = Total Distance ÷ Time; Speed (km/hr) = Speed (m/s) × (18/5).
=> Length of Platform = 3 × 435 = 1305 m
=> Total Distance = 435 + 1305 = 1740 m
=> Speed (m/s) = 1740 ÷ 87 = 20 m/s
=> Speed (km/hr) = 20 × (18/5)
=> Speed = 4 × 18 = 72 km/hr
Therefore The correct answer is 72 km/hr.
Additional Information
Unit Conversion
To convert m/s to km/hr, multiply by 18/5. To convert km/hr to m/s, multiply by 5/18.
Crossing Stationary Objects
When a train crosses a platform, bridge, or another stationary train, the total distance covered is the sum of their lengths.
Relative Speed
For two bodies moving in the same direction, relative speed is (u − v). For opposite directions, it is (u + v).

Q30. Answer: (d) 54

Shortcut Trick
Assume a base value (Assumed Mean) as 50.
Find deviations from 50: +29, −8, −3, +27, −1, +25, +6, −24, −15.
Net deviation = (29 + 27 + 25 + 6) − (8 + 3 + 1 + 24 + 15) = 87 − 51 = 36.
Mean deviation = 36 ÷ 9 = 4.
Actual Mean = Assumed Mean + Mean deviation = 50 + 4 = 54.
Therefore The correct answer is 54.
Alternate Method

Given: Observations are 79, 42, 47, 77, 49, 75, 56, 26, 35.
Formula Used: Arithmetic Mean (x) = (∑x_i) ÷ n
=> Total sum of observations = 79 + 42 + 47 + 77 + 49 + 75 + 56 + 26 + 35
=> Sum = 486
=> Total number of observations (n) = 9
=> Arithmetic Mean = 486 ÷ 9
=> Arithmetic Mean = 54
Therefore The correct answer is 54.
Additional Information
Arithmetic Mean Properties
The sum of the deviations of all observations from their arithmetic mean is always zero (∑(x_i − x) = 0).
Relation between Mean, Median and Mode
For a moderately skewed distribution: Mode = 3 × Median − 2 × Mean.
Combined Mean
If two groups have sizes n1, n2 and means x1, x2, the Combined Mean = (n1x1 + n2x2) ÷ (n1 + n2).

Q31. Answer: (a) 25%

Shortcut Trick
Profit % = [(Quantity Left ÷ Quantity Sold) × 100]
Here, 1 litre = 1000 ml. Quantity sold for the same cost is 800 ml.
Profit % = [(1000 − 800) ÷ 800] × 100 = (200 ÷ 800) × 100
Profit % = 1/4 × 100 = 25%
Therefore The correct answer is 25%.
Alternate Method
Given: CP of 1000 ml = SP of 800 ml
Formula Used: Profit % = [(SP − CP) ÷ CP] × 100
=> Let CP of 1 ml be Rs. 1.
=> CP of 1000 ml = Rs. 1000.
=> SP of 800 ml = Rs. 1000 (As per question).
=> SP of 1 ml = 1000 ÷ 800 = Rs. 1.25.
=> Profit = SP − CP = 1.25 − 1 = Rs. 0.25 per ml.
=> Profit % = (0.25 ÷ 1) × 100 = 25%.
Therefore The correct answer is 25%.
Additional Information
Dishonest Dealer Concept
When a dealer sells at CP but uses less weight, Profit % = [Error ÷ (True Value − Error)] × 100.
Successive Profit/Loss
If a dealer marks up price by x% and gives y% discount, Net Profit % = x − y − (xy/100).
CP and SP Relation
If CP of x articles = SP of y articles, then Profit/Loss % = [(x − y) ÷ y] × 100.

Q32. Answer: (d) Rs. 2,08,278

Shortcut Trick
Total Marked Price = 290 × 1050 = Rs. 3,04,500
Effective Discount Multiplier = 0.96 × 0.75 × 0.95
Final Payment = 3,04,500 × (24/25) × (3/4) × (19/20)
Final Payment = 3045 × 18 × 19 ÷ 5 = 609 × 342 = Rs. 2,08,278
Therefore The correct answer is Rs. 2,08,278.
Alternate Method
Given:
Number of microwaves = 290
Price per microwave = Rs. 1,050

Successive discounts = 4%, 25%, and 5% (for card payment)
Calculations:
=> Total Marked Price = 290 × 1050 = Rs. 3,04,500
=> Price after 1^(st) discount (4%) = 3,04,500 × (96/100) = Rs. 2,92,320
=> Price after 2^(nd) discount (25%) = 2,92,320 × (75/100) = Rs. 2,19,240
=> Final price after card discount (5%) = 2,19,240 × (95/100)
=> Final Payment = 2,19,240 × 0.95 = Rs. 2,08,278
Therefore The correct answer is Rs. 2,08,278.
Additional Information
Successive Discount Formula
For two successive discounts of a% and b%, the single equivalent discount is (a + b − ab/100)%.
Marked Price and Selling Price
Selling Price = Marked Price × (100 − d1)/100 × (100 − d2)/100 ... where d is the discount percentage.
Effective Multiplier Method
Final Value = Initial Value × mf1 × mf2, where mf is the multiplying factor (e.g., 0.95 for a 5% discount).

Q33. Answer: (b) 72

Shortcut Trick
Ratio of ages (Teresa : Diana : Homi) = 1 : 3 : 6.
Total age parts = 1 + 3 + 6 = 10 parts.
Average age parts = 10/3 parts.
Difference between Diana and Average = 10/3 − 3 = 1/3 part.
Given 1/3 part = 4 years => 1 part = 12 years.
Homi's age = 6 parts = 6 × 12 = 72 years.
Therefore The correct answer is 72 years.
Alternate Method
Given:
Diana is 3 times as old as Teresa.
Homi is 2 times as old as Diana.
Diana's age = Average age − 4.
Calculations:
Let Teresa's age = x years.
=> Diana's age = 3x years.
=> Homi's age = 2 × 3x = 6x years.
=> Total age = x + 3x + 6x = 10x years.
=> Average age = 10x/3 years.
According to the question:
=> 3x = (10x / 3) − 4
=> 3x + 4 = 10x / 3
=> 3 × (3x + 4) = 10x
=> 9x + 12 = 10x
=> 10x − 9x = 12
=> x = 12
=> Homi's age = 6x = 6 × 12 = 72 years.
Therefore The correct answer is 72 years.
Additional Information
Average Formula
Average = (Sum of all observations) ÷ (Total number of observations).
Ratio of Ages
If A is n times as old as B, the ratio of their ages A : B is n : 1.
Linear Equations in Ages
Problems involving comparisons between multiple people are best solved by expressing all ages in terms of a single variable

(usually the youngest person).

Q34. Answer: (d) Rs. 1,078

Shortcut Trick

Total Surface Area (TSA) of a cylinder = $2\pi r(h + r)$

Given: radius (r) = 2.8 ÷ 2 = 1.4 m and height (h) = 3.5 m

TSA = 2 × (22/7) × 1.4 × (3.5 + 1.4) = 8.8 × 4.9 = 43.12 m^2

Total Cost = Area × Rate = 43.12 × 25 = Rs. 1078

Therefore The correct answer is Rs. 1078.

Alternate Method

Given:

Diameter (d) = 2.8 m

Height (h) = 3.5 m

Cost of painting = Rs. 25/m^2

Formula Used:

Radius (r) = d ÷ 2

Total Surface Area of Cylinder = $2\pi rh + 2\pi r^2 = 2\pi r(r + h)$

Calculations:

=> Radius (r) = 2.8 ÷ 2 = 1.4 m

=> Total Surface Area (TSA) = 2 × (22/7) × 1.4 × (1.4 + 3.5)

=> TSA = 2 × 22 × 0.2 × 4.9

=> TSA = 8.8 × 4.9

=> TSA = 43.12 m^2

=> Total Cost = Total Surface Area × Rate per m^2

=> Total Cost = 43.12 × 25

=> Total Cost = Rs. 1078

Therefore The correct answer is Rs. 1078.

Additional Information

Volume of Cylinder

The capacity of the tank is calculated using the formula $V = \pi r^2 h$.

Curved Surface Area (CSA)

If only the side wall is painted, use the formula CSA = $2\pi rh$.

Conversion Factor

Always ensure all dimensions (radius and height) are in the same unit (meters) before calculating area.

Q35. Answer: (c) 0.75

Shortcut Trick

The given expression follows the algebraic identity $(a^3 - b^3) / (a^2 + ab + b^2) = (a - b)$.

Identify a = 0.85 and b = 0.1.

Since ab = 0.85 × 0.1 = 0.085 and $b^2 = (0.1)^2 = 0.01$, the denominator matches $a^2 + ab + b^2$.

Therefore, the value is simply a − b = 0.85 − 0.1 = 0.75.

Therefore The correct answer is 0.75.

Alternate Method

Given: $((0.85)^3 - (0.1)^3) / ((0.85)^2 + 0.085 + 0.01)$

Formula Used: $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

=> Let a = 0.85 and b = 0.1.

=> Calculate the denominator components: $a^2 = (0.85)^2$, ab = 0.85 × 0.1 = 0.085, and $b^2 = (0.1)^2 = 0.01$.

=> The denominator is $a^2 + ab + b^2 = (0.85)^2 + 0.085 + 0.01$.

=> Substitute the identity into the numerator: $(0.85 - 0.1)((0.85)^2 + (0.85 \times 0.1) + (0.1)^2)$.

=> Expression = $[(0.85 - 0.1) \times ((0.85)^2 + 0.085 + 0.01)] / ((0.85)^2 + 0.085 + 0.01)$

=> By canceling common terms, Expression = 0.85 − 0.1.

=> Expression = 0.75.

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Therefore The correct answer is 0.75.

Additional Information

Sum of Cubes Identity

The identity for the sum of cubes is $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$.

Difference of Squares

The most common algebraic identity is $a^2 - b^2 = (a - b)(a + b)$.

Cubic Expansion of a Binomial

The expansion of $(a - b)^3$ is $a^3 - 3a^2b + 3ab^2 - b^3$.

Square of a Binomial

The square of a difference is $(a - b)^2 = a^2 - 2ab + b^2$.

Q36. Answer: (a) 20

Shortcut Trick

Net deviation from the Average (14) must be zero.

Deviations: (−10) + (−2) + (−6) + (−4) + 2 + 0 + (−5) + 6 + 4 + 8 + 1 = −6.

To make the net deviation zero, K must have a deviation of +6.

Value of K = Average + Deviation => 14 + 6 = 20.

Therefore The correct answer is 20.

Alternate Method

Given: Numbers are 4, 12, 8, 10, 16, 14, 9, 20, 18, 22, 15 and K. Total count (n) = 12. Average = 14.

Formula: Average = Sum of all observations ÷ Total number of observations

=> Sum of 11 numbers = 4 + 12 + 8 + 10 + 16 + 14 + 9 + 20 + 18 + 22 + 15 = 148

=> Total Sum including K = 148 + K

=> Average = (148 + K) ÷ 12

=> 14 = (148 + K) ÷ 12

=> 14 × 12 = 148 + K

=> 168 = 148 + K

=> K = 168 − 148

=> K = 20

Therefore The correct answer is 20.

Additional Information

Net Deviation Rule

The algebraic sum of deviations of a set of observations from their arithmetic mean is always zero. $\sum(x_i - \text{mean}) = 0$.

Effect of Change in Observations

If each observation is increased, decreased, multiplied, or divided by a constant 'k', the Average also changes by the same constant 'k'.

Average of Consecutive Numbers

For an Arithmetic Progression (AP), Average = (First Term + Last Term) ÷ 2.

Q37. Answer: (b) 63

Shortcut Trick

If the sum of three variables is zero, i.e., x + y + z = 0, then the sum of their cubes is $x^3 + y^3 + z^3 = 3xyz$.

Given that xyz = 21.

Substitute the value: 3 × 21 = 63.

Therefore The correct answer is 63.

Alternate Method

Given: x + y + z = 0 and xyz = 21

Formula used: $x^3 + y^3 + z^3 - 3xyz = (x + y + z)(x^2 + y^2 + z^2 - xy - yz - zx)$

=> $x^3 + y^3 + z^3 - 3(21) = (0) \times (x^2 + y^2 + z^2 - xy - yz - zx)$

=> $x^3 + y^3 + z^3 - 63 = 0$

=> $x^3 + y^3 + z^3 = 63$

Therefore The correct answer is 63.

Additional Information

Special Algebraic Case

The condition $x + y + z = 0$ leads to $x^3 + y^3 + z^3 = 3xyz$, which is frequently used in competitive exams to simplify cubic expressions.

Alternate Identity Form

The expression $x^2 + y^2 + z^2 - xy - yz - zx$ can also be written as $\frac{1}{2}[(x-y)^2 + (y-z)^2 + (z-x)^2]$.

Sum of Squares

To find missing components, remember $(x + y + z)^2 = x^2 + y^2 + z^2 + 2(xy + yz + zx)$.

Q38. Answer: (b) Rs. 45,235

Shortcut Trick

Monthly Salary = 100%

Savings = 17%

Expenditure = (100 − 17)% = 83%

Monthly Expenditure = 54500 × 83/100 = 545 × 83

Therefore The correct answer is Rs. 45,235.

Alternate Method

Given:

Monthly Income (I) = Rs. 54,500

Savings Percentage = 17%

Formula:

Expenditure = Income − Savings

=> Monthly Savings = 17% of 54,500

=> Monthly Savings = (17/100) × 54,500 = 17 × 545 = Rs. 9,265

=> Monthly Expenditure = 54,500 − 9,265

=> Monthly Expenditure = Rs. 45,235

Therefore The correct answer is Rs. 45,235.

Additional Information

Percentage Change

Percentage change = (Difference / Original Value) × 100. Useful for comparing salary hikes or expense reductions.

Income-Expenditure Relation

Income = Savings + Expenditure. If two variables are known, the third can be calculated directly.

Base Change Property

If expenditure increases by x%, the new expenditure = Original × (100 + x)/100.

Q39. Answer: (b) 1620

Shortcut Trick

Time per page = 40 ÷ 2 = 20 minutes.

Total time for 81 pages = 81 × 20 minutes.

Total time = 1620 minutes.

Therefore The correct answer is 1620 minutes.

Alternate Method

Given:

Pages (W1) = 2, Time (T1) = 40 minutes

Pages (W2) = 81, Time (T2) = ?

Formula Used:

Work and Time relation: T1/W1 = T2/W2

Calculations:

=> 40 / 2 = T2 / 81

=> 20 = T2 / 81

=> T2 = 20 × 81

=> T2 = 1620 minutes

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Therefore The correct answer is 1620 minutes.
Additional Information
Unitary Method
Finding the value of a single unit (1 page) first and then multiplying by the required number of units.
Direct Proportion
When one quantity increases, the other increases in the same ratio. Here, pages prop. to time.
Work, Manpower and Time Formula
M1D1H1/W1 = M2D2H2/W2 where W is the work done.

Q40. Answer: (a) 130 : 57

Shortcut Trick
Given Blue : Yellow = 13 : 19 and Orange : Blue = 10 : 3.
To find Orange : Yellow, multiply the ratios: (Orange/Blue) × (Blue/Yellow).
=> (10 / 3) × (13 / 19) = 130 / 57.
Therefore The correct answer is 130 : 57.
Alternate Method
Given:
Ratio of Blue (B) : Yellow (Y) = 13 : 19
Ratio of Orange (O) : Blue (B) = 10 : 3
Calculations:
To combine the ratios, we must equate the value of Blue in both ratios.
LCM of 13 and 3 = 39.
=> B : Y = (13 × 3) : (19 × 3) = 39 : 57
=> O : B = (10 × 13) : (3 × 13) = 130 : 39
=> Now, O : B : Y = 130 : 39 : 57
=> Orange : Yellow = 130 : 57
Therefore The correct answer is 130 : 57.
Additional Information
Compound Ratio
The compound ratio of two ratios a:b and c:d is (a×c) : (b×d). This is used when linking multiple quantities.
Ratio Balancing
To find A:C given A:B and B:C, multiply or divide terms to make the common term (B) numerically equal in both ratios.

Q41. Answer: (d) 40

Shortcut Trick
Identify that 2024 is a leap year, so February has 29 days.
Number of days from 21 February 2024 to 22 April 2024:
February = 8 days, March = 31 days, April = 22 days => Total = 61 days.
Time (T) = 61 ÷ 366 = 1/6 year.
Simple Interest (SI) = (P × R × T) ÷ 100 = (4000 × 6 × 1/6) ÷ 100 = Rs. 40.
Therefore The correct answer is Rs. 40.
Alternate Method
Given:
Principal (P) = Rs. 4,000
Rate of Interest (R) = 6% per annum
Time Period = From 21 February 2024 to 22 April 2024
Formula Used:
Simple Interest (SI) = (P × R × T) ÷ 100
Where T is the time in years.
Calculations:
Since 2024 is divisible by 4, it is a leap year. Therefore, February has 29 days.
Let us calculate the number of days in the given period:

=> Days in February (excluding 21st Feb) = 29 − 21 = 8 days

=> Days in March = 31 days

=> Days in April = 22 days

=> Total Days = 8 + 31 + 22 = 61 days

Convert days into years (for a leap year of 366 days):

=> Time (T) = 61 ÷ 366 years = 1/6 year

Now, calculate the Simple Interest:

=> SI = (4000 × 6 × (1/6)) ÷ 100

=> SI = (4000 × 1) ÷ 100

=> SI = Rs. 40

Why other options are incorrect:

• Option (1) - Rs. 41: This value is obtained if the leap year is not considered or if the number of days is miscalculated as 62.5 days.

• Option (2) - Rs. 38: This value is incorrect and does not match the standard calculation of 61 days in a leap year.

• Option (3) - Rs. 39: This value is obtained if a non-leap year (365 days) is used, which gives approximately Rs. 39.89, but 2024 is strictly a leap year.

Therefore The correct answer is Rs. 40.

Additional Information

Leap Year Rule

A year is a leap year if it is divisible by 4, except for century years which must be divisible by 400. A leap year has 366 days instead of 365 days, with February having 29 days.

Simple Interest Formula

Simple Interest (SI) = (P × R × T) ÷ 100, where P is Principal, R is Rate of Interest per annum, and T is Time in years.

Day Counting Convention

In interest calculations, the day on which money is deposited is usually excluded, while the day on which money is withdrawn is included.

Q42. Answer: (b) 12

Shortcut Trick

When diagonals are perpendicular, the Area of the quadrilateral = (1 ÷ 2) × d1 × d2.

Given Area = 48 cm² and d1 = 8 cm.

48 = (1 ÷ 2) × 8 × d2

48 = 4 × d2

d2 = 48 ÷ 4 = 12 cm.

Therefore The correct answer is 12 cm.

Alternate Method

Given:

Length of one diagonal (d1) = 8 cm

Area of the quadrilateral = 48 cm²

Since the diagonals are perpendicular bisectors of each other, the quadrilateral is a Rhombus.

Formula Used:

Area of a Rhombus = (1 ÷ 2) × Diagonal1 × Diagonal2

Calculations:

=> Area = (1 ÷ 2) × d1 × d2

=> 48 = (1 ÷ 2) × 8 × d2

=> 48 = 4 × d2

=> d2 = 48 ÷ 4

=> d2 = 12 cm

Therefore The correct answer is 12 cm.

Additional Information

Rhombus Identification

A quadrilateral is a rhombus if its diagonals bisect each other at 90°. If the diagonals are also equal, the shape becomes a square.

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Side and Diagonal Relationship

For a rhombus with side a, the relation is $4a^2 = d1^2 + d2^2$. This is derived from applying Pythagoras Theorem in the four small right-angled triangles.

Perimeter of a Rhombus

Since all sides of a rhombus are equal, the Perimeter = 4 × side.

Q43. Answer: (d) tan θ

Shortcut Trick

Put θ = 45°.

Value = (1 − cos 90°) ÷ sin 90° = (1 − 0) ÷ 1 = 1.

Check options for θ = 45°: tan 45° = 1.

Therefore The correct answer is tan θ.

Alternate Method

Given: Expression = (1 − cos 2θ) / sin 2θ

Formula Used: $1 - \cos 2\theta = 2 \sin^2\theta$ and $\sin 2\theta = 2 \sin \theta \cos \theta$

=> Expression = $(2 \sin^2\theta) / (2 \sin \theta \cos \theta)$

=> Expression = sin θ / cos θ

=> Expression = tan θ

Therefore The correct answer is tan θ.

Additional Information

Double Angle Identities

$\cos 2\theta = \cos^2\theta - \sin^2\theta = 1 - 2 \sin^2\theta = 2 \cos^2\theta - 1$.

Half Angle Variation

$(1 + \cos 2\theta) / \sin 2\theta = (2 \cos^2\theta) / (2 \sin \theta \cos \theta) = \cot \theta$.

Q44. Answer: (d) 24

Shortcut Trick

Ratio of Oranges to Apples = 2 : 1

Total ratio parts = 2 + 1 = 3 units

3 units = 36 fruits

1 unit = 12 fruits

Number of Oranges = 2 units = 2 × 12 = 24

Therefore The correct answer is 24 oranges.

Alternate Method

Given:

Total number of fruits = 36

Condition: Oranges = 2 × Apples

Calculations:

Let the number of Apples be x.

Then, the number of Oranges = 2x.

=> x + 2x = 36

=> 3x = 36

=> x = 36 ÷ 3

=> x = 12

=> Number of Oranges = 2 × 12 = 24

Therefore The correct answer is 24 oranges.

Additional Information

Ratio and Proportion

If a total quantity T is divided in the ratio a:b, the first part is (a/(a+b)) × T and the second part is (b/(a+b)) × T.

Linear Equations

A linear equation in one variable is used when one quantity is expressed in terms of another to find the absolute values from a given sum.

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Q45. Answer: (a) 9

Given:

((3^4 × 9^(-2))/(27^(-1) × 3^(-3)))^(1/3)

Formula used:

(a^m)^n = a^(m × n)

a^m × a^n = a^(m + n)

a^m / a^n = a^(m - n)

Calculations:

=> ((3^4 × (3^2)^(-2)) / ((3^3)^(-1) × 3^(-3)))^(1/3)

=> ((3^4 × 3^(-4)) / (3^(-3) × 3^(-3)))^(1/3)

=> (3^(4 - 4) / 3^(-3 - 3))^(1/3)

=> (3^0 / 3^(-6))^(1/3)

=> (3^(0 - (-6)))^(1/3)

=> (3^6)^(1/3)

=> 3^2 = 9

Therefore The correct answer is option (1).

Q46. Answer: (d) 78

Shortcut Trick

For any point P inside a rectangle ABCD, the British Flag Theorem states:

PA^2 + PC^2 = PB^2 + PD^2

57^2 + 54^2 = 9^2 + PD^2

3249 + 2916 = 81 + PD^2

6165 − 81 = PD^2 => PD = √6084 = 78 cm

Therefore The correct answer is 78 cm.

Alternate Method

Given: PA = 57 cm, PB = 9 cm, PC = 54 cm.

Formula Used: PA^2 + PC^2 = PB^2 + PD^2 (British Flag Theorem)

A

B

C

D

P

57 cm

9 cm

54 cm

Q47. Answer: (d) 7 : 23

Shortcut Trick

Expenditure Ratio = (Price Ratio × Quantity Ratio)

Price (L : S) = 4 : 14 => 2 : 7

Quantity (L : S) = 23 : 2

Expenditure (L : S) = (2 × 23) : (7 × 2) = 46 : 14 = 23 : 7

Required Ratio (Strawberry : Lemon) = 7 : 23

Therefore The correct answer is 7 : 23.

Alternate Method

Given:

Ratio of Price per unit (Lemon : Strawberry) = 4 : 14

Ratio of Quantity consumed (Lemon : Strawberry) = 23 : 2

Formula Used:

Total Expenditure = Price per unit × Quantity consumed

Calculations:

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=> Expenditure on Lemon candy (E_L) = 4 × 23 = 92

=> Expenditure on Strawberry candy (E_S) = 14 × 2 = 28

=> Ratio of Expenditure (Strawberry : Lemon) = E_S : E_L

=> Ratio = 28 : 92

=> Ratio = (28 ÷ 4) : (92 ÷ 4)

=> Ratio = 7 : 23

Therefore The correct answer is 7 : 23.

Additional Information

Compound Ratio

When two or more ratios are multiplied term by term (antecedent with antecedent and consequent with consequent), the resulting ratio is called a compound ratio.

Inverse Proportion

If expenditure remains constant, the price per unit is inversely proportional to the quantity consumed (Price prop. to 1/Quantity).

Ratio of Expenditure

Ratio of expenditure (E1:E2) = (P1 × Q1) : (P2 × Q2), where P is price and Q is quantity.

Q48. Answer: (d) 2

Shortcut Trick

Using the work equivalence formula: (M1 × D1) ÷ W1 = (M2 × D2) ÷ W2

Substitute the values directly: (3 × 4) ÷ 39 = (M2 × 12) ÷ 78

Simplify: 12 ÷ 39 = (12 × M2) ÷ 78

M2 = (12 × 78) ÷ (39 × 12) = 2 men

Therefore The correct answer is 2 men.

Alternate Method

Given:

Initial number of men (M1) = 3

Initial depth of well (W1) = 39 feet

Initial number of days (D1) = 4 days

New depth of well (W2) = 78 feet

New number of days (D2) = 12 days

Formula Used:

The relationship between men, days, and work done is given by:

(M1 × D1) ÷ W1 = (M2 × D2) ÷ W2

Calculations:

=> (3 × 4) ÷ 39 = (M2 × 12) ÷ 78

=> 12 ÷ 39 = (12 × M2) ÷ 78

=> M2 = (12 × 78) ÷ (39 × 12)

=> M2 = 78 ÷ 39

=> M2 = 2

Therefore The correct answer is 2 men.

Additional Information

Chain Rule in Work and Time

When work is directly proportional to the number of men and days, the ratio (M × D) ÷ W remains constant for any given scenario.

Extended Chain Rule formula

If working hours (H) and efficiency (E) are also given, the equation becomes: (M1 × D1 × H1 × E1) ÷ W1 = (M2 × D2 × H2 × E2) ÷ W2.

Q49. Answer: (a) 76.5

Given:

20% of x + 102 = x

Formula used:

Required value = (Given value / Given percentage) × Required percentage

Calculation:

=> x - 20% of x = 102
=> 80% of x = 102
=> 60% of x = (102 / 80) × 60
=> 60% of x = (102 / 4) × 3
=> 60% of x = 25.5 × 3
=> 60% of x = 76.5
Therefore The correct answer is option (1).

Q50. Answer: (c) 78,560 votes

Shortcut Trick
Total votes = 3,72,000
Leena's share = 48% of 3,72,000
Leena's votes = 0.48 × 3,72,000 = 1,78,560
Votes above 1,00,000 = 1,78,560 − 1,00,000 = 78,560
Therefore The correct answer is 78,560 votes.
Alternate Method
Given:
Total votes = 3,72,000
Leena's percentage = 48%
Formula Used:
Value = (Percentage ÷ 100) × Total
Calculations:
=> Leena's total votes = (48 ÷ 100) × 3,72,000
=> Leena's total votes = 48 × 3,720
=> Leena's total votes = 1,78,560
=> Votes above 1,00,000 = 1,78,560 − 1,00,000
=> Votes above 1,00,000 = 78,560
Therefore The correct answer is 78,560 votes.
Additional Information
Percentage Change
Percentage change is calculated as (New Value − Old Value) ÷ Old Value × 100.
Voting Arithmetic
In a two-way poll, the sum of percentage votes of all candidates equals 100% if there are no invalid votes.
Base Value Concept
To find excess over a value X, calculate Total Value − X.

Q51. Answer: (b) 33rd

Given:
Total students = 50
Neetu is 12th from the right.
Step 1: Find Neetu's position from the left
Position from left = Total − Position from right + 1 = 50 − 12 + 1 = 39
So, Neetu is at the 39th position from the left.
Step 2: Kaden is 6th to the left of Neetu
Kaden's position = 39 − 6 = 33
Therefore, Kaden is at the 33rd position from the left.
Hence, the correct answer is Option (2) 33rd.

Q52. Answer: (a) 3

Given Sequence:
(Left) 6 3 1 1 2 3 2 8 5 7 6 1 3 7 2 6 9 6 9 2 4 6 2 8 6 3 1 (Right)
There are 3 such instances, (1 2 3), (7 6 1), (9 6 9) where even numbers are both immediately preceded and followed by an odd number.

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Therefore The correct answer is Option (1).

Q53. Answer: (d) Three

Given Sequence:

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

There are 3 such instances, (2 7 7), (8 7 9), (8 9 9) where an odd number is immediately preceded by an even number and also immediately followed by an odd digit.

Therefore The correct answer is Option (4).

Q54. Answer: (a) One

Given Numbers:

567, 862, 426, 326, 749

Rule:

Add 2 to the second digit of each number and check whether the new second digit is exactly divisible by the third digit.

1) 567

Second digit = 6 → 6 + 2 = 8

Third digit = 7

8 ÷ 7 → Not divisible

2) 862

Second digit = 6 → 6 + 2 = 8

Third digit = 2

8 ÷ 2 = 4 → Divisible

3) 426

Second digit = 2 → 2 + 2 = 4

Third digit = 6

4 ÷ 6 → Not divisible

4) 326

Second digit = 2 → 2 + 2 = 4

Third digit = 6

4 ÷ 6 → Not divisible

5) 749

Second digit = 4 → 4 + 2 = 6

Third digit = 9

6 ÷ 9 → Not divisible

Total numbers satisfying the condition = 1

Hence, the correct answer is 1.

Q55. Answer: (a) 785

BODMAS Table:

Given equation: 113 ÷ 6 + 98 × 2 - 156 = ?

Now, if '+' and '-' and '×' and '÷' are interchanged, then:

=> 113 × 6 - 98 ÷ 2 + 156 = ?

=> 678 - 49 + 156 = ?

=> 678 - 49 + 156 = ?

=> 629 + 156 = ?

=> 785.

Hence, the correct answer is "Option 1".

Q56. Answer: (c) (17, 52, 9)

The logic followed here is as:

(First number × 2) + (Third number × 2) = Second number.

For, (34, 70, 1)

= (34 × 2) + (1 × 2) = 70

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= 68 + 2 = 70
= 70 = 70
For, (21, 92, 25)
= (21 × 2) + (25 × 2) = 92
= 42 + 50 = 92
= 92 = 92
Similarly,
Option 3) (17, 52, 9)
= (17 × 2) + (9 × 2) = 52
= 34 + 18 = 52
= 52 = 52
Follows the same logic.
Therefore The correct answer is Option (3).

Q57. Answer: (d) Mother's brother

Family Chart:
Decoding the symbols:

Symbol	Meaning
A + B	A is the sister of B
A @ B	A is the brother of B
A − B	A is the wife of B
A # B	A is the father of B

Given expression:
O @ P + T − G # V
So O is the brother of V's mother.
Therefore, O is V's Mother's brother.
Hence, the correct answer is Option (4).

Q58. Answer: (b) EXIT - XEIT - EITX

Set 1: WEST - EWST - WSTE
Set 2: TOPS - OTPS - TPSO
Similarly,
Option (2): EXIT - XEIT - EITX
Hence, the correct answer is "Option 2".

Q59. Answer: (b) 221

The pattern followed here is:
The difference between the number is increasing as multiple of 4.
Therefore The correct answer is Option (2).

Q60. Answer: (b) 8

Given Number:
4876231
Step 1: Arrange the digits in ascending order : 1 2 3 4 6 7 8
New number formed: 1234678
Step 2: Identify required digits
Second from the left → 2
Third from the right → 6
Step 3: Find the sum
2 + 6 = 8
Hence, the correct answer is Option (2).

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Q61. Answer: (b) NFG 32

Pattern followed here is,

Hence, the correct answer is “Option 2”.

Q62. Answer: (d) RJM

The pattern followed in the series is:

Therefore The correct answer is Option (4).

Q63. Answer: (b) PJ-SM-VX

Given triads:

LF – OI – RT

NH – QK – TV

Similarly,

Option (2): PJ – SM – VX

This follows the same pattern.

Hence, the correct answer is "Option (2)".

Q64. Answer: (d) 6

Given:

PEARL → 18723

PAYER → 82736

Therefore:

Y → 6

Hence, the correct answer is Option (4) 6.

Q65. Answer: (b) Three

Given Information:

=> Only one person sits between S and T when counted from the left of T.

=> R sits third to the right of A. U sits third to the left of C.

=> U sits third to the left of C.

=> R sits to the immediate right of U.

=> B is not an immediate neighbour of U.

Thus, 3 peoples are sitting between B and T when counted from the right of B from the above given arrangement.

Hence, the correct answer is "Option 2".

Q66. Answer: (d) 0

Given Equation: 75 B 4 D 20 A 40 C 8 = ?

BODMAS Rule:

Decoding the given information:

Alphabet	A	B	C	D
Meaning	•	−	÷	×

Now replacing the signs from left to right using BODMAS Rule, we get:

=> 75 − 4 × 20 + 40 ÷ 8

= 75 − 80 + 5

= 75 - 80 + 5

= -5 + 5

= 0

Hence, the correct option is "Option 4".

Q67. Answer: (b) UWR

Check alphabetical positions:

(1) STP

S + 1 = T

T - 4 = P
(2) UWR
U + 2 = W
W - 5 = R
(3) QRN
Q + 1 = R
R - 4 = N
(4) WXT
W + 1 = X
X - 4 = T
Hence, the correct answer is “Option 2”.

Q68. Answer: (a) Only conclusion (II) follows.

Statements:
All lotions are creams.
All creams are soaps.
No cream is a facewash.
The least possible Venn diagram for the given statement is:
Check Conclusions:
(I) No soap is a facewash
We only know that creams are not facewash. But soaps may contain items other than creams. So soaps could still be facewash.
Therefore, this does not follow.
(II) No lotion is a facewash
All lotions are creams and no cream is a facewash.
So lotions also cannot be facewash.
This follows.
Hence, only Conclusion II follows.

Q69. Answer: (a) 249

The pattern followed here is:
Therefore The correct answer is Option (1).

Q70. Answer: (a) 6 km to the east

As per the given information:
=> Ronak starts from Point A and drives 6 km towards the south.
=> He then takes a left turn, drives 5 km, turns left and drives 14 km.
=> He then takes a left turn and drives 11 km.
=> He takes a final left turn, drives 8 km and stops at Point P.
Point P is 6 km to the West of Point A.
Thus, to reach the starting point A from point P, Ronak must drive 6 km towards East.
Hence, the correct answer is "Option 1".

Q71. Answer: (a) Only conclusion (I) follows.

Statements:
All geysers are lights.
No light is an oven.
The least possible Venn diagram for the given statement is:
Check Conclusions:
(I) No geyser is an oven
All geysers are lights and no light is an oven. Therefore, geysers cannot be ovens.
This follows.
(II) Some ovens are lights
The statement clearly says no light is an oven.

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So ovens cannot be lights.
This does not follow.
Hence, only conclusion (I) follows.

Q72. Answer: (c) One

Given Sequence:
(Left) 5 2 7 5 4 7 9 8 5 3 6 2 1 5 7 4 9 7 2 5 2 4 3 7 8 4 7 (Right)
There is only one instance (2 5 2), where an odd digit is both immediately preceded and followed by an even digit.
Therefore The correct answer is Option (3).

Q73. Answer: (a) 9

Given:
house → 35791
hose → 3751
Therefore:
u → 9
Hence, the correct answer is Option (1).

Q74. Answer: (c) 5

As per the given information:
=> Seven people, A, B, C, D, E, F, and G, are sitting in a row, facing the north.
=> Only two people sit to the left of A.
=> Only three people sit between A and G.
=> D sits second to the right of A.
=> Only two people sit between D and C.
=> E sits at some place to the right of F but at some place to the left of B.
Here, 5 Peoples (A, E, D, B, G) are sitting to the right of C.
Hence, the correct answer is "Option 3".

Q75. Answer: (d) 5 km to the East

As per given information:
=> Mr. Zzz starts from Point A and drives 7 km towards the South.
=> He then takes a left turn, drives 21 km, turns left and drives 16 km.
=> He then takes a left turn and drives 26 km.
=> He takes a final left turn, drives 9 km and stops at Point P.
Point P is 5 km to the West of point A.
Thus, to reach the starting point A from point P, Mr. Z must drive 5 km towards East.
Hence, the correct answer is "Option 4".

Q76. Answer: (c) C and P

As per the given information.
=> A, B, C, E, F, P and Q are sitting around a circular table, facing the centre.
=> F sits third to the left of C.
=> Only one person sits between C and P when counted from the left of P.
=> Only two people sit between B and E when counted from the right of E.
=> A is an immediate neighbour of B.
From the above arrangement, C & P are sitting Immediate right and left of Q.
Hence, the correct answer is "Option 3".

Q77. Answer: (c) 58

Given:
Hirani is 17^(th) from the left.
Tushar is 32^(nd) from the left.
Tushar is exactly between Hirani and Kiran.

Kiran is 12^(th) from the right.
Step 1: Find Kiran's position from the left
If total people = N
Kiran's position from left = N − 12 + 1 = N − 11
Step 2: Use the condition "Tushar is exactly between Hirani and Kiran"
Middle position = (Position of Hirani + Position of Kiran) / 2
32 = (17 + (N − 11)) / 2
Step 3: Solve
64 = 17 + N − 11
64 = N + 6
N = 58
Hence, the total number of people in the row is 58.
Correct Answer: Option (3).

Q78. Answer: (a) PLN−JFH

Given pairs:
AWY → UQS
RNP → LHJ
Check the pattern (alphabet positions):
Similarly,
Option (1) PLN - JFH
The same pattern is followed.
Hence, the correct answer is Option (1).

Q79. Answer: (c) 951

The pattern followed here is:
The difference between the number is increasing by multiples of 2.
Therefore The correct answer is Option (3).

Q80. Answer: (a) LOI

Check alphabetical positions:
LOI
L(12) → O(15) = +3
O(15) → I(9) = −6
QTO
Q(17) → T(20) = +3
T(20) → O(15) = −5
HKF
H(8) → K(11) = +3
K(11) → F(6) = −5
ILG
I(9) → L(12) = +3
L(12) → G(7) = −5
Pattern:
Most clusters follow +3 and −5.
QTO → +3, −5
HKF → +3, −5
ILG → +3, −5
LOI follows +3, −6, which is different.
Hence, the correct answer is Option (1).

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Q81. Answer: (a) Madhya Pradesh

The correct answer is Madhya Pradesh.

Key Points

• The Defence Research and Development Organisation (DRDO) successfully tested its indigenous Stratospheric Airship Platform on 3 May 2025.

• The test was conducted in Madhya Pradesh, a state in central India known for its favorable geographical and climatic conditions for testing high-altitude platforms.

• The Stratospheric Airship Platform is an advanced high-altitude platform designed by DRDO for surveillance, communication, and strategic purposes.

• This indigenous development is a significant milestone in India's defense capabilities, as it reduces dependence on foreign technology and aligns with the government's 'Make in India' initiative.

• The platform operates at an altitude of over 20 kilometers in the stratosphere, enabling it to provide seamless surveillance and communication over large areas.

Additional Information

• Defence Research and Development Organisation (DRDO):

• DRDO is an agency under the Ministry of Defence, Government of India, responsible for the development of advanced defense systems and technologies.

• It was established in 1958 and has since been a key player in enhancing India's defense capabilities.

• DRDO has contributed significantly to areas like missile systems, radars, electronic warfare systems, and aircraft technology.

• Stratospheric Airship Platform:

• An unmanned aerial vehicle designed to operate in the stratosphere at altitudes of 20-50 kilometers.

• It is equipped with advanced surveillance systems, communication relays, and navigation tools.

• Applications include border surveillance, disaster management, and communication network enhancement.

• Its ability to remain stationary at high altitudes makes it an effective alternative to satellites for certain applications.

• Madhya Pradesh:

• Located in central India, Madhya Pradesh is known as the 'Heart of India' due to its geographical location.

• The state is strategically important for defense-related testing due to its vast, open terrains and relatively low population density in certain areas.

• It has been a site for various defense and space research activities due to its favorable conditions.

• Make in India Initiative:

• Launched in 2014, this initiative aims to transform India into a global manufacturing hub.

• It focuses on promoting indigenous production in various sectors, including defense, to reduce dependency on imports.

• The development of the Stratospheric Airship Platform is a step forward in achieving self-reliance in advanced defense technologies.

Important Points

• High-Altitude Platforms vs Satellites:

• High-altitude platforms like the Stratospheric Airship can provide real-time surveillance and communication capabilities without the high costs associated with launching satellites.

• They are more flexible and cost-effective for short-term operations compared to satellites.

• They can be deployed quickly and relocated as per operational requirements.

• Future Prospects:

• DRDO plans to integrate AI and machine learning technologies into the Stratospheric Airship Platform for enhanced capabilities.

• The platform is expected to play a crucial role in India's border security and disaster management efforts.

• It also has potential applications in civil aviation and commercial communications.

Q82. Answer: (b) Mohd. Arif Khan

The correct answer is Mohd. Arif Khan.

Key Points

• Mohd. Arif Khan was appointed as the Deputy Chief Executive Officer (CEO) of SBI General Insurance in June 2025. This appointment highlights his extensive experience in the insurance and financial sectors.

• SBI General Insurance is one of the leading insurance companies in India, providing a wide range of general insurance solutions. Deputy CEO positions are crucial for strategic decision-making and operational excellence.

• The appointment of Mohd. Arif Khan is a strategic move by SBI General Insurance to strengthen its leadership team and expand its market presence.

• Prior to this role, Mohd. Arif Khan has held various senior leadership positions in the insurance and financial services industry, showcasing his expertise in business development, operations, and customer service.

• This move aligns with SBI General Insurance's growth trajectory and its vision to enhance customer-centricity and innovation in the insurance domain.

Additional Information

• SBI General Insurance:

• SBI General Insurance is a subsidiary of State Bank of India (SBI), India's largest bank.

• It provides a range of general insurance products, including health insurance, motor insurance, home insurance, and travel insurance.

• Established in 2010, SBI General Insurance has grown significantly, leveraging SBI's extensive branch network and customer base.

• Role of Deputy CEO:

• The Deputy CEO plays a pivotal role in steering the company's operational strategies and ensuring alignment with the organization's objectives.

• Key responsibilities include overseeing business processes, driving innovation, and achieving growth targets in competitive markets.

• The role also involves strategic collaboration with stakeholders and ensuring regulatory compliance.

• Insurance Sector in India:

• India's insurance sector is regulated by the Insurance Regulatory and Development Authority of India (IRDAI).

• With a rapidly growing economy and increasing awareness, the insurance industry in India is experiencing significant growth.

• The industry is divided into two categories: life insurance and general insurance.

• General insurance companies like SBI General Insurance cater to diverse needs such as health, vehicle, travel, and property insurance.

• Mohd. Arif Khan's Background:

• Mohd. Arif Khan is known for his expertise in the insurance and financial services sector, with a proven track record of driving business growth.

• He has contributed significantly to operational efficiency, customer satisfaction, and market expansion in his previous roles.

• His leadership is expected to bring innovative solutions and enhance the competitiveness of SBI General Insurance.

Important Points

• State Bank of India (SBI):

• SBI is India's largest public sector bank and has a vast network of branches across the country.

• The bank has a diversified portfolio, including banking, insurance, and asset management services.

• SBI's subsidiaries, such as SBI General Insurance, benefit from its strong brand reputation and customer base.

• Insurance Penetration:

• Insurance penetration in India is relatively low compared to global standards, presenting significant growth opportunities.

• The government and private players are working to increase awareness and accessibility of insurance products.

• IRDAI's Role:

• IRDAI regulates the insurance industry in India to ensure transparency, fairness, and consumer protection.

• It plays a critical role in approving new products, monitoring compliance, and addressing grievances.

Q83. Answer: (b) 16 january

The correct answer is Jan 16 2026.

Key Points

• The Lokpal of India celebrated its 1st Foundation Day on 16 January 2026. This is an important milestone for the institution, marking its establishment and operationalization.

• The Lokpal was constituted under the Lokpal and Lokayuktas Act, 2013, aimed at addressing corruption and enhancing transparency in governance.

• The institution of Lokpal is responsible for investigating complaints of corruption against public servants, including the Prime Minister (with certain exceptions), ministers, and other public officials.

• The Foundation Day celebrations signify the commencement of the Lokpal's role in promoting accountability and integrity within governmental processes.

• The Chairperson and other members of the Lokpal are appointed by a selection committee comprising the Prime Minister, Chief Justice of India, Speaker of Lok Sabha, and an eminent jurist.

Additional Information

• Lokpal and Lokayuktas Act, 2013:

• The Lokpal and Lokayuktas Act was enacted in 2013 to address corruption and ensure accountability in public offices.

• The Act mandates the establishment of a Lokpal at the central level and Lokayuktas at the state level.

• The Lokpal is empowered to investigate complaints against public servants, including ministers, parliamentarians, and bureaucrats, but excludes complaints against the judiciary.

• Composition of Lokpal:

• The Lokpal consists of a Chairperson and up to eight members, with 50% of the members from judicial backgrounds and at least 50% from Scheduled Castes, Scheduled Tribes, Other Backward Classes, minorities, and women.

• The Chairperson must be a former Chief Justice of India, a Supreme Court judge, or an eminent person with expertise in anti-corruption policies.

• Selection Process:

• The Chairperson and members are selected by a committee comprising the Prime Minister, Chief Justice of India, Speaker of Lok Sabha, Leader of Opposition in Lok Sabha, and an eminent jurist.

• The selection process ensures transparency and fairness in appointing individuals to these critical roles.

• Key Features of Lokpal:

• The Lokpal has the power to prosecute public servants, confiscate ill-gotten wealth, and impose penalties.

• It functions autonomously and is not subject to the directions of any government authority.

• It has jurisdiction over central government officials, including complaints against the Prime Minister, with certain restrictions.

• Important Developments:

• The Lokpal began functioning in March 2019, following the appointment of its Chairperson, Justice Pinaki Chandra Ghose.

• The institution is seen as a pivotal step in strengthening India's anti-corruption framework.

Important Points

• Legal Provisions:

• The Lokpal has the power to order investigations through agencies like the Central Bureau of Investigation (CBI).

• It can also recommend disciplinary action against public servants found guilty of corruption.

• All public servants are required to disclose their assets and liabilities to the Lokpal.

• Challenges:

• The Lokpal faces challenges related to staffing, infrastructure, and procedural delays.

• Ensuring independence and avoiding political interference are critical for its effective functioning.

• Impact:

• The establishment of Lokpal is a significant step towards curbing corruption and promoting good governance.

• It fosters public trust in the government by ensuring accountability and transparency in administration.

Q84. Answer: (d) Ministry of Environment, Forest and Climate Change

The correct answer is Ministry of Environment, Forest and Climate Change.

Key Points

• The Ministry of Environment, Forest and Climate Change (MoEFCC) released the 'Model Rules for Felling Trees in Agricultural Lands' to streamline regulations for tree felling on farmland, ensuring sustainable forestry practices.

• These rules aim to promote afforestation and reforestation while addressing the concerns of farmers and stakeholders about the legalities of felling trees on their agricultural lands.

• The model rules emphasize a simplified process for obtaining permission for tree felling, reducing bureaucratic barriers and encouraging farmers to plant more trees.

• Under these rules, states are advised to adopt a framework that balances ecological conservation and agricultural productivity, ensuring that farmers are not discouraged from integrating trees into their agricultural practices.

• The initiative aligns with India's commitment to increasing forest and tree cover under international agreements like the Paris Agreement and the Bonn Challenge.

Additional Information

• Ministry of Environment, Forest and Climate Change (MoEFCC):

• The MoEFCC is the nodal agency in the Indian government for planning, promoting, coordinating, and overseeing the implementation of environmental and forestry programs.

• Its responsibilities include formulating policies and guidelines for environmental conservation, afforestation, and biodiversity protection.

• The ministry plays a critical role in implementing India's commitments under various international environmental treaties, such as the UN Framework Convention on Climate Change (UNFCCC).

• It also oversees laws like the Forest Conservation Act, 1980, and the Environment Protection Act, 1986.

• Importance of Tree Cover on Agricultural Lands:

• Trees on agricultural lands provide numerous benefits, including soil stabilization, carbon sequestration, microclimate regulation, and habitat for biodiversity.

• Agroforestry practices, which integrate trees with crops and livestock, are promoted globally to enhance farm productivity and resilience to climate change.

• India's National Agroforestry Policy (2014) encourages farmers to adopt tree-based farming systems.

• Challenges in Tree Felling Regulations:

• Stringent regulations in many states discourage farmers from planting trees, fearing legal complications during harvesting.

• The 'Model Rules for Felling Trees in Agricultural Lands' aim to simplify this process and remove obstacles to sustainable forestry practices on private lands.

• India's Global Commitments:

• Under the Paris Agreement, India has committed to creating an additional carbon sink of 2.5 to 3 billion tonnes of CO_2 equivalent through additional forest and tree cover by 2030.

• The Bonn Challenge aims to restore 26 million hectares of degraded land in India by 2030, contributing to global restoration goals.

Important Points

• Afforestation Initiatives: The Indian government has launched several programs like the National Afforestation Programme (NAP) and the Green India Mission to promote tree planting and forest conservation.

• State-Level Adaptation: States are encouraged to customize the model rules to suit their specific ecological and socio-economic conditions.

• Role of Farmers: Farmers play a crucial role in increasing India's tree cover, and supportive policies can empower them to adopt sustainable forestry practices.

• Economic Incentives: Policies promoting tree felling on agricultural lands often include provisions for economic incentives, such as subsidies and tax benefits, to encourage adoption.

Q85. Answer: (b) Sitaare Zameen Par

The correct answer is Sitaare Zameen Par.

Key Points

• Sitaare Zameen Par is the film by Aamir Khan that was released in June 2025.

• The title of the film, "Sitaare Zameen Par," translates to "Stars on Earth," which is symbolic and resonates with the themes of inspiration and emotional depth often found in Aamir Khan's movies.

• Aamir Khan is renowned for his dedication to meaningful cinema, and this film aligns with his legacy of producing and acting in socially relevant and impactful films.

• The release of Sitaare Zameen Par marked a significant milestone in Aamir Khan's filmography, as the movie was highly anticipated by both critics and fans alike.

• The film's release in June 2025 was accompanied by extensive promotional campaigns and garnered widespread attention in the Indian film industry.

Additional Information

• Aamir Khan:

• Aamir Khan is a celebrated actor, producer, and director in the Indian film industry, often referred to as the "Perfectionist" due to his attention to detail and dedication to his craft.

• He has delivered iconic films such as Lagaan, Dangal, Taare Zameen Par, and PK, which have left a lasting impact on audiences worldwide.

• Aamir Khan is known for addressing social issues and pushing boundaries in Indian cinema, making his movies both entertaining and thought-provoking.

• Indian Cinema Trends:

• The release of Sitaare Zameen Par in 2025 showcases the evolving trends in Indian cinema, focusing on content-driven narratives and innovative storytelling.

• Modern Indian films increasingly address themes like mental health, personal growth, and societal challenges, resonating with global audiences.

• Other Films by Aamir Khan:

• Aamir Khan has worked on various projects, including Dangal, which highlighted women's empowerment through sports, and Taare Zameen Par, which focused on children with dyslexia.

• His movies often feature unique storylines and socially relevant themes, making him a standout figure in the industry.

• Significance of Film Release:

• June 2025 saw a major theatrical release for Sitaare Zameen Par, contributing to the resurgence of Indian cinema post-pandemic challenges.

• The timing of the release was strategically chosen to maximize audience engagement during summer vacations and festive seasons.

Important Points

• Film Industry Trends in 2025:

• Indian cinema in 2025 embraced diverse genres and explored innovative storytelling techniques to cater to a global audience.

• Major actors like Aamir Khan played a key role in redefining cinema by focusing on narratives that combine entertainment with societal impact.

• Other Options:

• Sky Force: While this was an anticipated project, it was not released in June 2025.

• Fateh: Another notable film, but its release date did not align with June 2025.

• Raid 2: This sequel had its own relevance but was unrelated to the correct answer.

Q86. Answer: (a) 10 years

The correct answer is 10 years.

Key Points

• Revised RBI Guidelines (April 2025): The Reserve Bank of India (RBI) issued updated guidelines allowing minors aged 10 years or older to independently open and operate savings accounts without requiring a guardian or parent.

• Empowering Financial Independence: This move aims to promote financial literacy and independence among young individuals, encouraging them to understand and manage their finances from an early age.

• Eligibility Criteria: Minors must meet the age threshold of 10 years and comply with bank-specific requirements, such as providing necessary documentation like birth certificates or school IDs.

• Account Features: Banks typically impose certain limitations on minor-operated accounts, such as transaction caps and restrictions on overdrafts, to ensure safe usage while teaching financial responsibility.

• Bank-Specific Policies: While RBI sets the baseline guidelines, individual banks may implement additional features or rules for minor accounts, such as linking them to guardian accounts or offering tailored benefits.

Additional Information

• Purpose of RBI Guidelines:

• To promote financial inclusion by enabling younger individuals to access banking services.

• To instill discipline and knowledge about savings, spending, and banking processes early in life.

• Global Practices:

• Many countries, such as United States and United Kingdom, offer similar provisions for minors to open savings accounts, emphasizing global trends in fostering financial independence.

• The age limit varies by country, with some allowing accounts to be opened by minors younger than 10 years, but with stricter parental oversight.

• Benefits of Minor Savings Accounts:

• Encourages financial planning and budgeting skills at an early age.

• Provides minors with a secure place to save allowances, gifts, or earnings.

• Helps in building a foundation for future financial activities, such as opening full-fledged accounts or availing loans.

• Important RBI Guidelines:

• Minors can access savings accounts independently if they are at least 10 years old.

• Such accounts can be operated for basic banking services, including deposits, withdrawals, and online transactions under limited thresholds.

• Guardians may still retain oversight in certain cases, depending on the bank's internal policies.

Important Points

• Legal Framework: Banks are required to adhere to RBI guidelines while ensuring compliance with Know Your Customer (KYC) norms for minor accounts.

• Parental Controls: Banks may offer additional features like parental notifications or transaction monitoring for minors operating accounts independently.

• Educational Outreach: Financial institutions and schools often collaborate to educate minors about financial literacy, leveraging these accounts as practical learning tools.

• Digital Banking: With the rise of digital banking, minors can also access mobile banking apps or online portals under controlled settings.

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Q87. Answer: (a) Shanghai, China

The correct answer is Shanghai, China.

Key Points

• The World Rowing Championships is a premier international rowing regatta organized by World Rowing (FISA).

• The prestigious event for 2025 will be hosted in Shanghai, China, which is known for its modern infrastructure and capability to host international sports events.

• The decision to award the hosting rights to Shanghai highlights the city's growing significance as a hub for global sports and its commitment to promoting rowing as a competitive sport.

• Shanghai has world-class sports venues, including facilities designed to accommodate international standards for rowing events.

• The city has previously hosted several international competitions, demonstrating its organizational expertise and readiness for large-scale events.

Additional Information

• World Rowing Championships:

• The World Rowing Championships is an annual event organized by World Rowing (FISA), the international governing body for the sport of rowing.

• It includes events for men, women, and para-rowers, attracting participants and audiences from around the globe.

• The Championships play a crucial role in determining world-class rowers and serve as an important qualifier for the Olympic Games.

• Shanghai, China as a Sports Hub:

• Shanghai is one of the most developed cities in China and has been a focal point for international sports events, including the Formula 1 Chinese Grand Prix and the Shanghai Masters Tennis Tournament.

• The city boasts modern infrastructure, such as the Shanghai Water Sports Center, which is well-suited for hosting rowing competitions.

• Shanghai's strategic location and accessibility make it an ideal destination for international participants and spectators.

• Importance of Rowing Events:

• Rowing is one of the oldest sports in the Olympic Games, dating back to its inclusion in 1900.

• The sport emphasizes teamwork, endurance, and precision, making it a favorite among athletes and viewers alike.

• Hosting international rowing events like the World Rowing Championships helps promote the sport and encourage local participation.

• Upcoming Rowing Events:

• While the 2024 Olympics will feature rowing events in Paris, France, the 2025 World Rowing Championships in Shanghai will serve as a major highlight for the sport.

• World Rowing continues to expand its global reach by hosting events in diverse locations, fostering international collaboration and competition.

Q88. Answer: (d) Arjuna Award (Lifetime)

The correct answer is Arjuna Award (Lifetime).

Key Points

• The Arjuna Award is one of India's prestigious sports honors, instituted in 1961, to recognize exceptional achievements in sports and athletics.

• It includes a bronze statue of Arjuna, a certificate, and a cash prize. As of recent updates, the cash prize associated with the award is Rs. 15 lakh.

• The Lifetime category of the Arjuna Award is specifically intended to honor athletes who have displayed exemplary dedication and achievements over their entire career, serving as role models for younger generations.

• Sucha Singh, a former cyclist, received the Arjuna Award under the Lifetime Achievement category in 2025 for his outstanding contribution to Indian cycling and his role in promoting the sport at various levels.

• The award recognizes not only the recipient’s sporting achievements but also their efforts in mentoring and uplifting the sport in their region or nation.

Additional Information

• Arjuna Award:

• The Arjuna Award was established by the Government of India to recognize exceptional achievements in sports and to motivate athletes to continue excelling in their respective fields.

• Recipients are chosen based on their performance over the last four years, consistent excellence, and their contribution to the promotion of sports.

• It covers a wide range of sports disciplines, including mainstream sports, indigenous sports, and para-sports.

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• Famous past recipients include Sachin Tendulkar, P.V. Sindhu, and Abhinav Bindra.

• Eligibility for Lifetime Arjuna Award:

• The Lifetime Achievement category is awarded to sportspersons who have dedicated their lives to sports, achieving excellence and contributing significantly to the development of their sport.

• It is not limited to recent performances but also considers the recipient's long-term contributions to the field.

• The selection process involves recommendations from a committee appointed by the Ministry of Youth Affairs and Sports.

• Sucha Singh’s Contribution:

• Sucha Singh is a renowned cyclist who represented India in various national and international competitions.

• He played a pivotal role in popularizing cycling across different regions, especially in rural parts of the country.

• His lifetime dedication to cycling and mentoring young athletes was recognized with the Lifetime Achievement Arjuna Award.

• Other Sports Awards in India:

• Khel Ratna Award: The highest sporting honor in India, awarded for outstanding performance at the international level over a period of four years.

• Dronacharya Award: Given to coaches for their exemplary role in training athletes to achieve excellence in sports.

• MAKA Trophy: Presented to the best university for sports in India, recognizing the role of educational institutions in promoting sports.

Important Points

• Key Features of Arjuna Award:

• It aims to encourage athletes to achieve higher levels of performance and represent India internationally.

• The selection process is rigorous, ensuring that only deserving candidates are honored based on merit and contribution.

• Awardees serve as ambassadors of Indian sports, inspiring young athletes to strive for excellence.

• Historical Context:

• The Arjuna Award has been instrumental in highlighting the significance of sports as a profession in India.

• It has contributed to the development of sports culture and recognition of athletes from various socioeconomic backgrounds.

Q89. Answer: (d) iGOT Karmayogi

The correct answer is iGOT Karmayogi.

Key Points

• iGOT Karmayogi is an online learning platform under the National Programme for Civil Services Capacity Building (NPCSCB), launched by the Government of India.

• The platform is designed to provide continuous learning and capacity-building opportunities to government employees, including newly inducted recruits.

• It aims to help civil servants acquire role-specific competencies and focuses on a comprehensive approach toward skill development.

• iGOT Karmayogi offers self-paced learning modules, interactive content, and assessments, ensuring that employees are equipped with the required knowledge and skills for effective governance.

• During the Rozgar Mela, newly recruited personnel can leverage iGOT Karmayogi alongside formal skill programs to enhance their professional capabilities.

Additional Information

• iGOT Karmayogi Platform:

• It is part of the Mission Karmayogi, launched in September 2020, to improve public service delivery by enhancing the capacities of civil servants.

• The platform is managed by the Karmayogi Bharat, a Special Purpose Vehicle (SPV) established by the Government of India.

• It offers courses on areas like leadership, ethics, governance, and IT skills, among others.

• iGOT Karmayogi ensures transparent, accountable, and citizen-centric governance by upskilling the workforce.

• Rozgar Mela:

• The Rozgar Mela is an initiative by the Government of India to provide employment opportunities to youth.

• The 15^(th) edition of the Rozgar Mela is scheduled for April 2025, focusing on recruiting individuals into various government roles.

• New recruits are provided with formal training programs, including skill development on platforms like iGOT Karmayogi.

• National Career Service (NCS):

• The NCS portal is a government initiative aimed at connecting job seekers with employers and providing career-related services.

• It offers services like employment counseling, vocational guidance, and job matching.

• However, it does not provide in-depth training programs like iGOT Karmayogi.

• SWAYAM:

• SWAYAM (Study Webs of Active-Learning for Young Aspiring Minds) is an initiative by the Government of India to provide free online education.

• It offers courses across diverse disciplines but is not tailored for role-specific government training like iGOT Karmayogi.

Important Points

• Comparison of Platforms:

• iGOT Karmayogi: Focused on skill enhancement for government employees through structured and role-specific training modules.

• SWAYAM: Provides free online courses for students and professionals but lacks government-focused content.

• National Career Service: Primarily a job portal for connecting employers and job seekers, not a training platform.

• e-Shram Portal: A database for unorganized workers, aimed at welfare services but not designed for structured training.

• Significance of iGOT Karmayogi:

• Prepares civil servants for 21^(st)-century challenges through competency-based training.

• Empowers government employees to deliver efficient and effective public services.

• Promotes a culture of continuous learning and innovation.

Q90. Answer: (d) Davos

The correct answer is Davos.

Key Points

• The World Economic Forum (WEF) annual meeting is traditionally held in Davos, Switzerland, a renowned ski resort in the Alps.

• Davos has been hosting the WEF since its inception in 1971 by Klaus Schwab, making it synonymous with this globally significant event.

• The meeting gathers leaders from various sectors such as business, politics, academia, and civil society to discuss pressing global issues like climate change, economic development, and technological innovation.

• The 2025 annual meeting focused on topics such as global economic recovery, sustainability, and multilateral cooperation post-pandemic challenges.

• Davos is chosen for its serene atmosphere, which encourages productive dialogue and fosters collaboration among leaders.

Additional Information

• World Economic Forum (WEF):

• The WEF is an international non-governmental organization headquartered in Cologny, Geneva, Switzerland.

• It was founded by Klaus Schwab in 1971 with the aim of improving the state of the world through public-private cooperation.

• The annual meeting in Davos is attended by over 3,000 participants, including heads of state, CEOs, and leaders from various industries.

• Why Davos?

• Davos is located in the Swiss Alps, providing a neutral and secluded environment for discussions on global issues.

• The small size of the town ensures that attendees are focused on the conference's agenda without distractions.

• 2025 Meeting Themes:

• The 2025 WEF meeting addressed key issues such as climate resilience, digital transformation, and equitable economic recovery.

• It emphasized the importance of multilateral cooperation in tackling challenges like global inequality and climate change.

• Other Notable Locations:

• While Davos is the traditional venue, WEF has occasionally hosted meetings elsewhere, such as Geneva and New York during extraordinary circumstances.

• For example, the WEF held its 2021 meeting in Singapore due to pandemic-related considerations.

Important Points

• Leadership and Participation:

• The WEF fosters collaboration among governments, businesses, and non-profits to address global challenges.

• Prominent attendees include CEOs, heads of state, Nobel laureates, and activists.

• Impact:

• Many global initiatives such as Climate Action Platform and Internet Governance Forum have been launched from Davos discussions.

• The meetings have a significant influence on shaping global policies and fostering innovation.

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Q91. Answer: (c) Himachal Pradesh

The correct answer is Himachal Pradesh.

Key Points

• Rajiv Gandhi Van Samvardhan Yojana was inaugurated on 2 June 2025 by the Himachal Pradesh government to promote afforestation and environmental conservation.

• The scheme aims to enhance forest cover, conserve biodiversity, and ensure sustainable development in the state of Himachal Pradesh.

• It focuses on the active participation of local communities and stakeholders, including the promotion of eco-friendly practices and sustainable livelihood opportunities for rural populations.

• Himachal Pradesh, known for its rich biodiversity and dense forests, has been a pioneer in environmental initiatives and forest conservation programs.

• The scheme aligns with national objectives of improving climate resilience and boosting eco-tourism, which Himachal Pradesh is renowned for.

Additional Information

• Himachal Pradesh:

• The state is located in the northern region of India and is known for its Himalayan landscapes and dense forests.

• Himachal Pradesh has 66.52% of its geographical area under forest cover as per recent reports.

• It is a hub for eco-tourism, with several initiatives to maintain and enhance its natural beauty.

• The state is proactive in addressing climate change and promoting environmental sustainability through innovative policies and schemes.

• Forest Conservation in India:

• India has launched multiple initiatives to conserve forests, including the National Afforestation Programme.

• The government aims to achieve 33% forest cover under the National Forest Policy.

• Afforestation programs not only preserve biodiversity but also mitigate the effects of climate change and promote sustainable development.

• Rajiv Gandhi Van Samvardhan Yojana:

• This program is named after former Prime Minister Rajiv Gandhi to honor his contributions to environmental and social development.

• The scheme is designed to involve local communities in afforestation activities, ensuring their active participation and benefiting their livelihoods.

• It includes measures for maintaining soil quality, reducing deforestation, and improving water resources within forest areas.

• Afforestation and Sustainable Development:

• Afforestation is crucial for achieving sustainable development goals (SDGs), particularly those related to climate action and life on land.

• Forest conservation programs contribute to carbon sequestration, reducing global greenhouse gas emissions.

• These initiatives also support rural economies by providing employment opportunities and sustainable livelihoods.

Important Points

• Himachal Pradesh's Environmental Policies:

• Himachal Pradesh has been recognized for its pioneering efforts in environmental conservation and sustainable development.

• The state has implemented strict regulations to curb deforestation and promote afforestation.

• It is known for its eco-friendly tourism policies that attract visitors while maintaining the ecological balance.

• National Afforestation Programme:

• Launched by the Ministry of Environment, Forests, and Climate Change, it aims to enhance forest and tree cover across India.

• It provides funds and technical support to states for implementing afforestation initiatives.

• Himachal Pradesh has been an active participant in this program, contributing significantly to increasing the country’s forest cover.

Q92. Answer: (c) Tuhin Kanta Pandey

The correct answer is Tuhin Kanta Pandey.

Key Points

• Tuhin Kanta Pandey was appointed as the Chairperson of the Securities and Exchange Board of India (SEBI) in March 2025. This is a pivotal role that oversees the regulation of the securities market in India.

• He succeeded Madhabi Puri Buch, who was the first woman to lead SEBI, marking another significant leadership transition for the regulatory body.

• Tuhin Kanta Pandey was previously the Secretary of the Department of Investment and Public Asset Management (DIPAM) under the Ministry of Finance, where he played a crucial role in managing India's disinvestment program.

• The selection of the SEBI Chairperson is a highly scrutinized process, typically undertaken by a high-level committee consisting of senior government officials and experts, ensuring the appointee has the necessary expertise and experience in financial markets and governance.

• The tenure of the SEBI Chairperson is typically three years, extendable based on performance and the government's discretion.

Additional Information

• About SEBI (Securities and Exchange Board of India):

• SEBI was established in 1988 and given statutory powers on 30th January 1992, through the SEBI Act, 1992.

• It is headquartered in Mumbai, Maharashtra, with regional offices in key cities like Delhi, Kolkata, Chennai, and Ahmedabad.

• The primary functions of SEBI include protecting the interests of investors, regulating the securities market, and promoting its development.

• SEBI also monitors and regulates the activities of stock exchanges, brokers, sub-brokers, and other intermediaries.

• Tuhin Kanta Pandey's Contributions:

• As the Secretary of DIPAM, he spearheaded several successful disinvestment programs, including the strategic sale of Air India in 2021, a landmark achievement in India's economic reforms.

• He has extensive experience in financial management, public policy, and governance, making him a strong candidate for the SEBI Chairperson role.

• His expertise in asset monetization and public finance aligns with SEBI's goals of ensuring market efficiency and investor protection.

• Key Challenges for SEBI Chairperson:

• Ensuring market stability amidst global economic uncertainties and fostering investor confidence.

• Strengthening regulations to curb insider trading, market manipulation, and other fraudulent activities.

• Promoting financial literacy and inclusion among retail investors.

• Leveraging technology and innovation to enhance market transparency and efficiency.

• Other Options Explained:

• Madhabi Puri Buch: She served as SEBI Chairperson from March 2022 to March 2025 and was the first woman to hold this position.

• Shaktikanta Das: He is the Governor of the Reserve Bank of India (RBI) since December 2018, with no involvement in SEBI leadership.

• Arvind Panagariya: An economist and former Vice Chairman of NITI Aayog, he has no direct association with SEBI.

• Option 5: This option is invalid and does not pertain to the question.

Important Points

• SEBI's Key Functions:

• Regulating the stock exchanges and securities market in India.

• Monitoring and regulating mutual funds, venture capital, and alternative investment funds.

• Ensuring the fair and transparent functioning of the securities market.

• Educating investors and enhancing their understanding of financial markets.

• Significance of SEBI:

• SEBI plays a critical role in maintaining the integrity and efficiency of Indian financial markets.

• It ensures that companies adhere to regulatory norms and safeguards the interests of small and retail investors.

• By promoting corporate governance, SEBI fosters transparency and accountability in the financial ecosystem.

Q93. Answer: (c) Air Pollution Prevention Penalties

The correct answer is Air Pollution Prevention Penalties.

Key Points

• The ‘Control of Water Pollution (Grant, Refusal or Cancellation of Consent) Guidelines', 2025, primarily focuses on water pollution control and does not include any explicit provisions for penalties related to air pollution prevention. Therefore, the option mentioning air pollution is not relevant to these guidelines.

• The guidelines aim to establish a streamlined consent process for industries and entities to ensure compliance with pollution control norms, making the process more efficient and transparent.

• Stricter location criteria are part of the guidelines to ensure that industrial units are set up in designated areas to minimize environmental impacts and prevent water pollution.

• The guidelines provide a framework for the clear enforcement of rules, ensuring that industries adhere to water pollution control

measures strictly.

• However, there is no mention of penalties or measures specifically targeting air pollution prevention within these guidelines, as they are solely focused on water pollution control.

Additional Information

• Streamlined Consent Process:

• The guidelines ensure that the process of granting, refusing, or canceling consent is simplified, reducing delays and enhancing compliance by industries.

• It promotes a digital approach by incorporating online applications and tracking for transparency and accountability.

• Stricter Location Criteria:

• To reduce environmental impacts, industries are required to be located in designated industrial zones or areas that meet specific environmental safety criteria.

• This measure ensures that industries are not established near sensitive ecosystems, water bodies, or residential areas.

• Clear Enforcement of Rules:

• Industries must comply with specific standards for effluent discharge, and violations are subject to penalties as per the Water (Prevention and Control of Pollution) Act, 1974.

• The enforcement mechanisms include regular inspections, monitoring, and reporting requirements to ensure compliance.

• Focus on Water Pollution:

• The primary objective of these guidelines is to address and mitigate issues related to water pollution, ensuring the preservation of water resources.

• They do not extend to air pollution, which is governed by separate regulations like the Air (Prevention and Control of Pollution) Act, 1981.

Important Points

• Water (Prevention and Control of Pollution) Act, 1974:

• This act serves as the foundation for controlling water pollution in India and empowers state and central pollution control boards.

• It provides for penalties, such as fines and imprisonment, for entities violating water pollution regulations.

• Air (Prevention and Control of Pollution) Act, 1981:

• This act is specifically designed to combat air pollution and includes provisions for penalties related to air quality violations.

• It is separate from the guidelines for water pollution control and is administered by air pollution control boards.

• Implementation:

• The guidelines are implemented by State Pollution Control Boards (SPCBs) and the Central Pollution Control Board (CPCB).

• These bodies are responsible for monitoring industrial compliance and enforcing water pollution control measures.

Q94. Answer: (a) 5th

The correct answer is 5th.

Key Points

• Finland became the 5th European country to exit the Ottawa Landmine Treaty in June 2025.

• The Ottawa Treaty, also known as the Mine Ban Treaty, was adopted in 1997 to prohibit the use, stockpiling, production, and transfer of anti-personnel landmines.

• Countries exiting the treaty typically cite concerns about national security and the need for landmines in specific defense strategies as reasons for withdrawal.

• Prior to Finland, four other European nations had already exited the treaty, demonstrating a growing trend of nations reconsidering their commitments due to evolving geopolitical threats.

• Finland's decision was influenced by its unique geographic location and security considerations, especially in light of tensions in the Nordic-Baltic region.

Additional Information

• Ottawa Treaty:

• The Mine Ban Treaty was formally adopted in 1997 and entered into force in 1999. It aims to eliminate anti-personnel mines globally due to their devastating impact on civilians.

• As of 2023, 164 countries are signatories to the treaty.

• The treaty prohibits the use, production, stockpiling, and transfer of anti-personnel mines and mandates the destruction of existing stockpiles.

• It also includes provisions for victim assistance, mine clearance, and mine risk education.

• Finland’s Security Concerns:

• Finland shares a long border with Russia, making it a strategically sensitive region.

• The country’s withdrawal from the treaty aligns with its need to adopt flexible defense strategies in response to geopolitical tensions in Eastern Europe.

• Landmines are often seen as critical tools for border defense and deterrence against potential aggressors.

• Other Exiting Nations:

• Countries that have exited or refused to sign the treaty often cite similar reasons, such as national security and the strategic importance of landmines in certain terrains.

• For example, Russia, China, and the United States are not signatories to the treaty due to their defense policies and global military commitments.

• Humanitarian Impact:

• Anti-personnel mines have caused significant harm to civilians, including injuries and deaths, long after conflicts have ended.

• International organizations like the United Nations and ICRC advocate for the universal adoption of the treaty to protect civilians and ensure post-conflict recovery.

• Countries leaving the treaty face criticism from humanitarian groups for potentially undermining global efforts to eliminate landmines.

Important Points

• Global Statistics: According to the Landmine Monitor, over 5,500 casualties were reported annually from landmine-related incidents as of 2022.

• Mine Clearance: Many countries undertake extensive mine clearance programs to meet their treaty obligations. For instance, Cambodia and Afghanistan have made significant progress in mine clearance despite challenges.

• Defense vs. Humanitarian Debate: The decision to use or ban landmines often sparks debates between national defense priorities and humanitarian obligations.

• Technological Alternatives: Modern technologies, such as surveillance systems and automated defense mechanisms, are being explored as alternatives to landmines for border security.

Q95. Answer: (c) 11

The correct answer is 11.

Key Points

• India won a total of 11 medals at the 2025 World Boxing Cup, a significant achievement in the international boxing arena.

• The tally of medals reflects India's growing prominence in the sport of boxing, with contributions from both male and female athletes across various weight categories.

• This success at the 2025 World Boxing Cup highlights the impact of improved training facilities, government initiatives, and support provided to Indian boxers in recent years.

• The medal count includes a mix of gold, silver, and bronze medals, showcasing the depth of talent in the Indian boxing contingent.

• India's performance at the event also aligns with its broader goal of excelling in global sports competitions and preparing for future events such as the Olympics.

Additional Information

• World Boxing Cup:

• The World Boxing Cup is an international boxing competition where athletes from various countries compete in different weight categories.

• It is organized by the International Boxing Association (IBA), the governing body for amateur boxing worldwide.

• The event serves as a platform for showcasing emerging talent and fostering healthy competition among nations.

• It is held biennially and features both men’s and women’s events.

• Indian Boxing Achievements:

• India has consistently improved its performance in boxing over the years, with athletes winning medals in events like the Olympics, Asian Games, and World Championships.

• Prominent Indian boxers include Mary Kom, Nikhat Zareen, Amit Panghal, and Lovlina Borgohain, who have brought international acclaim to the country.

• Training centers such as the National Boxing Academy in Rohtak and the Army Sports Institute in Pune have played a key role in nurturing talent.

• Government Initiatives:

• The Indian government has launched schemes like Target Olympic Podium Scheme (TOPS) to provide financial and infrastructural support to athletes.

• Programs like Khelo India aim to identify and develop young sports talent in the country.

• Significance of the 2025 World Boxing Cup:

• The event served as a preparatory ground for Indian boxers ahead of major competitions like the 2028 Summer Olympics.
• India's performance at the event boosted the morale of athletes and inspired upcoming boxers to pursue the sport professionally.

Important Points

• Weight Categories:
• In boxing, athletes compete in different weight divisions such as flyweight, lightweight, middleweight, and heavyweight.
• Each category has specific weight limits, and athletes must qualify within these limits to compete.
• Scoring System:
• Boxing matches are judged based on a scoring system where points are awarded for clean punches and defensive skills.
• The boxer with the highest points at the end of the match, or the one who achieves a knockout, is declared the winner.
• Role of Coaches:
• Coaches play a pivotal role in preparing boxers by developing their techniques, strategies, and mental strength.
• India has a growing pool of experienced boxing coaches, some of whom have international certifications.

Q96. Answer: (a) Navdeep Singh

The correct answer is Navdeep Singh.

Key Points

• Navdeep Singh is a renowned para-athlete from India who has gained recognition for his exceptional achievements in the field of para-athletics.
• He was awarded the prestigious Arjuna Award in 2025 for his outstanding contribution to para-athletics, a sport that promotes inclusivity and showcases the resilience of athletes with disabilities.
• The Arjuna Award is one of the highest honors given by the Government of India to athletes for their consistent performance and dedication to their respective sports.
• Navdeep Singh's achievements have inspired countless individuals, especially in the differently-abled community, to pursue sports and demonstrate their capabilities on national and international platforms.
• His recognition with the Arjuna Award further emphasizes the government's commitment to recognizing and supporting para-sports in India.

Additional Information

• Arjuna Award:
• The Arjuna Award was instituted in 1961 by the Government of India to recognize outstanding achievement in sports.
• It is presented annually by the Ministry of Youth Affairs and Sports and includes a bronze statuette of Arjuna, a certificate, ceremonial dress, and a cash prize.
• The award is not limited to able-bodied athletes but also extends to para-athletes, showcasing inclusivity in sports recognition.
• Para-athletics:
• It is a category of track and field athletics designed for athletes with physical disabilities, including visual impairment, amputations, and cerebral palsy.
• Events in para-athletics include sprints, middle and long-distance races, throws (shot put, discus, javelin), and jumps (long jump, high jump).
• Para-athletics is governed by the World Para Athletics, a subcommittee of the International Paralympic Committee (IPC).
• Other Para-athletes in India:
• Sumit Antil: A celebrated Indian javelin thrower and Paralympic gold medalist.
• Avani Lekhara: The first Indian woman to win a Paralympic gold medal in shooting.
• Yogesh Kathuniya: A discus thrower who clinched a silver medal in the Paralympics.

Important Points

• Significance of Para-sports:
• Para-sports play a crucial role in empowering differently-abled individuals and promoting inclusivity in society.
• India has been actively participating in para-sports events, including the Paralympic Games, and has witnessed remarkable performances by its athletes.
• Recognition of Para-athletes:
• The Government of India provides financial assistance, training facilities, and awards to recognize and support para-athletes.
• Efforts are also made to raise awareness about para-sports and encourage participation at the grassroots level.

Q97. Answer: (d) January 2025

The correct answer is Jan 2025.

Key Points

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• Genomics Data Conclave: The Genomics Data Conclave is a significant event aimed at advancing genomic research and data sharing among scientists and researchers in India.

• 'GenomeIndia Data' dedication: During the conclave, Prime Minister Narendra Modi dedicated the 'GenomeIndia Data' to researchers to promote scientific innovation and exploration in genomics.

• The event took place on January 1, 2025, marking the official launch of this initiative to enhance India's capabilities in genomic data analysis and research.

• Significance of the data: The 'GenomeIndia Data' is expected to contribute to advancements in healthcare, personalized medicine, and biotechnology by enabling scientists to better understand the genetic makeup of India's diverse population.

• The Prime Minister's involvement underscores the importance of genomic research in shaping the future of healthcare and other scientific innovations in India.

Additional Information

• GenomeIndia Project:

• The GenomeIndia Project is a national initiative launched by the Government of India to map the genetic diversity of the Indian population.

• It aims to collect and analyze genome samples from across the country to build a comprehensive database for scientific research and healthcare applications.

• This project is expected to help identify genetic disorders, improve disease diagnosis, and facilitate the development of personalized medicine.

• Importance of Genomics:

• Genomics is the study of the complete set of DNA (including all genes) within an organism. It plays a crucial role in understanding hereditary diseases and developing targeted treatments.

• Advancements in genomics have paved the way for revolutionary technologies like CRISPR and personalized gene therapy.

• Applications of Genomic Data:

• Genomic data is used in healthcare for early diagnosis of diseases, drug development, and creating personalized treatment plans.

• In agriculture, it helps in crop improvement and developing pest-resistant varieties.

• It also has applications in forensic science for solving crimes and identifying individuals.

• Global Genomic Initiatives:

• Similar projects worldwide include the Human Genome Project (HGP), which successfully mapped the entire human genome in 2003.

• Countries like the USA, UK, and China are investing heavily in genomic research to address public health challenges and innovate in biotechnology.

Important Points

• Prime Minister Narendra Modi's Role: His active involvement in science and technology initiatives reflects India's commitment to advancing research and innovation.

• Genomic Data Accessibility: The dedication of 'GenomeIndia Data' ensures that researchers have access to high-quality genomic data, fostering collaboration and innovation in the field of genomics.

• Healthcare Benefits: The insights gained from genomics research can significantly improve healthcare delivery, particularly in a diverse country like India.

• Future Prospects: The GenomeIndia Project and initiatives like the Genomics Data Conclave are expected to position India as a global leader in genomic research and personalized medicine.

Q98. Answer: (d) 106th Constitutional Amendment Bill

The correct answer is 106th Constitutional Amendment Bill.

Key Points

• The 106th Constitutional Amendment Bill is popularly referred to as the Nari Shakti Vandan Adhiniyam, which translates to "Women Empowerment Act" in English.

• It aims to provide 33% reservation for women in the Lok Sabha (House of the People) and the State Legislative Assemblies.

• This bill was introduced with the objective of enhancing the political participation of women in India, ensuring gender equity in decision-making processes.

• The constitutional amendment ensures that the seats reserved for women will rotate periodically among different constituencies, ensuring fair representation across all regions.

• It highlights India's commitment to achieving gender equality as outlined in the United Nations Sustainable Development Goals (SDG-5).

Additional Information

• Historical Context:

• The demand for women's reservation in legislative bodies has been a long-standing issue in India, with various political parties and activists advocating for it since the 1990s.

• The 84th Amendment Bill in 1999 and the Women's Reservation Bill introduced in 2008 were earlier attempts that faced hurdles in Parliament.

• Global Practices:

• Countries like Rwanda, Sweden, and Norway have implemented similar measures, with Rwanda having the highest percentage of women in Parliament globally at over 60%.

• India ranks 148th globally in terms of women's representation in Parliament, underscoring the need for such reforms.

• Implementation:

• The 106th Constitutional Amendment requires the approval of both Houses of Parliament with a two-thirds majority and ratification by at least 50% of state legislatures.

• Once enacted, this reservation will initially apply for a period of 15 years, after which it may be extended based on necessity.

• Significance:

• This amendment is expected to bridge the gender gap in political representation, fostering inclusive governance.

• It will provide a platform for women to address issues like healthcare, education, and gender-based violence more effectively.

Important Points

• Constitutional Provisions:

• Article 81 deals with the composition of the Lok Sabha, and this amendment introduces specific provisions for women's reservation.

• Article 170 covers the composition of State Legislative Assemblies, where similar reservations will be applied.

• Challenges:

• Ensuring the effective implementation of this reservation without political or social resistance may be challenging.

• Critics have raised concerns about the potential tokenism of women in politics if not accompanied by broader systemic reforms.

• Way Forward:

• Capacity-building programs and leadership training for women are essential to make this reservation impactful.

• Efforts to promote gender equality in political parties and grassroots governance structures should complement this amendment.

Q99. Answer: (c) February 2025

The correct answer is Feb 2025.

Key Points

• The grand finale and prize distribution ceremony for the Defence Innovation Challenge for Excellence (DICE-2024) was organized during the prestigious Aero India 2025 event in Bengaluru.

• This event was hosted by the Marathwada Accelerator for Growth and Incubation Council (MAGIC), which focuses on fostering innovation in the defence sector.

• The event was held in the month of February 2025, aligning with the Aero India 2025 schedule, which is a biennial air show and aviation exhibition organized by the Indian Ministry of Defence.

• The specific date for the grand finale was Sat Feb 01 2025, marking the beginning of the Aero India 2025 event.

• The timing of this event is critical as Aero India is a significant platform that brings together innovators, defence personnel, and industry leaders to showcase technological advancements and discuss future opportunities in the defence sector.

Additional Information

• About Aero India:

• Aero India is a biennial air show and aviation exhibition held in Bengaluru, India, organized by the Ministry of Defence.

• It serves as a major platform for showcasing the latest advancements in the aerospace and defence sectors.

• The event attracts participation from global companies, defence organizations, and policymakers, fostering collaborations and technological exchanges.

• The 2025 edition of Aero India is expected to focus on themes like indigenization, innovation, and Atmanirbhar Bharat (self-reliant India).

• Marathwada Accelerator for Growth and Incubation Council (MAGIC):

• MAGIC is an organization dedicated to fostering innovation and entrepreneurship in various sectors, including defence.

• The council supports startups and innovators through incubation, mentorship, and funding opportunities.

• In the context of DICE-2024, MAGIC played a crucial role in organizing the challenge and providing a platform for innovators to showcase their solutions.

• Defence Innovation Challenge for Excellence (DICE):

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• DICE is a platform aimed at encouraging innovation in the defence sector by inviting solutions from startups, innovators, and research institutions.

• The challenge focuses on addressing critical defence-related problems and fostering the development of indigenous technologies.

• Winners of the challenge are provided with recognition, funding, and opportunities for collaboration with the defence industry.

• Importance of February for Aero India:

• The Aero India event traditionally takes place in February, making it a suitable time for hosting events like DICE finals.

• This timing ensures maximum participation from global defence and aerospace stakeholders who attend Aero India.

Important Points

• Aero India's Global Significance:

• Aero India is one of the largest air shows in Asia, providing a platform for global aerospace and defence companies to showcase their products and technologies.

• The event plays a vital role in promoting India's defence exports and attracting foreign investments in the aerospace sector.

• Indigenization in Defence:

• Events like DICE are aligned with the Indian government's initiative to boost indigenization in the defence sector under the Atmanirbhar Bharat Abhiyan.

• Such challenges encourage the development of home-grown solutions, reducing dependence on imports and strengthening national security.

• Collaboration Opportunities:

• Platforms like DICE and Aero India foster collaboration between startups, the defence industry, and government organizations.

• These collaborations lead to the development and deployment of cutting-edge technologies in the defence sector.

Q100. Answer: (b) 24.7 million

The correct answer is 24.7 million hectares.

Key Points

• The Revised Green India Mission (GIM) Plan, released in 2025, aims to increase forest and tree cover by approximately 24.7 million hectares by the year 2030.

• The Green India Mission is one of the eight missions under the National Action Plan on Climate Change (NAPCC), launched by the Government of India to address climate change challenges.

• The mission focuses on ecosystem restoration, afforestation, and reforestation in degraded forest lands and other areas, contributing to improved carbon sequestration and enhanced biodiversity.

• Under the revised plan, the mission has set ambitious targets to restore degraded ecosystems, improve the quality of forest cover, and enhance ecosystem services such as water security, soil fertility, and livelihood generation.

• It is part of India's commitment to achieving its Nationally Determined Contributions (NDCs) under the Paris Agreement to combat climate change through sustainable forest management and increased green cover.

Additional Information

• Green India Mission (GIM):

• GIM was launched in 2010 as part of the National Action Plan on Climate Change (NAPCC).

• Its primary objective is to increase the forest cover and improve ecosystem services such as biodiversity conservation, water catchment protection, and carbon sequestration.

• The mission emphasizes community participation in forest management and conservation efforts.

• It also focuses on enhancing the livelihood opportunities of forest-dependent communities through sustainable practices.

• Paris Agreement and India's NDCs:

• India's Nationally Determined Contributions (NDCs) under the Paris Agreement aim to achieve a reduction in the emissions intensity of its GDP by 33-35% by 2030, compared to 2005 levels.

• The Green India Mission contributes to India's land use and forestry commitments by enhancing carbon sinks.

• India has pledged to create an additional carbon sink of 2.5 to 3 billion tonnes of CO_2 equivalent through increased forest and tree cover.

• Global Context of Afforestation:

• Afforestation and reforestation initiatives are critical components of global efforts to address climate change and achieve sustainable development goals.

• Organizations such as the United Nations Framework Convention on Climate Change (UNFCCC) highlight the role of forests in carbon sequestration and mitigating climate change impacts.

• Countries worldwide are implementing similar programs to restore degraded lands and increase forest cover, aligning with international goals like the Bonn Challenge and REDD+.

• Important Points:

• India's forests serve as a critical resource for carbon sequestration, helping to mitigate the effects of global warming.

• Afforestation programs contribute to improving soil fertility, preventing soil erosion, and ensuring water security in forest-dependent regions.

• The Green India Mission promotes the adoption of climate-resilient practices in agricultural and forestry sectors, enhancing the sustainability of ecosystems.

• Increased green cover helps in conserving native flora and fauna, safeguarding India's rich biodiversity.

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